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Editorial: The Changing Face of Education

John Thornby [1,2] *

[1] Centre for Professional Education, University of Warwick, Coventry, CV4 7AL
[2] Centre for Education Studies, University of Warwick, Coventry, CV4 7AL
* Correspondence: John.Thornby@warwick.ac.uk & wjett@warwick.ac.uk

On behalf of the Editorial Board, it gives me great pleasure to introduce the inaugural issue of the *Warwick Journal of Education – Transforming Teaching* (WJETT). At time of writing, education at all levels in the United Kingdom faces a host of challenges: from changes to funding for schools and the threat (or solace) of academisation (depending on perspective), through to the Teaching Excellence Framework for Higher Education which has put university teaching under the microscope for the first time. At all levels, performance measures and league tables are at the forefront, placing added pressure and accountability on leadership teams.

It is a time of great uncertainty and unease, as the country prepares to face a new government whose plans for education have yet to be fully revealed. While aspects of the previous government's education whitepaper (DfE, 2016a) have already been revoked, it seems likely that further change is on the horizon, with a revitalised vision for multi-academy trusts and "new, stronger accreditation" (*ibid.*, p.32) to replace Qualified Teacher Status. More recently, in their manifesto for the 2017 General Election, the Conservative Party (2017) unveiled plans for a "world class technical education" (*ibid.*, p.52), with a reformed qualifications framework that seems likely to impact the Further Education sector. Moreover, the manifesto promises to build at least 100 new free schools per year and universities will be incentivised "to become involved in academy sponsorship or the founding of free schools" (*ibid.*, p.50). Whatever happens, though, policy will undoubtedly play a major role in education throughout the next parliament:

> …education has become one of the most important policy areas for governments across the world. Human capital in the form of a highly educated population is now accepted as a key determinant of economic success. This has led countries to search for interventions which will lead to continuous improvement and to instigate major programmes of transformational change. Evidence of relative performance internationally has become a key driver of policy. That evidence suggests, perhaps unsurprisingly, that the foundations of successful education lie in the quality of teachers and their leadership. High quality people achieve high quality outcomes for children. (Donaldson, 2011, p.2)

Here Donaldson recognises the impact of education policy on economic success, but also identifies the importance of transformation within education and that quality breeds success. This affirms that challenges should be met head-on, with innovation and creativity. It is through the work of outstanding individuals – leaders and practitioners – that the education landscape can be improved.

In the Higher Education sector, Barber *et al.* (2013) foretell of a metaphorical 'avalanche' – a cataclysmic event sent to challenge complacency and stagnation. The cost of a university education has risen in recent years while the value of a degree has declined, causing universities to question their distinctiveness and placing added emphasis on teaching quality and the student experience.

These are, indeed, challenging times; but with challenge comes change, and it is such change that draws the focus of this journal. WJETT has been established in order to capture the work that goes on,

at all levels and across all kinds of educational institutions, in transforming teaching and learning to address these various challenges and nurture Donaldson's "high quality people", in pursuit of "high quality outcomes" – not just for children, but for all stakeholders.

This journal, we hope, serves to bridge the gap between academic researchers and practitioners at the chalk-face and aims to deliver innovative and creative pedagogy, alongside intellectual discourse on a range of educational issues – in an accessible fashion that we hope will be palatable for the practising teacher. WJETT is intended as a platform to disseminate best practice and is an opportunity for practising teachers and senior leaders to share their innovations in teaching and learning. This includes (but is not limited to) practitioner research; large-scale, whole-school or institutional initiatives and case studies; as well as issues relating to educational leadership, professional development and teacher education.

This project is intended as a catalyst to bring the communities of teaching and educational research closer together, with a view to promoting evidence-based practice within classrooms, across the University of Warwick's immediate partnership of schools and beyond. These goals are closely aligned to the new *Standard for Teachers' Professional Development* (DfE, 2016b) and the renewed drive for teaching to become a more evidence-informed profession, endorsed by Donaldson (2011), Carter (2015) and the recently established Chartered College of Teaching.

We use the term "teacher" in its most general sense and recognise that education occurs not only in schools, but also nurseries, colleges and universities as well as a host of other contexts, including pupil referral units, faith organisations and professional and subject associations. As such, WJETT invites contributions from the Further and Higher Education sectors, as well as Early Years, Primary, Secondary and alternative education settings.

As the name of the journal suggests, the theme for WJETT is "transformation". To that end, we begin this inaugural issue with some insights from Philippa Cordingley (Chief Executive, CUREE). CUREE is an internationally acknowledged centre of expertise in school and college improvement, as well as evidence-informed leadership and practice in education. In a short interview feature by Bart Crisp, Philippa reflects on recent transformations in education and their impact over the last decade, and forecasts the changes she would like to see in the near future.

The issue also features reflections on a science outreach project conducted by PhD students Cathy Rowland and Anna York (School of Life Sciences, University of Warwick). This project was established to educate children about Antimicrobial Resistance, while also presenting a positive and engaging image for science and strong female role models to transform the teaching of elements of the Key Stage 3 biology curriculum.

Academics Madeleine Findon and Sue Johnston-Wilder (University of Warwick) seek to address the low skill levels of undergraduate students via their "Growth Zone Model": a sensitive and inclusive approach, rooted in the use of both narrative and scientific modes of thought across all subject areas, to develop growth mindsets and promote academic resilience among learners.

Kate Mawson (University of Warwick) reflects on her Multi Author Blog project, designed to capture the experiences of trainee teachers and their "legitimate peripheral participation" in the teacher-as-researcher community of practice. The timing of this work is apt, given the renewed vision for teaching as a scholarly and evidence-informed profession and the improved access to research provided by the Chartered College of Teaching.

This issue of WJETT also provides a selection of student essays, focussing on different areas of pedagogy: Sandeep Purewal (PGCE student, University of Warwick) discusses the relevance of Shakespeare in the modern classroom and creative approaches to teaching The Bard's plays; Laura Meyrick (MA student, University of Warwick; English Teacher, President Kennedy School) investigates innovative ways to encourage pupils to read; and Jo Denton (EdD student, University of Warwick) explores the use of dynamic geometry software to (literally) transform shape in the mathematics classroom. Sasha Taylor (Worcester University) also provides insights into the contested nature of differentiation.

These collected works emphasise the importance of teachers continuing to take an active interest in their own professional development and subject specialism, particularly in response to renewed scrutiny of teachers' subject-specific knowledge and research literacy (Munday, 2016).

Finally, Editors Deborah Outhwaite and Ralph Tabberer (University of Warwick) provide insights into the international education landscape, the ways in which it 'borrows' performativity structures from the English education system and what can be learnt by embracing culture and difference in educational settings.

We hope you find this issue as stimulating and thought-provoking as we have, and that you enjoy reading the works we have selected. If you would like to be involved in WJETT in the future (as an Author, Reviewer or Editor) then please email wjett@warwick.ac.uk or visit the journal's webpage, http://journals.warwick.ac.uk/index.php/wjett/, where electronic versions of the articles are available (including supplementary material that is not included in the print version).

John Thornby – Editor-in-Chief, WJETT
June, 2017

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Editorial Board

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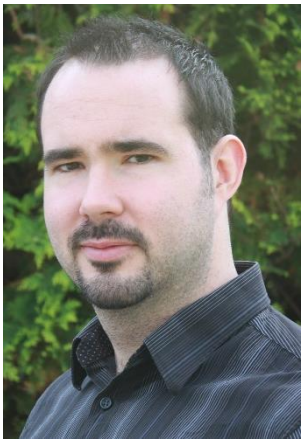
Editor-in-Chief



John Thornby is a Senior Teaching Fellow at the Centre for Professional Education, University of Warwick. Following a successful research career in mathematical and physical sciences, John has transitioned into education via A-level teaching for the Further Mathematics Support Programme. He now has leadership responsibility for Initial Teacher Education for STEM subjects, as well as postgraduate study skills.

His research interests include understanding attrition rates in STEM education, modelling indicators for success in teaching, gender in mathematics, strategies to tackle teacher shortage, as well as the nature of subject knowledge. He leads a national working group to review the content and policy structure of subject knowledge enhancement courses.

John is a Senior Fellow of the Higher Education Academy and a peer-reviewer for their National Teaching Fellowship scheme. He is also an editor for *the International Journal of Gender, Science and Technology* and has established WJETT with the help of a strategic project grant from the Institute of Advanced Teaching and Learning (IATL), at the University of Warwick.

Dr. Deborah Outhwaite
Editor

Deb Outhwaite is a Senior Teaching Fellow in Professional Development at the University of Warwick, where she runs the MA in Professional Education for teachers from all phases of education. A qualified 11-18 teacher, Deb was in secondary education for 12 years prior to university teaching and was an A-Level examiner.

Her Doctor of Education thesis focussed on senior leaders in schools and the International Baccalaureate. Deb now co-convenes the Leadership Preparation and Development RIG for BELMAS, and is an elected member and Trustee on BELMAS Council. Deb is also an elected member of IPDA's International Committee, and is a Parent Governor in an 11-18 outstanding comprehensive school. Deb is a Senior Fellow of the Higher Education Academy, and mentors staff from across the University of Warwick for their fellowship applications.

Mr. Chris Heal
Editor

Chris Heal has been a teacher for seven years and a senior leader for over half of that time. He has worked across Warwickshire as a Specialist Leader of Education, developing in-school teaching and learning and delivering CPD across a range of pedagogical practices. Chris is currently Assistant Headteacher at Bilton School in Rugby where he has responsibility for Teaching and Learning and Key Stage 5 achievement.

Prof. Ralph Tabberer

Associate Editor (International)

Ralph Tabberer was a teacher in London for several years before moving into education administration in 1989. He worked for almost 10 years at the National Foundation for Educational Research and joined the Department for Education and Skills (DfES, later renamed the DCSF) in 1997, where he worked with Professor Sir Michael Barber in the School Effectiveness Unit. He was Head of the National Grid for Learning from 1999-2000 before becoming Chief Executive of the Teacher Training Agency, which later became the Training and Development Agency (TDA).

Ralph left his position as Director General of Schools at the DCSF in 2008 and in March 2009 became Chief Schools Officer and Chief Operating Officer at GEMS Education, the worldwide education conglomerate headquartered in Dubai. In January 2012, he left to set up his own series of businesses, under the collective name of BBD Education.

The theme and purpose of Ralph's educational writing, these days, is international. For most of his career he worked in England with English schools. Since 2009, he has worked and sometimes lived abroad. The experience brought new insights into school strengths and weaknesses. He often says that he feels that he has had to learn everything he knows again, and afresh.

Ralph is an Honorary Professor of the University of Warwick.

An Interview with Philippa Cordingley (CUREE)

Bart Crisp [1] *

[1] CUREE, Coventry, CV1 2FJ, UK
* Correspondence: bart@curee.co.uk

Philippa Cordingley is the Chief Executive of CUREE and an internationally acknowledged expert in using evidence to develop education policy and practice. She leads CUREE and has a hands-on role in many of its projects including the development of the evidence based National Framework for Mentoring and Coaching; the creation of innovative practical resources to engage practitioners with research (e.g. Research for Teachers, The Research Informed Practice (TRIPs) web site and of a bank of micro enquiry tools for the Economic and Social Research Council's Teaching and Learning Research Programme and for the General Teaching Council. She also leads CUREE's research and evaluation projects ranging from a three-year large scale, multi-disciplinary evaluation of the implementation of the National Curriculum to the evaluation of in-school development projects. She has particularly enjoyed designing and leading CUREE's innovative and rigorous, yet user friendly, approach to evaluation that has proved very successful in the creativity and education field through, for example, CUREE's work for the National Gallery, the Sage Gateshead and Sing Up.

She is the founder and professional adviser to the National Teacher Research Panel, chair of the EPPI Centre Impact of CPD Review Group, an Honorary Fellow of the College for Teachers, a Fellow of the Royal Society for the encouragement of Arts, Manufactures and Commerce (RSA), Visiting Senior Research Fellow at Sussex University and a member of the Steering Groups of several HE research centres/projects. She also leads CUREE's strategic partnership with the Nuffield Foundation.

What do you think has made the biggest positive difference to teaching practice over the last decade?

I think ultimately it is an increased sense of confidence for professionals as professionals, which flows from lots of things: the growth of interest in teaching as a research informed profession (3% interest in 1997 to over 40% in the teacher census survey in 2010); the successes of Teach First and the publicity campaign about the strength and depth of the profession; more attention to continuing professional development and especially enquiry based professional learning; and involving schools and the profession more broadly in the important work of training and inducting teachers into the profession. We learn so much from supporting others' professional learning!

Why do you think it is important to think about how to transform teaching?

Pupils are the citizens of the future. The world is very uncertain and offers huge challenges and opportunities. Teaching and learning in the public education system is fundamental to developing a positive national identity and the skills we need to build an intellectually generous and sustainable

future full of wisdom alongside knowledge. This is deeply dependent on the profession and its leadership.

What do people who wish to help transform teaching need to remember?

If you want teachers and the profession to learn you have to model learning through the leadership you offer and the systems you create. Evidence about how pupils are responding to the changes we make, organised around teachers' aspirations for pupils, is the best springboard for depth, inclusivity and engagement.

What are the biggest challenges faced by those who wish to transform education for teachers?

The high stakes assessment and accountability regime and the impoverished view of the curriculum is front and centre. Increasing our focus on depth of knowledge does make sense, but it is depth that matters and even that is not an end in itself – purpose is absolutely key as well. Teachers and policy makers have to organise curriculum thinking around using clarity about why the things we teach matter, and how they work in contexts that are meaningful to pupils, for such depth to make a difference.

What have you been involved in which you think has made the biggest positive difference to teaching practice, and why is/was it so successful?

I think promoting teaching as a research and evidence-informed profession in the mid-nineties. Key to making this work was working bottom-up (e.g. through the NUT's support for systematic reviews and evidence based co-coaching and by establishing the National Teacher Research Panel). Developing biennial National Teacher Research conferences also helped create a critical mass of interest and respect for the profession. The panel played a very important but not widely-known part in, for example, setting up the ESRC Teaching and Learning Research Fund. Campaigning for evidence informed Continuing Professional Development (CPD) is the other strand. But we worked top-down too, helping national agencies like the Teacher Training Agency, the Qualifications and Curriculum Development Agency and the National College for School Leadership to promote and facilitate evidence-informed practice. Top-down support included creating things like the National Framework for Mentoring and Coaching and videos and tools to exemplify it. The Framework is still in use today – in fact the Welsh government recently asked us to update it and have made it a core part of their CPD policy. The last big building block has been using the evidence to campaign for a focus not just on CPD done to teachers but on continuing professional development *and* learning done by them too.

What are the aspects of teaching you would most like to see transformed over the next decade?

I would like to see teachers in England and around the world focusing on and being given substantial roles in and time for curriculum design. By design I mean planning, developing, evaluating and refining learning experiences beyond the level of individual lessons by, for example:

- Developing diagnostic assessment well before the start of a scheme of learning, so teachers can make informed judgments about where to linger and where to work at pace because pupils will progress anyway
- Working collaboratively with peers to develop coherent schemes of learning and enable depth in learning by making cross curriculum connections
- Using their content knowledge and knowledge of pupils to make the formal curriculum meaningful to pupils, especially those with low social capital for whom school is an alien environment.

Antimicrobial Resistance: Raising Awareness and Inspiring the Next Generation of Scientists

Cathy Rowland [1] *, Anna York [1]

[1] School of Life Sciences, University of Warwick, Coventry, CV4 7AL, UK
* Correspondence: C.E.Rowland@warwick.ac.uk

Abstract Antimicrobial resistance (AMR) poses a major threat to modern medicine and has a wider socio-economic impact worldwide. Public awareness is a key priority in decreasing the burden of AMR, and so we describe the development and execution of 'Antibiotic Awareness', a workshop for key stage 3 (KS3) pupils delivered by researchers from the University of Warwick. The workshop aimed to highlight the importance of antibiotic resistance, in addition to providing a novel opportunity for students to engage with scientists in this widening participation project. The session was one hour, comprising an introductory talk, three activities and a plenary question and answer session. The workshop was delivered to 233 students, in two schools, and complemented the KS3 curriculum. The workshop was assessed on three criteria; student responses to questions (at the end of the session and in a two month follow-up), student feedback, and teacher feedback. Overall, 88% of students felt that we 'had done a good job'. Immediately after the workshop, the majority were able to define antibiotic resistance and answer plenary questions. However, at follow-up, retention was low. The initial delivery of the workshop indicated that it was informative and engaging, but also identified opportunities for improvement.

Peer review: This article has been subject to a double blind peer review process

Keywords: Antibiotic Resistance; Key Stage 3; Outreach; Science; STEM; Workshop

GLOSSARY OF TERMS

Antibiotic: Drugs used to treat bacterial infections

Antibiotic resistance: When bacteria develop or acquire mechanisms that prevent them from being eliminated by antibiotics

Antimicrobial resistance: The resistance of microorganisms (bacteria, viruses and fungi) to the drugs used to eliminate them

Bloom's taxonomy: A hierarchy of learning objectives by complexity

Elaborative interrogation: A technique in teaching whereby students give explanations in support of a stated fact or concept

Human capital: (As used in the Review on Antimicrobial Resistance) A strategic priority describing the need to increase the number of people researching antibiotics and resistance mechanisms

Office for Fair Access (OFFA) Agreement: A strategic document for universities which states fee limits and mandates the outreach and financial support that are required as access measures

Process question: A question where students answer with an explanation

Product question: A question to which students give a single answer

Single colony streaking: A technique in microbiology whereby the way in which a culture of bacteria is spread on an agar plate causes dilution of the cells, such that 'single colonies' (groups of cells that have grown from one single cell) can be observed

Rosenshine's principles of instruction: A set of principles for teachers to maximise the impact of instruction

Widening participation: A policy in UK Higher Education that aims at increasing the proportion of under-represented groups that enter higher education

INTRODUCTION

It is estimated that by 2050, deaths linked to antimicrobial resistant infections could reach 10 million globally per year, surpassing deaths linked to cancer (O 'Neill, 2016). Antibiotic resistance occurs when bacteria develop or acquire mechanisms that prevent them from being eliminated by antibiotics (drugs used to treat bacterial infections). Antibiotic resistance is a growing threat to modern medicine; in addition to treatment of infections, antibiotics are important for medical procedures involving surgery, and are key in the management of conditions such as cancer and diabetes.

The Review on Antimicrobial Resistance (AMR) (O 'Neill, 2016) generated a set of 10 key recommendations and interventions that could best address the problem. Among these were public awareness; sanitation and hygiene; and human capital (i.e. increasing the number of research scientists), which served as the catalyst for this widening participation project. The importance of public awareness and education in AMR is increasingly being recognised with yearly campaigns such as 'Handle Antibiotics with Care' from the World Health Organisation, which serves to communicate key messages in tackling antibiotic resistance. In addition, in 2006, Public Health England (PHE) led the e-Bug project, an online educational resource that was aimed at educating children about microbiology, prevention, control and treatment of infectious diseases, as well as AMR (Kostkova *et al*., 2010).

In this article we describe the design, execution and reflection of 'Antibiotic Awareness' a workshop for key stage 3 (KS3) students, which addresses the three aforementioned recommendations from the Review on AMR (O 'Neill, 2016). The workshop builds upon key concepts that have been addressed previously in other resources, but tailors them towards use in the classroom, specifically for KS3 students. In contrast to the e-Bug project, 'Antibiotic Awareness' offers hands-on activities facilitated by research scientists. The workshop aimed to pique the students' interest in science, technology, engineering and mathematics (STEM) and widen their choice of career options.

