ETON JOURNAL FOR INNOVATION AND RESEARCH IN EDUCATION

ETON COLLEGE

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EDITORIAL

Iro Konstantinou | *Editor*

The articles for this issue and the theme 'Tradition and Change' were decided before the unprecedented changes brought upon education by Covid-19. At the beginning of this year, no one could have predicted that months would be spent in front of screens while students were learning remotely or that half the world's student population would be out of school or university. While at the beginning of the year many teachers were grappling with questions concerning the merits and wider use of educational technology in the classroom, we now rely on educational technology to communicate with students at all.

Big questions are being asked at the moment about education: the crisis has generated greater discussion of questions concerning the role, format and purpose of exams; the need for reform of curricula to reflect current needs; teacher and pupil well-being; the impact of school closures on disadvantaged pupils; and the future of education and what the new normal will look like. However, this journal issue does not address these questions. We wanted, instead, to look at the evolution of teaching and learning from the perspectives of educational research, experimentation, and the science of learning. These broader questions will be addressed in the next issue of the journal instead.

Admittedly, debates on educational reform that stem from new technologies and innovative methods risk jumping towards a hasty rejection of what might be seen as outdated teaching and learning methods which are not relevant to 21st century concerns, when education must have a global outlook. However, in a time of unprecedented change, it is worth reflecting on what we can learn from tradition and what innovation has to add to the toolbox teachers already utilise in the classroom. It can also be argued that it is important to adapt our practices to the modern needs of education while ensuring a continuum within our institutions, so as not to lose sight of what we value and what is most important in education. The amalgam of articles that follow reflect upon what this process might look like.

This issue is divided into four sections.

Editors' responses to the topic of tradition and change

First, the sub-editors for this issue, four students in Year 12, reflect on tradition, change and what these mean for them as students. They reflect on Eton as a school with a long history and whether the traditions of the school are still relevant; they discuss educational technology and whether it can replace teachers; they debate whether teaching at Eton can be described as traditional; and lastly, they look at motivation and how what we now know about the science of learning might shape how teachers try to motivate students.

Changing perceptions and questioning practice

The second section takes a whole-school perspective and looks at teaching, school culture, and performance. Bill Lucas provides a framework for expansive education; Bruce Collins draws from his experience in changing the school culture through collective responsibility and reframing perceptions of shame; and in their co-authored article, David Weston and Ian Campbell discuss change to performance management and review in schools to inspire future development. The section concludes with articles by Adrian Skilbeck and Jonathan Beale on the possible limits facing the science of learning. Skilbeck examines what it means to take education seriously through research-informed approaches towards education. Beale outlines some of the limits of the science of learning by describing where it risks becoming a form of 'scientism'.

Changing practices and reflections

The third section comprises a number of pieces which cover individual research projects, reflections, or experimentation in the classroom. The articles in this section look at motivation, memory, empathy, subject-specific questions, technology, and AI. The wide range of topics covered is testament to the plethora of questions facing educators when it comes to the evolution of teaching in light of the developments in the science of learning and educational research more broadly.

Interdisciplinary research collaborations

The last section acts as an extended case study. The articles in this section piece together the story of how universities, schools, and research organisations can collaborate to change or inform teacher practice. The different viewpoints of the contributors in this section – from the Director of BERA, an academic at Oxford University, a school Research Lead, and teachers – describe the process of collaboration. By bringing down institutional silos through the sustained efforts of educators, change can happen where it matters the most: in the classroom.

THE CRISIS HAS GENERATED GREATER DISCUSSION OF QUESTIONS CONCERNING THE ROLE, FORMAT AND PURPOSE OF EXAMS

TRADITIONS AND CHANGE: VIEWS FROM A PUPIL

Flynn Whittaker | *Year 12, Eton College*

When people think about Eton College, some of its traditions tend to jump to mind. Having asked my housemates, school dress, chapel, the unique sports, the unique punishments and the single-sex nature of the school were those most often mentioned, and would probably reflect the pre-conceptions of public and tourists. However, in this age of global social change, it seems increasingly to be the case that Eton should make a few concessions. In particular, the chapel, uniform and sanctions are traditions which are considered by some to be in need of reform. Whether this is wise is something that requires careful thought.

One dimension to be considered is what makes this school, or any school, the kind of successful institution that parents want to send their children to. The facilities and school infrastructure are certainly part of this decision. The great quality of teaching is also undeniable. However, these can be found in many schools around the world. It can be argued then that a big draw to the school is the traditions. Traditions are what make an institution unique. For this reason, traditions should be best left to evolve themselves, and neither submitted to enforced change nor prevented from forming.

Traditions become a part of a school's fabric simply from being long-lasting aspects of daily life. Many traditions at Eton, such as the bizarre nomenclature or the structure of sanctions, have endured due to a lack of motivation for change. To attempt to change words to which we have we become accustomed after a period of exposure, or to replace a sanction with a comparable alternative, can seem impractical and needless respectively. Further, traditions that are easy or appear logical to change must have survived due to the perceived impact its removal would have had. Unfortunately, as traditions are so unique, it is near impossible to look for comparable examples to predict these possible impacts.

Historically, these realities are reflected in the record of changed tradition. Take school dress (uniform) as an example of a tradition under constant scrutiny. Although it seems near-unchanged since Victorian times, there have in fact been a number of changes: the top hats, variations in uniform by height, and Pop (prefect) wax hat stamps have all disappeared, each as a result of a social change. For example, top hats became no longer a requirement in 1948 when silk became more scarce during post-war rationing and supply chains to the Empire were under question. The Provost and Fellows (the governing body) even had a committee for the matter, before settling on their conclusion. Top hats immediately became a lot rarer, although not prohibited until the incumbent Headmaster Chenevix-Trench codified dress in 1964. Although both these instances show that traditions and rules can change, it literally took a war to instigate the first change, and a new, liberal, Headmaster to complete the progression. Furthermore, there were considerable issues caused by this change in top hat rules, including an anonymous letter sent to the Eton Chronicle in 1953, stating;

'DEAR SIRS,—Let it be hoped that in Coronation year, Etonians may once again have the privilege of wearing the Top Hat. Let it be remembered that the price is reduced when the hats are sold in quantity.'

This nostalgia for top hats in 1953 would probably be replicated by the abolition of school dress now.

These reflections on the history of changing traditions are of interest because, with no exactly comparable environment to study the potential effects of such a change, the past is our only point of reference. One might argue that this example indicates that change to traditions should only be enacted in circumstances of wider change, and only having considered and accepted the likely consequences of these actions.

In 1972 an instance of great social change hit Eton, along with the rest of Britain. Eighteen students had snuck out during the miners' strikes to a 'rock-n-roll jamboree' in casual change, and for their trouble were temporarily suspended. However, the resulting student backlash and demonstrations led to the allowance of casual dress in the school within strict parameters. Although the contemporary social change was unparalleled, and the laying of the draconian rules seems insignificant in comparison, there were still ramifications. The *New York Times* lamented at the time that the allowance of casual change and the abolition of top hats would come as a great 'disappointment to American tourists … capturing for immortality with cameras the depressed demeanor of a youth of 13 in penguin attire.'[1]

The government itself has weighed in on the value of traditions, or at least traditional institutions and actions in independent schools, with extensive reports and commissions. The first major one to consider traditions was the Royal Commission of 1861 and the ensuing 1868 Public Schools Act. Among its numerous findings, the recommendations of, 'The introduction of new branches of study, and the suppression of old ones', prompted a major break from tradition. A second example of governmental intervention is the 1968 Newsom Report following the 1968 Royal Public Schools Commision. However, in this case, it first lauded the Eton tradition of having both a Dame and a Housemaster, writing, 'Children need counsel and advice from their elders of both sexes', showing a clear nod to a beneficial tradition. This is in stark contrast to the extensive criticism of many facets of daily life, for example, 'Personal fagging, like beating by prefects, is a type of excessive authority which would be deeply resented by the vast majority of children in the maintained sector'. Following such criticisms, extensive change to daily life followed in this era. Coal fires were phased out, fagging abolished, rooms and boarding houses fully incorporated and standardised,

and subjects formalised. However, the conditions such as regular beatings and lack of central heating that were being complained about were excessively anachronistic to the point of government intervention over human rights concerns. Modern complaints over school dress or minor punishments (such as 'tardy book') bear no comparison. The change in traditions reflected a fundamental change in the school's attitudes to its responsibilities to pupils.

Although education should aim to attain rational action, I think that traditions can help learning. If a student does not have to constantly think about, for example, their clothes, they are able to better focus on study. Similarly, the rigid structuring of the day and enforced rituals such as chapel and house sports remove time spent planning the day ahead, and give pupils a break from academic endeavours. Scholars, such as Weber, have been pessimistic about the impacts of traditional hierarchies; I draw an altogether more positive conclusion from history, psychology, and politics. I argue that traditions should not be changed flippantly nor without sufficient cause. Historic changes, normally required due to social change, always had an abundance of provocation, such as from war, the government of the day or pupil riots. And yet the implications were not and cannot be predicted, due to the 'natural selection' of traditions throughout time. Moreover, the positive effects of traditions, as a steady hand to guide daily life and lift burdens from the rational mind, as well as any particular advantages, should not be underestimated. Traditions should only be changed with the utmost respect.

[1] New York Times, 14.11.1972, Page 12.

ALTHOUGH IT SEEMS NEAR-UNCHANGED SINCE VICTORIAN TIMES, THERE HAVE IN FACT BEEN A NUMBER OF CHANGES: THE TOP HATS, VARIATIONS IN UNIFORM BY HEIGHT, AND POP (PREFECT) WAX HAT STAMPS HAVE ALL DISAPPEARED, EACH AS A RESULT OF A SOCIAL CHANGE

HOW WILL TECHNOLOGY CHANGE TRADITIONAL EDUCATION, AND COULD IT EVER REPLACE TEACHERS?

Rowan Vinayak | *Year 12, Eton College*

According to a report by Smoothwall, 96% of teachers believe technology has had a positive impact in the way children participate and learn in lessons (Rogers, n.d). In addition to that, the former Secretary of State for Education, Damian Hinds, recognised that technology can be an effective tool to help reduce workload, increase efficiency, engage students and communities, and provide tools to support excellent teaching and raise student attainment.

Yet it is questionable whether it can replace the role of the teachers. Why is this so?

Technology makes independent learning easy through online courses, videos or apps. However, all of these need teachers to create them. Children need to learn to use computers to do online sessions that are taught by teachers. In addition, teachers provide more to students than just education; they are mentors, role models and instil key skills into children such as time management and communication. Human interactions and skills cannot be replaced by technology.

There are online platforms such as MOOCs (Massive Open Online Courses) or Coursera, which has over 45 million users. A verified certificate with them will cost between £40 and £100. Thus, MOOCs have the potential to compete with universities and have as much value as a university degree. Their price and convenience can make them appealing compared to attending university. So why haven't MOOCs caused universities to disappear? The cost of going to university is (hopefully) offset by the fact that employers favour employees who have demonstrated commitment and effort towards something. Moreover, Lederman (2019) highlights the drop in how many people register to start these courses in the last couple of years. It can be argued that the lack of human interaction, the lack of collaboration with peers, which allows you to dig deeper into content or receive reassurance might be one of the reasons for this.

This is not to say that there are not many examples of technology changing the traditional classroom education of students for the better. Apps have become an ever more popular way of learning. By 2017, Quizlet had over 50 million monthly users and by 2018, Kahoot had over 70 million monthly active users. They can be very engaging tools to use in the classroom. Another example is how modern languages can be learnt in a number of ways utilising technology: through quizlet, podcasts, videos and most likely more ways in the near future.

Educational technology will very likely bring some of the most remarkable changes in the classroom. It is still early to assess the impact but it is worth mapping the journey.

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TO WHAT EXTENT IS ETON'S TEACHING TRADITIONAL?

Oliver Lewey | *Year 12, Eton College*

Eton is often perceived to be a bastion of tradition. We wear uniforms designed centuries ago and learn in buildings some of which are hundreds of years old. However, whilst it is easy to see Eton as an archaic institution, were we to look inside the classroom, would our perception change?

On the one hand, our education is not too dissimilar to that of the Victorians. There is an emphasis placed upon trials (internal tests) where one is expected to be able to recall lots of facts. Charles Dickens' Hard Times is in part a critique of an approach that places the learning of facts as the cornerstone of Victorian education. In this sense, there is an argument to be had that not a lot has changed. When one opens an examination paper, one is often confronted by a series of questions that require facts. This is not something that merely applies to science or geography exams. Even in more abstract subjects like divinity, there are several questions that are devoted in their entirety to the recollection of facts. Therefore, in this sense, Eton's teaching is geared towards a model of education that is over one hundred years old.

However, there is a case to be made that Eton is at the forefront of modern education. iPads, for instance, are a clear indication of the school's modernity. This is a step that many schools, be it in the private or state sector, are yet to make. Indeed, the extent to which technology is used in lessons is an indication of just how quickly the school looks to evolve. Fifteen years ago, all homework was completed with pen and paper and there was no Firefly (an online platform) to remind boys of their tasks; today the story is completely different. Many boys depend upon their devices to do work and have made checking Firefly a part of their daily routine. As a school, we use far more technology in the classrooms than most, which one could argue is indicative of how much the school values the advancements in technology and what they have to offer to modern education.

In addition to this, the school seems to be putting a lot of resources into trying to evolve how it teaches boys. The creation of The Tony Little Centre (CIRL) has been telling of how important being innovative and creative with education is to the school. Such emphasis and investment being put into an area that is specifically designed to advance innovative teaching and learning methods would suggest that Eton is by no means traditional in its approach to education. On the contrary, this would imply that the school is instead looking to pioneer new research into education so as to become a modern and forward-thinking educational institution.

Overall, whilst Eton definitely has fragments of its former self still visible in the way it seeks to educate, I believe that its teaching is not traditional. Evidently, it is hard not to place a lot of emphasis on what the public exam boards require while trying to objectively gauge students' ability as best they can. However, from my experience, teachers do try and explore beyond the syllabus and utilise modern techniques while also keeping to methods they know work well. The school seeks to broaden the repertoire of teaching methods teachers are adept at using, so that they combine their experience and expertise with traditional methods with innovative methods that are supported by an evidence-base as effective.Therefore, I would say that Eton searches for the best way to teach, be it traditional or modern. Perhaps a combination of the two is the best approach and one which can benefit pupils.

SUCH EMPHASIS AND INVESTMENT BEING PUT INTO AN AREA THAT IS SPECIFICALLY DESIGNED TO ADVANCE INNOVATIVE TEACHING AND LEARNING METHODS WOULD SUGGEST THAT ETON IS BY NO MEANS TRADITIONAL IN ITS APPROACH TO EDUCATION

THE ROLE OF COMPETITION IN MOTIVATING STUDENTS

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Twice per year Eton boys are presented with a 'trials card': a sheet of paper summarising their performance in internal examinations. Among other things, the card contains the boy's numerical ranking relative to his cohort. Faculty members have been debating for some time whether this practice needs to be changed. . Proponents argue that it promotes 'healthy competition' which motivates the boy towards academic success. Opponents argue that it demotivates those who rank towards the bottom end: they stop trying and blame their 'failure' on lack of revision. However, I would contend that the argument runs deeper than this. The root question is not whether rankings are motivational, but whether competition is a healthy basis for motivation in the first place.

As Galloway et al. (2004) point out, educational policy in Britain in the late 20th century was based on promoting competition. This caused students to define 'success' in terms of their relative performance rather than their independent progress. However, judging success only by comparison to others may harm the wellbeing of students. As Atkinson (1964) describes, the very concept of this success necessitates the possibility of failure. In this sense, boys can be driven more by a fear of failure than by a desire to succeed. Martin & Marsh (2003) elaborate on the dangers of this, concluding that students become more prone to 'anxiety, low resilience, and vulnerability to learned helplessness'. The last of these often applies when boys are numerically ranked. 'Learned helplessness' refers to a situation in which the student stops trying because s/he believes that her or his actions will have little effect. Even if the student has a good grasp of the subject, s/he will still see her or his performance as a 'failure'. This has a clear demotivational effect as well as an inevitable impact on the student's self-esteem. The ranking system implies that education is a zero-sum game – it is not possible for all students to succeed. But why should this be the case?

It can be argued that competition has a motivational effect on some students (Kilduff, 2014). If the ranking system were abandoned, students might struggle to find new ways to motivate themselves. Why is motivation so difficult to achieve? Albrecht & Karabenik (2017) argue that education should be framed as relevant to life after school. Students can thus be motivated by understanding the applications of their learning. This is a tempting approach, but somewhat unrealistic. It is very hard to extract real-world applications from many syllabi, especially at a GCSE level. Even then, teachers might struggle to convince students that the applications are relevant to them personally. At a sixth form level, the relevance approach to motivation might have more success, especially as students have specialised in subjects which they find interesting. Still, students tend to look at the very immediate outcomes of their actions.

Ideally, students would be intrinsically motivated to learn – that is, motivated simply by a desire to understand instead of external pressures, examinations, or university prospects. This type of learning has many benefits. Students have greater satisfaction with the school experience because they actively enjoy learning. Furthermore, the quality of their learning improves (Sheldon & Biddle, 1998). However, achieving this intrinsic motivation is by no means an easy task.

What can be successful in instilling motivation?

Students must first discard their fear of failure. Humans, and especially teenagers, are driven by their need to achieve competence (Newman et al., 1992). In order to actively enjoy learning, students must be encouraged when they get an answer right, and not put down if they make a mistake. This gives students a willingness to venture ideas, which invigorates class discussion. Furthermore, students should they feel that they are making a positive contribution to the group (Bransford et al., 1999). Group projects or class discussions are an effective way to foster this feeling, and teachers should do their best to ensure everyone's contributions are considered. Teachers could also experiment with student-led teaching, which "empowers students with direct ownership of the learning experience" (Marvell et al., 2013). This might seem daunting to a 16-year old but if this becomes the norm in the classroom, students will embrace it.

All these techniques are worthy of consideration. However, as Galloway et al. (2004) note, "...there is no consensus about the nature of motivation, nor even about the most appropriate way to analyse it." With this in mind, there is no one system which can motivate everyone. The onus is on the student to develop his or her own method, and the school can only do its best to provide an environment which makes this as easy as possible. Despite some of the concerns voiced, there is still a place for competition in education. After all, a sense of competition prepares students for the competitive world they will enter after university. However, what should underpin motivation is an environment which makes learning as enjoyable and as rewarding as possible.

STUDENTS MUST FIRST DISCARD THEIR FEAR OF FAILURE. HUMANS, AND ESPECIALLY TEENAGERS, ARE DRIVEN BY THEIR NEED TO ACHIEVE COMPETENCE

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THE BEST OF BOTH WORLDS: WHY SCHOOLS NEED TO AVOID SIMPLE BINARY ALTERNATIVES TO STAY RELEVANT

Bill Lucas | *Professor of Learning & Director of the Centre for Real-World Learning, University of Winchester*

The metaphors we use about schools tell us much about our views of what their purpose is. Tabula rasa. Empty vessel. A key to unlock possibilities. A prison. A voyage of discovery. A garden. A factory. Where curriculum is 'delivered'. Where curiosity is cultivated. And so on. The tabula rasa image suggests an unchanging world in which adults decide what knowledge needs to be 'etched' on the blank slate of their pupils' minds, while the discovery journey indicates a less certain view on what is needed today. Such comparisons often indicate either a yearning for past times and tradition or a dissatisfaction with the status quo and a preference for change. Few images combine a love of the past and of the future, a delight in tradition and with change; but such fruitful combinings are exactly what is needed in an ever more polarised world.