DESIGNING THE WORKSHOP

In line with the strategic priorities from the University of Warwick's Office for Fair Access (OFFA) Agreement, and in recognition of the importance of public awareness and outreach in tackling AMR, a KS3 workshop entitled 'Antibiotic Awareness' was designed. With the widening participation policy in mind, the workshop was trialled at two schools with differing OFSTED results and levels of pupil premium. Furthermore, the two schools varied in classroom environment, teaching style and student

behaviour, which provided a suitable sample population for a small-scale trial. The use of small-scale trials/pilot studies permit the identification of logistical problems and assess the likely success (van Teijlingen & Hundley, 2002) of the workshop, within a limited budget.

The authors and workshop designers are PhD students working in the field of AMR mechanisms at the University of Warwick. Inspiration, advice and guidance was initially garnered from key public health campaigns and professional educators in order to best achieve the twin goals of effective communication about antibiotic resistance, and widening participation in science. The School of Life Sciences (SLS) outreach team and the Centre for Professional Education (CPE) assisted with the workshop design, preparation of activities and demonstrator training.

Devising the Content

The content of the workshop was founded on a combination of key messages from public health campaigns, the priorities of the Review on AMR, and in supporting areas of the KS3 national curriculum (Department for Education, 2014) - see Figure 1. The underpinning concepts of the workshop, such as the differences between bacteria and viruses, are discussed within the UK national curriculum (Department for Education, 2014). AMR may be covered with teaching of concepts such as evolution at KS3, and 'health, disease and the development of medicines' at key stage 4 (KS4) (Department for Education, 2014). Since prior learning is important in permitting progression of learning (Parkinson, 2002, 153 - 67) consideration was given to delivering the workshop to KS4 students. However when discussing outreach initiatives for engineering, Wilson & Chizeck (2000) suggest that recruitment of students into science by outreach is more effective prior to high school, as fewer students will have lost interest in science at this stage. KS3 was therefore chosen as the target audience for the workshop, and the introductory talk was structured such that the students' current understanding could be assessed, and the content adjusted to the appropriate level. Hattie (2003) identified feedback, instructional quality, classroom environment and questioning among a set of influences that have a large effect on student learning. The incorporation of these influences into the workshop was sought through the training of demonstrators, and the structure and pedagogy of the workshop itself.

Training of Demonstrators

All demonstrators were provided with comprehensive training to ensure the highest teaching standards (incorporating Hattie's (2003) influences) and the best learning experience was provided. The demonstrators participated in two training sessions, the first from the CPE, which encompassed the Teachers' Standards, best teaching practices, and classroom management techniques. Demonstrators were then equipped with strategies to support students in completing the activities and maintaining focus. This was beneficial for the instructional quality and classroom environment of the workshop.

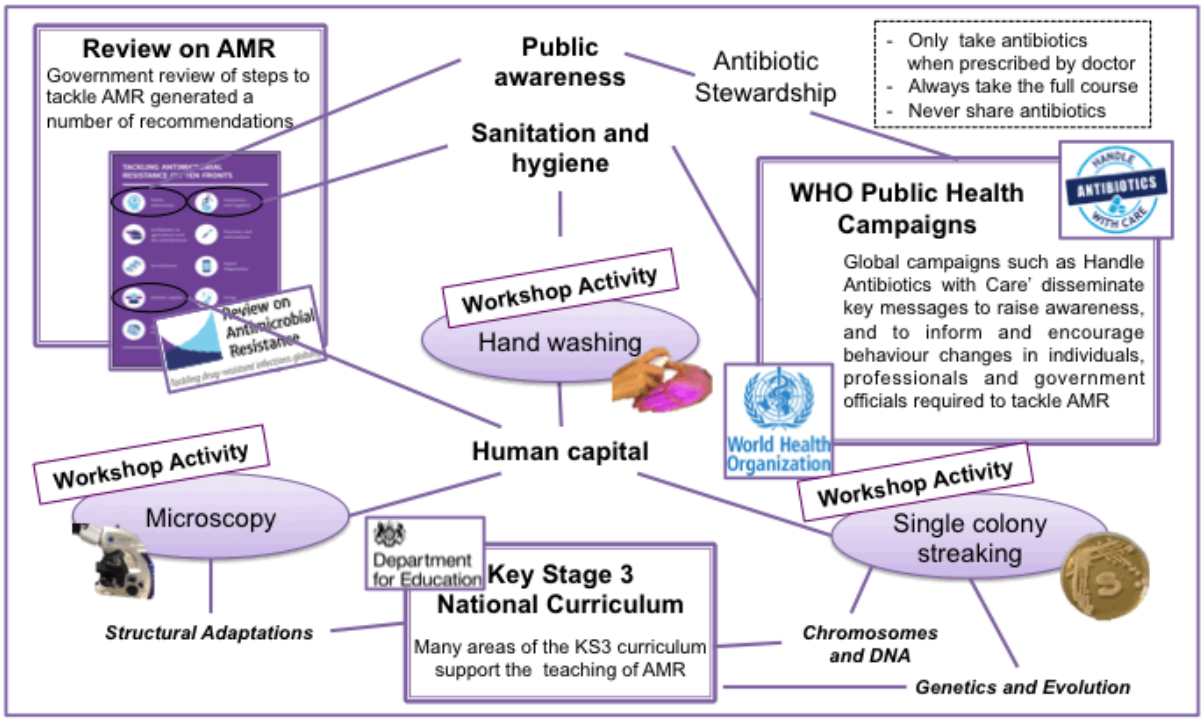


Figure 1: *Key components of the workshop. Key messages from the Review on AMR, public health campaigns and certain areas of the key stage 3 national curriculum contributed to the content of the 'Antibiotic Awareness' workshop. The workshop aimed to tackle 3 of the 10 recommendations of the Review on AMR, namely human capital; public awareness; and sanitation and hygiene. The latter two are also primary goals of global public health campaigns such as 'Handle Antibiotics with Care', which prompted the inclusion of the hand washing technique activity. The microscopy and single colony streaking activities were designed to promote science and assist human capital whilst directly supporting three subject areas within the KS3 national curriculum.*

The characteristics of good science teachers are defined by Parkinson (2002, 2) as enthusiasm; identification and communication of clear learning objectives; and knowledge about the science being taught. In addition, teachers' level of content knowledge has been linked to gains for students (Coe *et al*., 2014). In order to nurture these attributes in the demonstrators, the second training session, delivered by the organisers, focused on providing demonstrators with the level of content knowledge required for supporting student learning throughout the workshop; and defining clear desired learning outcomes (Box 1). Demonstrators were instructed to communicate these to students during the initial introductory talk, and then subsequently at each activity station. Emphasis was placed on clear communication of desired learning outcomes, as this is likely to increase chances of students' achieving them (Hattie, 2012, 47). Along with their natural enthusiasm for science, these training sessions ensured that the demonstrators were equipped with the characteristics of good science teachers.

BOX 1 – DESIRED LEARNING OUTCOMES

- Discuss (as a class) what antibiotic resistance is
- Describe how antibiotic resistance develops, and how different factors may contribute (e.g. prescribing, hygiene, patient compliance, farmers' use of antibiotics)
- Explain why antibiotic resistance is an important issue, and who will be affected by it
- Develop skills in single colony streaking, and discuss how this technique is used by microbiologists
- Conceptualise bacterial growth on agar plates and relate this to mutations in DNA that give rise to antibiotic resistance
- Demonstrate how effective hand washing technique can be used to reduce the spread and development of antibiotic resistance
- Compare the structures of the cell wall in Gram-positive and Gram-negative bacteria, and apply information in the workbook to identify Gram-stained bacteria using light microscopes

Structure of the Workshop

The workshop was designed for delivery to classes of approximately 30 pupils during timetabled science lessons (one-hour duration). It comprised an introductory talk followed by rotation around three activities; hand washing technique, microscopy, and single colony streaking of Baker's yeast (to mimic bacterial growth). Students also received a workbook and were encouraged to complete it during the session. Figure 2 gives an overview of the structure of the workshop.

The introductory talk began with a word game, where students were asked to raise their hands to assess familiarity with words and phrases such as 'germs', 'DNA' and 'antibiotic resistance'. To gauge students' understanding of these words, they were subsequently asked to provide definitions; this created an optimal classroom climate for learning by encouraging participation and establishing an atmosphere where student engagement and feedback is the norm (Hattie, 2003).

The hands-on activities were expected to improve student engagement and the overall impact of the workshop, since studies show that they improve students' perception of involvement and autonomy, resulting in more positive results (Vennix *et al.*, 2017). Throughout the workshop, an open dialogue between instructors and students was actively encouraged. Particular emphasis was placed on responding to, and encouraging questions, as well as checking students' understanding, in line with Rosenshine's principles of instruction (Rosenshine, 2012).

Sanitation and hygiene was a key recommendation of the Review on AMR (O 'Neill, 2016) and in addition, The National Institute for Health and Care Excellence (NICE) recently publicised advice that children should be taught how to wash their hands effectively, to reduce spread of infection and thereby decrease use of antibiotics (Regis & Stone, 2017). This prompted the inclusion of the hand washing technique activity which used GloGerm™ Spray Oil, a hand gel which simulates the spread of bacteria and illustrates sites on the hands that have been missed during washing.

The microscopy activity addressed a number of points within the KS3 curriculum including 'how to observe, interpret and record cell structure using a light microscope' (Department for Education, 2014).

The single colony streaking activity used baker's yeast as a safe alternative to bacteria. This activity provided an opportunity for students to develop a technique commonly used in microbiology laboratories. In addition, this activity allowed on-going interaction with the classes, as their plates were incubated at the SLS, and images were uploaded to the Integrate AMR website (http://www2.warwick.ac.uk/fac/cross_fac/wamic/integrate/outreach/). These were then shown to the students as a class during a short follow-up session, delivered by the teachers.

The classes were divided into three groups of ~10, by randomly allocating students to a colour (red, orange, green) which corresponded to the starting activity. Microscopy and hand washing activities were explained by the demonstrator to the entire group of 10, which were then split into smaller groups of two or three for practical purposes (microscopy and hand washing activities). Students completed the single colony streaking activity individually after a single demonstrator explained to the entire group, with additional demonstrators providing one-to-one support where necessary thereafter.

During the sessions, student feedback was collected using a voting system, with coloured tokens and jars. Students were asked 'Which activity did you like best?' with a jar for each activity for students to cast their vote; and 'Did we do a good job explaining what Antibiotic Resistance is?', with green for 'yes', yellow for 'sort of', and red for 'no'. Teachers were asked to provide any qualitative feedback via email following the conclusion of the workshop.

RESULTS

Feedback at the time of the workshops was overwhelmingly positive in each case, with 88% of students voting that we had done 'a good job explaining what Antibiotic Resistance is'. There was a high level of engagement from the majority of pupils, and the preference for the different activities (both on the day and on follow-up two months later) is presented in Figure 3a. The desired outcomes, as assessed by the plenary questions, were well achieved, as all classes were able to answer the questions and discuss their thoughts. Follow-up data on students' answers to the same set of questions are presented in Figure 3b. Feedback from teachers at each school was both positive and complimentary; examples of feedback received are presented in Box 2.

BOX 2 – QUALITATIVE FEEDBACK

'The level of support provided by your staff was extremely good and allowed all the students to fully access the content. The booklet was interesting and informative with appropriate activities. All staff involved thought it was an extremely worthwhile activity for the students, not only for the content but also to give them a chance to interact with people from University, which has helped to raise their aspirations. This is particularly important for boys' - Teacher

'The sessions were very well planned, explained and delivered. Most of all everyone learned new aspects of microbiology' - Teacher

'I enjoyed learning about how many germs get around so quickly' - Student

'I know that hand washing is really important because of a amazing workshop. Big thanks to the Warwick University' - Student

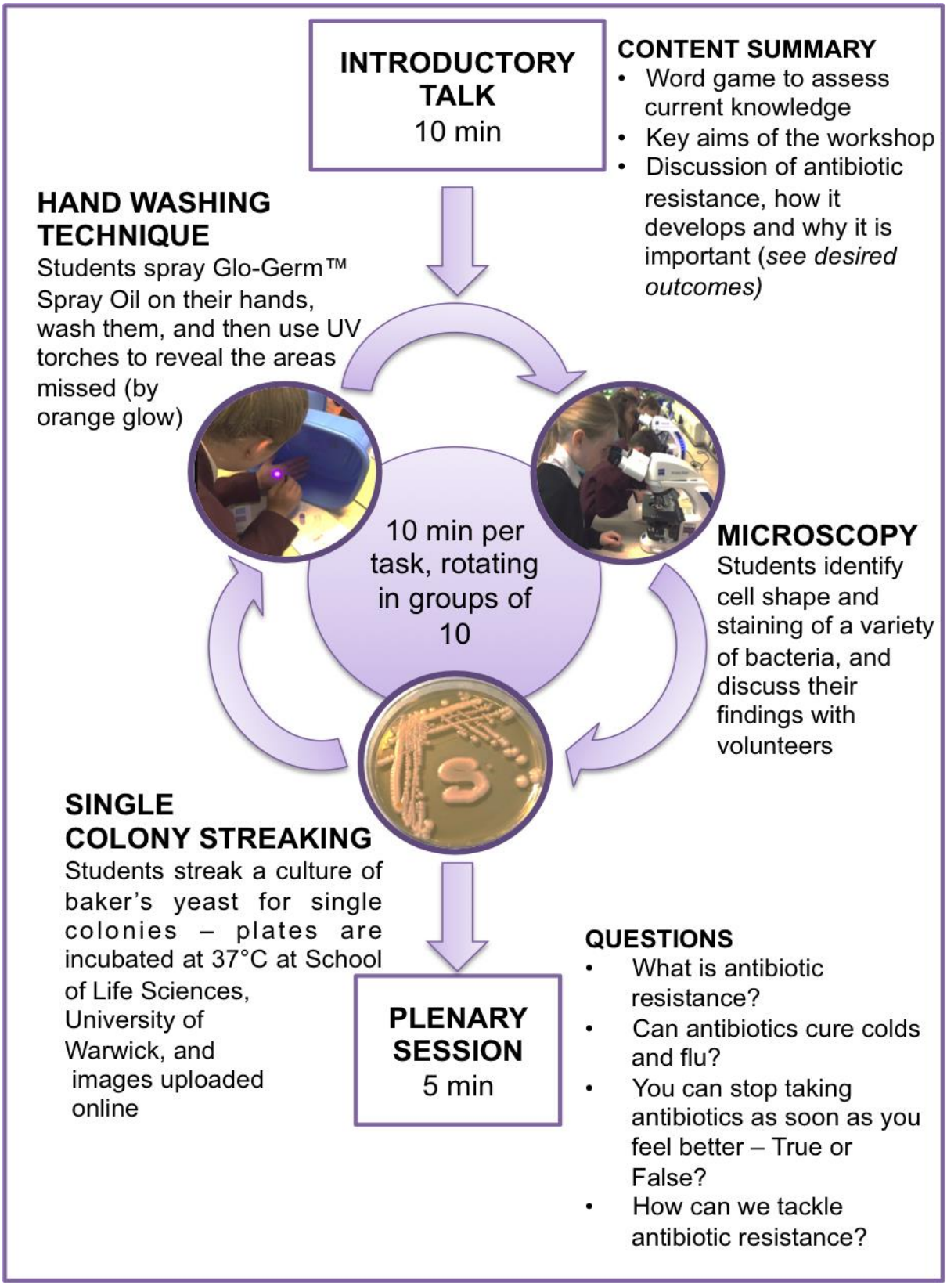


Figure 2: *The structure of the 'Antibiotic Awareness' workshop. The introductory talk was presented using a PowerPoint presentation, with class engagement through questions and discussion. The class was split into three groups at random, with each group rotating between the three activities. The workshop was concluded with a plenary session in which progress was measured using the questions shown.*

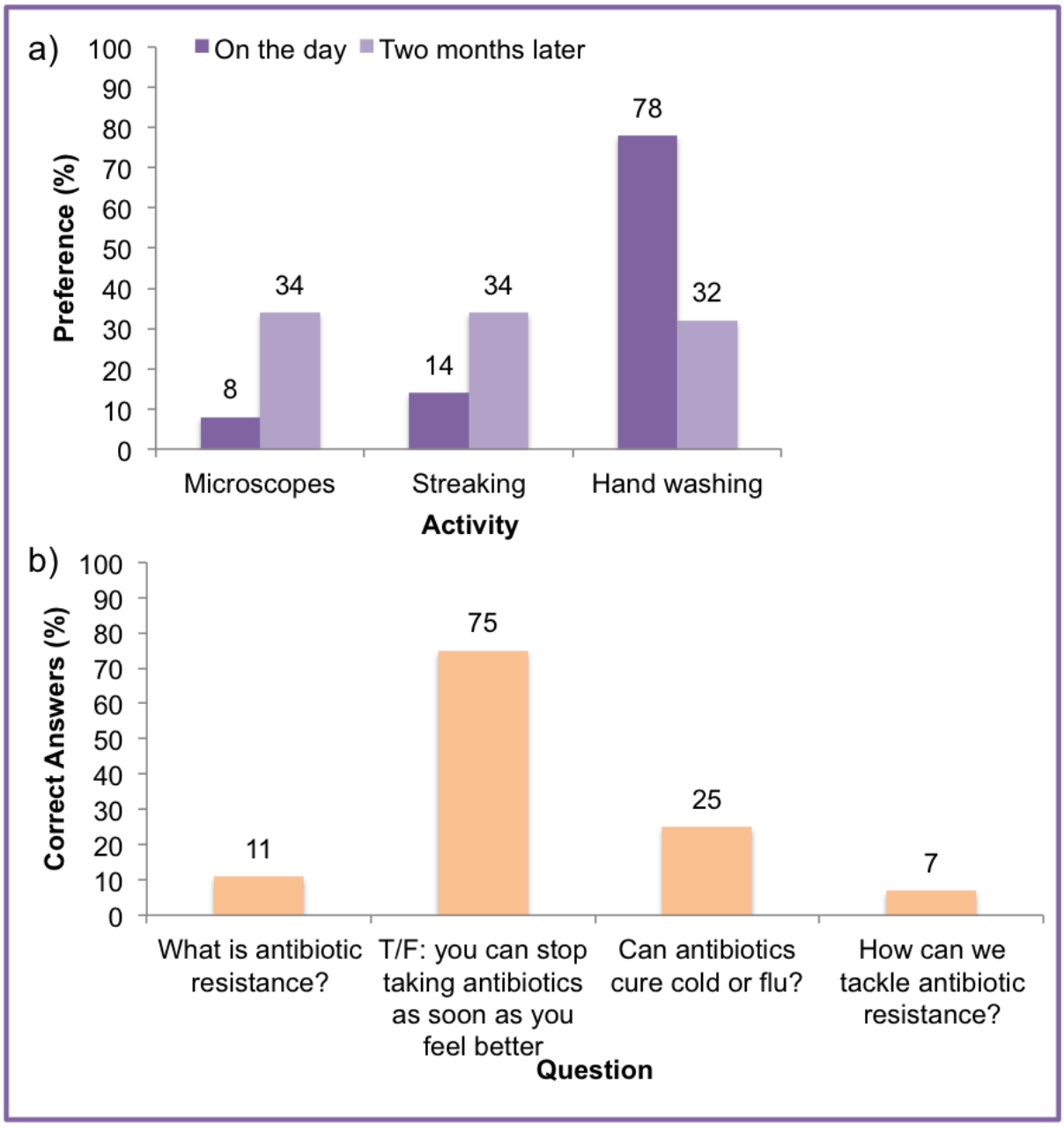


Figure 3: *Measures of the popularity of the various activities, and learning outcomes for the pupils. For both data sets, the total number of respondents was 44. a) Comparison between the day of the workshop (dark purple) to two months later (light purple) for student activity preference (by overall percentage). Whilst preference on the day was for the hand washing activity, there was a more even distribution of preference when checked two months later. b) The proportion of correct answers (by overall percentage) to the plenary session questions at follow-up two months after the workshop. The majority of students correctly answered 'false' to 'you can stop taking antibiotics as soon as you feel better', but retention was low for the other questions. T/F: True or false.*

DISCUSSION

Workshops such as 'Antibiotic Awareness' are a powerful tool to engage school-age children with the issue of antibiotic resistance and to empower the next generation to tackle this problem. Within a

one-hour session with each class, pupils were able to progress from having not heard of antibiotic resistance, to discussing how it arises and what preventative measures can be taken, whilst also learning new scientific skills.

Assessing the Workshop Outcomes

During the plenary session the key learning points were discussed as a class. At this time, the majority of students could correctly answer the questions. This was not the case at follow-up two months later when students were asked to individually answer the same set of questions. Figure 3 shows that, at follow-up, 25% of students understood that antibiotics do not cure cold or flu, and 75% correctly identified 'you can stop taking antibiotics as soon as you feel better' as false. However, a consideration for the future would be the phrasing of questions; when asked 'can antibiotics cure cold or flu?', a yes/no answer was expected, however 11% of students misinterpreted this question and selected either 'cold' or 'flu' as their answer – this therefore produced a bias in the results to this question making it difficult to include in the analysis. For more complex questions, such as 'what is antibiotic resistance' and 'how can we tackle antibiotic resistance', only 11% and 7% of students were able to provide correct answers such as 'always using the full course of antibiotics' and 'washing hands better'. Multiple choice answers may be a useful tool in the future.

Interestingly, the timing of obtaining feedback appeared to influence the results; two months after the workshop, activity preference was more evenly distributed, with 32%, 34% and 34% preferring hand washing, microscopy and single colony streaking respectively (Figure 3). This disparity may be explained by the difference in the nature of the feedback (i.e. voting versus a questionnaire), as well as a reduction in participation in feedback at two months. In the future, use of a questionnaire would standardise the feedback and allow direct comparison of retention of information by students after two months. Similarly, due to time pressures on teachers the feedback obtained was minimal and non-constructive, therefore standard questions for feedback from teachers may provide a more informative assessment of the workshop.

Benefits of University-Led Outreach Programs

Whilst tools such as e-Bug are an excellent resource for assisting teachers' lesson plans, the 'Antibiotic Awareness' workshop aims to engage with students using hands-on activities and inspire them into STEM subjects by providing a unique opportunity to interact directly with research scientists. This is supported by feedback from a teacher involved, who said the workshop gave students *'a chance to interact with people from University which has helped to raise their aspirations'*. A study of a similar 'scientist in the classroom' program, The Science Squad, reported (from interviews with school teachers and facilitators of the program) up to 92% enhanced interest and engagement in the program (Laursen *et al*., 2007). The '*novelty of a presenter different from the regular teacher*', was also found to impact upon students, with interviewees from both groups reporting increased attention in comparison to the usual teacher. These results corroborate observations from the workshop – the majority of students engaged with the presentation and activities, and asked questions to the demonstrators, indicating their interest in the content.

The workshop was delivered by a diverse group of researchers with equal female to male representation: since frequent, quality contact with successful in-group members (such as female scientists) contributes to improving implicit self-beliefs and raising career aspirations, which is

particularly important for inspiring girls into STEM related careers (Asgari *et al*., 2010). The involvement of research active staff in delivery of the workshop may also benefit the teachers in a professional capacity; respondents, both Science Squad members and teachers, in the study of The Science Squad program, reported gains for teachers including new teaching approaches, and advice on improvements for experiments and activities (Laursen *et al*., 2007).

Another advantage of 'Antibiotic Awareness' (over school-delivered resources) is that the teaching style is different compared to standard classroom teaching, with a higher demonstrator to student ratio. Similarly to a reduction in class size, this may result in higher levels of student engagement (Schanzenbach, 2014). However, a disadvantage of the 'Antibiotic Awareness' workshop is the cost of materials and access to equipment. However, when delivered by a university, funding and equipment can be made available; and the workshop offered free of charge to schools.

Consequently, this workshop format is particularly well suited to collaboration between Universities and local schools. In contrast, if adaptation for delivery by teachers was desired, a number of alterations would be required, and so initial involvement with research-active staff may be mutually beneficial. Different tasks would need to be chosen to suit the cost and availability of equipment, and the timing of activities may need to be altered to account for the lower demonstrator to student ratio.

Pedagogical Techniques

The workshop was designed to encourage imaginative and original thinking, as well as achieving simple recall of key facts from the students. Furthermore, a number of different teaching strategies were implemented throughout the workshop from whole class discussions to small group work, to ensure accessibility of material to different students.

Imaginative and original thinking was encouraged through the use of questioning. In developing their dynamic model of educational effectiveness, Creemers & Kyriakides (2006) described questioning and class discussion as effective teaching, although importance was placed on the technique. The authors particularly valued process questions, where students provide explanations, in contrast to product questions, where students give a single response. Whilst the talk did contain a high ratio of product to process questions, this was balanced by the use of the plenary session questions, which required explanations of some of the key concepts introduced in the workshop. For example, one question asked 'can antibiotics be used to treat colds and flu, and why?' requiring understanding of the messages that colds and flu are viral; and that antibiotics cannot treat viral infections. The responses to the plenary questions also allowed us to reinforce key messages and correct any misunderstandings.

The combination of cross-contextual questions with the puzzles and 'lab book' spaces of the workbook was intended to encourage students to achieve a higher level of thinking, (understanding) as described by Bloom's Taxonomy (Krathwohl, 2002). In addition, the lab book allowed students to learn to record and evaluate the tasks, which are key aspects of practising science and a requirement of the KS3 curriculum (Department for Education, 2014).

Throughout the introductory talk, a number of additional discussion points were raised, such as the impact of inability to treat infections. This technique, designated as 'elaborative interrogation' (whereby students give explanations in support of a stated fact or concept) is ranked by Dunlosky *et al*., (2013) as having 'moderate utility' in a ranking of 10 learning techniques, indicating the possibility for better retention of the knowledge conveyed than by simple rereading of the materials provided.

Praise was used throughout the introductory talk to encourage students to engage with the discussion questions, whereas the activities offered opportunities for demonstrators to give feedback to students. Feedback has been found to have a lesser effect on achievement when combined with praise (Hattie 2012); these two aspects of classroom interaction should therefore continue to be kept separate.

In summary, the pedagogy used in 'Antibiotic Awareness' would be expected to improve learning outcomes and complement material delivered in the curriculum.

Implementing the Activities

Activities were explained to students in groups of 10. However, within-class grouping (groups of four or five) has been shown to be beneficial, especially in science subjects, and therefore division into two or three smaller sub-groups may be a useful method for improving the activities (Lou *et al*., 1996). Recent studies indicate that the highest performing student pairs are girls' friendship pairing whilst boys' friendship pairs perform at the lowest levels, interestingly both female and male acquaintance pairs were found to perform at a mid-level (Kutnick & Kington, 2005). Therefore in order to facilitate learning for both girls and boys, to minimise off-task behaviour and to streamline the process, students were randomly allocated to groups prior to the workshop (Kutnick & Kington, 2005). This also alleviated the pitfalls of ability-based grouping in terms of false ideas of uniformity (Coe *et al*., 2014). Groups were assigned in advance, and assistance from teachers ensured appropriate groupings (e.g. to avoid behavioural issues between particular individuals). This was highly beneficial and maximised time spent on the activities.

The activities were delivered in 10-minute time slots with a two-minute warning, prior to rotation to the next activity. This provided structure to the workshop, ensuring that it ran smoothly. For both microscopy and hand washing technique activities, 10 minutes was adequate; however, for single colony streaking, where more context was required in order for students to understand the premise of the activity, the time was not sufficient. Whilst it was possible to streak plates in the allocated time, demonstrators and teachers felt that the students did not learn as much as in the other activities. This may explain the students' feedback, where single colony streaking was preferred by only 14% of students.

The hand washing technique activity was enjoyable and informative, with 78% of students voting it as their favourite activity. Students appeared to enjoy and benefit from microscopy during the workshop, but this was the favourite activity of only 8%. This may be because microscopy is more familiar to students, and was less interactive, as the students were only required to look down the microscope.

Evaluation of the Workbook

The workbook was fun and educational, and helped bridge the gap between pupils of different abilities by providing additional work to the higher attaining students. It also helped maintain focus for students who were waiting their turn during an activity.

The order of pages within the workbook could be re-considered, since the current layout with the 'Lab book' at the back and relevant information distributed throughout the workbook proved to be engaging for many students, but more challenging for less able members of the class. It may be more useful for the workbook to be assembled into activity-based sections.

Completion of the puzzles in the workbook was incentivised by a prize draw of two 'Giant Microbes' per school. This greatly aided in the engagement of students with the content of the workshop, as understanding of the content presented was required to complete the puzzles. The workbooks were collected by teachers following the workshop, and on reflection this would have been better supported with provision of a crib sheet for 'marking' the workbook. This would also have encouraged continued dialogue about AMR between students and teachers beyond the workshop itself.

Key Considerations for Future Workshops

The workshops herein discussed were highly enjoyable both for the majority of students, and for the demonstrators who delivered the sessions. In order to build on this success and ensure the smooth running of future workshops, the following constitute the areas the authors feel are key to address.

During the planning stage, communication with the school via the head of department was most often by email or telephone. Difficulty was experienced in finding a suitable time to talk directly, introducing delays due to existing restraints on teachers' time. For future workshops, it may be more effective to build a stronger relationship with the school by having a trainee teacher leading the project, with whom the school can liaise directly and provide a more suitable channel of communication.

A number of small improvements to the workshop would include development of additional activities to form a repertoire, from which schools can select specific activities best suited to their needs; improvement to the order of the workbook; potential inclusion of additional, more challenging work for high achieving students; and providing a crib sheet for teachers to continue dialogue about AMR following the conclusion of the workshop. If these changes were implemented a second small-scale trial would be beneficial to assess the effectiveness of refinements, and would increase chances of obtaining funding on a larger scale.

CONCLUSIONS

Overall, this workshop was very well received; feedback indicated that 88% of participants felt that *'[you] did a good job at explaining antibiotic resistance'*. The format therefore appears to be successful in communicating key messages relating to AMR to KS3 students, whilst also engaging students and furthering their interest in science. A number of points within the national curriculum were addressed, and widening participation will permit students from a wide range of backgrounds to be inspired by researchers to attend university and pursue interests in STEM related subjects.

The format of this workshop appeared to result in a well-received, enjoyable session for the majority of students, with demonstrable learning on key messages related to antibiotic resistance. Between the two schools there was variation in the teaching style, student behaviour and rapport between teachers and students. Despite these differences, the workshop was well received and the outcomes similar for both schools, suggesting that it could be implemented in a range of schools. The authors intend that this workshop will be distributed to more schools within the local community in the near future and will inspire other researchers to conduct similar workshops. This format has the potential to be applied to convey other key topics in science, whilst sparking interest in STEM subjects for a wide range of students.

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Shakespeare in the Classroom: to be or not to be?

Sandeep Purewal [1,2] *

[1] Centre for Professional Education, University of Warwick, Coventry, CV4 7AL, UK
[2] Kenilworth School and Sixth Form, Kenilworth, CV8 2DA, UK
* Correspondence: s.purewal@ksnadmin.ksn.org.uk

Abstract This paper explores the arguments surrounding Shakespeare's place in the classroom amid recent changes to the National Curriculum. First, it will explore arguments suggesting that the works of William Shakespeare are not relevant to the lives of young people today: as a result, the compulsory study of Shakespeare in schools risks alienating students, many of whom come from different ethnic backgrounds. Once acknowledging these arguments, however, the paper will propose that the themes and ideas that run through Shakespeare's works are universal, surpassing barriers such as race and class. In this way, the plays are as relevant today as on the day they were written. The paper will argue that rather than Shakespeare being irrelevant, it is outdated teaching practices that limit the benefits of Shakespeare. Finally, the paper will explore a range of creative approaches to the teaching and learning of Shakespeare which possess the potential to significantly increase student engagement.

Keywords: Education; English Literature; Professional Development; Shakespeare; Teaching and Learning

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INTRODUCTION

As part of recent changes to the National Curriculum, the Department for Education has placed an increased emphasis on students reading and engaging with the works of William Shakespeare. As opposed to studying "one or two sections of the play, reinforced by showing a video" (Thomas, 2016, p.42), students are now expected to read entire works by Shakespeare. Furthermore, Key Stage 3 students are now obliged to study two plays as opposed to one (Department for Education, 2014, p.15). The changes follow claims that "pupils can leave school without studying anything more than bite-sized extracts of Shakespeare's most famous plays such as *Hamlet, Macbeth, King Lear, Othello* and *Romeo and Juliet*" (Paton, 2013). However, there are growing concerns that rather than increasing student engagement with Shakespeare, the educational reforms will alienate pupils. As theatre director Mark Powell states, "Our schools are full of Shakespeare, but often in completely the wrong places. Old uncle Bill has become the relative that we invite to family gatherings out of habit, not because we actually want to" (2014). For the last few decades, there have been growing concerns that the vast majority of pupils struggle to engage with the playwright, and it is feared that this problem will only increase amid the changes to the curriculum. An online petition that called for the Department for Education to "reconsider the changes to English Literature GCSE" has received over 65,000 signatures (Stevens, 2014), showing that many share these concerns. This essay explores the issues surrounding Shakespeare's place on the National Curriculum. First, it will explore the debate of whether Shakespeare is relevant to the lives of young people today. As Blocksidge states, "If Shakespeare has nothing valuable to offer the pupil, then his place in the curriculum is suspect" (2005, p.8). If Shakespeare is deemed relevant to the curriculum, however, the focus then shifts to why so

few students are able to engage with his works. It will propose that this is due to uninspiring and outdated pedagogical approaches that see teachers lecturing at desk-bound students. A more active approach to teaching and learning, however, possesses the potential to completely transform the traditional classroom, increasing student engagement immensely.

SHAKESPEARE IN THE CLASSROOM: REDUNDANT OR RELEVANT?

The works of Shakespeare are often accepted as essential to one's intellectual and even moral development: "by studying 'great literature', … pupils not only imbibe morality, they develop a new engagement with life" (Ward and Connolly, 2008, p.298). Nevertheless, whilst it can be difficult "to question the taken-for-granted status of Shakespeare in the English curriculum, and further, in the Western literary canon" (Balinska-Ourdeva et al., 2013, p.334), there has been a noticeable shift in attitudes towards Shakespeare's place on the National Curriculum in the last few decades. In recent years, a host of practitioners and educational researchers have used the forum of blogging to passionately argue that Shakespeare's language is outdated and that he is no longer relevant to the lives of today's young (see Pett 2015; Bhageria, 2015; Shaffer, 2014). These ideas are reflected in a survey assessing students' attitudes to Shakespeare, carried out by the Royal Shakespeare Company (RSC) in partnership with the Centre for Educational Development, Appraisal and Research (CEDAR). The results of the survey showed that 80% of students "felt that Shakespeare's plays had no relevance to their lives" (Lighthill, 2011, p.37). Lighthill argues that these figures highlight how "most students engage reluctantly with Shakespeare's plays, and that this attitude has changed little over the last two decades" (ibid.). Considering this, one might question why Shakespeare is still deemed as 'essential' reading.

According to postcolonial discourse, the answer to this question lies in the fact that the works of Shakespeare have been used as a tool of power and influence since the height of the British Empire and continue today to symbolise Britain's ideological superiority (Balinska-Ourdeva et al., 2013, p.334). During the era of colonialism, "Shakespeare was regarded as the greatest achievement of his race and culture, a badge of English superiority" (Kapadia, 1997, p.2). Hence, "Through literature and particularly through Shakespeare, Britain constructed and promoted herself as a culturally and morally superior nation whose colonization … was a benign, civilizing enterprise" (ibid.). The works of Shakespeare, based on English morals and values, became a civilising tool, saving the natives from their 'barbaric', backwards cultures. Whilst we have, of course, moved a long way from this narrative, keeping the study of Shakespeare compulsory nevertheless positions the playwright at the top of the literary hierarchy, reinforcing the notion that Western civilisation is superior to other cultures. Teacher Dana Dusbiber, who makes the place for completely scrapping the study of Shakespeare, reiterates this idea: as we give Shakespeare priority on the syllabus, "we (perhaps unwittingly) promote the notion that other cultural perspectives are less important" (2015). Dusbiber teaches at Luther Burbank High School, the largest inner-city school in Sacramento, California. A significant majority of her students are non-white; she thus argues that the works of one white man are irrelevant to the lives of her students, many who come from low socioeconomic backgrounds. Moreover, she is concerned that "so many of my colleagues teach a canon that some white people decided upon so long ago and do it without question" (ibid.). One should bear in mind that Dusbiber's article is an opinion-piece that is based solely on her own experiences in the classroom. Her comments thus relate to a different education system in a different social climate. However, her article has received a significant response globally, affirming that many share her concerns. In addition, her comments can be applied to schools in England that have a majority of ethnic minority students. A recent report has shown that 27.9% of

secondary school pupils are of minority ethnic origins; this figure has been rising year on year (Department of Education, 2016, p.8). As Lighthill states, "in today's multi-ethnic, multilingual Britain, students have little enthusiasm for colonialist icons of British social and cultural history" (2011, p.38).

Coles takes this argument one step further, suggesting that the study of Shakespeare does not only alienate students from ethnic minority backgrounds, but risks making all but the most privileged students feel inadequate and inferior (2013, p. 63). The compulsory study of Shakespeare "in the National Curriculum [has been] promoted as both a democratising and a unifying move" (Coles, 2013, p. 50), giving students from all backgrounds the opportunity to access Britain's wealth of culture and tradition. However, according to Coles, this 'ideology' is deeply flawed: "If policymakers continue to adhere to a view of culture which presents it more as a body of elite knowledge rather than as social practice, then students who do not come from backgrounds where Shakespeare forms part of their cultural capital, are unlikely to find it the liberating experience it is claimed to be" (2013, p. 63). As part of Coles' study, she interviewed Emma, a low-achieving student who, when asked what she thought of Shakespeare, replied that "I think you have to be intelligent to understand what he's saying, coz I think he's confusing" (2013, p.58). To quote Coles, "the final part of [Emma's] statement perhaps indicates that she excludes herself from the elite group able to understand Shakespeare" (ibid.). Hence, rather than 'unifying' students, the compulsory study of Shakespeare reinforces traditional societal boundaries which dictate that one must be of a certain class or breed to be considered intelligent and cultured. Few would disagree that this principle is both outdated and narrow-minded. However, by increasing the focus on the works of Shakespeare and traditional British texts, and by removing modern American texts such as *To Kill a Mockingbird* and *Of Mice and Men* from the GCSE syllabus, the government have "narrowed the curriculum and [taken] choice away from teachers" (Stevens, 2014). With all the other demands of the education sector, "it will be hard for any teacher to teach more than these set texts and we simply don't believe these choices are the right ones for all students" (ibid.). A more flexible curriculum would allow for students from a range of backgrounds and with differing interests to equally succeed. Moreover, with reports that white-working class boys are falling further behind than any other ethnic group (*Sutton Trust,* 2016), it can be reasoned that they in particular have little to gain from studying the plays of Shakespeare. Many of these boys struggle with reading and writing: rather than feeling dispirited by attempting to read a four-hundred-year-old play, perhaps what they need is the chance to develop relevant and transferable skills that will aid them in seeking apprenticeships and jobs?