As I write, the Covid-19 pandemic has closed schools, abruptly stopping GCSE and A level examinations and turning kitchens into temporary class rooms. Virtual teaching or flipped learning, once seen as the method of choice of the futurists, is now an essential tool for those favouring more traditional approaches. Teams and Zoom are the new blackboard and chalk.

The false opposites virus in education
It has taken a pandemic to make us come to a very pragmatic accommodation of tradition and change in our current responsibilities as educators. Of course debates about the purpose of schooling are not new in European education. Jean-Jacques Rousseau's fictional work *Emile* (1762) argued that children were essentially good and not,

as the Puritans had suggested, wicked and that pupils should be given more freedom to explore their senses rather than being constrained by adults. Rousseau's ideas were seen as so dangerous that the book was publicly burned. In fact, his arguments were subtler than his progressive mantle has allowed many to appreciate. It took Friedrich Froebel, John Dewey, and Maria Montessori to interpret them in more practical ways. You could argue that Bedales in Hampshire and School 21 in London are exemplars today of a more nuanced version of genuinely radical thinking, both institutions stressing the need to blend head, heart and hand, exploring the best of the past and the future.

Roms, Trads and Mods
In Educating Ruby: what our children really need to learn, (2015), Guy Claxton and I pictured these different voices in education as warring 'tribes'. The Roms or romantics look back to Rousseau for their inspiration. The Trads or traditionalists tend to have an idealised version of grammar school curriculum as their inspiration. In a light-hearted way we tried to move beyond the binary positions - Roms and Trads - by inventing a third tribe, the Mods. Mods, the modest or moderate tribe, see education as an altogether more complex and subtle phenomenon combining the best of the past with the most thoughtful imaginings of what is yet to come.

In practice, it is in the classroom where teacher attitudes to the purposes of education are experienced most clearly. Some while ago, I described the pedagogical choices teachers are faced with as a series of ten continua, as seen in Figure 1.
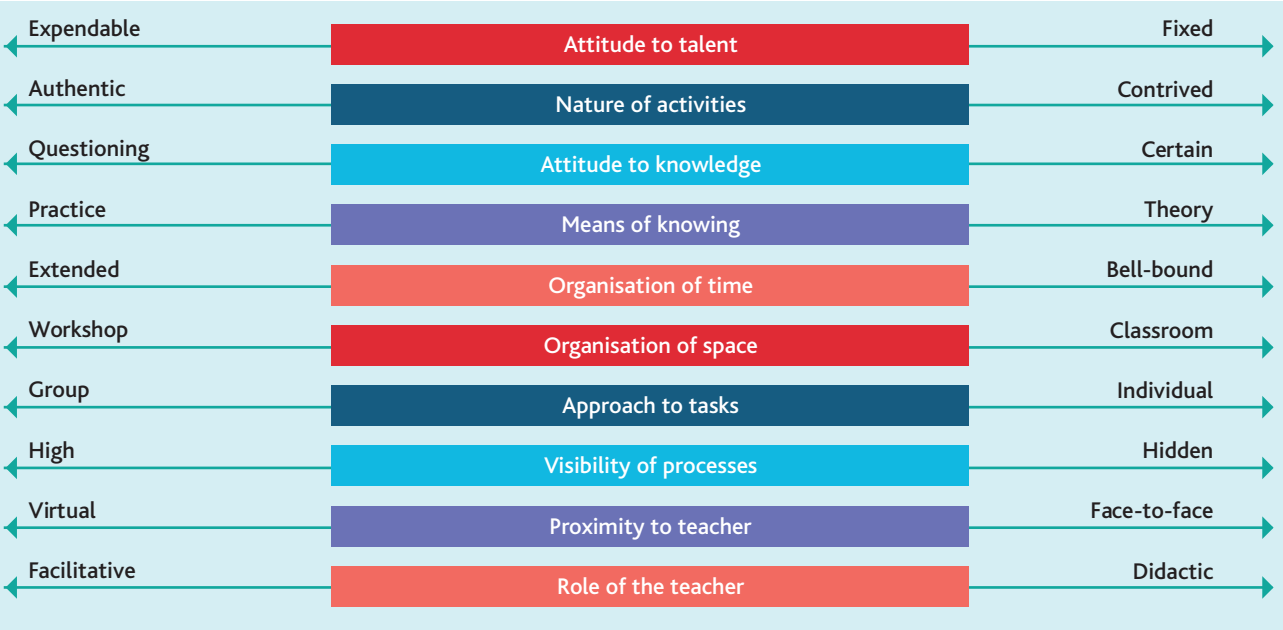

Figure 1 – Ten choice points for teachers (Lucas, Claxton and Spencer, 2013).

I used to think that how teachers choose to teach was a matter of belief, Trad or Rom or Mod to use the language of *Educating Ruby.* To take the last of these continua for example, a teacher might choose to be almost entirely didactic believing that, as a knowledgeable person, she should pass on the best that has been thought to her pupils; or largely facilitative, seeing every child as an innately good 'Emile' capable of exploring the world with only scant guidance.

If we are going to move away from a fundamentally binary view of the demands of tradition versus the opportunity of change, it may help us to consider each of the ten alternatives in Figure 1, in the light of the kind of learning outcome we are wanting to achieve in any particular situation and then choose the most appropriate pedagogies.

1. Attitude to talent – expandable or fixed
Whether you are successful or not in the real world depends to a large degree on your mindset. Those with a growth mindset (Dweck, 2006) see the making of mistakes as an indicator of effective learning. They enjoy stretching themselves and are always looking to see how they could be 'even better if…'. By contrast those with fixed mindsets are more risk-averse and, wrongly thinking that their talent is innate, see little value in practising and putting in effort. They ascribe their success or failure in life (like their height or their eye colour) to their genes. Whether or not you agree with the way growth mindset has become something of an educational meme (as has been acknowledged by its creator Carol Dweck)[1] the essential validity of such approaches to developing resilient learners has been widely found in educational research (Lucas and Spencer, 2018).

2. Nature of activities – authentic or contrived
If your goal is to prepare learners for the real world, then schools may seem strange places. For their currency is the subjects which go to make up a school's timetable or curriculum rather than the future. David Perkins (2009) created a useful metaphor - 'playing the whole game of learning' - arguing that whatever we are teaching we should make the game worth playing, working hard at engaging learners and giving them choices wherever possible.

3. Attitude to knowledge – questioning or certain
In much school learning questions are asked and answers are given. There is often one correct answer. But as we get older we realise that the really interesting issues in life often have many interpretations. Ellen Langer puts this helpfully with her concept of 'mindful learning':

A mindful approach to any activity has three characteristics: the continuous creation of new categories; openness to new information; and an implicit awareness of more than one perspective.

Langer has shown how 'could be' language from teachers invites learners to become more active, inquisitive members of the class, rather than to see themselves as 'merely' doing their best to understand and remember something that is already cut and dried.

Of course there are many occasions when certainty is smart: when life is endangered; when dealing with some aspects of morality and so forth; just as there are questions of science and mathematics where we are still seeking answers and have only theories to offer at this stage.

4. Means of knowing – practice or theory
A child touches a hot log on an open fire for the first time and reacts with a cry of pain. She may go on to experiment and find out whether all wood in fires is painfully hot or she may have reached a compelling abstract theory that fire causes heat and that wood burns. Experimenting with burning wood is an extreme case of practical learning by experimentation. In a classroom context, it is more likely that a teacher will be considering what theoretical understanding will enable a more complex calculation, which knowledge of the use of tenses will enable a more fluent essay, when it is best to learn to play minor and major chords, or when to understand that the third note will be flattened in the minor key.

Having a theoretical understanding is an essential aspect of learning to transfer learning from one context to another; being encouraged to practise experimentally, within reason, promotes learner engagement.

5. Organisation of time – extended or bell-bound
The unit of work in the real world is a day, not an hour long lesson, and almost every teacher will admit to the frustration of the bell going just when things are getting interesting. Mihaly Csikszentmihalyi coined the word 'flow' to describe the state of mind which learners can achieve if they are deeply absorbed in their learning, an optimal experience in which learners find deep fulfilment and in which they become unaware of time. To achieve the state of flow three things need to be in place: the task needs to be sufficiently demanding and engaging, the learner needs to have enough skill to be able to tackle the task without undue anxiety or stress, and there needs to be sufficient time available.

Even within a typical school timetable teachers can transcend the compartmentalisation of the curriculum by explicitly making connections to other areas and, from time to time, thinking in half-days, whole days and even whole weeks for the planning of learning.

6. Organisation of space and resources – workshop or classroom
How a space is laid out contains clues as to the views of the teacher who has organised it. If tools are locked away in cupboards it suggests that tools are controlled by the teacher rather than freely accessible. If dictionaries are stored on high shelves, it implies that students must ask the teacher before using one. If work in progress can be left out safely, then it might suggest that the design process is seen as a useful part of making something. If drawers and cupboards are clearly labelled it might be assumed that students are to be encouraged to be resourceful and explore and use their contents. And so on.

[1] https://www.tes.com/news/growth-mindset-where-did-it-go-wrong

Of central importance is the desirability of providing opportunities for 'work in progress' to be stored, shown and seen and explored by other students. In an ideal world teachers will choose to model their own creative or learning endeavours by sharing their works in progress too, either literally or through descriptions of their own learning.

7. Approach to tasks – group or individual

In the real world team-work is an essential way of working and learning. The ability to work collaboratively in groups to solve problems is one of the attributes cited by employers across the world as desirable.

As well as the social intelligence implied by watching and noticing others there is a specific way that young people can help each other. Normally referred to as peer learning, this kind of group working occurs when learners explicitly seek to learn from and with each other. David Boud's description makes this clear:

Students learn a great deal by explaining their ideas to others and by participating in activities in which they can learn from their peers.

In 2015 the influential Programme for International Student Assessment (PISA) administered the first ever test of collaborative problem-solving.[2] But its impact has yet to be felt in schools. The idea that individuals not groups are tested, that has been with us for so many centuries, remains influential. Until collective endeavour is assessed it is likely to remain valued more on the sports pitch and in the concert hall than as an integral part of learning in classrooms.

8. Visibility of processes – high or hidden

Buildings used to hide their central heating ducts and lighting cables until the Pompidou Centre in Paris made a feature of them. John Hattie's seminal book, *Visible Learning,* (2009) is explicit about his central contention in its early pages:

'It is critical that teaching and learning are visible. There is no deep secret called 'teaching and learning'; teaching and learning are visible in the classrooms of successful teachers and students….What is most important is that the teaching is visible to the student and learning is visible to the teacher.'

The more that learners see what is going on as they are learning it, the better they will be able to understand and apply it in different contexts.

9. Proximity to teacher – virtual or face to face

In today's temporarily 'locked-down' world this question hardly needs a further thought. Screen sharing today is simply yesterday's blackboard writing.

But all of us need to think more deeply about how we can use online to help students develop appropriate learning dispositions and to access worlds beyond the school gates as well as learning how to build in physical movement rather than simply staring at a screen.

10. The role of the teacher – facilitative or didactic

From the moment teachers enter a room full of students they are faced with choices about the role they play. But as even this brief exploration of the other nine decision points in Figure 1 has illustrated, the computations that teachers make are complex.

The traditional view of teaching is that teachers should be didactic and students should take their lead. The more progressive view is that students are facilitators of their learning with teachers somehow on the side. But such simple binary comparisons are deeply unhelpful. They tend to produce teachers who defend positions they think they should have rather than inviting them and their colleagues to think about what blend of teaching methods will be most effective for students in a specific context.

Perhaps the metaphor I am reaching for to describe schools today is of a bridge linking past and future: a bridge with trees growing on it, rather like the one planned for the Thames but existing only as a figment of my imagination. This clever bridge will somehow winnow out the best of yesterday to take with us on our journey into an unknown future.

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THE IMPACT OF SCHOOL CULTURE ON TEACHING AND LEARNING

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Brené Brown (2012) asserts that in her years of research into shame and vulnerability she has 'never been to a shame free school' (p. 189). She further posits that 'Shame breeds fear' and, in the process 'it crushes our tolerance for vulnerability, thereby killing engagement, innovation, creativity, productivity, and trust' (2012, 188).

Before joining the International Boys' Schools Coalition in April 2019, I taught at an independent boys' school in South Africa. In addition to teaching English, I served as the Director of Academic Innovation, a role that encompassed research, curriculum design and the professional development of staff. In that role, I was tasked with developing a robust program for the professional growth of the school's teaching staff. We became more intentional about regular staff development and designed an offering with a multiplicity of opportunities that – in theory – should have translated into a shift in classroom practice, an embracing of new ideas, creativity in curriculum innovation, and a renewed commitment to personal mastery. Both a framework and opportunities for curriculum innovation existed but we were finding little evidence of this translating into a real change in classroom practice. The deeper we dug and researched, the more we realised that a culture of shame had developed in our organisation.

Peter Sheahan[1] posits that shame kills innovation and leads to people holding back on ideas, resisting giving necessary feedback to superiors and fear of speaking up in front of clients (or parents, in the case of schools). Furthermore, he mentions that because of the deep fear humans have of being wrong, organisations are at risk of becoming stagnant and failing to move forward (Brown, 2012, 65). Senge asserts that leaders of successful teams are those who are 'working to build new types of organizations—decentralized, non-hierarchical organizations dedicated to the well-being and growth of employees as well as to success' (2006, 15). Bridwell-Mitchell explains that 'researchers who have studied culture have tracked and demonstrated a strong and significant correlation between organizational culture and an organization's performance' and describes the building blocks of an organisation's character as follows: 'culture is connections' and 'culture is core beliefs and behaviours' (Shafer, 2018).

How then does culture connect to teaching and learning? I would assert that there is a direct correlation between a positive school culture and the effectiveness of teaching staff. Motivated and committed teachers who buy into a school's vision give students their best. Similarly, in schools, negative organisational cultures filter down and impact students. In Brown's research, 85% of interviewees recall incidents at school that were significantly shaming, to the extent that these incidents changed the way they thought of themselves as learners (2012, 189-190).

School leaders need to reflect on the culture of their schools. Negative cultures can develop over time and it's counterintuitive to assign blame. However, once one recognises that a problem exists, it's incumbent upon courageous leaders to make the necessary decisions to shift to a culture that unlocks engagement, innovation, creativity, productivity, and trust.

A good place to start is to reflect on the following ten-point checklist based on Sheahan and Brown's definition of shame culture (Brown, 2012, 65, 189).

- Do staff and students hold back on ideas?
- Do staff and students fail to give managers or superiors much needed feedback?
- Are staff afraid to speak up in front of parents and are students afraid to speak up in front of teachers?
- Do staff and students have a deep fear of being wrong?
- Do staff and students have a deep fear of being belittled?
- Do staff and students have a deep fear of feeling less than, or not enough?
- Are blaming, gossiping and favouritism markers of your organizational culture?
- Is there evidence of bullying by leaders in your organisation?
- Is there evidence of public criticism and reprimands in your organisation?
- Does your school have reward systems that belittle, shame, or humiliate staff or students?

Furthermore, do your teachers and students have the permission to pursue new ideas? Are teachers and students given the tools to succeed when implementing these new ideas? Do you give them the freedom to fail while trying, and to learn from those failures? And, does your organisation provide ample support for those who need to get back up and try again?

Shifting culture is a challenge for many school leaders and is possibly best summarised by Senge:

Argyris argues that most managers find collective inquiry inherently threatening. School trains us never to admit that we do not know the answer, and most corporations reinforce that lesson by rewarding the people who excel in advocating their views, not inquiring into complex issues. (When was the last time someone was rewarded in your organization for raising difficult questions about the company's current policies rather than solving urgent problems?) Even if we feel uncertain or ignorant, we learn to protect ourselves from the pain of appearing uncertain or ignorant. That very

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process blocks out any new understandings which might threaten us. The consequence is what Argyris calls 'skilled incompetence'- teams full of people who are incredibly proficient at keeping themselves from learning. (2006, 25)

What we don't want in schools is teachers who display Argyris's skilled incompetence. We want to create cultures of learning where both teachers and students can thrive.

As a school, we decided to address the culture of shame that – for whatever reason – had surfaced in our organisation. Challenged by the work of Brown on shame and vulnerability, and Senge's insights into the creation of learning organisations, we worked intentionally towards creating a culture where the following guiding principles became our plumbline:

Guiding Principle 1: Be Brave; Show Up

We wanted our teachers to try new things, even if it meant failing. We wanted our teachers to strive valiantly, to get back up, to go the extra mile, and to show enthusiasm and devotion. In order to encourage this, we encouraged school leaders (Headmaster, Senior Leadership Team, Heads of Departments, and others) to model bravery, to admit their failures, to ask for help and to model trying new things. This proved a powerful contributor to future success in teaching and learning. We were challenged by Sheahan's reflection that 'This notion that the leader needs to be in charge and to know all the answers is both dated and destructive. Its Impact on others is the sense that they know less, and that they are less than' (Brown, 2012, 65).

Guiding Principle 2: In the Arena Together

Instead of working against each other, we aimed to paint a clearer picture of the school's shared vision and encouraged everyone in the team to pull in the same direction. Senge claims that 'most players see their job as managing their position in isolation from the rest of the system. What is required is to see how their position interacts with the larger system' (2006, 48). Moreover, Brown suggests that she hasn't 'encountered a single problem in schools that isn't attributed to some combination of parental, teacher, administrative, and/or student disengagement and the clash of competing stakeholders vying to define one purpose' (2012, 16). We wanted to create an environment in which all stakeholders not only understood the vision but contributed to it. As Senge asserts, 'the practice of shared vision involves the skills of unearthing shared 'pictures of the future' that foster genuine commitment and enrollment rather than compliance' (2006, 9).

Guiding Principle 3: Wired for Connection

Schools are communities. We wanted to strive for an authentic community. Bridwell-Mitchell's definition is that 'in a strong school culture, there are many, overlapping, and cohesive interactions among all members of the organization' (Shafer, 2018). As a result, we actively pursued open channels of communication and tried to rebuild trust in the system. One of these initiatives was to be more transparent about the discussions taking place at school executive level.

Guiding Principle 4: Being Vulnerable

Challenged by Brown's work, we began to strive for a culture that embraced vulnerability because we wanted our teachers to be daring leaders. We wanted to see, amongst others, 'adaptability to change, hard conversations, feedback, problem solving, ethical decision making, recognition [and] resilience' (Brown, 2018, 43) in our teaching team and students. All of these have vulnerability as their foundation. We wanted our school community to understand the things that give life purpose and meaning.

Guiding Principle 5: You are Enough

We live in a world that sends us the message that an ordinary life holds little meaning. Students and teachers constantly feel the need to measure up. However, we wanted our school culture to be one where community members know they are valued for who they are, and that what they bring to the community is enough. Overcoming a scarcity culture like this is hard work. It requires an awareness, commitment and intentionality from school leaders every single day.

These five guiding principles have helped to develop a culture of learning for staff and students where deep thinking has become commonplace and new ideas are given room to breathe. They have underpinned a culture where nothing is expected of teachers unless they have been empowered to do so. Freedom to try new things has become the norm and people celebrate the growth potential that comes from engaging with failed attempts. Generative listening and a desire to learn have become markers of culture, and people are more supportive as a result. A strong bent towards personal mastery has ensued, marked by a strong desire to learn and solve problems, and ask penetrating questions. For schools, the enquiring minds of their teachers should be one of their most valuable assets.