Whilst these are valid arguments regarding the relevance of Shakespeare in schools, the issues raised have been refuted by various scholars, not least by Rex Gibson. He argues that the ideas and themes that run through Shakespeare's works – including emotions of "love, hate, awe, tenderness, anger, despair, jealousy, contempt, fear, courage, wonder" - are universal to all, irrespective of boundaries such as class or ethnicity (Gibson, 1998, p.3). Whilst "Shakespeare's times were very different from our own, […] human emotions are common to all ages" (ibid.). Falling foolishly in love at the drop of a heartbeat, becoming consumed by a fear of what lies ahead, feeling isolated and detached from loved ones: these experiences are synonymous with adolescence. In this way, the works of Shakespeare possess the potential to unite students from a range of backgrounds, making them aware of all that they have in common. Thus, from the soliloquys in which Hamlet contemplates the nature of his existence to Lady Macbeth's tumultuous descent into madness, Shakespeare's preoccupation with the complexities of the human mind make his plays ever-intriguing and ever-compelling.

Moreover, what distinguishes Shakespeare from other playwrights and authors is the fact that his plays are full of ambiguities and uncertainties, lending an endless supply of readings and interpretations. *Henry V,* a history which narrates the events of the Battle of Agincourt in the Hundred

Years' War, has roused heated-debate across the centuries. Many read the play as a pro-war epic, containing some of "Shakespeare's most rousing, patriotic speeches" and depicting the "well-supported rule of a unified, ordered realm" (Woodcock, 2008, p.1). Laurence Olivier's 1944 adaptation, released towards the end of the second world war, celebrates the honour and glory of fighting for one's country. Others, however, argue that the play presents a more complex view of warfare: "Henry V is haunted by problems merely deferred, not resolved; in the long view, its hero's success looks transitory, even futile" (Maus, 2008, p.1471). In fact, a 2003 Royal National Theatre production of the play became a pertinent political commentary on the controversial invasion of Iraq. Through the ages, the play has functioned as a social commentary on the nature of warfare. Hence, Shakespeare's plays are full of complexities and ambiguities that allow for differing interpretations, making them as relevant today as they were on the day they were written. In fact, the works of Shakespeare offer students the chance to discuss, debate and explore fundamental issues in a way that few other literary texts can do.

Whilst some argue that Shakespeare is not relevant to the lives of young people today, Gibson argues that "successful Shakespeare teaching is learner-centred": the ambiguous nature of the plays gives every student the opportunity to "create his or her own meaning" (1998, p.9). He adds:

> Each student brings his or her own culture to every lesson. That rich variety of culture is a resource that Shakespeare lessons can celebrate and employ rather than dismiss. [*Macbeth*] has been set in the worlds of medieval Japanese Samurai, Chicago gangsters, a German Walpurgisnacht with Spiderwomen witches, a Hare Krishna-type religious cult, and the leather-clad world of a rock and roll musical. (Gibson, 1998, p.9)

Due to the universal themes that run through the plays, Shakespeare does not have to limit or alienate students from diverse backgrounds. Rather, reading his works can give students an opportunity to explore their cultures, and themselves, in new and meaningful ways. British rapper and poet Akala, for instance, trains young people "to develop their love of Shakespeare's language by developing their love of their own street language", using Shakespeare as a lens to explore contemporary black British culture (AHRC Press, 2013). As part of an interview with *The Economist*, Akala argues that "It's not about lowering the quality… it's about demystifying Shakespeare. It's about getting people to hear the words and feel the words, and then you can analyse the words later" (2015). In this way, the works of Shakespeare are able to transcend societal boundaries like few other texts, offering all students, irrespective of circumstance, a pathway into literature. Furthermore, Mary Powell teaches in a school in California where "over 70 percent of the students […] are Latino and on a free and reduced lunch program" (2010, p.6). As is "often the case with high poverty students, several of them are struggling readers and writers" (Powell, 2010, p.6). However, after adopting a more 'active' approach in the classroom, her students have thoroughly enjoyed reading Shakespeare. Whilst it must be acknowledged that her essay relates to an education system in a different social climate, her case-study shows that when "managed by a committed, confident and supported teacher," (Irish, 2011, p.15) students from a myriad of backgrounds can engage with and benefit from reading the works of Shakespeare. In fact, one can directly compare Powell's case study to that of Dusbiber's; both teach in Californian schools with a significant non-white demographic yet both have had very different experiences of teaching Shakespeare. It follows, then, that the question is not whether Shakespeare is still relevant for young people but how his works can be effectively taught in the classroom for maximum student engagement.

PEDCAGOGICAL APPROACHES TO THE TEACHING OF SHAKESPEARE

The plays of Shakespeare clearly possess the potential to captivate and absorb students. Nevertheless, a significant majority of young people still fail to engage with his works. According to Blocksidge, the root of this contradiction lies with the fact that outdated teaching practices are still being employed in the classroom. These traditional approaches to teaching Shakespeare involve classes "sitting behind desks, following the text…" (Blocksidge, 2005, p.7), as passages are read out by selected students. However, this approach is deeply flawed, as Kaplan suggests: "Most reading aloud by students in classrooms results in the [speaker] struggling to say the words – clearly, slowly, and loudly – with little attention paid to what they are saying – especially, if the person is reading the work for the very first time" (2007, p.7). Often, the speaker struggles through the unfamiliar language, so focussed on their pronunciation that they are unaware of what the words actually mean. Meanwhile, the rest of the class, whose only responsibility is to follow along, quickly lose focus. Dame Judi Dench, renowned for her work with the Royal Shakespeare Company and the National Theatre Company, comments on how her experiences of studying *The Merchant of Venice* at school almost put her off Shakespeare for life. As part of an interview for a documentary, she describes how students were required to read six lines each of the play, "regardless of who was saying them": "It made it a complete nonsense… It ruined the play for me, completely ruined the play" (Furness, 2014). It is troubling that this vision of a mid-twentieth-century classroom is still commonplace today: indeed, it is hardly surprising that so many students are unable to connect with Shakespeare on a meaningful level.

Moreover, if a student is brave enough to put up their hand and admit that they "don't get it", the teacher - pressurised by need to cover a whole play in a specific amount of time - is forced to quickly summarise the events of the scene before moving on to the next. Soon, the class become completely reliant on the teacher as 'translators', as the principle meaning makers (Warner, 1997, p.147). By the time the class has finished reading through the play and are required to move on to analysing Shakespeare's language in depth, many are still trying to get their heads around the intricate plots. The well-meaning teacher might deem their students incapable of forming their own opinions and will instead tell students why a certain phrase is significant or why a particular motif has been repeated. To quote Powell:

> Teachers are supposed to have all the answers, but dramatic literature is a playground of opinions: why does Juliet say this? Why would Macbeth do that? The real answer is that we don't know, but teachers are not encouraged to say just that: "I don't know." Their own suppositions are often reported back in essays as facts. (2014)

Reynolds claims that "Generations of students who find themselves intimidated or bored by Shakespeare should blame their teachers for… well, *teaching it*" (2012, p.164; emphasis in original). She suggests that rigid interpretations of Shakespeare's works should not be taught to students for them to learn by heart. Instead, teachers should trust both themselves and their students by "[creating] the conditions under which genuine personal response can flourish" (Soltysek, 2016, p.51). Shakespeare's plays, the narratives, the characters should be actively experienced through the acts of roleplay and discussion. Whilst this approach can be a daunting choice for teachers to make in a world increasingly dominated by high stakes testing, allowing "Shakespeare to connect and react with what is inside [students]" (Irish, 2011, p.15) is of incontestable benefit to their analytical and critical thinking skills, as well as their creativity.

According to Jean Piaget, children learn through interacting with their environment, through "making meaning of their experiences" (Aubrey and Riley, 2016, p.36). One might question, therefore, how effective it is for students to experience the world of Shakespeare from their desks. Spencer argues

that Shakespeare should instead be approached as a script, a "blueprint for performance" (Spencer, 2016, p.59). This approach will hook students, immersing them in the narratives of the plays and temporarily removing them from the space of the classroom. Moreover, students will find it much easier to create thoughtful and critical responses to the plays once they have heard them, seen them and been moved by them (Spencer, 2016, p.58). With the changes to the curriculum demanding that plays are covered in their entirety, teachers may claim that they simply do not have the time to employ a more active and creative approach to teaching Shakespeare. However, according to the National Curriculum, KS4 students should be able to "make an informed personal response [to texts], recognising that other responses to a text are possible and evaluating these" (Department for Education, 2014, p.15). Covering whole plays on an artificial level will not suffice: "true scholarship is not found in a dry surface of the plays, but in a deep conceptual and theoretical understanding and appreciation" (Spencer, 2016, p.57). Whilst time constraints might not allow each and every scene to be covered in an equal amount of depth, teachers should use their judgement to focus on the scenes that they consider most effective and engaging.

As mentioned earlier, students can struggle to navigate the storylines of the plays when reading them for the first time. Thomas, however, offers a creative solution: before the text is even introduced, the class should spend some time interacting with the storyline:

> A group of students mime the action of a story outline as read out loud by teacher, then re-mime it doublespeed as teacher re-reads it super-fast. Then improvise words of their own to match the mimed action. Then add some authentic lines from the text. They then select moments from the action as sculpted tableaux or freeze-frames to use as theatre posters. (2016, p.45)

By engaging with the storyline as a whole, students will find it easier to comment on the structure of the play as they begin to read it. For instance, if reading *Macbeth,* the teacher might ask their students why Shakespeare opens the play with the Witches. At this early point, students will consider the role that the Witches have in the events that unfold. Furthermore, Thomas' 'miming' activity can be taken a step further by encouraging students to form an emotional response to the play. If reading *Twelfth Night,* the teacher might ask students to imagine that they are Viola, lost in a strange land with no money and fearing that a family member is dead: all students will be able to relate to this fear of losing a loved one. The teacher could even use hot seating to explore Viola's character in more depth. If students feel emotional invested in the narratives of the play before they begin to engage with the text itself, their reading will be more fruitful and they will be better placed to offer their own, personal interpretations. Moreover, when students move on to reading the Shakespearean text, the play will feel more familiar and, as a result, less daunting.

When the text is approached, teachers should continue to implement an 'active' approach to studying the play. Mary Powell, whose innovative pedagogical methods were mentioned earlier, uses performance to make students more comfortable with the unfamiliar language of Shakespeare. One of her starter activities involves her giving each of her students a different line from a scene. She then asks her students to "mingle with one another, saying their lines as if they are taking part in different scenarios, which include being at a party with friends or sneaking into their house at 2am" (2010, p.7). This approach creates a 'safe space' in which the students become more confident, "experiencing Elizabethan language in their contexts" (ibid.). When the class read through and perform the scene later in the lesson, "students recognize their lines from this activity and feel a sense of ownership with the text, often exclaiming, "That's my line!" This transfer of ownership from teacher to student allows students to feel in control of their own learning" (Powell, 2010, p.7). Moreover, by "expressing the

same lines to suggest different situations," the students "learn how important subtext is" (ibid.); indeed, this is an important skill that will allow them to engage with the play at a higher level.

Instead of reading Shakespeare's text from behind desks, students should be encouraged to bring them to life through performance: after all, "Shakespeare's plays were not written to be studied in an English classroom" (Reynolds, 2012, p.163). One effective exercise is to ask small groups to perform a specific scene following different interpretations. Soltysek offers the example of Act 2, Scene 7 of *Macbeth* where, after Macbeth expresses his doubts about killing King Duncan to Lady Macbeth, the pair resolve to go ahead with the murder. One group will be given the proposition that Lady Macbeth is evil and, understanding her husband's weaknesses, bullies him into going forward with the plan (Soltysek, 2016, p.52). Another group will perform the scene following the interpretation that Macbeth is worried about being held accountable for the king's murder: "when his wife enters, he seems to back out of the scheme, knowing she will attempt to persuade him again. He manipulates her, so that in the event of him being caught, he can shift the blame to her" (ibid.). By providing the class with interpretations to follow, the teacher offers sufficient support, ensuring that students are not overwhelmed by Shakespeare's language. However, by offering multiple interpretations, the teacher reinforces the fact that there is no clear meaning and, as a result, the factor of uncertainty is introduced into the classroom, this being critical in the learning process (Johnston and Maurer, 2002). Once the groups have performed, the class can discuss which interpretation they find most effective and why, backing their points up with textual evidence. Students will have their opinions opposed by others in a secure and positive learning environment: in this way, they will encounter different perspectives. They will also be inspired to explore the text independently to support and develop their own arguments, acquiring key critical thinking skills in the process.

CONCLUSIONS

The Department for Education's changes to the National Curriculum have placed an increased emphasis on students reading the works of Shakespeare. The move has added fuel to an already heated debate on whether it is still necessary for young people to study the works of a white man that lived four centuries ago. Indeed, reports suggest that a significant majority of young students find Shakespeare irrelevant and uninspiring. Furthermore, many have argued that the changes to the curriculum will only discourage struggling students, negatively affecting their attitudes to learning and hindering their academic performance. However, this essay has argued that Shakespeare's works are both relevant and beneficial for students. The themes and emotions that run through the pages of the plays are timeless, surpassing barriers of sex, race, and class. Furthermore, the plays allow students to explore themselves in new ways, thus aiding personal growth and development (Gibson, 1998, p.4). Hence, it is not Shakespeare's place on the curriculum that is detrimental to students: rather, it is outdated pedagogical practices that see students being lectured at from afar. To quote Irish, "Shakespeare teaching in the 21st century must allow for more than reciting quotes and received opinions" (2011, p.18). The pedagogical approaches outlined in this essay allow for a more explorative, more meaningful experience in the classroom where all students are offered the opportunity to fully engage with the works of the Shakespeare. As Powell aptly states, "you don't need an expensive education to understand the words [of Shakespeare], but you do need the luxury of time, space and specialism to put his words on their feet and try them out" (2014). When taught effectively, Shakespeare is of incontestable benefit to students: his works offer young people the chance to gain essential critical thinking skills, to develop their communication skills, and to embrace their creativity.

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Addressing the Low Skill Levels of University Undergraduates in the United Kingdom

Madeleine Findon [1] *, Sue Johnston-Wilder [1]

[1] Centre for Education Studies, University of Warwick, Coventry, CV4 7AL, UK
* Correspondence: M.Findon@warwick.ac.uk

Abstract There seems to be an increasing problem with basic skills acquisition for young people in the UK. Lower levels of facility with literacy and numeracy than older generations are being reported, including for those with higher levels of education. In this article, we attribute the problem to prevalent fixed mindsets, resulting in a lack of attention to developing both narrative and scientific modes of thought in all learners, and also to the important affective domain: beliefs, attitudes and emotions. This can lead to the unintended exclusion of learners within certain subjects, based on their existing strengths and weaknesses.

We propose the development of a newly sensitive and inclusive approach, rooted in the use of both narrative and scientific modes of thoughts across all subject areas, developing growth mindsets, promoting academic resilience and using the 'growth zone model' explicitly with learners.

Keywords: Literacy; Numeracy; Modes of thought; Narrative; Scientific; Anxiety; Resilience; Mindset; Growth zone model

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INTRODUCTION

Despite sixteen UK Universities appearing in the list of top 100 Universities across the world (Times Higher Education, 2016), a recent study published by the OECD (Kuczera et al., 2016) has revealed a worrying trend in higher education in the UK. In comparison with the 22 other countries measured, university students in the UK have the worst levels of numeracy and literacy skills, with one in 10 students having 'low basic skills' (Kuczera et al., 2016). In spite of some concerns about the aims and methods of the OECD (e.g. Sjøberg, 2016), these figures certainly prompt concern about the education system in this country up to the age of 18. The OECD study stokes existing fears that highly educated young Britons may be excluded from employment because they lack basic skills and that 'as a nation we will not be successful in today's globalised marketplace if our population does not have the skills that employers need' (Vorderman et al., 2011, p.18). It is our contention that there is also a danger that the issue may persist because of a lack of understanding in schools, colleges and universities about the role of the affective domain on the acquisition and performance of basic skills.

These concerns chime with a recent small-scale, exploratory survey we conducted amongst staff and students in the Centre for Education Studies (CES) at the University of Warwick, applying a pragmatic approach (see Hammond & Wellington, 2012). From 84 responses, it appeared that around 20% of participants lacked confidence in their writing skills and 37% lacked confidence in their numeracy skills. Interestingly, from a higher education perspective, over half of the participants did not feel that they had received sufficient support to improve their skills. For the OECD (Kuczera et al., 2016), such issues have the potential to devalue UK university degrees, as students with poor skills are ushered through (the OECD study indicates that skills levels remain low after graduating); poor basic skills can

also impede widening participation as students from non-traditional backgrounds feel ill-equipped to deal with the demands of university courses.

Further complications are revealed in recent news about higher education relating to gender inequality. According to figures released by the Universities and Colleges Admissions Service (UCAS, 2016), women are much more likely than men to apply for university and men from disadvantaged areas are least likely to apply. Information from the Higher Education Statistics Agency (2015) indicates that within these figures, males remain more likely to pursue 'science' subjects than their female counterparts. These data are of interest in considering the skills issue because they mirror further research from the OECD (2012) that indicates a strong gender divide in terms of basic skills preference, with 15 year old females outperforming males in reading while males tended to outperform their female counterparts in mathematics. There is a case for suggesting that not only is skills development generally poor, but it is also unequal and gendered. It is noteworthy that such gendered differences are not consistent across countries (OECD, 2015), a point which we will discuss further later in the paper.

Poor skills development could not only be affecting achievement, but driving students to act in unethical ways. There has been an apparent recent upsurge in cheating in UK university assessments (Graham-Matheson & Starr, 2013). Some researchers attribute this to increased student numbers, the rise of the internet and an increase in availability of services offering academic writers for hire (Graham-Matheson & Starr, 2013); however, it is worth noting that cheating detection has also improved (Bertram Gallant et al., 2015), potentially revealing a persistent problem as opposed to a new one. An interview by the BBC with a commercial essay writer indicated that his UK-educated customers lacked basic writing skills (Bomford, 2016).

It seems counter-intuitive that skills levels should be so low at a time when some people argue that too much attention is paid to basic skills, perhaps to the detriment of a broad and balanced curriculum (Wilshaw, 2016). Rather than looking at what is being taught and getting mired in arguments for and against teaching relative clauses and Pythagoras' Theorem, we focus on the processes of teaching and learning, chiming with Marshall McLuhan's (1964) oft-repeated assertion that 'the medium is the message'. What messages are children receiving about learning basic skills through our teaching methods and processes? One area of research that has begun to address the effects of unintentional messages is the study of mathematics anxiety and the consequent impact on progress in mathematics. Mathematics anxiety has roots stretching back throughout the history of educational research, as witnessed by the work of Dreger and Aitken (1957) on 'Number Anxiety', that is, negative emotional reactions to arithmetic. In recent years, the field of maths anxiety has developed apace, and has received attention in Government guidance for educational strategies (e.g. Department for Education, 2012). An equivalent category for research around affective influences upon literacy development has not yet been identified, perhaps mirroring the lower prevalence of literacy problems as identified in our own research or possibly even differing societal attitudes towards the two subject areas.