Ultimately, schools need to make the cultural shift to create a rich environment for teaching and learning. These cultures value the giving and receiving of help, the giving and receiving of authentic feedback, the active resistance of gossip, name-calling and favouritism, replacing blame with accountability, and the intentional building of community. This will warrant courageous leadership and decision making and – possibly most importantly – requires school leaders to turn 'the mirror inward; learning to unearth our internal pictures of the world, to bring them to the surface and hold them rigorously to scrutiny' (Senge, 2006, 8).

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IMPROVING PERFORMANCE: FROM TRADITION TO CHANGE

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This year's demise of public exams is a golden opportunity to revolutionise the way we appraise and performance-manage teachers. Research suggests that many traditional approaches are, in any case, too expensive, time-wasting and not effective indicators of actual performance. A few schools are pointing to a new way and it's time we learned from them.

In a recent study we conducted, we surveyed 250 school leaders about areas of their school's professional environment that needed improvement. Their top answer was the creation of a genuinely non-bureaucratic and developmental performance management system. When it came to wider improvement priorities, a huge priority (noted by 45%) was the development of pedagogical coaching. These numbers suggest that leaders are searching for more effective ways to support and develop staff while maintaining a suitable level of accountability.

Every year we interview hundreds of school staff through our CPD Audit. Headteachers and teachers repeatedly tell us how frustrated they are with traditional approaches to performance management. School leaders complain that they struggle to use appraisal systems to gain any traction for their school improvement priorities and their staff feel demotivated. Earlier this year, we co-published research with NFER (Worth and Van den Brande, 2020) which showed that teachers felt they had low levels of autonomy over their own professional development goals (often set through appraisal), despite this area's importance in job satisfaction and retention.

Back in 2012, the UK Department of Education introduced the Teacher Appraisal and Capability reform. It proposed a new policy model of revisiting schools' performance management systems which aimed to ease the practices for assessing and monitoring teachers' performance, and deal with lack of capability. Eventually, schools can remove teachers from their post within 9-months if they don't meet the standards of practice. The question is whether this 'shape up or ship out' approach ultimately leads to better outcomes for both pupils and teachers. There are signs it doesn't; rather, it might be producing several unintended effects on teachers, such as 'increased workload [which leads] to poor health and feeling undervalued' (for example see Ofsted, 2019, 6).

Many schools have already changed appraisal, of course. Schools are rapidly abandoning graded lesson observation – even in 2018 over two third of teachers reported (Teacher Tapp) that this practice no longer happened in their school. However, appraisal is often strongly tied to exam results and book scrutiny, and decisions on career advancement and pay progression are influenced by judgements made against these processes.

Against this background, what does the research tell us that we need to do?

The Centre for Evidence-Based Management (CEBM) explored appraisal across many sectors and found that in complex tasks (such as teaching), setting outcome-focused goals is not always effective, but 'behavioural and learning goals remain the most effective way to drive performance' (CEBM, 2018). When it comes to feedback on performance, many schools opt for feeding back judgements and data, but CEBM found that 'it is people's reactions to feedback, and not the feedback itself, that determine how it affects performance'. In practice, this means putting processes in place to check teachers' immediate satisfaction with appraisals, as 'the most central factor in how people respond to feedback is whether they see it as fair.' Furthermore, Shaun Pichler explored the research to find that, 'rater-ratee relationship quality is more strongly related to appraisal reactions than appraisal participation or performance ratings' (2012, 720); while CEBM (2018) also find that, 'The most central factor in how people respond to feedback is whether they see it as fair'.

This shift away from incentivised performance against hard outcomes is also backed up by the Education Endowment Foundation (EEF) who find that 'approaches which simply assume that incentives will make teachers work more effectively are not well supported by existing evidence' (2018).

These findings are further reinforced by school-based research on teacher improvement from Kraft and Papay (2014) who found that a key determining factor in whether teacher performance increases is 'the extent to which teacher evaluation provides meaningful feedback that helps teachers improve their instruction, and is conducted in an objective and consistent manner'. We need to ensure that teacher voices are heard during the appraisal processes and that they're supported to move towards development targets that are meaningful.

So, as we look toward a year where there will be no exam results and very limited internal data, we now have a golden opportunity to redesign our national approach to performance management. We can take heart from leaders such as Chris Moyse, Head of Staff Development at Bridgewater College Trust, who suggests in his blog a focus on 'getting better' rather than 'being good'. By encouraging staff to focus on a learning orientation over a performance orientation we can change the culture and give teachers the space to grow and develop in a way that will have the biggest impact on students. Lessons can be learned from the growing number of schools who have radically overhauled their systems, hitting the sweet spot where staff morale and buy-in is high, performance is improving and school improvement is given genuine traction with an appraisal system that produces real results.

Another example is the Notre Dame High School, Norwich, a Teacher Development Trust Network member and TDT regional hub, where they have successfully changed from a top-down performance management system to a more co-created 'performance development' system. Developmental conversations around goal-setting and identifying future needs are separated from light-touch accountability conversations, assessing teachers for continued performance against the Teacher Standards.

Appraisers and line managers are carefully trained to use coaching conversations. Senior leaders share a common agenda for performance development meetings, focused on co-constructed targets and asking helpful questions. This gives teachers a greater sense of agency in setting their own developmental goals.

The school has moved away from a 'what went wrong' mentality – staff agree that the aim of meeting should be to inspire future development, so the focus is on discussion on strengths and ensuring that there is an opportunity to check-in afterwards so that the individual being evaluated has had a healthy amount of time to reflect upon and process feedback.

Research suggests that the benefits seen from involving teachers in choosing goals but not giving them total control allows leaders to harness teacher autonomy to benefit pupils and staff (Maughan et al., 2012). Understandably, this can be quite challenging when leaders are responsible for pupil outcomes and whole school improvement. But the long-term benefits of allowing teachers to feed into their development goals in a structured way can create a dynamic and motivated team of teachers.

So let's use this difficult era to build something better for every teacher in every school, to create a genuinely developmental and supportive environment that's free of ineffective bureaucracy. To quote Chris Moyse from a talk he gave in 2020, we need a national shift in effort from 'proving' to 'improving'. And to quote Dylan Wiliam (2019), 'the recipe for improving teacher quality is very simple. Create a culture where every single teacher in the school believes they need to improve, not because they're not good enough but because they can be even better'.

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ARE THERE LIMITS TO THE SCIENCE OF LEARNING?

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In recent years, there has been a turn towards evidence-informed teaching and learning in education. The evidence that informs this practice is provided by the cognitive sciences – psychology, with its focus on the mind and behaviour and, perhaps to a lesser extent, neuroscience and its insights into the human brain. For educator Tom Bennett (in Hendrick, 2019), this is a period of renaissance in education in which no teacher should call themselves a professional unless they are familiar with the key literature from the learning sciences. For the American organisation Deans for Impact, the goal identified in their document *The Science of Learning* is nothing less than the transformation of teacher education and the elevation of the teaching profession, to be achieved through 'data-informed improvement', 'common outcome measures', 'empirical validation of effectiveness' and 'transparency and accountability for results' (Deans for Impact, 2015). Even the well-known advocate of knowledge-rich learning, E. D. Hirsch, has rejected the earlier influence on his thinking of the radical Italian political philosopher Antonio Gramsci, stating, 'In the end it doesn't matter what Gramsci said … since cognitive science clearly indicates that broad, commonly shared knowledge is essential for effective language use' (Hirsch, 2016, 157). Together, these examples give a picture of what it is to take education, in particular the importance of learning, seriously. In practice, being a good educator has come to mean someone who takes an active interest in the science of learning and who is up-to-date with innovation in education by engaging with the latest research. Practical and theoretical insights from the learning sciences are helping to improve standards of teaching and raise the attainment of pupils. Despite this, there are voices critical of the prominence given to the science of learning in current educational policy and practice. The most direct of these has been Jan Derry. Derry's work directs us towards the importance of the social world in which the mind is formed and human learning takes place, learning that is better characterised by reference to the norms of academic disciplines and inferential thinking; that is, the giving and receiving of reasons, rather than the acquisition, storage and recall of information.

Jan Derry: norms, reasons and inferences

Jan Derry (2020) has recently questioned the assumptions underpinning the current emphasis on cognitive load theory for our understanding of learning. Broadly speaking, she argues that the cognitivist approach of the learning sciences has been unable to do justice to what is distinctively human in our learning, by which she means we cannot ignore the role that norms, reasons and conceptual frameworks play in our lives. Derry contrasts this with the emphasis that is placed within current education policy and practice on the

acquisition of factual knowledge and the perspectives from cognitive psychology that provide the theoretical justification for both academic content and pedagogical strategies.

Given that Derry herself is not unsympathetic to the need to teach factual knowledge, what precisely is the nature of her criticism? Essentially, her argument is with what she takes to be the misrepresentation of the mind's relationship to the world, and the way in which the theoretical perspective of cognitive psychology fails to fully capture the distinctive form of life of human beings. In viewing the individual atomistically, in terms of cognitive capacities such as memory and the ability to process information, the learning sciences offer a picture of the mind as distinct from the world and view its contents as representations of states of affairs in the world. Derry believes this picture of the mind fails to acknowledge the way in which our capacities are 'actualised in social interaction through social practices that form the historical development of knowledge' (Derry, 2020, 7). In this alternative to a picture of capacities and mental states, 'mind and world are not separated, and inferential connections, arising through human activity, constitute representations in the first place' (ibid.). Thus, something more than the atomic acquisition of facts is significant for teaching and learning about how the mind works and its contents are constituted. Teaching and learning are generally conducted within social contexts and knowledge is in many respects a social enterprise. If our aim is to develop knowledgeable, independent thinkers, we do so by developing the capacity for rational, individual and collaborative engagement within social contexts of knowledge production, not by extricating ourselves from them (see Robertson, 2009).

Derry thus offers us a different way in which we might approach the relationship between teaching and learning, one which she develops around our distinctively human capacity to make inferences and express reasons through getting to grips with the conceptual norms within academic disciplines. Derry draws on the work of the philosopher Robert Brandom. Broadly speaking, Brandom's position is that we should understand concepts less in terms of their 'representational role of naming phenomena they stand for' and more in terms of the role they play in our ability to make inferences about how things are in the world as an expression of our understanding and grasp of meaning (Derry, 2020, 7). 'Psychology', Brandom writes, 'can study the matter-of-factual properties of contentful acts of judging and inferring, but not the semantically determined properties that govern them, the norms against which assessments of truth and rationality are to be made' (Brandon, 1994, 12, in Derry, 12).

In order to make these ideas more concrete, Derry provides an example from religious education. In her example, a teacher working in the context of a diverse, modern state school is attempting to introduce the Bible. She does so against a background aim of fostering understanding and appreciation of the practices and beliefs of different faith communities. To foster their interest and understanding, the teacher chooses not to teach didactically but to give the children opportunities to take a more active part in their learning.

In order to help them get to grips with key biblical concepts like law and prophecy, the pupils are encouraged to 'make their own Bible'. Perhaps we can already imagine how this might go astray. And so, in Derry's words, 'The children made a "fashion bible" in which the concept of law was illustrated by pictures and rules about the age at which particular items of clothing could be worn. The concept of prophecy was illustrated by predictions about the likely bankruptcy of clothes shops' (Derry, 16). At present, this does not seem so far-fetched but something has evidently gone wrong!

Clearly there has been a failure, but of what kind? The obvious answer is that the children still don't know anything about the Bible. Perhaps a more direct, teacher-led approach would have equipped them with this information; subsequent retrieval, testing etc. would have consolidated it. Arguably, their knowledge is simply inaccurate; but in Derry's view, the real failure is that it is unlikely that such an approach would foster 'any understanding at all of the practices or beliefs of particular faith communities' (ibid.). However, it is not obvious that a fact-based approach would achieve this either. Derry is not denying the importance of teaching the facts in order to develop the knowledge of young people. She is concerned by what she sees as the absence of a rich sense of human activity, activity characterised by the norm-based character of practices and beliefs and the giving and receiving of reasons in their study.

The problem could be expressed as one of depth. According to Coe et al. (2014), great teaching requires both depth of subject knowledge and depth of pedagogical understanding. It also requires good judgement. In Derry's example, content has been trivialised in order to make it relevant and enable pupils to find meaning in their learning. Conceptions of knowledge, learning and the curriculum all seem impoverished. This does not mean that planning was slapdash or formally inadequate. Nor does it mean that the pupils haven't worked with purpose, care and diligence. The thoughtlessness is of a different kind. There has been a failure of seriousness.

If, as I suggested at the outset, our seriousness about the importance of education and learning is reflected in having an evidence-informed attitude towards learning, then we would be equipped to avoid such failures in our own teaching. However, the force of Derry's critique is that we might require a different orientation to our teaching, one that is not so readily informed by evidence but which is nonetheless indicative of what is important in the content of our teaching and gives

it depth. Derry's concern is that the current relationship between evidence-informed pedagogical theory and academic content lacks the richness and depth that is possible in human learning and the problem is the underpinning provided by the science. This sounds heretical but Derry is asking us to consider the limits of the science of learning in understanding what is important in human learning.

The philosopher Rush Rhees argued that 'the difference between being a good teacher and a poor one is… not a matter of being more or less infused with [a] scientific outlook' (Rhees, 1969, 3-4). Rhees himself was not hostile to science, but believed that there were limits to the answers it provided, arguing that the significance of these depended not so much on whether the answers could be 'accepted just as they were given' (p.10) as they did on the scientist's perception of the kind of answers they were. For Rhees, this means recognising that the questions we have about the world are not simply about the acquisition of a certain kind of knowledge about the world but are also in part an attempt to understand our existence in the world – to make sense. One of the tasks of the teacher is to help their pupils in this. However - and this is why Derry's analysis has purchase - to do so, we need to look beyond the toolbox provided for us by the science of learning.

There is a further question: as educators, how can we do justice to the different ways in which the knowledge we impart has a seriousness for those we teach, beyond the instrumental or even the purposeful? Perhaps we should consider how a carefully directed use of reason can do justice to both the normative constraints of a knowledge domain and enable the child to experience things for him or herself so that he or she may come to recognise the conceptual richness of subject content in ways that are personally meaningful. This does not turn its back on the science of learning but looks beyond it.

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THE LIMITS OF THE SCIENCE OF LEARNING

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The science of learning and its benefits

The science of learning is a relatively new interdisciplinary field that aims to increase our knowledge of how human beings learn by drawing upon evidence from the natural, cognitive and psychological sciences, and through so doing improve educational outcomes. It offers many benefits for education. For example, it has made useful contributions towards showing the effectiveness of certain learning strategies. This is important because our intuitions about the effectiveness of learning strategies are often inaccurate. This is convincingly argued in a recent bestselling book on the science of learning, *Make It Stick*. The 'most effective strategies', the authors write, 'are most often counterintuitive' (Brown et al 2014, 2). Some of the counterintuitive claims the authors support with scientific evidence are that learning is more effective when it is effortful and we are bad at assessing the success of our own learning (ibid., 3).

The science of learning can also help debunk untenable scientific theories about learning, some of which have gained widespread acceptance. These include 'neuromyths': pervasive beliefs about the brain which are insufficiently supported by scientific evidence. An example is the widespread belief that we only use around 10% of our brain capacity. This neuromyth is often considered fact, but there is no scientific evidence to support it.[1]

There is considerable scepticism in education about the science of learning. A degree of scepticism is healthy, but excessive scepticism sometimes becomes hostility or wilful ignorance. Showing the benefits the science of learning offers for education could help alleviate excessive scepticism towards it. A healthy degree of scepticism involves an awareness of the limits of the science of learning.

The limits of the science of learning

The greatest obstacle facing the science of learning is bridging the gap between theory – scientific evidence – and practice – applying that evidence in education. Crossing this bridge too hastily can lead to 'scientism': excessive belief in the power or value of science.[2]
An example of scientism would be the view that the natural sciences can encompass those domains often argued to be particularly difficult to exhaustively subsume within the explanatory sphere of the natural sciences: philosophy, intentionality, morality, and the supernatural.

Perhaps education is another domain that is particularly difficult to encompass within science. Teaching and learning could never be completely reduced to or based upon the science of learning. Education is a humanistic discipline, involving human interpretation across a wide range of people and contexts. It is a complex field, consisting of a variety of approaches and methods for teaching many disparate subjects. It involves input from many areas of enquiry; judgements about learning based on a broad set of criteria; and managing human behaviour across age groups where emotional, intellectual, psychological and physical developments are rapid and significant.

A related argument has recently been put forward by Dylan Wiliam, in a discussion of the limits of research in education. Wiliam argues that an expert teacher's knowledge cannot be explained to another person such that both parties then possess the knowledge. You could not, for example, explain to someone how to ride a bike such that they could ride a bike themselves; even with the most detailed and clear instructions, a person cannot ride a bike until they have learned how to do it themselves. Similarly, Wiliam argues that 'teacher expertise cannot be put into words': we can offer detailed training on how to teach, but 'there is no set of instructions that will be guaranteed to work' (Wiliam, 2019). Wiliam connects this argument to the role of research in education by arguing that there are many areas of teaching and learning where there is either no research evidence or research evidence is not applicable within a specific context. He argues that while it is important for teachers to know about research in order to 'make smarter decisions about where to invest their time', '[c]lassrooms are just too complicated for research ever to tell teachers what to do' (Wiliam, 2019).

In this sense, Wiliam argues, education can be 'research informed' but not 'research based'. Wiliam's distinction and argument can be applied to the role of the science of learning in education. Education can be informed by scientific research but cannot be a research-based discipline. Medicine is, for example, research-based: medicine is prescribed on the basis of empirical evidence showing that it can prevent or be used as a treatment for a disease. A research-informed discipline is informed by research but need not make recourse to research to justify the employment of its practices, such as teaching and learning practices.

[1] See Harrington et al, 'Introduction: The "BrainCanDo" Approach to Teaching and Learning' in Harrington et al 2021.

[2] For an account of scientism and an overview of recent literature on scientism, see Beale 2019.

Many teaching methods have been successfully employed for a long time without research showing why they are effective. The lack of research evidence supporting their effectiveness does not, however, imply that we should give them up for methods the effectiveness of which is supported by research evidence; nor should we think of those methods that are not yet supported by research evidence as less pedagogically valuable than those that are.

This is not to say that certain areas of education cannot be research-based; it is, rather, to say that education as a whole cannot be entirely research-based. We can use scientific evidence to give support to and develop the effectiveness of teaching and learning methods, but if we had to base the effectiveness of teaching and learning as a whole on research, much of what takes place in the classroom would lack research support. In some cases, this would be because there is not yet the relevant research; but in others it would be because research in certain areas will not tell us much. This is because education is a complex, humanistic enterprise which involves many aspects, some of which are not reducible to exhaustive explanation in scientific terms.

Examples of what would count as scientism in education

In what follows, three examples are outlined of attitudes towards the science of learning where accusations of scientism are warranted.

1. Assuming that scientific methods and findings can be immediately or straightforwardly applied in educational contexts

Claims concerning the application of scientific methods or evidence in education need to be justified, because their application is not straightforward, for at least two reasons. First, education is not a branch of science. Second, education is a vastly complex field and a humanistic discipline. So, we need to provide clear links between scientific evidence and its application in education.

2. Holding that it is not possible to provide a good education without recourse to the science of learning

An example of this would be holding that education that is not informed by the science of learning is inadequate. The uncontroversial view that the science of learning can improve education does not entail the controversial view that without attention to the science of learning, education is in some way deficient. The latter would follow from the former if (a) the science of learning were shown to improve education to a highly significant degree; or if (b) attention to the science of learning could lead educators to follow much more effective teaching and learning practices, and the effectiveness of those practices were well supported by research from the science of learning.