Although 'literacy and numeracy' may traditionally be held up together as the touchstone of much Western education, in wider UK society and in the classroom there appears to be a gulf between the two disciplines. This gulf manifests itself in the perceived qualities of each field: numeracy, and by extension mathematics, is perceived as a 'hard' subject, requiring 'surface' learning techniques (e.g. memorization of facts) and natural talent (Nardi and Steward, 2003), whereas literacy or English is a 'soft' subject requiring 'deep' techniques (e.g. exploration and meaning-making) (Jarvis & Woodrow, 2001). One study found that school leaders in US were also more likely to seek outside assistance for numeracy provision than for literacy, owing to their perceptions of it as a more highly defined subject

requiring more formal expertise (Burch & Spillane, 2003). Perceptions about the differences between these subjects influence how they are treated, and learned, by teachers and by students.

We contend that there is less distinction between literacy and numeracy than might be assumed. Our research indicates that many students in the UK are being excluded unnecessarily from either subject; to learn both well requires attention to both 'hard' and 'soft' techniques. We will be referring to the associated modes of thought as 'scientific' and 'narrative', inspired by Bruner's (1991) thinking. We further argue that it is possible to develop resilience following experiences of exclusion or harm. This article will address possible explanations for why the development of basic skills in the UK is relatively poor, including social, cultural and policy perspectives, and look at what can be done to improve provision for the next generations of learners, with particular reference to the building of a concept of academic resilience that includes literacy as well as numeracy.

SKILLS DEVELOPMENT IN THE UNITED KINGDOM

The results from the OECD study are not an indication that the UK education system has traditionally fallen short – our older generation has significantly better skills levels than those of other countries – it is that the younger generations of other countries have improved significantly, whereas ours have not (Kuczera et al., 2016). It seems incongruous that this should have occurred when considering the increased attention that has been given to educational research, policy and practice in UK over the last few decades (British Education Research Association, 2013). However, we seem to have made very limited progress in UK between generations, and in relation to other countries, and it is important to understand why that is the case before we can consider solutions.

The OECD results excluded those whose formative education took place abroad (Kuczera et al., 2016); therefore the lack of improvement in levels of basic skills is not associated with a growing immigrant population of young people. Literacy and numeracy, or English and Mathematics, have been viewed as the core of education and schooling in UK for as long as formal education has existed − St Augustine brought with him the classical model of education that included grammar and arithmetic (Gillard, 2011). Indeed, it is being argued at present that so much attention is being paid to these subjects that other areas of the curriculum are suffering (Wilshaw, 2016). If sufficient consideration has been given to the promotion of basic skills, then there must be an issue around how literacy and numeracy is currently being taught if the apparently increased effort is having zero or even negative effects upon the results.

The OECD examined two groups − those aged 16-24 and those aged 55-65 − and found that the older group were comparable to their peers in other countries while the younger group were considerably behind (Kuczera et al., 2016). It was not our intention to gain an accurate picture of cohort disparities from the CES data: only seven of our 84 respondents fitted into the older category, being born before 1960, and 24 were born post-1991, fitting the younger category. Looking at the results in terms of percentages does seem to suggest that fewer of our younger students received formal grammar instruction and felt confident in their English and Maths skills; however, we would need evenly matched sample groups in order to accurately measure for the effect noted by the OECD.

Primary education in the UK generally takes place between the ages of 5 and 11 (12 in Scotland). This means that the older cohort in the OECD study would have been in primary school between approximately 1955 and 1970 and the younger cohort between 1997 and 2011. Interestingly, formal grammar instruction had begun to fall out of favour leading up to 1955 and is claimed to have 'died' by the early sixties: up until the year 2000 'little or no' grammar was taught in English schools (Hudson

& Walmsley, 2005, p2). This state of affairs was unique and seems to have been the result of a lack of research into the subject at university level and the emergence of some research that suggested that grammar study had limited impact on writing skills (Hudson & Walmsley, 2005). Modern research seems less convinced of this last finding, though there seems to be a consensus that the methods of parsing and analysis that were most prevalent were confusing rather than helpful to pupils (Hudson & Walmsley, 2005). This is not to say that several generations are completely ignorant of English grammar; Hudson & Walmsley (2005) indicate that teachers have passed on information from their own half-remembered schooling and grammar-type projects were rolled out into schools periodically. This is borne out by our survey results, which indicated that most of our respondents had a grasp of the majority of the language concepts that we asked them about.

While the term 'grammar' might be a little nebulous in its meaning, it is held to mean 'the structural pattern, the code, the knowledge, or the competence which a speaker has acquired and which enables him to understand, to formulate, and to produce grammatical sentences in his language' (Pelosi, 1973, p.331-332). It might appear, then, that English language teaching, at least in England, has failed to provide systematic understanding of the subject for decades, though whether this is the whole story behind skills level stagnation is far from clear. Tantalisingly, Hudson & Walmsley (2005) indicate that the 'death' of grammar in the classroom was only one of a host of decisions that may have contributed to later levels of functional illiteracy; however, they do not indicate what these other elements might have been.

Over the equivalent timescale, the highest achieving students in England were doing well in mathematics compared with those in other countries, but a long tail of underachievement has been established for some time (NFER, 2013). Dreger and Aiken (1957) noted that 'many persons report in clinical sessions and in academic classes that they are emotionally disturbed in the presence of mathematics'. One of the reasons given for this was maternal overprotection, which we might summarise today as lack of resilience. Previously, however, HM Inspectors (1876, cited in Cockcroft, 1982) ascribed the problem to imperfect teaching and the scarcity of good teachers; it was also hoped that raising the school leaving age to 15 in 1947 would increase the skills of young people but according to the Mathematical Association (1954, cited in Cockcroft, 1982) after 7 years there was no evidence of any marked change.

We contend that mathematical underachievement is in part due to the 'fixed mindset' (see Dweck, 2006) that came to pervade thinking in UK: this is a view that the student either has mathematics ability or they do not − intelligence is fixed. This has combined with the recruitment of specialist mathematicians as teachers for the majority rather than recruiting users of mathematics, a focus that has pertained since the days of Henry VIII (Taylor, 1954), leading to a perception of numeracy and mathematics as a closed shop for many learners. In Singapore, by contrast, there is a much greater focus on teacher education, using Bruner's (1986) ladder of accessibility (Enactive-Iconic-Symbolic) and on a growth mindset, appreciating effort rather than innate ability. Skills levels in Singapore have improved markedly, the older generation being amongst the worst performing of all countries measured, while the younger generation performed better than the OECD average in literacy and scored more highly than any other participating country in numeracy (OECD, 2016).

More generally, we know that despite a move to more progressive, child-centred practices in England in the Sixties, the majority of the period in question, from 1970 onwards, was marked by particular traits that are still to be found in our education system today: an 'obsession with tests, targets and tables' (McAvoy, 2004, cited in Gillard, 2011, chapter 10). What is particularly interesting about the increased focus on testing, in light of the OECD information (Kuczera et al., 2016), is that while in

England we were feeding our obsession, many other countries, especially in the European Union, were choosing to scrap such measures (Gillard, 2011). When we consider the impact of the 'fixed mindsets' referred to above, researchers suggest that there is a link between testing and the development of a fixed view about intelligence. Yeager and Dweck (2012) note that education and testing have become more stringent, yet the constant measuring of learning against standards plays into a fear or expectation (particularly amongst adolescents) that the resulting grades are an indication of who they are as people, not of a temporary performance. Yeager and Dweck (2012) suggest that unless a degree of resilience is developed against this assumption, the motivation and performance of students will generally decline. We will discuss this further in a subsequent section.

It should be emphasised that none of these factors alone can necessarily completely account for the decline in skills levels − education is embedded within a complex web of systems, all of which will have a bearing on how a child develops (see Bronfenbrenner, 1979). As an example, funding is presently an issue receiving a great deal of attention in the media (e.g. Hawkins, 2017). Environment too may play a part; periodically we find complaints in the media about increasing class sizes; however, owing to how modern schools and classes are structured, the trend suggested by official data suggests both class sizes and pupil/teacher ratios have shrunk between the two cohorts we have mentioned (Department for Education and Skills, 2003). That said, a report from the OECD (2014) found that class sizes in the UK were amongst the biggest, in terms of pupil/teacher ratios, in the developed world.

When compared to other countries, it appears that there are several differences in how education in the UK addresses teaching and learning, and particularly literacy and numeracy development, yet none of these alone adequately accounts for the lack of progress. We propose that beneath the surface of these choices about teaching and learning is a deeper, cultural problem that informs curriculum content and practice and impacts upon the learners' endeavours.

THE FALSE DICHOTOMY

The idea that literacy and numeracy are different in form and structure is neither natural nor true − but it is an idea that appears to persist in recent Western culture. In order to prove the fallacy of the division, we can look at the existence of individual polymaths or Renaissance men, such as Lewis Carroll or Leonardo da Vinci. However, it has been posited that the stratification and specialisation of skills and knowledge is a consequence of an increasingly complex society (Robinson, 2001). Although the fracturing of disciplines might be viewed as inevitable, it has been suggested by theorists such as Robinson (2001) and Csikszentmihalyi (1999) that such divisions can lead to a stifling of creativity and innovative practice, to the detriment of learning and development. At a more specific level, this article is concerned with the notion that the deepening division between disciplines such as literacy and numeracy may be affecting the ability of young people to adequately equip themselves with basic skills in these areas.

Ironically, from a purely etymological point of view, it has been pointed out that 'numeracy' and 'literacy' are intimately linked. The Cockcroft report (1982) is the originator of the term 'numeracy', meaning 'mathematical literacy' or the ability to cope confidently with the mathematical demands of adult life. The Oxford English Dictionary (2016) gives one of the definitions of 'literacy' as being 'the ability to "read" a specified subject or medium; competence or knowledge in a particular area'. Thus we would like to propose a single definition that might apply to either literacy or numeracy: the ability to understand and use a code of representation.

And yet, the Western world has a strong cultural attachment to binaries or dualism − good and evil, black and white, feminine and masculine. Nisbett (2004) particularly highlights the differences between Western and Eastern modes of thought and recognises that traditional Western thought has inherited from its ancient Greek roots a tendency to frame concepts in an 'either/or' scenario, whereas in traditional Eastern thought it is entirely possible for an idea to contain apparently contradictory elements at the same time. Such a perspective may be seen in the principle of yin-yang, where dark and light complete and complement each other, and in the story of the old farmer who responds to every twist of fortune, whether apparently propitious or not, with 'who knows what's bad or good?' (Nisbett, 2004). Thus the notion that literacy and numeracy, being classified as different fields, must have different aspects that require different attributes in order to access them is one that sits within existing Western schemas of classification and, we suggest, leads to unnecessary experiences of exclusion.

In more recent years, some of this Western attachment to binaries has been fed by the 'discovery' that certain processes connected to literacy, such as language processing, are confined to one hemisphere of the brain, while processes connected to numeracy are associated with the other hemisphere (Goswami, 2004). It is one of our aims to expose the fallacy of the binary thinking about literacy and numeracy that is so prevalent in our society; learning mathematics requires and can benefit from the use of language and narrative just as literacy requires and can benefit from logic and systematising. These are not new ideas: Wake (2007) examined such a theory in A-level Mathematics classrooms, arguing that if mathematics teaching is structured into narrative forms, as opposed to the presentation of isolated, abstract facts, it is better able to develop a mathematical argument with which students can engage. In terms of literacy, a study commissioned by the Teacher Training Agency (Medwell et al.,1998) identified that effective literacy teaching should include 'the deliberate and systematic teaching of the formal structures of written language' (chapter 5, no page number).

In fact, the most recent version of the *National Curriculum in England: English Programmes of Study* (DfE, 2014) includes some aspects that incorporate systematic thinking into English teaching. For example, Key Stage 4 requires students to analyse differences between spoken and written languages, choices of vocabulary, and evaluate the effectiveness and impact of language (DfE, 2014), which all arguably fall under Pelosi's (1973) definition of grammar. The document also provides a non-statutory glossary of grammatical terms for teachers (DfE, 2014), although knowledge of terminology does not in itself lead to the development of systematic thought. *The National Curriculum in England: Key Stages 1 & 2 Document* (DfE, 2013) contains statements about 'the development of pupils' competence in numeracy and mathematics, language and literacy across the school curriculum' (p. 4). That said, changes to the Mathematics programme focus on Maths in context and problem-solving (DfE, 2014), which, while welcome, do not go as far to embed narrative thinking into the teaching and learning of mathematics.

In spite of growing awareness of the value of both modes of thought, persistent attachments to binaries can mean that there is a danger of merely reversing the issue. The simple exchanging of one mode of thought for another is not what is being advocated by this article – it is the use of both modes in each subject. To replace one approach with another would simply lead to more of the same problems, but with the effects switched around. The synthetic phonics phenomenon, which may be viewed as an attempt to systematize literacy learning, is an example of how mode shift can be misapplied: synthetic phonics has come under fire from several quarters for prioritising one mode of learning over any other (Rosen, 2014). Rosen (2014) argues that this undermines children's ability to understand, engage with and enjoy texts. Without the complementary modes of scientific and narrative thought, complete mastery of either domain is difficult for many to achieve.

In the introduction of this article, we touched upon the work of Jarvis and Woodrow (2001), who identified that numeracy and literacy are generally perceived as being quite different subjects that require separate sets of skills. This research was carried out to examine why students picked certain subjects at university level (Jarvis & Woodrow, 2001). The authors looked into the taxonomies of academic studies and found that mathematics is classified as a 'hard' subject; that is a single-paradigm subject with relatively set content, areas of interest and research methodologies (Biglan, 1973 in Jarvis & Woodrow, 2001). The study found that learners' subject choices were influenced by their preferred methods of learning: thus students who were more inclined towards a deep approach to learning, had a relativist concept of knowledge, preferred interactive techniques and self-regulating their study, were more likely to choose a 'soft' subject such as English or one of the social sciences (Jarvis & Woodrow, 2001). It is particularly interesting that Jarvis and Woodrow (2001) acknowledged the role of students' beliefs about knowledge in this study.

Jacques Barzun (1991) noted this phenomenon previously in undergraduates, recognising that people would often lean more naturally either towards maths and science or towards the humanities. However, he strongly recommended that students should avoid specializing too early, and instead be given a broader base of skills and knowledge to build upon (Barzun, 1991). This is quite an interesting point to consider, because Jarvis and Woodrow (2001) found they were unable to identify whether students' learning preferences were innate or resulted from their educational interactions. Barzun (1991), however, believed that as a rule, learning in general is an innate process, but that it is vulnerable to external influence.

Thus far, we have identified that there are views extant about what type of basic skills are required in a given context and that these views impact upon whether or not a student chooses to pursue a related subject for further study. This choice may be affected by how students view themselves and how the perception of the subject fits with students' views about knowledge and learning. The Jarvis & Woodrow (2001) study was provoked by the recognition that choice of subject appeared to have both gender and ethnic markers. They found that the over-riding factor was personal learning preference (Jarvis & Woodrow, 2001); however, more recent research appears to show that such learning preferences may be subject to influence from internalised conceptions of gender, ethnicity, etc.

If the separation of skills has fed into gender beliefs, this may well have contributed to the situation where girls are underperforming in mathematics and boys are underperforming in literacy (e.g. OECD, 2012). This is a phenomenon that has been given some attention by research in the Australian context. Looking at adolescent self-perceptions related to English and mathematics, Watt (2004) found that boys' perceptions about their English ability and girls' perceptions about their mathematics ability declined throughout adolescence. On average, girls were found to perceive mathematics as more difficult and boys indicated that they felt English required considerable effort (Watt, 2004). Leder et al. (2014) found that the Australian general public identified mathematics as belonging to the male domain and English to the female. Many of the respondents of this last study felt that teachers could have a profound effect upon learning in these subject areas and while most said they did not know how teachers might feel about the performance of boys or girls, about ten percent felt that teachers would assume boys to be better at mathematics and almost twenty percent said teachers would feel the same about girls and English.

Interestingly, though the Australian research investigates a similar state of affairs to the UK, in many countries this gender preference is considerably less marked. The OECD (2015) PISA results from 2012 showed that while boys outperformed girls in maths in 38 countries, girls in Shanghai scored on average 610 points in maths – greater than the average score for boys from any other country in the

study and at the same level as boys from their own country. The study also showed gender equality for maths performance in Finland, Macao, Singapore and Taipei (OECD, 2015). Regarding boys performance in reading, though the overall results show poorer scores for boys across the whole sample, boys in the education systems that perform best have much better reading results than girls from other countries (OECD, 2015). The OECD (2015) suggests that their results indicate that there is no basis for assuming innate gender preferences for either subject area and that it is up to the educators and policy makers in an education system to develop strategies to close any gaps that might have appeared.

Beyond this, drawing on the cultural impacts upon thinking that were highlighted earlier in this section, we can see the effects of ethnic or cultural bias towards these subject areas. Bhattacharyya et al. (2003) for the Department for Education and Skills found that university students from most ethnic minority groups showed a preference for degrees in STEM subjects and Medicine while very few participated in languages or the humanities. These effects may be a result of attitudes within the cultures or ethnic groups themselves or of the attitudes of the education system towards students of these groups. One example of this latter effect might be the fact that about half as many students of Black-Caribbean origin are entered into higher-tier science and maths papers at the age of 14 as those of White-British heritage (Strand, 2012). Strand (2012) looked at prior attainment aged 11 to establish that this fact is not a consequence of prior underachievement and suggests that it may be more related to teacher expectations of this particular group.

There is consequently no evidence that indicates that ability or attainment in literacy and numeracy is particularly preordained by such general markers as gender or ethnicity or that learning in either field is necessarily characterized by unique approaches. Ultimately, it seems that these two systems of coding and de-coding information may well be similar in many ways, requiring a balance of scientific and narrative approaches in order to fully realise the learners' potential. However, the use of these two codes is fraught with cultural symbolism, affecting the degree to which a particular student is able to engage with them.

EXCLUSION AND INCLUSION

When we develop narrow views about how activities may be carried out, we run the risk of excluding those who either do not possess specific prior knowledge or are unable to participate in the prescribed manner. It is important to note that exclusion can be recognized as a threat to well-being by the developing brain (Siegel, 2010). Tanya Byron (2016) wrote recently ‘No child is born naughty or bad. A child or young person who shows behavioural difficulties that are challenging to those around them could be a child communicating distress. ...’ . Part of that distress may well be caused by exclusion – which may manifest as a result of:

> teaching and learning process not meeting the learning needs of the learner; teaching and learning process not corresponding to the learning styles of the learner; the language of instruction and learning materials is not comprehensible; learner goes through negative and discouraging experiences at school or in the programme, e.g. discrimination, prejudice, bullying, violence (UNESCO, 2016).

The idea that variation in the way individuals think and reason is important in understanding how to make learning more inclusive and effective was expressed by the psychologist Alfred Binet in the nineteenth century. Binet, who is associated with the development of IQ tests, observed that ‘there are, in any group of individuals, qualitative differences which are at least as important to know as are

the quantitative differences' (Binet & Henri, 1895, cited in Wolf, 1973, p.122). For example, Binet (1909) described one of his daughters as a 'subjectivist' and the other an 'objectivist'. Binet also noted that the rate of intellectual development varied by individual, and was affected by the environment: he did not hold a fixed mindset, but a growth mindset (Staum, 2011). The original purpose of the IQ test was to select children with whom to intervene, to help them develop intelligence more effectively (Siegler, 1992). Binet (1909) set up an experimental school, and showed for example that some pupils were underachieving simply because they could not see the blackboard due to variations in eyesight. It is ironic that Binet's belief that intelligence could be improved by education was forgotten as the focus of IQ testing shifted from the process of developing educational procedures for various learners who were underachieving to a classification of fixed intelligence that made that underachievement worse, at least in UK (Gordon and Wilkerson, 1966).

Even recently Binet's finding is still relevant: in a bottom maths set in an inner city school in England, half the children were found to have undiagnosed conditions that affected their academic progress (Johnston-Wilder, private communication) and while current figures are hard to come by, there is a much-quoted statistic that suggests that of the total number of university students found to be dyslexic, 43% of those were not diagnosed until they arrived in Higher Education (Singleton, 1999). Thus, underlying many apparent difficulties in skills acquisition there may be a range of conditions that are contributing to the unwitting exclusion of learners from literacy and numeracy.

That said, such conditions cannot in themselves explain the stagnation in skills levels. Regarding dyslexia, incidences are at around 5% of the population (Gosling, 2007) and not unique to the UK. When we consider the chauvinistic perspectives around literacy and numeracy that were outlined in the previous section, taking the view that numbers and letters must be learned in different specific ways, these views produce different cultures around each subject that the outsider may become excluded from. These views become embedded as one generation of learners teaches the next – 'high school teachers specialize in particular subjects and are members of subcultures linked to these subjects (Little, 1993; Siskin, 1991, 1994)' (Burch & Spillane, 2003, p 520). Consequently, the pattern of exclusion remains relatively unbroken.

Binet was also well aware of forms of anxiety, noting that test situations had the potential to intimidate young children (Binet & Simon, 1905). He also understood that there were longer term influences, such as health and previous experiences and effort that affected attainment (Binet, 1909). The relationship between feeling excluded and feeling anxious is one that has been explored subsequently by psychologists and neuroscientists. Williams (2007) suggests that feeling persistently excluded can result in depression and helplessness. Such negative emotions are known to shut down normal cognitive functions; the presence of heightened amounts of the so-called stress hormone, cortisol, can have a toxic effect upon brain matter (Siegel, 2010). Feeling bad has an impact upon the ability of the learner to fully engage with and succeed in the subject area from which they have been excluded. Thus it is possible to draw a link between cultural practices around subject areas and the struggles of individual learners.

We drew attention to the notion of fixed mindsets in our discussion about education in the UK today. According to Dweck (2006), 'The fixed mindset does not allow people the luxury of becoming. They have to already be.' (p.25.) For the excluded and anxious student, this means that, unless they are taught otherwise, they are unable to engage with the subject at present, and that it appears that this is a limitation within their own make-up that cannot be changed. Fortunately, Dweck (2006) amongst others believes that it is possible to challenge this mindset, both by educating professionals about the plasticity of the human brain and by encouraging learners to recognise the effect of effort upon their progress.

As yet, there do not seem to be any stringent criticisms of Dweck's work, though some blogs, news organisations and professional publications have suggested that it can lack clarity, be open to misuse or does not represent the whole story (e.g. Stannard, 2015). However, Dweck's (2006) work is not alone in its suggestions − it builds on the work of earlier researchers such as Bandura (1977), who highlighted that individuals rely on a certain amount of external feedback in order to build a vision of themselves as competent and confident. Bandura (1977) suggests that encouraging involvement in activities that are a little different or more difficult than that within the individual's usual scope, but that are essentially 'safe', can allow the learner to stretch their capabilities and begin to experience successes. Thus the teacher can gradually promote the learner's inclusion into a subject, but this process requires the knowledge and ability to incorporate both scientific and narrative approaches into pedagogy in order to help students move from the better established mode of thought to the other and back.

According to Binet, 'A few modern philosophers seem to lend their moral support to these deplorable verdicts when they assert that an individual's intelligence is a fixed quantity which cannot be increased. We must protest and react against this brutal pessimism... With practice, training, and above all method, we manage to increase our attention, our memory, our judgment, and literally to become more intelligent than we were before.' (Binet, 1909, pp.106-107) This is the message for the 21st century, brought to us again by researchers such as Dweck (2000) − it remains only for us to establish what such methods might look like.

If we continue to focus on IQ and underlying fixed mindsets, age-specific targets, and cause stress and anxiety in both learners and those who teach them, UK students will continue to underachieve. If we change our focus to fostering growth mind-sets, enabling progression across the lifespan and addressing barriers to learning, all our students, and especially the disaffected, can do better. Dweck and Yeager (2012) draw links between mindsets and lifelong resilience, the promotion of which Seligman (1995) suggests is the key to not only improved school performance, but better physical and mental health. We argue that we must also apply resilience thinking specifically to the learning of basic skills.

RESILIENT SOLUTIONS

While there is certainly much to be done in the development of more inclusive pedagogies, there is also a strong argument for trying to develop greater resilience in learners towards those subject areas that are less comfortable. Binet noted that 'a normal child shows an abundance of ideas' and that 'intelligence meeting an obstacle makes an effort against it' (Binet & Simon, 1905, p.137). Somehow in the process of modern education, many students come to behave more like those he called 'imbeciles' for whom ideas come slowly and 'the number of attempts to solve (the game) is extremely small'. Binet's work supports our thinking, namely that focus on generating as many approaches and possible solutions as feasible, making judgements about alternatives, progressively refining them to fit constraints and developing persistence and perseverance are key to increasing attainment in literacy and numeracy (Campione, Brown, & Ferrara, 1982; Williams, 2014).

Johnston-Wilder and Lee first adapted the notion of resilience to explore a solution to the maths problem that many students experience mathematics as a cause of upset, stress and failure (2008). Drawing upon the work of Vygotsky (1978), Dweck (2006), Bandura (2000) and Lave and Wenger (1991), and the resiliency literature (such as Waxman, Gray et al., 2003), they developed the growth

zone model and the pragmatic notion of mathematical resilience as 'what it takes to stay safely in the growth zone', namely: a growth mindset, agency, support and inclusion.

Students with mathematical resilience possess a growth belief related to their mathematical attainment. They do not feel excluded from mathematics; even when experiencing difficulties, they are confident in a successful outcome longer term. They are aware that there are resources to assist. As outlined by Williams (2014), they retain confidence when overcoming mathematical obstacles, persist, develop new skills if needed and draw upon the help and support of others as required (perseverance).

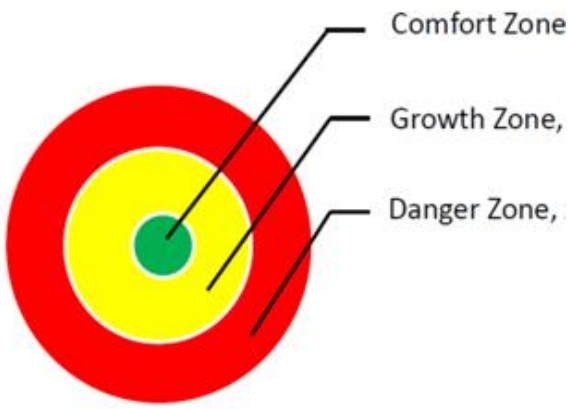

Figure 1: *Growth Zone Model: Johnston-Wilder et al. (2013)*

Figure 1 is a visual representation of the growth zone model representing three 'zones' or ways of experiencing learning from the point of view of the learner, using a psychosocial model of perceived risk. In the green zone, the learner feels safe and confident when dealing with problems on her own; she is able to use current knowledge to good effect and does not experience stress. In contrast, the red zone is experienced as a place of great danger, stress and lack of security. Learners in this zone experience a 'fight, flight or freeze' reaction; that is, a desire to battle against (rather than engaging with), or flee from the obstacle, or an inability to react cogently at all. Understanding the red zone requires awareness that the primitive part of the brain does not distinguish between physical and social threat, and that being embarrassed, excluded or left behind are all perceived as threats to the social brain, potentially triggering the amygdala to initiate a threat response that is not amenable to pre-frontal cortex activity (Siegel, 2010) such as doing formal mathematics.

It is in the growth zone that the learner will experience optimal growth (see also Zaretskii, 2009). The growth zone affords enough challenge to learn, a willingness to take managed risks and learn from mistakes, and goes hand in hand with the support of being part of a learning community that encourages the asking of questions, seeking alternative strategies and helping to prevent the learner from disengaging or being unable to engage with the mathematics. Binet described in his own terms the growth zone model, beginning with what is concrete and familiar to the learner, moving somewhat but not far beyond the learner's existing ability to understand and reason, with the active participation of the learners (Binet, 1909) and with appropriate support. Students introduced to this model often make the observation that their maths growth zone is 'too narrow' and willingly, explicitly set about extending it (see, for example, Chisholm, 2017).

So can the ideas of mathematical resilience be adapted to address problems with literacy? In our experience, and from wider reading, yes they can. Criticism, or worse, failure or rejection, can result in disabling anxieties. Anne, a programme manager at a university, attended an interview about mathematics anxiety. The interview touched on her other experiences at school and she said that in her experience: I never really learned [grammar], like I never properly grasped the basics and foundations of grammar... Apostrophes in particular still make me panic. Yeah. Apostrophes make me panic and so does the difference between bought and brought.' Anne reported having tried to address these issues repeatedly, for example by looking up on the internet and coaching herself: 'right come on I am an adult now I need to know the difference between these let's just sort it out' but was unsuccessful. The growth zone model enabled Anne to become more aware of the role of her own anxiety in impeding the learning of the more 'scientific' aspects of literacy, allowing her to feel less 'stupid' and empowered her to recognise when she had gone into the red zone. This meant she could employ strategies to manage her emotions so she could go on to make effective progress.

Anne also became aware that failure and rejection can be seen as 'a momentary and valuable setback, a time of learning, sharpening, and strengthening' (White, 1982, p xxi); she has resolved to build on this new insight in her practice designing programmes for volunteer teachers. In line with many other researchers who focus on psychological resilience in general (e.g. Hart et al., 2007), we have found that academic resilience, also more recently called 'academic tenacity' (Dweck et al. 2014), can be taught and learned, generally leading to improved academic performance. Developing academic resilience brings students into the company of people generally thought of as highly successful, who also experienced criticism and rejection, including e.e.cummings, Richard Bach, James Joyce and William Saroyan, who had over 7000 rejection slips (White, 1982, p5).

In highlighting the threat posed by the unfamiliar, and the utility of building upon existing experiences, the growth zone model reinforces the advantage of leaving behind the apparently dichotomous thinking about the nature of numeracy and literacy and developing an awareness of both scientific and narrative approaches to learning any subject. Early years practitioners have long been exhorted to start from the child in order to maximise learning (e.g. Bruce, 1997) and educators have begun to realise that the techniques employed with young children could have immense value if adapted and applied to learners of all ages (Robinson & Aronica, 2016). In order for educators to ensure that learners are able to access the growth zone, it is necessary for them to identify whether the learner has developed one mode of thinking more than the other, and develop activities that make links towards the other.

There are, however, other factors that need to be taken into account. According to Harrington (2013), what is required in what we call the growth zone of basic skills is:

1. Self confidence (i.e. having a growth mindset).

2. Risk taking (i.e. being ready to step into a personalised growth zone).

3. Optimism (i.e. re-interpreting past experiences in terms of inclusion and exclusion rather than ability).

4. Willingness to learn from mistakes (i.e. learning that making mistakes is part of the process of being in the growth zone).

5. Concern about what you *can* control, not what you *can't* (i.e. being agentic).

6. A strong network of trusted people (i.e. recruiting support).

We would add that many of the students who are under-achieving in basic skills either did not have much resilience originally or the bad experiences of early years and schooling have worn away what they had – and that research shows resilience can be grown. Relating our work explicitly to Harrington's list, resilience can be grown by:

1. **Spending some time in the green zone**. Students learn that there are times when they do not need to be further challenged, when too much else is going on in their lives, and that in maths and English they just need to give themselves time to practice, develop automaticity, and reflect and develop confidence and competence.

2. **Noticing when in the growth or danger zone**. Students can learn to differentiate when something is challenging or when it is dangerous to their emotional and academic well-being, when they are being asked to take risks and possibly make a step that is too large.

3. **Developing perseverance** as part of optimism. Students can learn to approach any barrier with a range of different strategies. We have found this can be developed by coaches using the Egan model of skilled helper: explore, options, action (Egan, 2002).

4. **Focusing on learning in growth zone**. Students can learn that growth zone experiences are about extending capability through making 'safe' mistakes'. If a student experiences himself as being in the danger zone, he may fight, flee or freeze, at least initially. He needs time to assess the situation and decide whether to proceed with caution, recruit more support or exit (and get a coffee). Students need to feel, at least to some degree, that they have some control in a situation.

5. **Using existing strengths**. If a student has well-developed narrative thought, this can be used to scaffold progress with maths, for example, by using the right hand page to explain thinking in words (Tobias, 1978). Similarly, if a student has well-developed scientific thought, they can use this to scaffold a long piece of writing, for example, by putting the main ideas into PowerPoint and sorting them as images then turning each slide into a paragraph. We have used this strategy frequently to help maths teachers write masters essays.

6. **Supporting each other.** Students can unlearn the message that they need to work on their own and that support is only available from the teacher. For most learners, it is much more effective to support each other in a pair or a group, talking things out, coming up with alternative solutions, sharing strengths and weaknesses (Johnston-Wilder & Lee, 2008).

Earlier in this section, we highlighted the need for educators to understand growth-zone friendly practices. In line with our messages about the perils of dichotomous thinking, we are wary that our messages should suggest that the above strategies are for students alone. As we acknowledged earlier, approaches to subject teaching become embedded generation by generation and teachers themselves may feel excluded from the very modes of thought that they need to promote. Educators are also learners; therefore they need to be granted the same, *safe*, opportunities to stretch their abilities as the students with whom they work. It is to be hoped that, in future, teacher training might incorporate some of these ideas, but for the current cohort we hope that continuing professional development such as that developed by the University of Warwick for Further Education college teachers, funded by the Education and Training Fund (WMCETT, 2017) might become more widely used, and recognised by policy makers as needing appropriate time allocation.

CONCLUSION

In view of the current statistics around skills levels and the research suggesting the impact of affect and beliefs upon skills acquisition, it seems imperative that a system-wide approach is taken to the teaching and development of literacy and numeracy. Such an approach would include sensitivity to the affective domain and inclusion, explicitly developing resilience, rather than relying upon tired and dated methods and taxonomies.

We specifically recommend that the association of numeracy with purely scientific modes of thought and literacy with the purely narrative is recognised as false and disabling to the learner. Accessing either requires the ability to understand and use a code of representation, which requires both scientific and narrative thought. Educators need to be able to employ both modes of thought when teaching these skills, whether that might mean the use of stories to promote mathematical understanding or recognition of the patterns and rules of language. It is also necessary for the skilled educator to gently move the learner from their preferred mode of thought to develop their use of the other.

We argue that taking such an approach could potentially reduce the inequalities around skills development that may be rooted in social notions around gender, ethnicity, excluding modes of thought and one-size-fits-all teaching. It is hoped that tackling such inequalities will contribute to an overall improvement in skills levels for young people in UK today and subsequent generations.

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Contested Knowledge: A Critical Review of the Concept of Differentiation in Teaching and Learning

Sasha Taylor [1,2] *

[1] Woodrush High School, Birmingham, B47 5JW
[2] School of Education, Worcester University, Worcester, WR2 6AJ
* Correspondence: sashataylor62@gmail.com

Abstract This paper explores the concept of differentiation in teaching and learning. It argues that theoretical perspectives, policies, frameworks and the implementation of ideas relating to the technique have become conflated, because of the contested nature of the term. This has led to increased inequality in the classroom, which is the opposite result of its intended purpose. The unevenness of differentiation is most apparent in attempts to improve the attainment of individual students and tailoring the curriculum to meet their needs. Even though differentiation appears to be a successful framework on the surface level, with deeper analysis, it is rather difficult to quantify the real benefits, as non-school factors such as the influence of culture, socio-economic background, gender, ability/disability, language and social class have an effect on the outcome of learners' educational achievement. Consideration of factors such as these on individual students could provide greater insights and help schools build a platform for more inclusive differentiated learning. This paper suggests that, for differentiation to be successful, teachers should make accommodation for learners' varied levels, needs and backgrounds. Moreover, this paper highlights the need for more research-led strategies aimed at closing the attainment gap among learners, particularly where differentiation fails to challenge existing learning paradigms.

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Keywords: Differentiation; Gender; Social class; Culture; Education; Attainment

INTRODUCTION

Differentiation is a framework or philosophy to enable students of all levels to attain their full potential (Munro, 2012). Achieving this centres on the acquisition, processing, construction and exposition of knowledge and the rationalisation of ideas (Munro, 2012, Brighton *et al.*, 2005; VanTassel-Baska and Stambaugh, 2005). Moreover, it involves the development of teaching materials, assessment procedures and an innovative curriculum, which lays the foundation for fulfilling the unique needs of all learners irrespective of their abilities and existing attainment (Brighton *et al.*, 2005; Hertberg-Davis, 2009). As studies show, effective use of differentiation can help to increase students' motivation, academic achievement and constructively build on students' previous knowledge (Munro, 2012 and Konstantinou-Katzi, 2013). However, teachers, particularly those who are new to differentiation, often misunderstand the technique, applying it as a form of 'scaffolding' for weaker learners or as a group work strategy (Hertberg-Davis, 2009). Differentiation also tends to be deployed as a tactic to hinge group tasks on gifted learners to ensure they are accomplished or to use them to tutor other students

or as a method for adulterating high-level content to achieve inclusivity or enjoyable lessons (*ibid*., 2009).

Although today's classrooms are highly diverse aligned to class, socio-economic background, gender, culture, language and abilities/disabilities, it appears students are being failed, because their individual needs were not being met (Brighton *et al.,* 2005; Department of Education, 2014; Thomsen, 2012; Civitillo, Denessen and Molenaar, 2016). Additionally, there is little consideration of factors such as students' level of preparedness, interest, motivation and learning profiles (Hertberg-Davis, 2009). While the differentiation framework seeks to address such classroom heterogeneity and challenges, however, studies suggest some teachers were reluctant or not equipped to instigate its implementation (VanTassel-Baska and Stambaugh, 2005; West and West, 2016). Teachers were often too saddled with classroom management concerns or had little or no training in the use of differentiation techniques and, therefore, lacked confidence, efficacy and perseverance in its application (West and West, 2016). Instead, many teachers tend to plan lessons aimed at students in the 'middle' perpetuating a generalised 'one size fits all' approach that does not account for the vastly varied needs of a pluralised classroom (Brighton *et al.*, 2005, p.9; Hertberg-Davis, 2009, p.251; Wu 2013, p.130; Westwood, 2013). Therefore, rather than being known for providing a multifaceted programme of activities capable of meeting the individual needs of students, differentiation is often labeled as a support mechanism for weaker learners, which does little to challenge the abilities of more able learners (Hertberg-Davis, 2009; Westwood, 2013).