For instance, concerning (a), evidence suggests that effective feedback improves learning to a highly significant extent, so it would be uncontroversial to argue that education without effective feedback is inadequate. Until a similar claim could be made about the science of learning, one could not convincingly argue that education without attention to the science of learning is inadequate.

Concerning (b), consider the evidence from the science of learning mentioned above which suggests that our intuitions about the effectiveness of learning strategies are often wrong. If attention to this evidence could increase the use of teaching and learning practices that are much more effective, then lack of attention to the science of learning would be among the possible reasons why education in such cases is deficient.

The claim that education that is not informed by the science of learning is inadequate may one day have greater force. Future developments in artificial intelligence in education are among those likely to generate the most significant educational advances. Consider, for example, if technology using artificial intelligence could mark students' work reliably and thereby substantially reduce the amount of marking required by teachers. Regardless of where the science of learning goes in the future, to hold that the science of learning has the potential to significantly improve education is uncontroversial.

3. Holding that one cannot be a proficient teacher without an understanding of the science of learning

While knowledge of the science of learning may improve a teacher's proficiency, it does not follow that a teacher is not proficient unless they possess such knowledge. For that claim to be justified, it would need to be shown that knowledge of the science of learning improves a teacher's proficiency to a highly significant degree.

The following analogy illustrates what constitutes a healthy approach towards crossing the bridge between scientific evidence and its application in education. One can be an outstanding musician with no formal education in music theory. But it is extremely likely that music theory will improve even the best musicians; and the best musical education includes music theory. Additionally, the most equipped musicians are well educated in music theory. Analogously, while knowledge of the science of learning is not necessary to be an outstanding teacher, it undoubtedly has the potential to be useful, and the most equipped teachers possess the knowledge yielded by the science of learning.

Concluding remarks

The greatest problem facing the science of learning is bridging the gap between theory and practice – i.e., between scientific evidence and its practical application in education. Crossing this bridge too hastily can lead to 'scientism': excessive belief in the power or value of science. This article has adumbrated some of the limits facing the science of learning, by describing some occasions where it risks becoming 'scientistic'.

Scientistic interpretations and applications of the science of learning are among the reasons for the mixed reception it has received. Awareness of its limits helps to avoid hazards concerning its application, what we can expect from it, and what educational decisions are made on its basis. Such awareness can help to lessen controversies concerning the science of learning and alleviate excessive scepticism towards it. Awareness of its benefits and limits can help to advance education through its application.

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THE GREATEST PROBLEM FACING THE SCIENCE OF LEARNING IS BRIDGING THE GAP BETWEEN THEORY AND PRACTICE – I.E., BETWEEN SCIENTIFIC EVIDENCE AND ITS PRACTICAL APPLICATION IN EDUCATION. CROSSING THIS BRIDGE TOO HASTILY CAN LEAD TO 'SCIENTISM': EXCESSIVE BELIEF IN THE POWER OR VALUE OF SCIENCE

THE ROLE OF SELF-DETERMINED CHOICE AND REALISTIC ASPIRATIONS IN ACADEMIC MOTIVATION AND ACHIEVEMENT[1]

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The question of motivation is not new and is arguably at the heart of what every educator aspires to: a classroom filled with pupils who want to learn and appreciate the inherent value of learning 'for learning's sake'. There has been some debate about how teachers and valued role models can best create the optimum conditions in which this type of academic motivation can thrive.

One area that has been considered within this broad field of motivation is the role of aspirations and expectations of pupil behaviour and academic performance. There is a long standing history of research in the fields of sociology and psychology that has demonstrated the powerful role that the aspirations of significant role models such as parents or teachers can play in children's growth, academic achievement and ultimate educational and occupational mobility (e.g. Sewell et al., 1969; see also Sewell & Shah, 1968). The emergence of social–cognitive models in psychology have also shed light on the powerful impact of the beliefs and attitudes of role models on children's behaviour and academic achievement (Parsons et al., 1982).

THERE IS AN IMPORTANT DISTINCTION TO BE MADE BETWEEN ACADEMIC ASPIRATIONS AND ACADEMIC EXPECTATIONS

Following from the early work of Albert Bandura, subsequent research continued to show how critical the role of expectancy beliefs are in motivating many different types of human behaviour (Bandura, 1977; Marsh & Parker, 1984; Pekrun, 1993). This has naturally translated to pedagogy and practice within an educational setting. Given the longstanding history it is not surprising that many educators and parents hold fast to the notion that having high academic expectations is central to inspiring greater pupil achievement. However, more recent research led by Kou Murayama and colleagues may suggest otherwise.

Academic aspirations vs expectations

Undoubtedly holding high aspirations for our pupils and children can bring with it a number of key benefits that can support academic achievement. For example, parents with high aspirations for their children's academic attainment are likely to be committed to, and highly involved with, their children, which will typically enhance academic achievement (Halle et al., 1997). The same can be said of teachers who hold high aspirations for their pupils. However, there is an important distinction to be made between academic aspirations and academic expectations. An aspiration is based on hope; it represents an ideal of what could happen; whereas expectation is a belief that is based on likelihood given the available evidence. It is important not to confuse the two. Holding high academic expectations and high academic aspirations are not the same thing and can differentially impact on pupils' performance and ultimate achievement.

It is important to recognise that holding high aspirations can have both positive and negative consequences for pupils. Excessively high aspirations that exceed realistic expectations of actual academic performance (i.e., over-aspiration) may lead to overinvolvement, excessive pressure to achieve, and high levels of control over a child's behaviour. Such controlling behaviour has been found to impact negatively upon pupils' development and achievement, increasing the risk of a range of negative outcomes (Grolnick, 2003; Roth et al., 2009; Robins & Beer, 2001). Thus, it is possible that parental and teacher over-aspiration can have counter-intuitive and ultimately deleterious effects on children's academic achievement.

Similarly, if this influence of parent and teacher expectations results in the pupils themselves forming mismatched academic aspirations and expectations this can also bring negative implications. For example, Boxer et al., (2011) compared students whose self-reported aspirations were greater than their self-reported expectations (over-aspired students) and students whose aspirations matched their expectations. They found that over-aspired students exhibited several academic and social risks, such as lower levels of school bonding, higher levels of test anxiety, elevated behavioural and emotional difficulties, and lower self-reported school grades. Furthermore, Rutherford (2015) found that those pupils who demonstrated a mismatch in their self-reported aspirations and expectations were more likely to experience difficulties with emotional wellbeing.

In a recent study conducted by Professor Kou Murayama and colleagues they measured the impact of parental aspirations on children's mathematics achievement over a 5-year period (Murayama et al, 2016). This study was longitudinal in nature and followed pupils in Germany and the USA throughout their time in secondary education to measure the long-term impact of aspirations over time. They found that when parental aspirations were too high

this had a detrimental impact on children's academic achievement. The authors note that this study highlights the danger of assuming that raising aspirations will promote greater academic attainment. Although the temptation has been to convey the overly simplistic message that raising aspirations will raise achievement, this research demonstrates that this may not necessarily be the case.

Balancing aspirations and achievement

Taken together, this body of work indicates the powerful role of expectations in shaping pupil behaviour and ultimate academic achievement and the importance of balancing aspiration and expectation so as not to leave pupils struggling with the negative effects of over-aspiration. A review of educational interventions aimed at improving aspirations concluded that there is little evidence to suggest raising academic aspirations had any positive impact on achievement (Cummings et al., 2012) and the work from Murayama and colleagues (2016) indicates that the converse may be true; unrealistic aspirations can have negative consequences on achievement. Thus, any future interventions ought to focus on facilitating opportunities and information for parents, teachers and children to support them to develop realistic expectations. We need to think about ways in which we can promote realistic target setting to cultivate academic success from within a place of psychological safety.

If our pupils are pushed too hard by others such as parents and/or teachers this can lead to pupils' own internalisation of mismatched academic aspirations and expectations for themselves, which may then lead to a range of negative consequences on the academic achievement and emotional wellbeing of pupils. As educationalists we have a responsibility to create an environment through which pupils' abilities are acknowledged and there is space for further development in line with realistic academic expectations. This can go some way towards creating the conditions in which self-mastery and intrinsic motivation thrive.

[1] The piece does not suggest that high expectations should not be set. Instead it points to the distinctions between aspirations and expectations and their impact on pupil wellbeing.

THERE IS A LONGSTANDING HISTORY OF RESEARCH IN THE FIELDS OF SOCIOLOGY AND PSYCHOLOGY THAT HAS DEMONSTRATED THE POWERFUL ROLE THAT THE ASPIRATIONS OF SIGNIFICANT ROLE MODELS SUCH AS PARENTS OR TEACHERS CAN PLAY IN CHILDREN'S GROWTH, ACADEMIC ACHIEVEMENT AND ULTIMATE EDUCATIONAL AND OCCUPATIONAL MOBILITY

Fostering intrinsic motivation

Further to setting realistic academic targets, there is a body of psychological research that has considered the motivational impact of providing pupils with self-determined choice over their learning. There is an important distinction to be mindful of when considering academic motivation. We can seek to motivate pupils by providing certain external rewards such as payment, merits etc… This will build extrinsic motivation (a reliance upon factors external to oneself to become motivated). Alternatively we can seek to foster intrinsic motivation, where an individual draws the motivation to succeed, academically or otherwise, from within themselves without the need for external praise and reward. Although we may be tempted to think that all motivation is good motivation, research has shown that offering extrinsic rewards, such as payment, can actually lead to a decrease in overall levels of motivation (Murayama et al., 2010); whereas if pupils build intrinsic motivation this has been found to enhance academic persistence and resilience in the learning environment (e.g. Gottfried, 1985) and to positively correlate with psychological wellbeing (e.g. Bhat and Naik, 2016). There are certain practices we can adopt that can help to engender greater intrinsic motivation in pupils. One small change that we can make is to provide opportunities for autonomy and self-mastery by creating cleverly crafted opportunities for choice within the learning environment.

In one study, Murayama et al (2015) placed participants into two conditions. In condition 1 they were assigned a task to complete, and in condition 2 they were given the opportunity to select a task for themselves from multiple tasks available to them. This self-selection enabled participants to select a cognitive task that also aligned with their own interests and values. Murayama et al (2015) found that in condition 2, when participants were given this opportunity for self-determined choice, task performance improved as compared to when they were assigned a task without choice (i.e., forced choice). This effect persisted even though the difficulty of the tasks was carefully controlled and matched across the two conditions. Thus simply enabling participants the opportunity to select a task was enough to increase motivation and subsequent task performance.

In the classroom, if we want to engender intrinsic motivation, a state in which pupils are motivated to learn 'for learning's sake' and not because of some external reward, then we need to provide opportunities for autonomy and self-determined choice. Equally, we may choose to work alongside pupils to meet them at their current level of academic attainment and support them to form realistic targets based on actual academic expectations and in so doing, provide the psychological safety needed to set achievable goals with the aim of gradually improving academic performance. From this place of safety, pupils are more likely to respond positively to these more realistic aspirations and gradually begin to improve their performance without suffering a negative impact on psychological wellbeing.

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LEARNING AND MEMORY

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Our understanding of human consciousness - what it is and how it relates to the brain's activities - is at an early stage. Cognitive scientists have developed models to try to describe how the processes of the brain that underlie learning and remembering operate. These models are simplifications of processes that in reality are highly complex and only partially understood.

To teachers, the usefulness of such models lies in their simplicity. They describe essential aspects of how memory works that practitioners can draw upon alongside their experience and expertise to develop better informed strategies for helping students to learn.

Different types of memory

An especially useful model for how memory works makes a distinction between working memory and long-term memory (Atkinson and Shiffrin, 1968). We use our working memory to attend to the here and now, to filter the continuous stream of information coming in from our environment. More important information is passed to our long-term memory, the huge repository where everything we know is encoded in 'schemas' of related ideas, facts and procedural knowledge.

The working memory can be thought of as the site of our consciousness. The knowledge in our long-term memory lies outside of our consciousness until we recall it. For example, when asked what a panda looks like you can easily access that information from your long-term memory even though a moment ago you weren't thinking about pandas.

Our long-term memory is apparently limitless but our working memory is extremely limited, both in terms of how much it can store and for how long (Miller, 1956). For this reason it can easily become overloaded: we have all had the experience of trying to hold a phone number in our working memory for a few seconds and losing it because of a distraction.

'Learning' is a process whereby information passes from the working memory to the long-term memory, where it is 'encoded' by linking it with what we already know. That is, we build up our knowledge gradually in ever-more-complex networks. To enable students to learn well it is helpful to understand in a little more detail how this process works.

Cognitive Load Theory: what is it and why it matters

One theory in particular, Sweller's 'Cognitive Load Theory', has been described by Dylan Wiliam in a tweet in 2017 as 'the single most important thing for teachers to know'. Sweller's theory looks at our cognitive architecture and explains how we process information by connecting it to our existing knowledge through increasingly complex schemas. A single schema is like a single unit of information, and the more we know (i.e. hold in our long-term memory), the more our limited working memory is freed up to process new information. To function well, the working memory therefore depends upon the long-term memory to reduce the 'load' it experiences.

Learner drivers know what it is like to suffer from working memory overload when they try to attend to their feet, their hands, the road and their instructor all at once. An experienced driver by contrast can do this effortlessly even while doing something else cognitively complex, such as holding a conversation with a passenger. This is because the activities involved in driving have become fully automatic in the long-term memory, so even when paying attention to the road most of the experienced driver's working memory is free to attend to the conversation. The more relevant knowledge we have assimilated into our long-term memory, the more effective our working memory is at processing incoming and new information. The same principle applies to students learning an academic subject.

It is easy for someone who has deep subject knowledge and can think more or less effortlessly in their discipline to underestimate how quickly a student who lacks that expertise can struggle with cognitive overload when encountering new information. To teach successfully, one needs to remain aware of what it is like not to have that knowledge or that fluency, and to know how to help one's students to acquire it in stages.

Memory in the age of Google

The claim that in the age of Google we no longer need to teach students facts, since they have easy access to all the information they could possibly need via their smartphone, betrays a misunderstanding of how thinking works. Until information has been integrated into the long-term memory a person has no choice but to try to engage with it using a very limited working memory (Christodoulou, 2014). This is a highly ineffective way of thinking because the working memory has limited capacity either to hold or to 'encode' information, and until someone has built up a large and reliable network of related knowledge in their long-term memory they will have no means of fully understanding the incoming information or of engaging with it critically. For example, an expert can easily spot a spurious argument because they have complex schemas of existing knowledge against which to assess it. A student who is looking a new topic up on Google can't do that.

Although students can be taught skills such as how to assess an argument in terms of consistency, validity and soundness, the claim that students can be taught

transferable thinking skills that they can apply across subjects needs a caveat: certain thinking skills do not exist separately from our long-term knowledge of the thing we are thinking about, and certain thinking skills cannot be applied across different fields of knowledge.

Effective strategies for teaching and learning

A simple way to reduce the load on working memory is to remove distractions while learning. Many students like listening to music while they work because it helps their mood, but this has been shown to impair learning by taking up processing space in the brain (Perham and Currie, 2014). For the same reason they should not keep their smartphone next to them, even if it is switched off (Mendoza et al., 2018). If they are using a device in class it is important that students are not distracted by opening multiple windows and switching focus between their work and other material such as the Internet. The limited working memory simply cannot multitask effectively in that way.

The fact that the mind processes visual and auditory memory separately has implications for how we present it. Presenting two pieces of visual information simultaneously (for example, a diagram with multiple accompanying annotations) splits the attention and loads the working memory; but presenting a piece of visual information with a simultaneous oral explanation aids learning by using two channels to create connected verbal and visual images of the material. This effect (known as 'dual coding theory', Paivio, 1990) only applies if the oral explanation complements the visual one, however; putting up a slide of writing and talking over it in words that don't match the text only splits the attention and overloads the working memory.

More complex skills, tasks and knowledge should be taught in stages so that the students gradually build up a schema of related knowledge in their long-term memory. This effectively increases the capacity of the working memory and allows them to take on more complex information. It's important to establish what the students already know at the outset and to build upon that knowledge. It's helpful to give them practice in worked examples or partially completed problems so that they can embed the process in their memory without overloading the working memory. As they become more expert at the process, the scaffolding can be gradually removed.

Learning is enhanced by distributing the process across multiple, spaced-out, short sessions (Capeda et al., 2008). This is because, paradoxically, forgetting aids remembering if one revisits the material just as one has begun to forget it. Students benefit from understanding this when they undertake revision. The common practice among students of last-minute 'cramming' before an examination is far from the best way to remember material: it works much better to use 'spaced repetition'. Moreover, topics are best studied and revised when interleaved with different topics, not in a single block, so that the mind is continually making shifts and discriminating between the topics (Rohrer and Taylor, 2007).

There is a large evidence base to suggest that one of the most effective ways to improve long-term memory is 'retrieval practice': recalling information from memory by answering questions, tests or practice essays (Roediger and Karpicke, 2006). This not only assesses what the student knows, it also improves their ability to retain it for later recall (ibid.). It is worth doing this immediately after learning something so as to test for understanding; but to make sure that students have really learned something we should test what they know some time after they learned it, when they have begun to forget it. The cognitive effort involved in recalling the material helps to embed it in long-term memory. Doing this repeatedly increases the ease with which we connect new material with our existing knowledge. Indeed, the impacts of 'retrieval practice' are especially strong in stressful situations such as high stakes examinations because the practice establishes multiple pathways in the brain which circumvent the impairment to memory that stress causes (Smith et al., 2016).

Evidence for 'what works' in teaching and learning requires careful handling. It can be tempting to reach for headline findings that seem to offer clear guidance without looking at the research behind the headline. The evidence base may be thin or contradictory. It may have been generated not in classrooms with schoolchildren but in laboratories with psychology undergraduates. 'Learning' can describe a wide range of activities, and a technique that applies to simple retrieval of facts may not apply to learning that leads to a complex understanding. Then there is what Steve Higgins (2018) refers to as the Bananarama Principle: 'It ain't what you do, it's the way that you do it'. Knowing that a technique has been shown by research to work in a laboratory does not tell a teacher how to apply it effectively with a particular class at a particular moment.

Nevertheless, research evidence can be a useful corrective to uninformed assumptions. We all tend to overvalue techniques for learning that feel easy (the so-called 'fluency effect'). Reviewing a topic by reading through material, highlighting key points, and re-organising notes will give an impression of familiarity with the material which is quite different from having a deep understanding of it and being able to recall and use it in a different context.

Retrieval practice, distributed practice and interleaving constitute what Bjork (1994) has described as 'desirable difficulties': manipulations during learning that actually improve long-term performance and memory. Less experienced students are unlikely to persevere with them because they give an impression of slow progress. Students need to be taught to understand them and stick with them because the evidence suggests that they make learning more permanent.

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MORE COMPLEX SKILLS, TASKS AND KNOWLEDGE SHOULD BE TAUGHT IN STAGES SO THAT THE STUDENTS GRADUALLY BUILD UP A SCHEMA OF RELATED KNOWLEDGE IN THEIR LONG-TERM MEMORY

EMPATHY AND MOTIVATION IN THE CLASSROOM:
HOW TEACHER-LEARNER CONNECTION FORMS THE BEDROCK TO UNLOCKING LEARNERS' POTENTIAL

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One of the key synergies among the authors is a fascination with motivation as a process that underpins learning. Through our independent work, we have discovered that the relationship between teachers and learners can have a significant impact on learner motivation This notion has been reinforced through our recent collaborations supporting children with executive functioning challenges through the organisation Connections in Mind. In our quest to understand why some children were not making progress, we discovered that the relationship between the teacher and the learner is a key, yet highly variable, part of what helps young people to engage with challenging tasks and reach their goals. In our experience we found that when a teacher shows empathy, a connection is made and from that springboard collaborative problem solving and learner engagement ensues. It seems pertinent to ask, therefore, whether the intentional use of empathy in the classroom could go a long way towards levelling the playing field. If this is the case, teachers can learn a great deal from the field of psychology in terms of the impact of empathy on educational processes and outcomes.

We all have personal stories of a favourite teacher who inspired us to learn. For Victoria it was Mr Reed, a bumbling and very traditional Geography teacher - elbow patches and all - who understood her and saw her potential as a learner when many other teachers had dismissed her abilities in the face of her dyslexia and executive function challenges. Just as the literature reports, his supportive manner encouraged Victoria to engage with the subject and achieve at the highest levels. We know from research that affective teacher-learner relationships are significantly related to motivation and engagement and positively related to achievement in school (Roorda et al, 2011).

However, there is something uncomfortable in this realisation. There is an inherent inequality in the fact that some children will flourish more than others based on something as subjective as their ability to connect with certain adults in their learning environment. It seems morally inexcusable simply to accept this: if we subscribe to the concept of meritocracy, effort and ability should ideally be rewarded equally (Mijs, 2016). If relationships have such a marked impact on learning then they inevitably skew the outcomes in an unjust manner. Indeed if outcomes from other professions were seen to be linked to relationships there would be an outcry: imagine if evidence emerged that some patients recovered from their ailments more quickly because of the quality of the relationship they had with their doctor.

So what is it about a relationship, specifically, that forges connection and allows for personal growth in the participants? Can educators learn something from other professions in this respect? Psychological and therapeutic research have sought to resolve this particular conundrum for centuries. One robust finding of this research concerns the importance of empathy in relationships (Myers & White, 2009). Whilst there is no consensual definition of empathy, it is believed to relate to the capacity to cognitively and emotionally understand another person's experience, resulting in an appropriate affective response consistent with the other persons' mental state (Cuff, Brown, Taylor & Howat, 2016). An integral part of therapist training is the communication of empathy (Lambert & Barley, 2001). Research into the empathy-outcome relation in therapeutic settings has identified empathy as a robust predictor of treatment outcomes and a key component of therapeutic alliance (Nienhuis et al, 2018). This finding spans therapy formats, the client's presenting problem, and the severity of the client's problem (Elliott, Bohart, Watson & Murphy, 2018). This begs the question: could teachers' ability to enact empathy in an educational context improve the experience and outcomes of our young learners?

Attempts have been made to transfer the skill of effective communication of empathy to the classroom. Chang et al (1981) demonstrated a clear link between teaching assistants' empathy and self-esteem in learners. Research has since indicated a strong association between teacher empathy and classroom outcomes (Feshbach and Feshbach, 2009). Despite evidence supporting the fundamental importance of empathic communication in our classrooms, attempts to establish it often stall due to concerns about professional boundaries (Arghode, Yalvac & Liew, 2013), and lack of effective training (Swan, and Riley 2015). It could be that our teachers are constrained by the British educational system's emphasis on rational and cognitive approaches, perhaps subverting their ability to express and enact empathy (Cooper, 2004). Indeed, empathy is a skill which needs specific training and support to develop, therefore we cannot expect teachers to be able to skilfully deploy empathy in their classrooms without devoting resources to developing this skill.

The first step in training professionals in empathy is to improve their understanding of the concept. Empathy and sympathy are often confused (Cuff et al., 2016). When perceiving sadness in another, 'empathy' refers to feelings of sadness in the self (i.e. the same emotion; feeling as),

whilst 'sympathy' refers to feelings of pity or concern for that person (i.e. a different emotion; feeling for) (Singer & Lamm, 2009). Sympathetic expressions are often formulaic and disingenuous resulting in disconnection, whereas empathetic expressions or feeling with another person elevate connection (Brown, 2012). Knowing the definition of empathy, however, is not enough to start applying it skilfully in a classroom. Teachers need to be taught the three distinct components that complete the empathic cycle: empathic listening comes first; communicative expression of the empathic response, whether verbal or non verbal, is next; and finally, the recipient's awareness of the empathic communication (Barrett-Lennard,1981). Teachers also need the space to practice empathy and notice the impacts of empathy on learning outcomes. Psychologists who train in clinical, counselling, or educational psychology do this over a number of years in their training, observation, practice and supervision (Marangoni, Garcia, Ickes & Teng, 1995). Traditional teacher training techniques such as self-reflection, journaling, and observation could easily form the foundation of training needed to support the practical implementation of empathic communication in teacher - learner interactions within our educational system.

Training in the mechanics of empathy is no doubt essential for its effective use in classrooms. Within our work at Connections in Mind, we also recommend that teachers try using a brief, whole-class, semi-structured protocol to remain attuned to students' challenges, experiences, and perspectives. It is simple: when responding to a struggling class, teachers ask, "What are your barriers to this task?" and "What kinds of strategies might we use to be successful?" This 'Barriers & Strategies Protocol' (BSP) is designed to replace less sensitive or supportive teacher responses, which consistently diminish relationships and trigger spirals of misbehaviour. When combined with direct teaching about executive functions, it forms a classroom approach called 'Activated Learning' (Faith, 2019) which incorporates mental contrasting techniques (Oettingen et al., 2009). Mental contrasting is a self-regulation strategy that requires the learner to first mentally elaborate on their desired future and then consider the obstacles they need to overcome in order to reach their goal. As a self-regulation strategy, mental contrasting increases motivation and promotes goal commitment by prompting learners to initiate goal-directed action (Gollwitzer et al., 2011). Teachers, and indeed entire learning communities composed of other learners as well, can use this technique to identify and empathize with a young person's barriers to learning and support their development of bespoke learning strategies. Using this approach, teachers' ability to employ empathy is scaffolded within a structure that is easy to learn and apply.

As teachers and psychologists, we believe we have a moral obligation to address the inequalities in learner motivation, engagement, and achievement caused by different teacher-learner relationships. In education, we can draw upon evidence from related professions such as psychology and social work to appreciate the potential for empathy to strengthen teacher-learner relationships. If strong relationships

are the bedrock from which all young people grow and learn, now is the time to invest in researching approaches that help students and their teachers communicate and appreciate each other's unique feelings and needs.

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TEACHING ENGLISH FOR THE REAL WORLD

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Teaching English for the Real World

Few professions are so frequently subjected to unwelcome advice as teaching. When I moved out of the profession over two decades ago and into business, it would never have occurred to me to advise a project manager or an accountant how to do their job. Yet barely a week goes by without someone, somewhere, earnestly pulling teachers' socks up for them and insisting they must change what they do. Most of this advice derives from the premise that teachers do not focus enough on what matters in a 21st century education. Some of the most influential, international educational organisations have pushed the idea for years that it is the job of teachers to nurture a generous list of what they argue are key employment skills. Examples include:

- Critical thinking and problem solving
- Creativity and innovation
- Communication and collaboration
- ICT (Information & Communications Technology) Literacy
- Media literacy

The sudden necessity for educational organisations of all kinds to rely on technologies to continue teaching children and students has added a huge boost to this idea. Global technology businesses, NGOs and thinktanks, all household names, have recently formed new partnerships to turbo-charge this agenda. It's an agenda that regards schools and teachers not as stakeholders but as expendable delivery channels. Once again teachers' professionalism is being ignored in pursuit of greater goals.

Although there are undoubted discrepancies between what happens in schools and what students are required to produce when they leave the school gates and enter the labour market, 21st century skills don't figure amongst them. I spent twenty years teaching and since then another twenty in business and I realise that were I to return to the classroom now, to teach English, I would have to do it differently. What I now know about professional writing, all that wealth of experience I have accumulated about how the English language functions in publishing and journalism, business, academic and commercial research, means I simply could not teach the way I used to. It would be unfair on the pupils. I would not be preparing them for the real world, a place where skills training is only a small corner of a much more challenging picture.

My new book, *Teaching English in the Real World* is my attempt to help people who are teaching English to do so in a way that genuinely prepares those they teach for what they will find outside the school gates, and to describe that picture in detail. The book isn't a practical guide just for English teachers. It's a much wider consideration of what schools should be doing if they wish to prepare secondary school children to be successful and effective users of English in the real world of work, higher education and adult life. It's my contribution to that fractious debate schools became unwittingly embroiled in the moment someone stood up in front of an audience sometime around 1998 and said, "Why bother reading a book when you can Google it?"

Why should we care about English teaching?

First, English is used everywhere, from the side of a bus to expensively commissioned commercial research and policy making. There is almost no aspect of English usage outside the school gates that isn't in some way mediated by technology. If English teachers don't appreciate this and shoulder the concomitant responsibilities, the consequences culturally and democratically are grave indeed. So far this simply hasn't happened and the dispiriting evidence is all around us. One of the most pernicious and worrying real-world changes new technology has brought goes right to the heart of what it means to be an English teacher, to the core of the social and cultural responsibility all English teachers bear. It's arguably the most significant gap in real-world English teaching. When Lewis Carroll put the following words into Humpty Dumpty's mouth in *Through the Looking-Glass*, he was writing for children. A scholarly mathematician, Carroll knew the value of precision and rules.

'When I use a word,' Humpty Dumpty said, in rather a scornful tone, 'it means just what I choose it to mean – neither more nor less.'

'The question is,' said Alice, 'whether you can make words mean so many different things.'

'The question is,' said Humpty Dumpty, 'which is to be master – that's all.'

One hundred and fifty years later and, with the help of technology, the real world is now overrun by Humpty Dumptys. Wherever you care to look, you will find evidence of a linguistic lawlessness that would have bemused Carroll and his contemporaries. It's there in the media – social and mainstream – politics, academia and the arts. Even big business isn't immune. Children need to be taught about the implications and risks posed by technology for the uses of the English language in school by their English teachers, because the subject provides the ideal platform for such discussions. Because the impact of technology on English usage has been ubiquitous, those who teach it now have a hugely important and new role to play in society.

THERE IS ALMOST NO ASPECT OF ENGLISH USAGE OUTSIDE THE SCHOOL GATES THAT ISN'T IN SOME WAY MEDIATED BY TECHNOLOGY

Secondly, GCSEs dominate the curriculum and have little impact on those real-world skills students do need to develop. GCSE English is especially disconnected from the real world and is largely devoid of content that prepares students for employment or even higher education. Children end up sitting a high stakes examination that is mostly about skills that aren't needed, for example writing fiction or mimicking print journalism, and which delivers only superficial knowledge about the language being studied, its history and its cultural significance.

As it stands, English is taught largely as a matter of skills, which are not always relevant in the real world. There is huge scope for English teachers in the first few years of secondary school to develop curricula that emphasise the global significance of English, that embed historical and literary timelines reflecting this perspective, and which rebalance the entire subject by introducing considerably more subject knowledge. The symbiotic relationship of studying literature, conventionally embedded in English teaching, with developing valuable skills should also be established in secondary education from the outset. Even traditional texts can be used to teach skills which are genuinely useful in the twenty-first century. The implications of linguistic lawlessness for debate, free speech and ultimately democracy could not be more extreme. Children must learn today that the English language is a rich and powerful gift, not a toy.

Joe Nutt's book *Teaching English for the Real World* was published by John Catt in May 2020.

ENCOURAGING ENGAGEMENT IN THE CLASSROOM WITH DIGITAL BADGING

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The use of badges in education is not a new phenomenon. Scouts and soldiers alike have been awarded patches and medals to denote experience and qualification for centuries. In schools, reward systems often employ similar tactics, utilising stickers, certificates and merit systems. The notion of awarding a badge for an achievement is also ubiquitous in the world of video games, where they are cleverly employed to encourage a range of behaviours (Wang and Sun, 2011). With the advent of reliable digital technologies, teachers and Ed Tech designers are increasingly employing digital badges in a bid to replicate the success seen in video game design. Digital badges can offer a lot more to a classroom dynamic than giving someone certain credentials. They can promote positive behaviours in students as they borrow from an area a lot of students are familiar with: video games.

Fig 1. Digital badges from an engagement management system the author is designing and trialling in his practice. These form part of a larger system of achievements, each awarded for attainment and positive pupil behaviour.

Badges for teaching and learning

Digital badges, much like video game achievements, can be implemented for a range of reasons. They can be used to record progress and congratulate students on achieving particular milestones, or their focus can be on creating unique challenges and encouraging students to approach the course in new ways. They might even guide students to consider ideas and skills they would perhaps miss without a specific prompt. All of this serves to enrich the student experience by detailing what is on offer in any given course, which skills students will develop and what knowledge they will attain.

In order to be successful, the design of a digital badging system should not be an afterthought bolted onto an existing course design. Rather, the system should be actively considered, designed and implemented alongside an overall course design (Rosenberger, 2019). Though badges are informed by the content and delivery of the course, it is also the case that the badging system can begin to inform the design and delivery of the course too. Taking this idea further, one application that game designers have achieved, and the educational world is catching up with, is the idea of stringing achievements and badges together into skill trees. If we were to apply this to an educational setting, a course's badges could be designed to follow on from each other in a narrative sense,

building a range of learning pathways for students to pursue. With multiple defined ways of approaching the same course, a teacher could achieve greater breadth and depth to what can often be a linear course design. Further, it helps to offer differentiation for students who may be trying to find their own voice in a subject.

Badges for motivation and engagement

It should be noted that there is a lot of debate in the literature regarding the nature of intrinsic and extrinsic motivation as they pertain to badging systems (van Roy et al, 2019). Several authors consider badges as being detrimental to engagement as they may sacrifice intrinsic motivation in favour of extrinsic reward, while others see digital badges as an important tool to complement a student's existing intrinsic motivation (Hense and Mandl, 2012; Grant 2014; Shields and Chugh, 2017). For those seeing little improvement in motivation or attainment, this might be because added token badges were simply added onto an existing course design (Morris et al, 2019; McKernan et al, 2015). However, this is an arguably flawed approach to implementing a badging system.

When designing a badging system, it is important to consider what properties and contexts make a badge motivating. Several examples in the literature will, for instance, utilise tiered achievements, commonly bronze, silver or gold badges (Morris et al, 2019). As there may be only one opportunity to earn a particular badge during a course, before moving to the next chapter, it is perhaps demotivating for students to achieve a permanent bronze or silver badge with no way of improving on it. For weaker students, falling short of their own expectations or comparing with stronger peers may diminish the educational experience and damage their future motivation. This is a hurdle that game designers have overcome in a number of ways. Some will simply avoid designing tiered achievements, while others will offer the opportunity to revisit and reattempt challenges. A player can therefore practise, improve and assess their progress multiple times. As educators, this is an element of course design that we should seek to foster and may be the approach needed to help digital badges reach their motivational potential.

Designing and Implementing a Badging System

This year I have designed and trialled an engagement management system supported by OneNote Class Notebooks. It is a heavily gamified experience aimed at encouraging students to develop good study habits alongside the traditional content being learned on any given syllabus. Students are provided with a tutorial at the onset of the course, explaining how to earn a range of digital badges, which were designed to complement the biology course being covered in class.

Fig 2. The digital badge system available to sixth form students alongside their introductory term of biology.

As well as offering badges for high attainment, many are also available for submitting work consistently and punctually, showing long-term effort and improvement, and responding to feedback. To aid with clarity, design choices around colours, shapes and styles were taken to consistently show which badges are for skills, and which are for academic content. In addition to badges encouraging desired behaviours, they have also proven useful in gathering learner data that cannot be captured in conventional mark books and databases. A badge profile for an individual student can help to codify a student's progress and understanding in a much richer way than raw percentages and grades can. By scanning through a student's achieved badges, I have found report writing and generating specific, useful feedback much simpler. I would also argue that the badge system has added a richness to the educational experience, something that a lot of digital courses are often criticised for (Bassili, 2008).

Achievements

Achievements

Fig 3. The badge profiles from two of the sixth form students currently trialling my engagement management system. Each gives a rich snapshot of a student's behaviour and attainment to inform feedback and reporting.

I have collected some data from students, through interviews, to ensure that they found the badges something which added to their learning experience. The majority of the class reported an improvement in engagement, motivation and organisation. While some students reported no increased engagement, none said they felt the demotivating effects discussed in some of the literature. However, one student did suggest that, had he fallen behind in earning badges, he may have felt demotivated if there was no way to go back and earn the badges again. Hence, flexibility in awarding these achievements is vital.

Conclusion

Despite conflicting findings in some of the literature, my initial trials with digital badging have been positive. Researching existing systems and their applications has informed the design process and helped me incorporate badges with much success. As well as helping to motivate and engage my students, it has positively affected my responsibilities outside of the classroom by capturing qualitative data for feedback and reporting that would otherwise have been lost. The system detailed above is still in its first iteration and will be redrafted and refined each year based on changes to the current course design and the needs of the students on the course. As a first foray into a young area of digital education, it has been both informative and rewarding.

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DELIVERING EFFECTIVE FEEDBACK THROUGH MICROSOFT ONENOTE

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It has long been acknowledged that feedback is one of the most significant drivers of student progress, where feedback describes any information that might help to close the gap between what is currently understood and what is intended to be understood. In his meta-analysis, *Visible Learning*, Hattie comments that the effect size of feedback is considerably higher than that of many other interventions or strategies. It is for good reason, then, that Black and Wiliam (1998, 13) conclude that 'extensive feedback leads to greater student engagement and higher achievement'.

The importance of delivering effective feedback is seen as equally important in an educational landscape which increasingly adopts online tools. Microsoft with Teams and OneNote[1] point, for instance, to the ease with which one can leave inked or typed comments on student work or the 'Review' function in Class Notebook, the digital equivalent of students leaving their book open at the appropriate page for teachers to mark. Whilst the technological apparatus of something such as Class Notebook certainly enhances the efficiency of delivering feedback, this is by no means a guarantee of enhanced efficacy. In Microsoft training courses, the types of feedback often demonstrated are lengthy summative comments or platitudinous remarks such as 'Great work' or 'Excellent', precisely the kinds of feedback that research indicates are less effective or sometimes even of net negative impact (Kluger and DeNisi, 1996).[2] As McKnight (2016) makes clear, when thinking about the interaction between teaching and technology, 'it is critical to move the focus beyond the technology itself, to how technology enables teaching and learning'. If one benefit of using technology is greater efficiency, but the practices being delivered more efficiently are arguably ineffective, as is the case in some of the examples from the Microsoft training materials, then it ought to be resisted. Yet, this does not need to be the case. Provided one is attentive to the underlying pedagogy and the extent to which it is rooted in robust evidence, tools such as OneNote, as with any tool, can be used to great benefit. This article will map out some of the ways in which OneNote can be utilised to deliver effective feedback. First, it will be useful to sketch out some guiding principles as to what constitutes effective feedback.

'The Power of Feedback': A Framework for Effective Feedback

In their 2007 article, 'The Power of Feedback', Hattie and Timperley differentiate between four categories of feedback, underpinned by a consideration of the student's goals in learning, their current performance towards that goal, and the necessary steps needed to progress. The first category they describe, labelled feedback on the task, attends to the accuracy of underlying knowledge required to complete a given task and might involve checking, for instance,

retention of historical facts, plot points within a novel or parts of a plant. The feedback will tend to be explicit and corrective in nature, either identifying misconceptions or specifying the previously unknown material. The second category, feedback on the process, is directed towards the manner in which information needs to be processed in order to fulfil the criteria of a given task. In other words, the feedback attends to the process undertaken to arrive at the product and any changes that may need to be made in that process in order to do better, such as rewriting an essay to include more discussion of historiography. The third category, feedback on self-regulation, is aimed at a student's metacognitive awareness of their own work, often seeking to increase self-efficacy. Such feedback draws attention to and addresses the stages of planning, implementation and evaluation whilst undertaking a given task, cueing the student to self-identify areas to be improved and the required steps to do so. The fourth, and least effective, type of feedback is feedback on the self, which usually takes the form of positive affirmations of student ability. This is the style of feedback often visible during training demonstrations of OneNote. In providing this conceptual analysis of feedback, Hattie and Timperley seek to outline the circumstances in which different types of feedback can be effective or ineffective, drawing attention to the need to ensure feedback is targeted at the most appropriate level. What are some of the ways, then, that OneNote can be best utilised in order to achieve this, using Hattie and Timperley's model as a theoretical framework?