Teachers often agree that differentiated instructions play a pivotal role in meeting the varied needs of learners (Burkett, 2013). However, Dixon *et al*. (2014) argue differentiated teaching requires practice. Teachers' experiences and skills in adapting lessons to fulfill students' varied learning needs are paramount to successful implementation of teaching and learning framework such as differentiation (Dixon *et al*., 2014). However, Civitillo, Denessen and Molenaar (2016) postulate that teachers' perception of classroom diversity is wide and varied, impacting individuals' understanding of differentiation and its application. Furthermore, Hertberg-Davis (2009) argues that misunderstanding of differentiation, particularly, among new teachers can lead to the classroom being less challenging for some learners. Consequently, training providers and schools should provide professional development to support differentiation. Teachers should be mentored and be provided with the opportunity to observe each other's differentiated lessons, give feedback after observation as well as being given the time to collaborate resources for effective differentiation (Dixon *et al*., 2014).

In examining the various perspectives, policies, frameworks and implementation strategies associated with differentiation, this article deepens understanding of its application in teaching and learning. Moreover, the article supports calls for more extensive research, which could add insights into the various factors that can impact the implementation of differentiation in the classroom (Dixon *et al*., 2014; Terwell, 2005). This could provide a basis for further development and training to ensure greater effectiveness and sustainability of the method. With limited knowledge of its operation and value, use of differentiation not only adds to an increased workload for teachers, but also means it remains a contested teaching and learning strategy. Discussion begins by defining differentiation, an outline of theories of knowledge and then considers implementation of strategies. The article further explores factors influencing differentiation, the benefits and contestation of the practice, before making concluding comments.

DEFINING DIFFERENTIATION

Differentiation is a contested concept, which is used in fields such as marketing, medicine and mathematics. The term's delineation is particularised to each domain as it is in education where differentiation essentially means tailoring teaching to attend to a specific student's needs and the way they learn (VanTassel-Baska, 2012). In essence, differentiation is a way of thinking about teaching and learning (Tomlinson, 2008). The premise is that schools should not affirm to students achieving prescribed norms, but should aim to enable them to maximise their potential (*ibid.*).

Moreover, students should be facilitated to develop as rapidly as possible, not only learn requisite content, but to also assume responsibility for their own lives as learners (*ibid.*). The intention is that by acquiescing to the individual needs of each student will allow them to progress at or beyond an expected standard (McNamara and Moreton, 1997). This can be achieved by differentiating learning materials, activities and how the student is being taught (Geelan *et al*., 2015). While this may appear a straightforward process, an array of definitions, methods of implementation, misunderstandings and the pervasiveness of criticism among educators have rendered differentiation a contested concept (Pollard and Filer, 2007; Brighton *et al*., 2005; Terwell, 2005). At its root is the conflict between traditional approaches to teaching and the concept of differentiation (Brighton *et al*., 2005). While conventional teaching places teachers at the centre of the classroom, differentiated philosophy situates the student in this position (*ibid.*). Similarly, it was the role of the teacher to direct learning; under differentiation, the teacher facilitates learning (*ibid.*).

Differentiation can be linked back to Vygotsky's (1978) intervention theory, which centres on the importance of focusing on learners as individuals and support for their academic achievements rather than on the curriculum (Daniels and Hedegaard, 2011). This child-centred approach, as opposed to a generalised curriculum focus, is the critical dimension that underpins Vygotsky's theory. In this context, facilitating more or improved intervention is not necessarily the best strategy (Vygotsky, 1978). Instead, there should be greater focus on supporting children's assimilation of classroom practices, participation and contribution to their individual development (Daniels and Hedegaard, 2011).

Vygotsky's (1978) ideas have been reinforced by Gardner's (1993) '*theory of multiple intelligences*'. Gardner (1993, p.56) believes there should be greater focus on 'individual-centered education', tailored to meet the needs of each child with specific focus on weaker areas of intelligence. In contrast to Vygotsky's and Gardner's theories, differentiation in the contemporary classroom seeks to promote greater scaffolding of teaching and learning based on learners' target grades rather than being used as a supportive approach concerned with individual needs and abilities (Hertberg-Davis, 2009). Tomlinson (2001) argues that differentiation is no longer regarded as the individualised approach as intended in the 1970s. The uncertainty has been heightened, as both themes are often used interchangeably, further exacerbating the misinterpretation of the central notion of differentiation.

In contemporary education, differentiation is delineated as a technique for facilitating learners as unique individuals, providing the opportunity for optimal learning (Petty, 2004). On the other hand, Terwell (2005) refers to differentiation as streaming, tracking or grouping students based on ability. The main purpose of differentiation is to bolster greater understanding of the requirements of children with Special Educational Needs (SEN), and, therefore, tailoring the curriculum to fulfil them. This indicates disparity and misconception of the purpose of differentiation. While Petty (2004) argues that differentiation should be for individualisation, Terwell (2005) contends it should be a technique for segmenting learners, not as individuals, but based on ability in comparison with their peers. The various recognitions of differentiation and its approaches indicate the need to question its uses and

evaluate whether successes in students' performances really can be linked to differentiation or whether it is due to other intrinsic or extrinsic factors.

The objective of differentiation is to encourage teachers to adapt their teaching, learning and assessment practice (Vickerman, 2009). As part of the Department for Education *Teachers' Standards*, teachers must adapt teaching to respond to the strengths and needs of all pupils. This includes knowing when and how to differentiate appropriately and using approaches, which enable pupils to be taught effectively (Department for Education, 2011).

However, there is no definitive guidance on how this might be achieved. Instead, individual teachers have to decide what they consider to be best practice in different learning environments. Even though teachers are usually best placed to understand the needs and abilities of their students, Terwell (2005) contends that variations in experiences, understanding, organisational culture and resources in differentiation, have led to the emergence of inequality in classrooms. In the same vein, several aspects of differentiated instruction and assessment challenge the belief of fairness among teachers and contradict beliefs commonly held by society (Brighton *et al.*, 2005).

While the Mariam Webster online dictionary (2016) definition of differentiation is rather concise - '*the process of* differentiating', other definitions are more expansive. According to Vickerman (2009) differentiation includes a range of teaching strategies and methods used by teachers to teach diverse students with varied needs in the same learning environment. Differentiation is widely viewed as a strategy for improving students' attainment by adapting the curriculum to meet the varied needs of learners (Lawrence-Brown, 2004). Schools' senior leadership teams, inspectors from the Office for Standards in Education, Children's Services and Skills (Ofsted) and education policy makers often regard differentiation as a valuable addition to teaching and learning. They believe differentiation positively impacts classroom experiences, leading to improved attitude to learning, better skills and ultimately, better student outcome (Brighton *et al*., 2005).

On surface level, it would be difficult to argue against the concept of differentiation (Brighton *et al*., 2005). Certainly, students benefit greatly when tasks are geared to match their individual learning needs (Brighton *et al*., 2005). Furthermore, Hertberg-Davis (2009) believes, differentiation is an ideal form of fulfilling the needs of gifted learners, a perfect remedy for resolving the issue that has affected gifted education for several years and is still mainly unresolved.

The notion of differentiation is often misunderstood and is regularly regarded by teachers as 'scaffolding' for weaker learners and not as a framework for fulfilling the unique needs of all learners regardless of ability (Davis, 2009). It may be argued that differentiation is a technique for addressing inequality in the classroom, defeating the perceived purpose of its intended aim. Furthermore, Weber *et al*. (2013) argue that teachers, in general, find differentiation complicated and challenging to implement. Similarly, Barthorpe and Visser (1991) suggest that differentiation is regularly used without full consideration of its meaning and that its implications are usually misunderstood. Do the merits of differentiation really outweigh the implications that positively enhance the uniqueness of individual learners?

THEORIES OF KNOWLEDGE AND DIFFERENTIATION

Knowledge can be either explicit or tacit (Eraut, 2000). Explicit knowledge, also known as codified knowledge, is regarded as information that is widely known and is usually recognised by its origin and epistemological status (Eraut, 2000). Tacit knowledge is subconsciously stored and used without

cognisant thought (Dudley, 2013). Tacit knowledge is also defined as being qualitative, not discursive, unconscious, while explicit knowledge is conscious, discursive and open (Schilhab, 2007). In an educational setting, Elliot *et al*. (2013) argue that mentors are able to guide mentees using their acquired skills and knowledge. Even though this is often very straightforward for routine tasks, it may be more problematic when the complexity of professional knowledge increases (Elliot *et al*., 2013). This is because such understandings are usually gained through experience or 'tacit knowledge' and are often difficult to articulate (Edmondson *et al*., 2003).

The suggestion is that knowledge is coded in organisational language or 'externalised' and not explicit for teachers to fully comprehend (Nonaka and Krogh, 2009). This is often evident in the inability of senior school leaders to guide teachers to effectively implement differentiation strategies. Although they may have in-depth tacit knowledge of how to differentiate and are able to implement these in their own teaching and learning approaches in the classroom, senior leaders may be unable to get this knowledge across to other teachers (Munro, 2012). This is reflected in Polanti (1966), cited in Elliot *et al*. (2013, p.85), who postulated that 'we can know more than we can tell'. In this context, Munro (2012) argues that there is limited knowledge by management on how to provide effective guidance for differentiation, which has resulted in the approach being seen solely as the responsibility of teachers.

In relation to differentiation in teaching and learning, the Department for Education (DfE) *Teachers' Standards* argues that teachers must adapt teaching to respond to the strengths and needs of all pupils. This includes knowing when and how to differentiate appropriately, using approaches that enable pupils to be taught effectively (Department for Education, 2011). However, the DfE propositions appear to be based on systemised concepts with information drawn from a combination of knowledge sources (Eraut, 2000; Nonaka and Krogh, 2009). Such an approach can impede the implementation of differentiation in the unfamiliar surrounds of the classroom (Eraut, 2000). The implication is that while the DfE recommends differentiation as an important teaching and learning framework, no explicit guidance is offered on how this may be achieved. Instead, individual teachers have to use tacit knowledge to decide what they consider to be best practice in different learning environments. This serves to exacerbate the contested nature of differentiation as an effective approach for teaching and learning.

IMPLEMENTATION OF DIFFERENTIATION

According to Weber *et al.* (2013) there are three factors to be considered with the implementation of differentiation These are: support teachers need to enhance their confidence in the approach, enhance ways in which classroom practices contribute to the execution of differentiated techniques and attributes that may improve or impede the introduction and development of differentiation (Weber *et al*., 2013). Central to effective implementation of differentiation is collaboration and co-operation (McNamara and Moreton, 1997). This requires guidance, support and leadership of experienced and highly skilled practitioners, who are essential to ensure efficiency of the strategy across all curriculums. However, differentiation is regularly regarded solely as the responsibility of teachers (Burkett, 2013) who are not always supported or guided by school leadership in applying differentiated approaches, and, too often, there is limited knowledge by management on how to provide effective provision for differentiation (Munro, 2012). Furthermore, for differentiation to be successful, Peter (1992) suggests that senior managers should restructure the way staff and students organise their work. Moreover, senior managers should initiate in-depth planning and provide ongoing support for teachers as part of its differentiation technique (Peter, 1992).

Lack of supervision means the implementation of differentiation fails to deliver the desired assistance and challenge for students. Peter (1992) argues that this is because teachers require extra time and effort, particularly, as differentiated instructions, tasks and assessments are very complex. Moreover, considerations such as class sizes, planning time, resources, increased teacher responsibility and arrangement for collaboration with colleagues must be taken into account for consistent application and effectiveness of differentiation (Brighton *et al*., 2005). Senior school leadership must also consider intervention, assessment, time and involvement outcomes in support of differentiated techniques (Barthorpe and Visser, 1991). However, a lack of direction has led to limited coherency among teachers and infrequent and largely unsuccessful attempts at the implementation and use of differentiation (Munro, 2012). This means that even though teachers may be able to provide in-depth explanation of differentiation, they struggle to execute it in daily practice (West and West, 2016).

BENEFITS OF DIFFERENTIATION

Differentiation in teaching and learning assists teachers in addressing the issue of dealing with learners of varied abilities and responding to their individual needs (Konstantinou-Katzia, 2013). Effective use of differentiation has been associated with increased learner motivation, higher academic achievement and greater collaboration among students with similar ability (McNamara and Moreton, 1997; Gentry and Owen, 1999; Hertberg-Davis, 2009). Educators are increasingly recognising the use of effective differentiation to fulfil the needs of each learner. Moreover, successful differentiation can fulfil the varied needs and abilities of students in the same classroom (Haelermans *et al.*, 2015).

It is argued that differentiation can play an influential role in nurturing identified talent in gifted learners (Hertberg-Davis, 2009). Moreover, differentiation allows students to progress at a pace suitable for them regardless of their knowledge, skills or previous understandings (Wu, 2013 and Valiande *et al.*, 2011). Differentiation, it is held, can provide a platform for innovation and ongoing reflection that boosts teaching and learning that would not be readily available in the form of 'one size fits all lessons' (Valiande *et al.*, 2011).

FACTORS IMPACTING DIFFERENTIATION

While the aim of differentiation, argue Tomlinson (2001) and Valiande *et al*. (2011), is to consider a more student-centred approach in teaching and learning, practitioners often fail to take account of other non-school factors that can have significant influences. These include social class (Hatcher, 1998), socio-economic background (van der Berg *et al*., 2002), gender (Berggren, 2008) and culture (Thomsen, 2012). Furthermore, Demack, Drew and Grimsley (2000) suggest that the increase in attainment difference among students based on social class and gender was a major cause for concern. In this context, Considine and Zappala (2002) have argued that attention to these factors on an individual basis can provide greater insights and help schools build a platform for more inclusive differentiated learning. Moreover, due to the inherent nature of tacit knowledge, teachers and policy makers do not appear to have an explicit understanding of how to apply in-depth differentiation and the best process for successful implementation to positively impact students with varied needs and backgrounds.

Social Class

Social class significantly impacts academic ability, pupils' self-confidence and the selection of educational institutions (Hatcher, 1998). Even when students from different social class display similar abilities, those from more advantaged backgrounds tend to achieve better academic results (Hatcher, 1998). This suggests that despite teachers' successful implementation of differentiation in the classroom, social class remains a persistent influence on the final educational achievement of students. Micklewright (1988) argues that while deploying techniques such as differentiation was an attempt by schools to 'bridge the gap' between students and to improve learning for all pupils, it failed to contribute to increased equilibrium. This indicates that social class and parental education significantly impact academic results even when the quality of teaching and ability are consistently controlled (Micklewright, 1988).

The influence of social class on academic results has blurred the actual effects of differentiation in education achievement, raising questions about its value as a teaching method. This fuzziness, argues Croxford (1994), means further investigation is necessary to understand exactly what differentiation adds to the teaching repertoire. Furthermore, as part of the differentiation process, learners are usually grouped together based on abilities. However, it is an approach that appears flawed. Neumeister *et al*. (2007) argue that class-based premises clouded teachers' judgment of gifted learners. Contextually, it would be difficult to judge the correct impact of differentiation on learner outcome. Furthermore, Haelermans (2015) asserts that the correlation between students' characteristics and other unobservable factors makes it difficult to determine the precise impact of differentiation.

Socio-Economic Background

There is a distinct correlation between students' academic achievement and their socio-economic background (Bakker, 2007). In particular, students from families with higher socio-economic background usually have superior academic outcomes than those with lower socio-economic status (Considine and Zappala, 2002). Similarly, van der Berg *et al*. (2002) argue that children from wealthier or highly educated parents make better progress and often outperform students from poorer backgrounds. As such, there appears the need for deeper scrutiny of education provisions rather than focus predominantly on what happens in the classroom. This is especially important, as students from lower socio-economic sets may display worse numeracy, literacy and comprehension levels, negative attitude to learning and more behavioural issues even when there are intervention activities by schools (Considine and Zappala, 2002).

These observations indicate that for differentiation to be successful, teachers need to make accommodation for learners' varied levels, socio-economic backgrounds and psycho-emotional characteristics, as these are critical components that may affect learning (Valiande, 2012). This poses the crucial question as to whether teachers are equipped with the skills and knowledge to facilitate the deficit caused by being from disadvantaged backgrounds through the provision of effective differentiated tasks or instructions for individual learners. Certainly, as these various viewpoints suggests, there needs to be greater emphasis on support and motivation for students to succeed regardless of the teaching methods deployed in the classroom.

Gender

There is a significant difference in educational achievement of students based on their gender, particularly those from lower socioeconomic backgrounds (Considine and Zappala, 2002). A major challenge for educators in the 21st Century is issues relating to gender (Aldridge, 2009). Gender inequality, argues Biemmi (2015), is a prominent feature in the education system. Although schools are considered one of the few places where equality might be achieved, lack of investment in policy could inhibit this potential (*ibid.*). This, according to Virtanen, Räikkönen and Ikonen (2014), has led to a major issue for differentiated teaching, as there are apparent differences in students' motivation based on gender.

According to Biemmi (2015) perception of different subjects between genders can be linked to degree choices and jobs. This impacts attitude towards learning certain subjects, as learners are more inclined to choose fields regarded as socially accepted for their gender (*ibid.*). This suggests that despite the best efforts of teachers, students may indicate a lack of motivation to study particular courses. Although, there is some evidence of effective differentiation to improve achievement in areas such as gender and poverty, the actual effect is difficult to quantify (Strand, 2010). Furthermore, it would be a misrepresentation of information to state that differentiation can be effective and can improve progress without considering factors such as gender and poverty.

Even though inclusive teaching plays a significant role in dispelling the traditional gender specific expectation, there still remains uncertainty about teachers' ability to effectively differentiate for the varied characteristics of learners (Westwood, 2013). This indicates that there needs to be further analysis on the impact of gender in implementing effective differentiation across a range of curriculum. In addition, Biemmi (2015) argues that the operation of perspectives such as differentiation in closing the gender gap in education needs to consider, not only teaching activities, but also a critical appraisal of academic culture and curriculum development.

Culture

Teachers are responsible for educating themselves about the different cultures and customs of students to be able to effectively deliver to multicultural classes (Westwood, 2013). As part of their differentiation technique, teachers must include methods and topics that interest learners from varied cultures. However, there appears little evidence of training being offered to teachers to enable them to understand and develop the relevant expertise to meet cultural variations among students. The need for training in understanding different cultures to enhance classroom practice is especially important. Brighton *et al.* (2005) suggest schools and teachers are finding it increasingly challenging to integrate learners from different cultures. One of the reasons for this is because schools and teachers do not have knowledge of what happens in the homes of individual students (Singh, 2008).

Within certain cultures, education is seen as the 'means to an end' and students will work exceptionally hard in an attempt to achieve at the highest level, regardless of the way they are being taught or the resources available. However, in other cultures, particularly those with older generations who are highly educated, education has great strategic value; therefore those learners are encouraged to follow certain paths (Thomsen, 2012). In this context, it would be difficult to credit the role of differentiation with regards to the achievement of such students without taking into consideration the impact of family and cultural influences.

Differences in culture can significantly impact students' reaction or behaviour towards certain activities or tasks in lessons. In addition, individual students from different ethnic backgrounds may vary in the way they see teachers in terms of indifference, disdain or respectability (Westwood, 2013). Therefore, for teachers to successfully implement differentiation and increase intrinsic motivation for learners of varied cultures, they need to understand the components of multicultural education (Neumeister *et al.,* 2007). Increased understanding can be gained from the use of case studies from different cultures to add insights to explanations and clarify ideas, the influence of people from different cultures on the development of knowledge, pro-actively seek to diminish prejudice, development of a teaching strategy that appeals to different learning styles and create a conducive learning environment that encourages and welcomes learners regardless of their ethnicity (Bank, 1993, cited in Neumeister *et al*., 2007). However, as these various debates regarding the influence of culture on educational attainment show, teachers might be aware of learners' potential, but are not adequately equipped or trained to ensure they are intertwined with differentiation techniques.