Feedback on the Process through Live Marking

One significant benefit to OneNote and Class Notebook, especially when used uniformly across an entire class, is the capacity and facility it provides for a teacher to offer feedback in the moment that work is being produced. When setting up a Class Notebook each student is provided with a private Notebook section in which they can store files and produce work, either by typing or digitally inking. The students cannot access each other's Notebooks, but the teacher is able to enter any of these spaces allowing them to provide feedback that is instantaneously seen by the student, as in Figure 1.
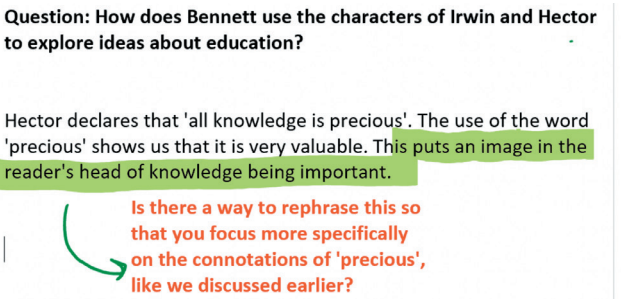

Figure 1: Feedback provided live and in the moment of producing a piece of work.

By providing specific and targeted feedback during the process of construction, the student is better able to recalibrate their efforts. This helps to cue a cognitive cycle of revaluation that will then feed into work on the remainder of the task. Such feedback also enables the teacher to address any misconception or misapplication at or close to the point at which it is made, helping to prevent it taking root. Whilst this strategy of live marking can be achieved by circulating the class with a pen, the use of OneNote has the benefit that attention is focused on the task, not the student - a benefit enhanced by the fact that the process is hidden from the rest of the class. Providing feedback in this manner, made both more efficient and more effective through the use of OneNote, aligns to Nicol's call for feedback to be 'conceptualised more as a dialogue rather than information transmission' (2006, 210). The feedback becomes part of an ongoing process of immediate revision, directly addressing the process that underpinned the initial student choices and feeding into what needs to happen immediately in order to close the gap between current and desired performance, as seen in the response depicted in Figure 2.
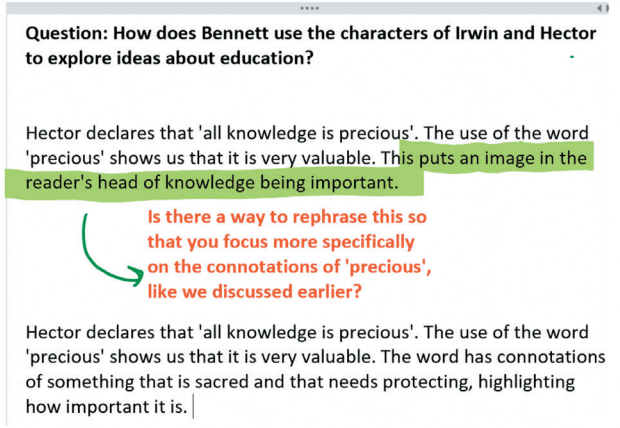

Figure 2: Recalibration in light of live feedback

Not all feedback is given as marking and as such the use of exemplar material is an extremely powerful way in which to deliver feedback. As Sadler (1989) argues, effective feedback has at its core the need for students to know what good performance looks like and how current performance relates to this; or as Hendrick writes in his 2018 *What Does This Look Like in the Classroom*, 'it's very difficult to be excellent if you don't know what excellent looks like' (25). By routinely using such 'exemplars of performance' (Orsmond, 2002), students are able to build up a scheme of what characterises high performance in a given area, but more crucially they are able to use this as a way in which to build metacognitive awareness of their own work. As Nicol argues, 'good quality external feedback is information that helps students troubleshoot their own performance and self-correct' (2006, 208). This is especially pertinent with the use of model responses that provide a concrete example against which to compare and evaluate their own work. It is for this reason such engagement with model responses might more accurately be labelled 'reverse engineering' wherein students are actively reflecting on and unpicking what makes the models successful.

In practice, this could take the form of the class collaboratively creating an exemplar response before then annotating and discussing those aspects of the work that meet the established criteria (as demonstrated in Figure 3). Students could then return to their own previously produced work, reflecting on it in light of the model.
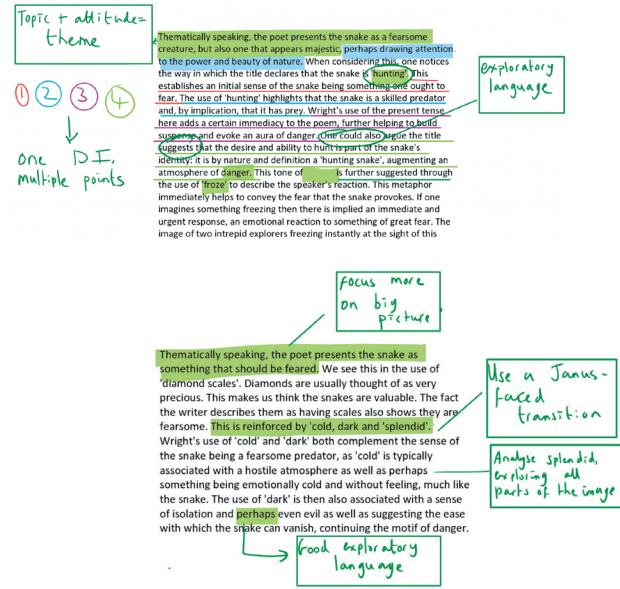

Figure 3: The model response at the bottom was created live in class and annotated as part of a discussion. The annotations on the top are the product of self-reflection in light of the model.

As in Figure 3, OneNote permits the annotated model to be placed alongside the original work, making it easier to draw comparisons and evaluate. This provides an opportunity for the student to develop cognitive routines in which they self-assess and self-identify areas within their work that could be improved upon, with this feeding forward into subsequent pieces of work. It is also possible for the teacher to record or capture their own screen and audio during the process of creating a model response, and to share this to help to develop metacognitive awareness, especially if the teacher verbalises the reasons for making certain choices. Such videos or indeed any worked examples can then be embedded directly in OneNote and saved for future reference. It is possible to create a distinct section within which to store any model responses, as in Figure 4.
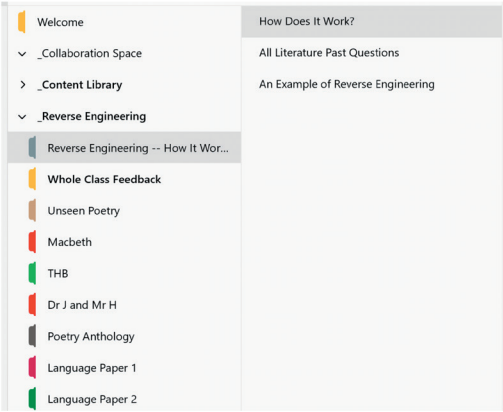

Figure 4: All model responses stored centrally and accessible to all students.

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[1] For clarity, OneNote is a Microsoft application that allows users to upload and store documents of various types, embed links to different media as well as type directly into the application, where it is then saved. It is organised around different sections within which pages are created, mimicking a traditional file divider. OneNote is not restricted to education, but Class Notebook adds education-specific features to OneNote as well as providing the capacity to add students to a OneNote so they have access to its materials and a personal space in which they can create work.

[2] As examples see *Microsoft's Introduction to OneNote Teacher Academy* online course or *OneNote Class Notebook: A Teacher's All-in-One Notebook for Students* online course.

IT ALSO MAKES THE USE OF AUDIO FEEDBACK, WHICH IS BECOMING INCREASINGLY POPULAR, FAR MORE EFFICIENT AS AUDIO CAN BE DIRECTLY EMBEDDED INTO ONENOTE.

Conclusions

Whilst many of the above strategies could be achieved to some degree using more traditional methods, such as worked examples and live model responses being completed with a visualiser, using OneNote does provide distinct advantages, especially in the case of live marking. It also makes the use of audio feedback, which is becoming increasingly popular, far more efficient as audio can be directly embedded into OneNote. As with the previous strategies, it is crucial to ensure such methods are underpinned by robust evidence, such as that any verbal feedback is actionable, pinned to a specific task for the student to complete and aligned to Hattie and Timperley's model for effective feedback. Wiliam has asserted, 'if you price teacher's time appropriately, in England we spend about two and a half billion pounds a year on feedback and it has almost no effect on student achievement' (cited in Hendrick, 2017, 27). It is important to ensure the methods being utilised are as effective as possible. Tools such as OneNote, and indeed technology more broadly, are not the only answer to this, but they can very much be part of the solution so long as they are used in a manner that supports and does not run counter to the available research.

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DOES 'GOOD AT MATHS' IMPLY 'GOOD AT PHYSICS'?
## THE BENEFITS OF TEACHING BOTH MATHEMATICS AND PHYSICS

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It is often assumed that students who are able mathematicians will 'naturally' thrive in physics. The counverse excuse may follow, that those struggling with physics might put it down to a lack of mathematical ability. With university admissions teams placing an emphasis almost solely on exam scores, if such simplistic interpretations are to be averted, such assertions must be unpicked with care and it is worth considering where the evidence lies in terms of assessing students' abilities in mathematics and physics based on their exam performance in these subjects.

In-House Research

A-level results were collated from London Academy of Excellence (LAE) and our partner school Brighton College, for those in the 2019 cohort sitting physics and mathematics (plus the further mathematics subset). It was assumed that with 86 candidates at both schools following exactly the same specifications, some consistency would be ensured. Raw scores out of 250 in physics were plotted against raw scores out of 300 in mathematics, and also against two complementary subsets: 'further mathematics' and 'single mathematics' (i.e. those not taking further mathematics). In addition, grade deficits were calculated for the three respective analyses. For example, 'M-P' is the difference between the mathematics and physics A-level grades. Notwithstanding raw score variation and disparities in grade boundaries, the data cloud in the first scattergram in Figure 1, below, clearly lurches towards higher scores in mathematics over physics. This tendency recurs in the M-P grade deficits, with only one student attaining higher in physics. Indeed, more than half the physics results were a grade or more below their mathematical counterparts. Were the 2019 mathematics papers more straightforward, or is physics just intrinsically more difficult?
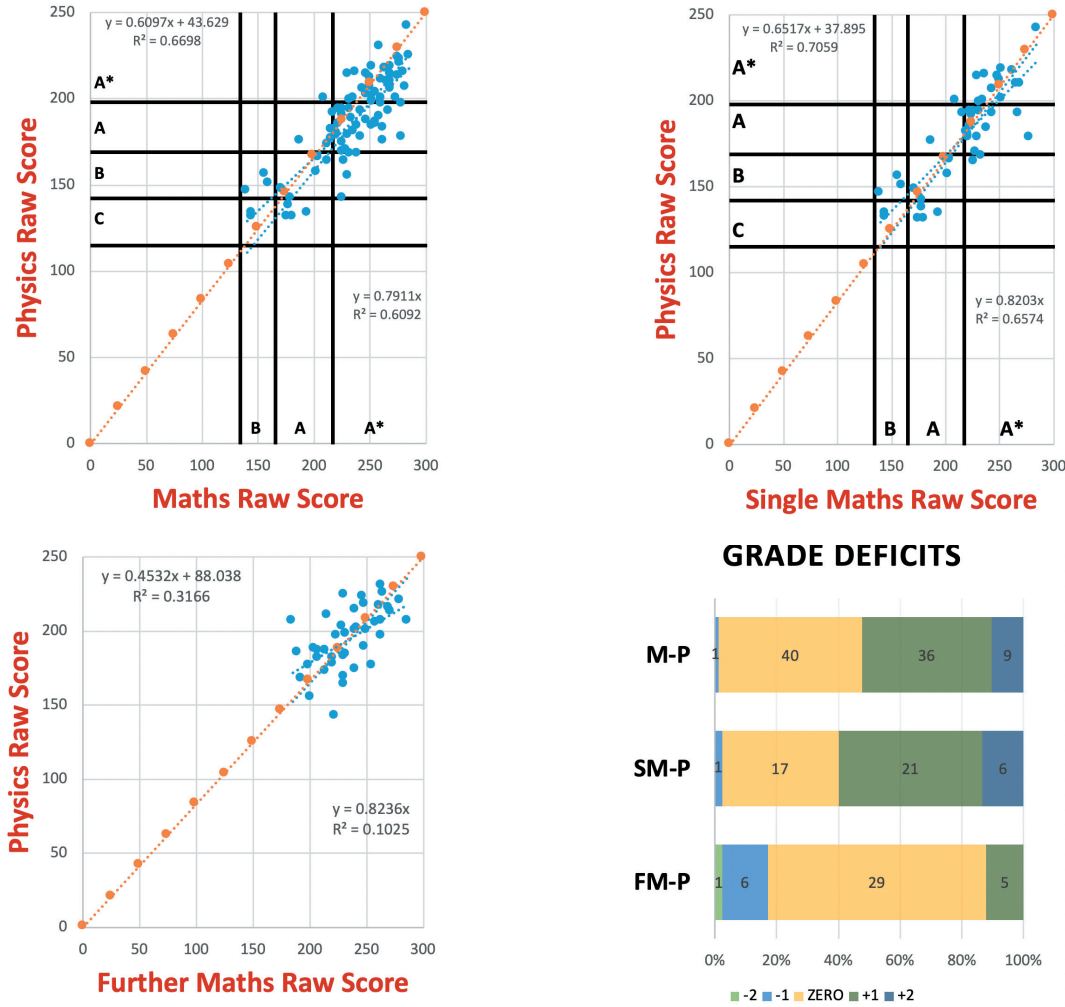
In Figure 1, an orange y=5/6x line straddles equal raw percentages (since 5/6 = 250/300), though grade boundaries in black display asymmetry. The upper trendline is the best-fit proper, with the corresponding correlation coefficient, whereas the lower trendline is forced through the origin (for comparison with the orange gradient of 5/6 =0.83). Grade dividers are missing from the third scattergram since a differing further mathematics module altered the boundaries somewhat. So M-P= 0 if a student achieved equal grades, but M-P= -1 if mathematics were a grade below physics (rare), e.g. A vs. A.*

Since many candidates taking physics were also sitting further mathematics, having twice as long to familiarise themselves with A-level mathematics content, removing these (41) individuals from the dataset leads to a fairer comparison in the second scattergram (Figure 2). While raw scores now display a more centralised distribution, the lower percentage grade boundaries in mathematics still result in a majority of grade deficits in physics.

Interestingly, when the subset with the (41) candidates who are studying further mathematics alongside physics is analysed, grade deficits dissolve between the subjects. If this suggests anything, it is higher attainment in physics. Is this because further mathematics matches physics in difficulty, or is it because the very able mathematicians pursuing the double A-level are simply very able and therefore more high-attaining?

Sample sizes so small are obviously symbolic, with trends that cannot be extrapolated to national generalisations. It can only be stated that some of the students taking both these subjects at two given schools in 2019 performed somewhat better in mathematics and ever so slightly worse in further mathematics, relative to physics, in a particular set of papers. Nevertheless, this research has illuminated a pattern of behaviour in each school that remains relevant to that particular institution. Therefore, carrying out a similar study over multiple years could prove rather enlightening.

Published Research

In an attempt to locate these outcomes within a national picture, Ofqual was contacted. The support officer explained that they did not have figures to share. Instead, they suggested delving into the National Pupil Database for discrete grades, though this would require authorisation from the Department for Education.

The challenging nature of meaningful comparison is a recurrent theme in current literature on this topic. Various sources cite *Relative Difficulty of Examinations in Different Subjects* (Coe et al, 2008), a comprehensive study from the University of Durham's Centre for Evaluation and Monitoring. A range of statistical methodologies are explained in that study, including 'subject pairs analysis' – which in its simplest form describes the 'grade deficits' previously calculated here. Pure exam performance does, however, make flawed assumptions in ignoring non-trivial factors such as intrinsic interest in the subject, quality of teaching, career aspirations and levels of preparation (Goldstein & Cresswell, 1996). Moreover, research suggests that candidate performance and exam difficulty are firmly entangled (Baird et al, 2000). While some find this unsolvable, others hope that a large enough sample would statistically iron out all issues (see Nuttall, 1974 – historically a key investigation).

Multiple analyses have tried to quantify the relative difficulty of A-level subjects. Most locate STEM at the upper end of a spectrum with numerical coefficients. Fitz-Gibbon & Vincent (1994) place physics above mathematics, as do Alton & Pearson (1996), who then place further mathematics above

physics. As for Coe et al (2008), over half a million A-level results were processed with seven different techniques. Physics trumped mathematics every time, whereas further mathematics was declared most difficult only once. They clarify that "Further Maths is an unusual A-level, with 58% of its 6500 candidates being awarded the top grade, A. Even more extraordinary… of those… two thirds also get As in all their other A-levels". This 'ceiling effect' annuls grade deficits where (more able?) candidates attain equally in other paired subjects. While more recent A* grades might help discriminate better, the latest technical reports on inter-subject comparability (Ofqual, 2018) – which also place physics above mathematics – still cite Coe et al (2008).

In addition to prior GCSE attainment studies, in their own self-referencing fashion, Ofqual base subject difficulty on the inter-boundary grade width, and hence the severity of the grading process itself. But there is a subjectivity to defining difficulty in terms of how rigorously we choose to examine. Patrick (1996) frames these challenges well: 'With one lobby claiming that A-level Mathematics is too hard in comparison … and another lobby claiming that A-level Mathematics is not hard enough because holders of the qualification are ill-equipped for… higher education'.

Yet the perceived difficulty of physics remains intertwined with mathematics. In 2008, QCA itself stated that physics 'required complex mathematical processes'. This is simply not true. Exponentials and logarithms aside, the vast majority of operations in a given A-level physics paper are well within the GCSE Mathematics syllabus. Still, the 'subject difficulty is related to an over-mathematical approach' (Pell, 1985, 129), apparently, while heads of science often consider the lack of mathematical knowledge to be the main challenge faced by their physicists (Sharp et al, 1996). We can agree to disagree.

Personal Teaching Experience

Candidate 2227 is a curious case: LAE's highest result in the 2018 UKMT Senior Mathematical Challenge, yet one of very few students in the 2019 cohort who attained a C grade in physics. I currently teach a hardworking Year 12 student who also earned a UKMT medal but, with physics exam scores in the lower fifth percentile, will have dropped the subject by the time you read this! There were actually ten candidates from the joint 2019 cohort who carried further mathematics into Year 13 having dropped physics in Year 12. Are these all anomalies, or illustrative of just how different physics and mathematics are?

Nobody denies that physics is the most mathematical science; indeed, most fields of theoretical physics are mathematics. But unlike the undergraduate module, A-level quantum mechanics does not require matrix algebra in Dirac notation; instead, a sixth former is more likely to find themselves explaining particle behaviour. The A* physicist must deliver such explanations with clarity, in a detailed yet concise paragraph that demonstrates understanding of cause and effect. The 2008 QCA inter-subject comparability study declares that 'Physics

requires little extended writing', but when likened to mathematics, a six mark exam question remains significant. To 'careful explanations' we can add 'recalled definitions', 'keyword interpretation' and 'experimental planning': further instances of literacy which able mathematicians might struggle with, contributing to the observed grade deficits.

Crucially however, the mathematics in physics often differs from the mathematics in mathematics. I would argue that the hardest aspect of numerical physics is the decision-making process before the arithmetic. Newton's Second Law is merely a sum equated to a product – the difficulty lies in choosing which forces to consider. Consistent analysis and application of concepts is the true skill of the physicist, not necessarily the mathematical follow-up. This is why many A-level mathematicians struggle with mechanics modules - decision-making has consequences!

Teaching Both?

So in keeping with the title of this article, should it follow that anyone 'good at teaching physics' is 'good at teaching maths'? During a period of relative stasis in the teaching of physics, I was fortunate to take on a Year 12 mathematics set (Core & Mechanics), which I followed up in Year 13 (Mechanics & Statistics). Pedagogical subject knowledge is acquired over time; so despite decades of tutoring A-level mathematics, classroom teaching felt like NQT year all over again, with multiple opportunities for self-reflection and self-evaluation.

As mentioned earlier, mechanics modules are physics, to the delight or terror of many mathematics teachers. Unfortunately, inter-departmental communication is rare on such matters, so opportunities are missed. Mathematics teachers may drop a tennis ball in class, but how many would request apparatus from the Physics Department to better demonstrate forces, moments, springs and motion? Do physics teachers know about Desmos, and do mathematics teachers know about Tracker? Just an awareness of when each department teaches different topics could help towards the constructive coordination of schemes of work.

Regarding my own pedagogy, a divergence began to manifest between a certain degree of comfort in physics, and eyes wide open in mathematics (to a refreshing variety of approaches from new departmental colleagues). I found myself getting multiple students up problem-solving on multiple whiteboards around the room. While I over-relied on past-paper questions in physics, I discovered countless resources for every little mathematics topic, from Integral to MadasMaths to Dr. Frost, making differentiation seamless and fluency practice thorough. And so forth.

So there is certainly much to be gained by allowing any experienced physics teacher confident in mathematics, or any experienced mathematics teacher with a background in physics or engineering, to teach an A-level set for a year. Attending two departmental meetings, under two heads of department, should prove a rich experience too – with increased cross-departmental dialogue inevitable.

We currently have an economics teacher teaching one mathematics set at LAE. In my next role, there will be another physicist, trained as a mathematics teacher, teaching physics for the first time. I hope that I might get involved with mathematics there too, as there are rich discussions to be had.

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AI MARKING, ASSESSMENT, AND FEEDBACK

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In 2018, Education secretary Damian Hinds challenged the tech industry "to launch an education revolution for schools, colleges and universities". This was met by several companies seeking to make Artificial Intelligence (AI) marking tools a useful addition to teachers' armoury. Given that auto-marking of multiple-choice questionnaires and the like is now standard in education, the real breakthrough in AI marking was in developing software that would be capable of marking complex, open-ended essay questions that test students' understanding. Statistics indicate that in subjects like mathematics the chance of a candidate getting the same grade for more than one examiner for the same piece of work is close to 100 percent,[1] but in more subjective subjects like English language or philosophy this probability falls to just over 50 per cent. Many positives of AI marking have been cited, ranging from the potential to provide fair, fast and unbiased summative assessment scores in high stakes testing to addressing teacher workload. Ofqual has announced its intention to explore the role AI may have in marking both GCSE and A Level exam papers, seeking 'not by replacing human judgement, but by using AI to support markers' (Black, 2020).

This paper explores how AI marking technology might be used to create a virtuous combination between humans and machines, taking advantage of what humans do best and what machines do best. It suggests the technology offers the potential to improve the quality of feedback and assessment as long as teachers retain a focus on quality staff-pupil interactions alongside its use. It will also explore potential dilemmas highlighted within the context of student and teacher interactions as a result of outsourcing student work, while weighing up the positives of time saving alongside negatives such as those resulting from the potential erosion of value afforded to the role of teacher.

The problem with data

Schools can sometimes become caught up in the process of generating increasing amounts of data on their students, tracking their progress in greater and greater detail. This stems from a variety of reasons: a perception of this being what Ofsted would like, accountability to parents / governors, and as a means of quality assurance, among others. However, there is a danger that, at its worst, a data driven context can lead to students being little more than data points: their experience of education is reduced to focus upon that which is measurable, placing more value upon that which can be demonstrated through data tracking

to show improvement. School reports and grade cards are also written every few weeks attributing numbers and value to a student. Because of this, effort and attitude to learning have seemingly become equally measurable, with students often found in the position of believing these numbers to have some kind of concrete value rather than being the very subjective perception of their teacher.

AI marking tools have the potential to exacerbate this problem. They generate data more quickly and easily, they rank students, they are blind to the wider 'stories' behind a student producing the work, and the meaning of a written output. Teachers have often bemoaned students 'not reading the comments', but if the marker is not really reading the work (simply an algorithm comparing their work to a model answer to look for similarities) then what does that suggest about the value of the piece of work? The essay is in danger of becoming little more than transactional data. Teachers move into the realm of service providers, the service being the 'handing over' of an education, with students consuming knowledge and providing essays to satisfy the spreadsheet. A problem with the idea of education as a commodity is that schools are so much more than opportunities for knowledge acquisition as a stepping-stone to good grades, higher education and then employment. It is the seeming 'intangibles' of schooling which are often what makes an education outstanding. Asking people what they remember about school will often result in a reply centred around the sense of how they felt cared for (or not) and whether they belonged (or not), rather than anything to do with quadratic equations or English Language essays. They will not have considered themselves as data points; their experience of education was, for the most part, not utilitarian in the sense that they could have been easily replaced by someone else. It was personal, creative and formative in who they are. They will not talk in terms of the numerically measurable.

As a result, we must continue to review and agree where the balance of power lies between automated and human. But, it is here that AI marking can be said to offer positive addition to the process of education as it has the potential to address the increasing importance of formative assessment to drive personalized learning and diagnostic assessment feedback; to allow students to practise and get instant feedback inside and outside of allocated teaching time; and to provide fair, fast and unbiased summative assessment scores in high stakes testing.

Formative assessment, personalised learning, and diagnostic feedback

AI provides the student with the opportunity to make corrections and resubmit their writing repeatedly (without adding to teacher workload), and the suggested improvements will change with each submission because the feedback provided by the AI tool can be scaffolded. Pupils will have the benefit of iterative feedback and then can look to improve their work with each version they submit. AI marking tools have been developed to have 'Improve' functions that offer feedback on common errors after the first submission and then, as the pupil edits those errors, surrounding errors are marked on the next view. The aim is to help them identify and eliminate common and repeated errors. Within e-marking tools, chatbots can also be beneficial for automating responses to common problems or questions. This helps speed up responses to pupil queries. The record and analysis of automated chats can then inform pupils of common problems or problems encountered by others completing the task, helping them to develop their work accordingly. Pupils can easily access this 'frequently asked questions' element outside of class time with no extra demands being made upon staff. The teacher can focus on those issues which require 'human' support, such as argumentation or nuance, humour, wordplay, analogy, or metaphor. The focus in all of this is not the mark per se, but the feedback that facilitates student improvement. The AI remains a tool which serves as an efficient means to an end, rather than an end in itself.

AI marking providing fair, fast and unbiased summative assessment scores

The potential for bias will always exist in human judgement and understanding. Controlling the extent to which an algorithm might exhibit its own bias is a major priority for the industry. But assessment technology continues to develop and many of the algorithms used are continuously being improved to offer better accuracy, fairness and standardisation. Often this is effectively achieved through a hybrid of human and AI marking.

In 2013 Cambridge Assessment English started funding the Institute for Automated Language Teaching and Assessment (ALTA)[2]. The AI marking tool developed is very powerful but human examiners work alongside it. They perform an irreplaceable role when completing the assessments, as the AI does not (fundamentally) understand English. For example,

one way it assesses 'vocabulary use' in speech and writing is by the similarity between the bigrams (two consecutive words) used in a candidate's response and those used by learners at various proficiency levels. Based on AI logic, a candidate is more likely to belong to a certain proficiency level if they use similar vocabulary to learners at that level. However, the speed and power of the auto-marker is combined with the human judgement, be that of examiners, annotators, assessment experts or data analysts. This type of AI is called Human-in-the-Loop (HITL or HITL-AI), it is one in which human beings fine tune and test the performance of the AI. This 'hybrid' marking model, combining the strengths and benefits of AI with those of human examiners, has many applications and can also reduce costs, save time, improve efficiency and give learners a faster turnaround for their results. It also enhances the quality of the exam, since two different judgements are combined to create a powerful assessment and learning tool.

Teacher perspectives

In collaboration with Prior Park College, we conducted a short pilot which utilised AI technology. The initial survey of teachers embarking upon the AI project at the school indicated that some felt it had the potential to positively improve student / teacher interactions in class. 'It could certainly be positive, if the AI marking framework frees up more time for supplementary discussion and verbal feedback'; 'It should help the students to focus on certain areas of their writing which will help teachers to plan lessons focused on particular areas'. No one in the Prior Park survey expressed a concern at the outset that it would erode the student/ teacher relationship. Everyone involved believed it would prove useful, changing the way work was marked but not changing the perceived level of care provided by the teacher.

However, some of the teachers expressed concern that the AI might struggle with 'picking up on subtleties and complex ideas'; and one commented, "I worry that the computer will not be able to pick up subtleties and nuance or gauge how successful/sophisticated an overall argument is…". The teachers indicated, however, that they had less trust in AI than they believed parents would have. This may be directly related to the teachers' deeper understanding of the marking process and its pitfalls. It remains to be seen whether these predictions or beliefs change over the course of the pilot.

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[1] It should be noted that many of the disagreements that occur in marking mathematics for example are centred around the 'working' or route a student takes to reach an answer. The answer being right or wrong only accounts for a proportion of the marks allocated. The common perception of mathematics, for example, being a concrete right or wrong answer is misguided.

[2] https://www.cambridgeassessment.org.uk/insights/keeping-artificial-intelligence-human-combining-the-power-of-ai-with-the-experience-of-examiners/

Conclusion

AI marking technology has the possibility of being an incredibly powerful tool within education. If it is used to support human markers rather than replace them completely, it has the potential to create a virtuous combination between people and machines, taking advantage of what human beings do best and what machines do best. The technology offers the potential to improve the quality of learning alongside the quality of staff-pupil interaction. It can be argued that as long as AI marking remains a tool to facilitate deeper understanding rather than having the data it generates as an end in itself then it has hugely positive potential in education.

Acknowledgements

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THE TIMELESS WISDOM OF SITTING IN ROWS

Tom Sherrington | *Education Consultant*

Some of the strangest debates or memes about education that pop up now and then are about the idea of students sitting in rows. You don't have to look too far to find people aligning this commonplace desk configuration along the axis of evil. Only recently I came across a tweet that mentioned children sitting in rows in a list of features of modern schooling that included 'compliant', 'submissive'…. It's just the weirdest thing. But it's not uncommon. Sitting rows = factory schooling, 19th C, Gradgrindian, 'Victorian' – all intended as pejoratives.

However, I would argue that sitting in rows is great because as a teacher you can see everyone's face at the same time. The reason classrooms are very often configured in this way is not because schools are old fashioned. It is because this very sensible, very human set-up has stood the test of time. Human? Of course it is. When I teach, I want to look everyone in the eye; I want to gauge their responses, hold their attention; I want to communicate with them. All of them. At the same time. This is the most intimate person-to-person aspect of teaching: eye contact. It matters; it's powerful. It's a deeply human element of communicating ideas and emotions.

Of course, this has a context. I'm a mathematics and physics teacher. It's not art or drama or PE. And, of course, sometimes, I might have a reason for them to turn around to form bigger groups – most of the time the best group of all is pairs; you and your neighbour. Sometimes, I want them to get up and do some practical work. Sometimes I want them to gather around in a huddle to see something close up.

But, most of the time, in the majority of situations when I am likely to be teaching, explaining, instructing, questioning – or getting my students up to do it – rows work absolutely beautifully. Is this about exerting my authority, sage on the stage, being in control, telling students things, asking them things…? Yes, of course it is. That's my responsibility. Is this a miserable, oppressive state of affairs for the poor compliant souls at my mercy? No. Not at all. They can see me; look me in the eye, communicate, engage, interact, listen, learn, think.

If you read Graham Nuttall's *Hidden Lives of Learners,* it can reveal a lot about peer influences in student learning – and it's not all good news. As I see first hand on many of my lesson observations, students sitting in groups continually distract each other. The dynamics of the peer space are strong. I've even been in classrooms with up to half the students sitting with their backs to the teacher, continually craning their necks like Regan MacNeil but largely facing the other way, tuned out. Sometimes, grouped tables have been there so long, students have developed a group table culture with a mighty force field around them virtually impossible to penetrate with learning. Almost as if telling the teachers and others that this is our space; so keep out.

The schools of the future won't all be about interactive micropods and blended autonomous triads – there will be teachers who know things explaining them to students sitting rows, keeping teaching and learning human. So it is vital that we keep the rows as they are.

This piece first appeared in the website teacherhead in 2018.

RESEARCH AND PRACTICE IN EDUCATION

Nick Johnson | *Executive director, British Educational Research Association*

The relationship between research, policy and practice is something that is much discussed but not always acted upon. That has been particularly the case in education. Almost fifty years ago, there was a call for a 'great debate' on education led by the then Prime Minister, James Callaghan, in a landmark speech at Ruskin College, Oxford. In this speech, which asked questions as to the purpose, efficacy and success of the education system, Callaghan claimed that 'parents, teachers, learned and professional bodies, representatives of higher education and both sides of industry, together with the government, all have an important part to play in formulating and expressing the purpose of education' (Callaghan, 1976). It is a remark that has got more contentious as the years have passed with many of the individual interests mentioned in that speech arguing for a monopoly of wisdom on the issue of education policy and practice. It came as no surprise to those of us working in education to hear the most recent great reformer of English education Michael Gove declare in the context of the EU referendum that "people in this country have had enough of experts" (Gove, 2016).

And yet linking research to practice has been at the heart of much of educational research. This has perhaps been epitomised by the work of Lawrence Stenhouse. As John Elliot has argued,

Stenhouse's idea of research-based teaching emerged as a way of linking the world of the educational theorist in the university with that of the teacher. It is the means by which the development of theory is disciplined by the problems of practice and places theorists under an obligation to translate their ideas into a form that can be tested in practice. (Elliott, 2006)

In 2014, BERA undertook a major review that looked at the relationship between teacher education and research which argued for 'self-improving education systems in which teachers are research literate and have opportunities for engagement in research and enquiry' (BERA, 2014). That report called for schools and colleges to become research-rich environments and for teacher researchers and the wider research community to work in partnership, rather than in 'separate and sometimes competing universes'.

That approach was first embodied in the British Curriculum Foundation (BCF) which Stenhouse helped to establish in the 1970s. Given that Stenhouse was also one of the early BERA Presidents and that his approach to practitioner research has always been a significant strand of BERA's wider work since 1979, it is perhaps fitting that the formal structure of the BCF was fully incorporated into BERA in 2013, the two organisations having worked alongside each other for a long period. In its current incarnation, the BCF aims to bring together all those with an interest in collaborative curriculum, research and development and is part of BERA's long-standing commitment to bringing researchers and practitioners together. This commitment has gathered strength in recent years as we have developed a major programme that brings teachers and researchers together.

Bridging the classroom and university divide

Even though BERA is mostly known to those working in higher education, it is dedicated to supporting and promoting teacher research. We believe that practitioners, academics and policy makers must collaborate to help shape the best quality education system. As part of this, we have developed a new teacher membership category and entered into a partnership with the Chartered College of Teaching to ensure that all members of their Chartered Teacher Programme receive a BERA membership. The BCF itself continues to organise vibrant events that bring researchers and practitioners together. The most recent of these, held in late 2019, was specifically designed to support teachers actively seeking and exploring means of developing their own institutional curricula. Its aim was to create a context in which curriculum development could be meaningfully developed, reviewed, shared and discussed. The report details the discussions on the day, as well as examples of the initiatives that were undertaken by schools.[1] The latest scheduled event was due to be one that provided an opportunity for education professionals from different systems and sectors in education to come together and share their ideas around curriculum development and wellbeing. These events are held regularly and even though the current situation has meant we postponed some of them, we have also moved a number of them online.

BERA has also developed a blog[2] that aims to provide a platform for teachers, as well as academics, to present research in short, accessible form. Developed from this, the BERA Bites series presents selected articles from the Blog on key topics in education, presented in an easily printable and digestible format to serve as teaching and learning resources for students and professionals in education. Recent issues of these include one on Research used or produced in schools: *Which informs practitioners most?*[3] and *Reimagining a curriculum for teacher knowledge.*[4]

BERA is also a funder of small-scale research projects. Of most direct relevance is the BCF Curriculum Investigation Grant which is intended to support research led by schools and colleges with a focus on curriculum inquiry and investigation. The grant is given biennially and is looking to help schools engage in research.[5]

In all this work and our approach we have tried to stay true to Stenhouse's vision where he argued:

Educational research has as its overriding aim the support of educational acts - it is not 'pure' but 'applied'. Yet it must also support the planning of research acts in educational settings. Our problem is to find approaches to research which produce theory which is of use both to practitioners of education and to practitioners of educational research and which enables both to act in the light of systematic intelligence. (Stenhouse, 1980)

WE BELIEVE THAT PRACTITIONERS, ACADEMICS AND POLICY MAKERS MUST COLLABORATE TO HELP SHAPE THE BEST QUALITY EDUCATION SYSTEM

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[2] www.bera.ac.uk/blog
[3] https://www.bera.ac.uk/publication/bera-bites-issue-5-research-used-or-produced-in-schools-which-informs-practitioners-most
[4] https://www.bera.ac.uk/publication/bera-bites-issue-4-reimagining-a-curriculum-for-teacher-knowledge
[5] https://www.bera.ac.uk/award/bcf-curriculum-investigation-grant

THE AFFORDANCES OF A SCHOOL-BASED RESEARCH LEAD IN UNIVERSITY-LED RESEARCH PROJECTS:
THE CASE OF OXFORD ARGUMENTATION IN RELIGION AND SCIENCE PROJECT

Liam Guilfoyle | *Research Officer, Department of Education, University of Oxford*

Conducting research is a challenging endeavour in any field or discipline. It involves pushing the boundaries of what we already know to generate the evidence for new knowledge. Research in the social sciences, and education in particular, can be complex because there can be numerous influential yet varying factors to consider, and a broad body of stakeholders as both producers and consumers of knowledge (including teachers, policy makers, researchers, and management).

In this article, I reflect, from the perspective of a university-based researcher in the Oxford Argumentation in Religion and Science (OARS) project, on the affordances and benefits of school-based 'research leads' in conducting research with teachers and pupils. I situate this reflection with respect to recent shifts in the wider educational landscape such as the growing desire for education practices to be evidence-informed and for teachers to engage with and in research.

Teachers' engagement with and in research

Of course, the idea of teaching being informed by theory and research is not new; it has been a feature of educational writing for over a century stretching back to at least the writings of Dewey (1904). The thinking on the place of research in education practice has been subject to many 'turns' over the subsequent decades (Mayer & Reid 2016), but today the call is as strong as ever for teachers to be engaged 'with' and 'in' research. This 'call' is evident in national public policy (Tripney et al. 2018; Coldwell et al. 2017), from academic organisations in education (BERA 2014), teacher professional organisations (Scutt & Harrison, 2019), funding bodies (Walker et al. 2019), and the wider literature (Zamorski & Bulmer 2002; Firth 2019).

Despite the apparent collective appetite across the educational landscape for teachers to engage with and in research, there are some very clear challenges in doing so. For example, the Chartered College of Teaching in England suggest these challenges might include issues of (1) funding, (2) time, (3) relevance to classroom practice, (4) negative perceptions of research, and (5) collaboration (Müller, 2019).

There are continued efforts to overcome the barriers and to support teacher's engagement with and in research. Funding has been made available both to investigate the issue (e.g. Wellcome Trust)[1] and to fund teachers direct conduct of research or afford them time to engage with research (e.g. see Johnson in this issue for BERA funding or the Teaching Council of Ireland, through the John Coolahan Research Support Framework).[2]

In this paper, I describe one additional support in greater detail – the appointment of dedicated staff members in schools to support teachers' engagement with and in research, referred to here as a 'research lead'. I describe the affordances of such a position from the perspective of a university-based educational researcher conducting a research project with teachers and pupils in schools.

The project context

My reflections on the affordances of the role of a Research Lead in schools emerge primarily from my work as a post-doctoral research officer on the Oxford Argumentation in Religion and Science (OARS) project (see www. OARSeducation.com). Being the project member primarily responsible for school liaison and data collection has provided me with a particular insight into the challenges and opportunities engaging in and with school-based research.

The three-year research and development project engages 30 teachers of science and religious education in England in collaborative continuous professional development (CPD). The CPD focuses on supporting students in learning how to make complex judgements in science, religious education and, importantly, in the issues where these subjects may overlap (Erduran, 2020); for example, in discussing the origins of the universe and life, or whether or not genes should be cloned. Such skills are important for achieving curriculum goals in both subjects (Chan et al., 2020; Erduran et al.,2019) but also for nurturing children as future citizens with the capacity to have productive conversations across divides of opinion and discipline (Guilfoyle, 2020).

The project has been developed in a manner that is cognisant of many of the challenges teachers normally experience when engaging in research, collaboration being one of them, especially since we are working across subject areas. Teachers from both subjects come together from within the same school, providing each other with an in-school peer community, and come together during CPD sessions to form a wider community (Vangrieken et al. 2017). They are also provided with an online space to communicate between workshops (Hodes et al. 2011). We recognise that time is precious. As a result, we organised our six CPD sessions to be held after school for a relatively short duration (90 minutes), alternated days to suit participating teachers' schedules where possible, and we recorded and shared sessions for teachers who could not make it. In sessions, we recognise the distributed expertise (Childs et al. 2014) where each individual in attendance is bringing worthwhile expertise to the collective learning. We ask for feedback

on data collection instruments from teachers and bring data back to the CPD sessions to inform our collective learning (Dam et al. 2020). Our CPD processes will be outlined in future publications.

Despite our adaptations to ameliorate challenges, many remain outside of our control. My observation, as the team member responsible for the majority of data collection and liaison with schools, is that teachers can often find it difficult to juggle research activities with their school workload. When decisions about prioritisation need to be made, it is understandable that the immediate tasks for their students take higher priority. As a result, the work of the research project can fade into the background of an unrelenting school workload. This experience is congruent with wider literature examining the workload of teachers (e.g. Sellen 2016). It raises questions about what can be done. The obvious answer might be to reduce the workload of teachers (a largely unobjectionable suggestion), but it is worth considering that even if this was the case, it is plausible that the immediate acts of teaching and learning might continue to take priority. So, another answer might be to provide stronger supports for teachers' engagement with and in research. I have been fortunate enough to experience instances of such school-based support in our OARS project.

Affordances of a school-based research lead

My experience of working with a school-based research lead (Dr Claire Willott of Holme Grange School) has shown me that this role can have significant affordances for a school's conduct of and engagement in research. A research lead can support teachers by reducing administrative load, maintaining momentum within active projects, and acting as a key in-school driver for ensuring a facilitative environment for collaboration and engagement. I will elaborate on each of these in turn.

Reducing Administrative Load

Despite the best effort of university-based researchers, engaging in research will bring a host of additional administrative activities for teachers. These can include responding to emails, setting up research visits, distributing parent information sheets and consent forms, and assisting with the collation of pertinent data. The school-based research lead can act as the primary point of contact within the school for all such activities and can dramatically reduce the administrative burden on teachers.

From the perspective of a university-based researcher, this also makes communication and organisation remarkably efficient and timely. Getting even a moment of a teacher's time on the phone can be a difficult task and a burden on the teacher who may otherwise be in class, meetings, or contacting parents. An in-school point of contact, who is informed and involved in the project, means that teachers' time is bracketed for the essential engagement in the research and the elements that will have most impact on teaching and learning. Information can then be more easily shared in-school by a brief conversation in passing, in the staff room, etc.

Maintaining Momentum

For reasons already discussed, externally-led research projects can become deprioritised and fade into the background in the flurry of school activity (even for the most enthusiastic of teachers). It can be a challenge for a university-based researcher to maintain momentum of projects within individual schools from a distance when the project runs over an extended period of time. Email reminders can be more problematic than helpful by adding to the administrative to-do list, check-in calls take more time from a teacher's days, and visiting the school just to check-in would be impractical for all parties. Aside from all of this, the very act of a university-based researcher making contact, even with the intention of being supportive, can result in teachers feeling guilty for not having had the time to engage.

A research lead, who is mindful of project timelines, can be better placed to keep research activities on the agenda in a way that is cognisant of the demands of that particular school context. Staying in contact with participating teachers can take the form of a very normal, day-to-day collegial or friendly chat – something that is not likely to instil a sense of guilt.

For collaborative projects, such as OARS, one major challenge can be for teachers who are embedded in two different departments with little interaction to find the time to collaborate. Anecdotally, this is a benefit of the interactions within our CPD sessions. Teachers have told us: 'we don't get the time in school to have these conversations, but we want to'. A research lead can help with organising such conversations in school, for example by organising weekly meetings which can provide a facilitative environment for engaging with and in research.

Supporting a facilitative environment for engagement

A research lead cannot be solely responsible for the environment of a school, of course. This will be influenced by a range of stakeholders and factors including but not limited to management, finances, and national policies. However, given their remit within the school context to support research, a research lead can be well placed to request changes to timetables or to other working conditions in order to support teachers' engagement in particular projects. Externally-led and funded research projects can come with criteria or requests of the participating teachers. In the case of the OARS project, teachers needed to be teaching Key Stage 3 students in science or religious education and be willing to collaborate with a colleague in the other subject area. Making adaptations to fit the criteria can be a challenge, depending on the school context. Where a research lead is in place in school, they can ascertain the possibility of meeting such criteria in the early phases of engagement with the project. This can be particularly helpful to university-based educational researchers when initially engaging schools in the recruitment process.

Implications and Conclusion

I described in the beginning of this article the increasing appetite across the educational landscape for teachers to engage with and in research. If we want this, then we need to ensure there are sufficient supports to allow teachers to engage without it being a significant additional burden on an already demanding workload. My experience is that teachers are generally passionate about engaging in these research opportunities but, understandably, their priorities are with the immediate needs of their pupils. As university-based researchers, we recognise this and try to design our projects in full cognisance of the demands on teachers and the reported challenges for engagement. However, there is only so much the design of a project can ameliorate the challenges. This article has reflected on one additional support that has emerged during the OARS project as offering particular affordances; this is the school-based 'research lead'.

There are many other supports that could be put in place, of course. I have been fortunate enough to work as part of the Research Engagement Group of the Teaching Council of Ireland, a committee dedicated to supporting teachers' engagement with and in research. The Teaching Council provides access to educational literature (including journals, books, and commissioned research) to every registered teacher, e-Zines with research article summaries on given topics, research webinars discussing both literature and research methodologies, providing funding for teachers to conduct research, hosting meetings and conferences to disseminate teacher research, and much more. The Chartered College for Teachers in England and the ResearchEd movement provide similar support for teachers engaging with and in research. Within the Department of Education at the University of Oxford, the Oxford Education Deanery provides another model by partnering university researchers and schools together to support the consideration and conduct of research in schools. There are undoubtedly many more approaches to supporting teachers' engagement with and in research. What makes the 'research lead' approach different is that it is school-based and in a sense a 'grass-roots' approach rather than a provision of an external body.

Acknowledgements

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CREATING A SCHOOL WIDE RESEARCH CULTURE:
THE CASE STUDY OF HOLME GRANGE

Claire Willott | *Research Lead, Holme Grange*

My aim in this article is to explain step by step how I grew the research culture at Holme Grange School over the course of a year. This is not intended as a blueprint for success but is offered rather as an approach that worked well and it is hoped that the reader can see how a similar approach in their own setting could result in the development of a research culture.

When I joined the school we had a small action research group in its third year of operation. We had two projects running. One was looking at the issue of simple punctuation mistakes that were regularly repeated in children's work. The other involved utilizing the standing desks in school. These projects were interesting starting points as one grew from identifying a problem in the classroom and the other grew from an interest and enthusiasm from the teacher. Both of these highlight key ways to get things started:

1. Explore an area of interest

2. Work around solving a problem in your classroom

The first step of growth came when I made contact with Jonnie Noakes at the Tony Little Centre for Innovation and Research in Learning (CIRL). Jonnie invited us to visit and advised that if we were serious about growing our research culture at Holme Grange then appointing a member of staff to focus on and lead research in school would be an important step. I was appointed to the research lead role and this was quickly followed by an invitation to meet other teacher researchers at a workshop held at CIRL.

Useful points that came from the workshop included the following:

- There is a world-wide drive towards evidence-based practice, and schools are part of this change.

- In order to translate evidence into changes in the classroom you need to create a research-engaged culture within your school.

- The role of the research lead is central to this culture change, along with vital support from your Senior Management Team (SMT).

- The research lead role can involve offering new ideas, starting discussions, acting as a sounding board as thoughts develop and supporting teachers to take these ideas further.

- Links with universities will help build your research culture.

- Develop inter-school professional learning communities with people you meet at workshops or on courses to discuss common research interests, what you have read and what you could try together.

- Create a research journal published by the school (start with presenting research summaries of others if your school doesn't yet do their own research.

As the research role grew I spent more time reading. I read books and websites and found the more I read the more I found other sources of information that I trusted. One useful source of peer-reviewed published articles is through membership of the Chartered College of Teaching. As I came across short and relevant articles covering areas of interest I passed them on to the relevant teachers. As your reading develops you quickly discover that the field is vast and that you need some way of selecting where to focus. This is where support from the SMT in your school is vital – you need to focus on areas where the SMT want to grow the school. One early piece of work that I carried out was to assess current thinking on marking and feedback in order to inform our policy update in this area. Such a small, concise task directed by need is ideal as you grow into the role.

Another approachable way to start is if your school wishes to try a new off-the-shelf intervention. At my school, a maths teacher wanted to review a teaching and learning platform to see if regular use addressing arithmetic would improve performance in the wider maths curriculum. We met to discuss what baseline testing could be carried out, when and how often the programme will be used and a suitable duration for the intervention (November-July) plus when would be a suitable review point (Easter). I acted as a sounding board as the practicalities were thought through and we met every so often to discuss if all was on track. At the end of the project, I will help with writing up and deciding the next steps based on the results found.

One book that I found very useful to read early on was full of practical examples of action research (Stylianides & Childs, 2019). I discovered there was a meeting being held at the Department of Education, Oxford University presenting some of the work covered in the book. I attended and found this to be a helpful way to meet university researchers. Holme Grange was then invited to participate in the OARS project (Department of Education, University of Oxford, 2020). In addition, following contact with CIRL, we had the opportunity to participate in an Eton and BrainCanDo project looking at building resilience in children. Both of these studies are currently ongoing and provide opportunities both for staff and for pupils to meet with university researchers and be part of their research. In addition, the potential that these studies offer in further developing higher-order thinking skills and building pupil resilience cannot be overlooked.

Having developed fruitful links with Oxford University and Eton College, I was encouraged to search for other local researchers. I regularly review the research website of the University of Reading's Institute of Education (Institute of Education Research, 2020), and became familiar with the work of Dr. Natthapoj Vincent Trakulphadetkrai. Vince was recruiting schools to aid his research on developing children's conceptual understanding of multiplication through creating story picture books about multiplication (Trakulphadetkrai, 2020). I contacted him and this resulted in a very interesting visit to Holme Grange where Vince trialled his test material that was in development for his larger scale study. This was mutually beneficial - as Vince gathered information on whether his tests were suitable for use in Year 4 he generously shared this data, giving us further insight into our own children's conceptual understanding of multiplication. This has inspired discussion with our Maths Departments as to how we can utilise this information to inform and improve our teaching further. This collaboration resulted in fruitful meetings with other Institute of Education staff with the possibility of Holme Grange becoming involved in future research and also receiving support from university academics in guiding our action research towards publication and presenting at conferences. University researchers need pupils in order to carry out their research in education and they are willing to contribute a great deal of expertise and support to schools in return for access to schools.

Having made links with three academic researchers at the start of this academic year things took off with regard to building our research-engaged culture within Holme Grange. Our Head devised a new CPD programme for all staff. This programme was a year-long involvement for staff who are given the choice of contributing to one of seven streams, one being research and development. Leading this Research and Development CPD is an aspect of my role that I have particularly enjoyed and has been very rewarding.

I worked with a core group of seven teachers to introduce them to action research in the classroom. My main focus was to break down barriers to research and to enable teachers to see that this was something they could do themselves. It was also vitally important that any research was based on a genuine interest or a real problem. We met for one hour every half term. Meetings involved round-table discussions where everyone participated and actions were agreed at the end of each meeting. Below is a summary of what was covered during these meetings:

Sept 2019 – General interest areas specific to each person were discussed at the first meeting. I could then select several pieces of relevant literature for each team member, to aid background reading ahead of the next meeting. In order to get started it is helpful to provide this support but as research confidence grows teachers will be able to carry out their own literature searches.

Nov 2019 – This meeting was focussed on how to form research questions. We used round table discussion to build knowledge as to why some questions were unhelpful and how they could be adjusted to be more specific.

This process was integral to everyone's learning and was an enjoyable process. Having posed a suitable research question during the meeting each teacher went away to plan a six-week classroom intervention.

Jan 2020 – Study design was discussed, taking the view that starting small, making the first project manageable and not overly complicated was important. Each project was discussed in turn, covering how baseline data would be collected, what would be measured during the six-week intervention and practically how the project would be carried out in the classroom.

Feb 2020 – Progress updates: some projects had started and some were still in the planning stage.

April 2020 – Final update from each project and discussion within the team. Future steps planned.

June 2020 – Whole-school feedback on the research carried out. The work is to be published in our Holme Grange research journal at the end of the academic year. As more teachers become involved in designing and running their own research projects this will naturally grow the research culture in the school and it is hoped that these discussions will take place in departmental meetings in the future.

The approach we have taken at Holme Grange has proved successful: each time a new avenue was explored it opened up new opportunities. As a result of our own growth we are now looking to support other local schools in developing their own culture of research.

Dominique Renouf-Soar, Teacher at Early Years Foundation Stage

I am a teacher working with a Reception class in the Early Years Foundation Stage. This year I had some children that needed stretching and challenging in mathematics. Previously, I had attended a course about making learning visible to the learner and I felt that I could use this to help pupils to recognise their successes and to see the ways in which their learning can be layered.

As part of this year's CPD at my school I signed up to be part of the research team to carry out an action research project. Initially, I had perceived a research project to be difficult to commit to in addition to my full time classroom responsibility and other professional development commitments. At the first meeting, we discussed our interests based on what was happening in our classrooms. I discussed how I wanted to stretch my more able learners in maths. During the following meetings I realised that my idea could be developed into a research project, and this could be much more straightforward than i had originally anticipated. Going through the process of formulating research questions, planning the intervention, and discussing collection of data has enabled me to realise that I was naturally undertaking action research in the classroom and this has transformed my perception of myself as an educator and researcher.

THIS PROGRAMME WAS A YEAR-LONG INVOLVEMENT FOR STAFF WHO ARE GIVEN THE CHOICE OF CONTRIBUTING TO ONE OF SEVEN STREAMS, ONE BEING RESEARCH AND DEVELOPMENT

Making learning visible to younger pupils has enabled them to become more able to make connections between different activities and then engage more fully in the action of learning. I now feel inspired to continue my research journey further and look forward to finding opportunities to listen and share research findings again in the classroom, linked especially to younger learners.

Judith Curtis, Religious Studies Teacher

Many teachers are inspired to conduct educational research as we are faced with situations daily which interest and puzzle us. The easy part is devising a research question which excites and inspires you to read further and conduct research in your own classroom. A hurdle I have faced in the past is being unsure whether the research I want to carry out is ethical and valuable. Starting a research project can be a daunting, and even a lonely task. This is where having a Research Lead in your school becomes invaluable in enabling the research to happen. With a Research Lead you have a partner in your project: someone within the school whose role is to support you in your research.

When our school purchased standing desks for classroom use, I was interested to investigate how effective they might be. Most research conducted to date has covered the health benefits of such desks, so I chose to focus on perceived impact on pupil learning and behaviour. I began my research with pupil online surveys about their preferred ways of sitting to study, and then conducted interviews after pupils had trialled the desks. My initial research was with Year 10. This academic year I am studying Year 7, and including more classroom observations. My main conclusion to date is that standing desks provide an outlet for pupils who find it challenging to sit for extended periods and like to fidget, and allows them to have more movement without distracting their peers or the teacher.

Ajay Bhatti, Head of Prep ICT and Business and Year 6 Form tutor

This was my first piece of educational research and initially I was unsure of what I would be required to do to ensure my work would be of interest and value adding. I was motivated as I had chosen an area that I had a genuine interest in. However, I was apprehensive at first and slightly daunted at the prospect of starting a research project. This was mainly due to my being new into teaching, having no experience of conducting a research project and also trying to fit the extra work into an already packed working schedule. The title of my project was 'Does teaching a programme focussed on the pitfalls of perfectionism help improve pupils wellbeing?'.

Through the research project, I spent six weeks discussing with Year 6 pupils in their Life Skills lessons the arguments around perfectionism. For example, we looked how one can reframe perfectionism and concentrate on striving for excellence. I encouraged them to focus on the things that went well in a day rather than the things that did not and we dispelled myths around perfectionism and focused on strategies to to overcome perfectionist tendencies and behaviours.

I NOW FEEL INSPIRED TO CONTINUE MY RESEARCH JOURNEY FURTHER AND LOOK FORWARD TO FINDING OPPORTUNITIES TO LISTEN AND SHARE RESEARCH FINDINGS AGAIN IN THE CLASSROOM, LINKED ESPECIALLY TO YOUNGER LEARNERS

Having a Research Lead provided me with a support network and guidance and alleviated the pressure. There were several key things that Claire did that made the work more realistic and manageable. She was able to dispel some major misconceptions of what a research project should entail. A plan with a clear view of what the key stages of a research project is required to go through was provided and this consisted of having regular check points to discuss with other project leads to share their progress, challenges and successes. This proved highly valuable as I along with others felt less alone and also was able to brainstorm or overcome any issues through shared learning and discussions. A guidance document and planning enquiry form was provided, this was helpful as it prompted questions that helped to kick start the project. Claire also provided the mentoring that was required, especially for someone like me who had no experience in research projects. She made the work accessible by helping to break it down into manageable chunks and providing weekly support in both group and 1:1 sessions when needed. I was often provided with relevant research, articles and contacts that helped me shape my project.

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