THE CONTESTATIONS OF DIFFERENTIATION

The concept of adaptive or differentiated teaching is a complex framework that demands continuous convoluted multitasking leading to excessive workload for teachers (Westwood, 2013). The practice of differentiation in day-to-day learning environments has been largely unsuccessful (Hertberg-Davis, 2009). This is rather concerning, as an approach that leads to excessive workload for teachers is likely to become unsustainable overtime (Westwood, 2013). Furthermore, trying to differentiate can be tedious for teachers exasperated by large class sizes, inadequate funding, negative attitude towards peers among students and lack of materials for effective differentiation (Westwood, 2013). In addition, it is very difficult to estimate the actual impact of differentiation on learner achievements as there is the need to consider the correlation of students' characteristics and other unobservable factors on academic outcome (Haelermans *et al.,* 2015).

The pressure of organising, researching and planning a range of instructions and activities to match varied learning needs in addition to all the other teaching responsibilities, will, ultimately, impact negatively on the quality of teaching (Galton *et al.*, 1980, cited in Peter, 1992). It would be almost impossible to accommodate for the range of variables that need to be considered in devising appropriate activities for individual learning needs (Galton and Williamson, 1992).

Moreover, if not closely monitored, differentiation may block learning opportunities for teachers and students, therefore, a more critical approach for curriculum development should be considered (*ibid.*). The most appropriate use of differentiation remains largely uncertain. In some cases, teachers use it as a scaffolding mechanism for weaker students with gifted learners not being fully challenged, but seen as anchors to ensure all tasks are completed (Hertberg-Davis, 2009). Even though teachers may be willing to adapt teaching strategies, they are often expected to implement differentiation with minimal support or training (Hertberg-Davis, 2009). In this context, it would appear there is the need for long-term professional development to promote enhanced teaching and learning through the use of differentiation.

Even though key enthusiasts of differentiation argue it is distinctly different from grouping, they are still unable to separate the two. For example, Tomlinson, a strong advocate of differentiation, admitted to Wu (2013) in an interview that grouping is a component of differentiation. Tomlinson also suggested that it was important that teachers are given time to develop an understanding to fully analyse how students progress academically (Wu, 2013). However, it would appear lack of funding,

and the pressures of training students for exams to enable them to meet societal expectations, means that schools are unable to afford that extra time for teachers. This is despite the fact that what is often required to aid learners success is additional support and encouragement (Westwood, 2013).

A further contestation of differentiation relates to ideas associated with theories of knowledge. Meeting the needs of a differentiated classroom requires teachers to draw tacitly from experience and practice to be able to react to individual student needs. In this sense, knowledge is used as an 'instrument' developed through 'trial and error, imitation, or model learning' as in teacher-training exercises (Toom, 2012, pp.625-626). However, this is contrasted with teachers, who, under instructions from their school's hierarchy, often have to use information or differentiated techniques drawn from educational bodies that are too codified or theoretically driven for implementation in the heterogeneous and ever-changing setting of a classroom. For example, a teacher might observe the mistakes a student is making in performing a skilful activity even though the teacher cannot express the explicit theory of action (Toom, 2012).

However, by identifying the errors, the teacher can guide the student to connect the elements of practice that already exist in their repertoire or to draw on their previous performances (Toom, 2012). In this context, the ability of the teacher to act spontaneously espouses creativity and innovation, which are the bedrock of differentiation in teaching and learning (Nonaka and Krogh, 2009; Toom, 2012). At the same time, however, knowledge from reports is often influenced by organisational culture, leadership, structures and incentive systems and can be 'fragile and fraught with uncertainty, conflicts of interests, and differences in mindset' (Nonaka and Krogh, 2009, p.640). Such inflexibility can be seen to inhibit the approach of differentiation. Crucially, while tacit and explicit knowledge should intertwine and be based on the same continuum (Nonaka and Krogh, 2009), they are often in conflict in relation to the implementation of differentiation in teaching and learning. It is a contestation, which not only adds to an increasing workload for teachers, but also augments inequalities in the classroom.

CONCLUSION

This exploration reveals there are benefits such as increased learner motivation when differentiation is implemented effectively in the classroom. However, it is very hard to achieve on a daily basis, because of the heterogeneous nature of most classrooms. Many practitioners believe there should be greater emphasis on inclusive and adaptive teaching that considers all learners in a common curriculum rather than focused on difficult-to-sustain, multifaceted programmes and activities in a classroom of mixed-ability students (Westwood, 2013). The contestation surrounding differentiation is that its uses and purposes can often lead to misunderstandings among teachers of how to best implement it. Therefore, it is regularly regarded as scaffolding for weaker learners, while leading to a less challenging learning environment for the more able learners (Hertberg-Davis, 2009).

There appears to be limited support or training, which is needed to support the sustainability of differentiation (Dixon *et al.*, 2014) This suggests the need for extensive research, planning and implementation. However, with limited knowledge of its operation or value as a teaching technique, the concept of differentiation will remain contested. Its only quantified contribution is likely to be increased workload for teachers thus negatively impacting the quality of teaching (Westwood, 2013).

This article has revealed that the highly acclaimed framework adds to inequality in education based on the premise that one size fits all (Terwell, 2005). Moreover, the technique is hampered by large

class sizes, available resources and limited time. Within this context, the concept of treating each student as a unique individual learner is debatable. The article emphasises how theories of knowledge adds to the complexities of differentiation in terms of tacit and explicit knowledge. It argues that organisations such as the DfE propose various theories of differentiation, but offer no real guidance on putting their ideas into practice, leaving individual teachers to implement their own techniques, which add to the contestation of the approach.

Various debates such as Civitillo, Denessen and Molenaar (2016) and Haelermans *et al*. (2015) indicate that teachers might be aware of the impact of non-school and unobservable factors on teaching and learning, but are not adequately equipped or trained to ensure they are intertwined with differentiation techniques to achieve successful results. Within this context, teachers need extra time and effort to successfully implement differentiation. This is because tasks and assessments are very complex (Peter, 1992). Furthermore, class sizes, planning time, resources, increased teacher responsibilities and arrangement for collaboration with colleagues, must be taken into account for consistent application and effectiveness of differentiation.

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Transforming Mathematics: Using Dynamic Geometry Software to Strengthen Understanding of Enlargement and Similarity

Jo Denton [1] *

[1] Centre for Education Studies, University of Warwick, Coventry, CV4 7AL, UK
* Correspondence: J.L.Denton@warwick.ac.uk

Abstract This article discusses the potential to use Dynamic Geometry Software (DGS) to form conceptual links across enlargement and similarity by developing learners' understanding of scale factor and ratio. From the theoretical perspective of situated abstraction, a combination of both situated cognition and mathematical abstraction, it analyses existing literature on the teaching, learning and assessment of enlargement and similarity as well as literature on DGS and how it acts as a microworld, where an array of situations in a mathematically consistent environment can be created. Particular focus is given to how the dragging and measurement facilities in DGS support abstractions through both amplification and reorganisation of traditional pencil and paper methods. The empirical element of this article describes a small scale classroom based project on the use of DGS as a microworld for transformation geometry. Through analysing learners' dialogue and written responses to tasks, it proposes that a combination of minimally pre-constructed tasks, peer-discussion and utilising the dragging and measurement facilities, can enhance the observation of patterns in transformation geometry and concludes that these conditions can support learners to move from the particular to the general, allowing abstractions to be conceived and strengthening learners' understanding of enlargement and similarity.

Peer review: This article has been subject to a double blind peer review process

Keywords: Dynamic Geometry Software (DGS); Mathematical Abstraction; Microworld; Situated Abstraction; Situated Cognition; Transformation Geometry

GLOSSARY OF TERMS

Situated cognition: the theory that all learning is in context as the classroom can provide the context.

Mathematical abstraction: the theory of moving from particular or specific examples to the ability to generalise.

Situated abstraction: where situated cognition and mathematical abstraction meet; the theory of making connections in mathematics through making sense of a concrete situation.

Microworld: a digital educational environment where learners can explore and receive immediate feedback from the technology.

Amplification: in terms of transformations using DGS, the ability to perform large numbers of transformations which would be time consuming without the technology.

Reorganisation: in terms of transformations using DGS, the ability to see between the usual transformations, for example enlargements between scale factor 2 and scale factor -2, allowing the

learner to see what happens at scale factor 1, and when an enlargement begins to reduce, or at what point the image goes in the opposite direction etc.

INTRODUCTION

Dynamic Geometry Software (DGS) is a digital technology which was developed in the 1980s; however it has not had the expected impact in the classroom (Jones, 2011; JMC, 2011). Even in 'successful' mathematics departments, DGS is often primarily used as a demonstration tool (Ruthven *et al.*, 2008) which has limited potential for learners to form and test their own conjectures. From the theoretical perspective of situated abstraction, a combination of both situated cognition and mathematical abstraction, in this article I discuss the potential to use dynamic geometry to form conceptual links across enlargement and similarity by developing learners' understanding of scale factor and ratio. Firstly I analyse the wealth of literature on DGS and how it acts as a microworld, where an array of situations in a mathematically consistent environment can be created. How this applies to the theoretical framework of situated abstraction is then discussed, with particular focus on how the dragging and measurement facilities in DGS support abstractions through both amplification and reorganisation of traditional pencil and paper methods. Literature on the teaching, learning and assessment of enlargement and similarity is reviewed, before presenting and analysing a small scale classroom based project on the use of DGS as a microworld for transformation geometry. Despite the plethora of research on dynamic geometry, "research on using DGS to teach transformation geometry is relatively limited" (Jones, 2012, p.49). Through analysing learners' dialogue and written responses to tasks, I propose that a combination of minimally pre-constructed tasks, peer-discussion and utilising the dragging and measurement facilities, can enhance the observation of patterns in transformation geometry. Finally, I conclude that these conditions can support learners to move from the particular to the general, allowing abstractions to be conceived and strengthening learners' understanding of enlargement and similarity.

LITERATURE REVIEW

Digital Technologies

Digital technologies play three distinct roles in education: tutor, tool and tutee (Taylor, 1980), however Ofsted reports indicate that they are not used to their full potential in mathematics (Ofsted, 2008), most likely because they are "predominantly teacher-led and mainly focused on presentational software" (JMC, 2011, p.6). This implies that digital technologies are mostly used for demonstrations, acting only as the tutor, which is often how teachers use DGS (Ruthven, 2012; deVilliers, 2006), indicating that there is a big divide between what the software is capable of doing and how even successful mathematics teachers use it (Glover *et al.*, 2007). Falbel (1991) believes technology should not just aid passive learning but help it to be more active, however its use as an explorative tool is not commonplace: "What we do not have is embedded practice in engaging students in using their skills with digital technologies to find out about, learn, apply and communicate aspects of mathematics" (JMC, 2011, p.16). In this article I will concentrate on the following opportunities using DGS: learning from feedback, observing patterns and seeing connections (Becta, 2009), to support concept development in a way which would not be possible with pencil and paper.

Leung (2011) refers to the importance of *techno-pedagogic task design* which "focuses on pedagogical processes in which learners are empowered with amplified abilities to explore, re-construct (or re-invent) and explain mathematical concepts using tools embedded in a technology-rich environment" (p.327). Leung and Bolite-Frant (2015) state that "a multi-tool teaching and learning environment provides learners a milieu where they can interact with different tools and representations" (p.221). Furthermore, Leung and Bolite-Frant (2015) list four key considerations in developing tool-based tasks:

> 1. Use strategic feedback from a tool-based environment to create learning opportunities for student.
>
> 2. Design activities to mediate between the phenomena created by a tool and the intended mathematical concept to be learned.
>
> 3. Make use of the affordances and constraints of a tool to design learning opportunities.
>
> 4. Switch between different mathematical representations or tools. (Leung, 2017, p.73)

Jones (2011), proposes three approaches to DGS pedagogy, illustrated in Figure 1, and Ruthven (2012) describes three case studies which support Jones' framework.

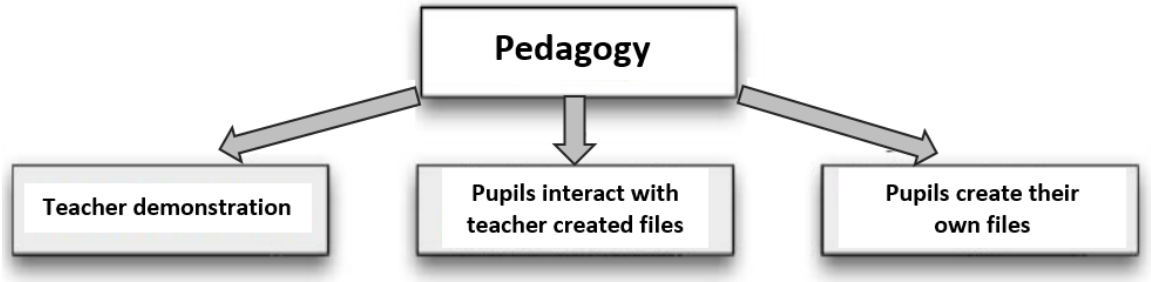

Figure 1: *Framework of teaching approaches with DGS (adapted from Jones, 2011, p.42).*

Both researchers suggest that learners creating their own files is preferable, however Jones (2011) concedes that in the middle scenario, "there is quite some teacher control over the material, but the approach can bring in opportunities for creative thinking and problem solving by learners" (p.42). In fact, according to Maymon-Erez and Yerushalmy (2006), investigation without guidance makes constructing new knowledge less likely, suggesting a minimally pre-constructed file where learners can create as well as manipulate could be the optimal approach (see Appendices 1-3 for more information, available alongside the online version version of this article).

Many researchers have discussed the benefits of dragging in DGS (Hölzl, 1996; Jones, 2002; Baccaglini-Frank & Mariotti, 2010), which aids "the making and justifying of generalisations based on the facility to look at sufficient cases" (Becta, 2009, p.4). It serves as both an amplifier to create an array of examples which would take too long to construct by hand, but also as a reorganiser to see between the examples (Pea, 1985), which many teachers do not appreciate as its key benefit (Ruthven *et al.*, 2008). Dragging also "helps pupils to notice 'what changes and what remains the same' and enables them to formulate and test their conjectures" (Becta, 2009, p.7); however, without guidance, mental constructions are not guaranteed as "understanding dragging means understanding that the dynamic manipulation preserves the critical attributes" (Maymon-Erez & Yerushalmy, 2006, p.5). The fixed attributes in the classroom based project were the properties of the transformations, so it was

important for pre-constructed files to allow the learner to perform these rather than just manipulate the images created.

The measurement facility also serves as both an amplifier and a reorganiser, as it is quick and provides a level of accuracy which enables reliable feedback on conjectures. This facility can be used to compare representations, for example comparing the ratios of sides and areas against the scale factor of enlargement, because "a medium which enables pupils to switch effortlessly between these representations enhances their conceptual development" (Becta, 2009). Measurements can be set to a specified degree of accuracy, however Olivero and Robutti (2007) discuss the "double nature of measuring" (p.138), warning that "increasing the number of decimal digits does not mean increasing the precision of the tool" (*ibid*.).

Situated Abstraction

Mathematical abstraction concerns moving from the particular to the general and *decontextualisation* is often viewed as vital in the process of developing higher order thinking (White & Mitchelmore, 2007). Piaget considered three forms of abstraction: empirical, focusing on objects; pseudo-empirical, concerning actions; and reflective, involving mental actions on mental objects (Tall, 2004). Similarly, the cognitive and sociocultural approaches to abstraction focus on moving from concrete to abstract. The cognitive approach achieves this by removing context, while the sociocultural approach considers context and activity to be inseparable due to the learner's personal history (Herschkowitz *et al.*, 2001). However, does the concrete necessarily precede the abstract? The dialectic perspective considers that the process does not start from the concrete at all, rather it shifts "from an undeveloped to a developed form of the abstract" (*ibid*., p.200).

Herschkowitz *et al.* (2001) take the sociocultural perspective, defining abstraction as "an activity of vertically reorganising previously constructed mathematics into a new mathematical structure" (p.195), where learners establish and strengthen interconnections, ensuring mathematical consistency between concepts. They identify observable elements of abstraction: constructing, recognising and building-with. Constructing is the process of building complex structures from simpler ones; recognising is seeing connections with previous knowledge which, according to the authors, is easier to observe than constructing; and building-with is transferring previously constructed knowledge by applying it to different contexts (Herschkowitz *et al.*, 2001). These actions are not completely independent of each other, nor necessarily linear in nature, as when constructing, the learner may need to access recognising and building-with structures from previous situations.

In situated cognition, the classroom culture provides the context in which learning can take place (Brown *et al.*, 1989) and the impact of the environment on learning is pivotal (Nardi & Stewart, 2003; Boaler, 1999). Figure 2 illustrates that where the two theories of situated cognition and mathematical abstraction meet, is another model of abstraction in context: Noss' & Hoyles' (1996) *situated abstraction*, a process of making connections in mathematics through making sense of a concrete situation (Pratt & Noss, 2002). From this definition, situated abstraction supports the notion of microworlds, which are "designed to be discovery-rich in the sense that little nuggets of knowledge have been scattered around in it for you to find" (Papert, 1987, p.80).

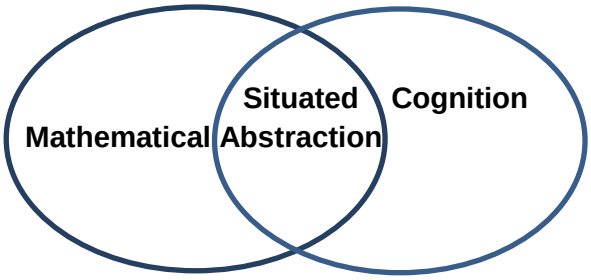

Figure 2: *Combining situated cognition and mathematical abstraction.*

In situated abstraction, instead of simply taking one extreme of learning in situ or the other of complete decontextualisation, which could be argued is not possible as the setting itself provides context, mathematical meaning is constructed by "drawing context into abstraction, populating abstraction with objects and relationships of the setting" (Pratt & Noss, 2010, p.27), suggesting it is broadening the context which allows learners to establish connections (Pratt & Noss, 2002). Pratt and Noss (2010) also view *purpose* as a key component in facilitating abstractions, as a purposeful task should maximise the significance of the feedback given from a microworld, which should lead to learners more readily appreciating the *utility* of the task which they believe is "an essential element of mathematical abstraction" (p.12), supporting Papert's (1972) stance that motivation in mathematics comes from "true personal involvement" (p.251).

Situated abstraction develops the ideas of building knowledge into schemas (Dubinsky & McDonald, 2002) and scaffolding in abstraction (Ozmantar & Roper, 2004), into the use of technology to establish connections, which Noss and Hoyles (1996) call *webbing*. However, according to Herschkowitz *et al.* (2001), Noss and Hoyles were not explicit how webbing linked to constructing new knowledge and so "did not provide a framework within which to investigate the process of abstraction" (p.198). In contrast, Pratt and Noss (2010) argue that situated abstractions are more observable than diSessa's (1993) phenomenological primitives (p-prims), which, in her model of abstraction in context, are small, unstructured fragments of knowledge, abstracted from experience and built into concepts called coordination classes. The classroom based project focuses on the situated abstraction model to explore concept development using DGS, but considers how observing learners constructing, recognising and building-with could help link constructing new knowledge with webbing.

Enlargement, Similarity and Proportional Reasoning

In general, the existing research is very positive about the use of DGS to support the learning of geometry (e.g. Arzarello *et al.*, 2013; Jones, 2011; Ruthven *et al.*, 2008), even if research on transformational geometry is limited (Jones, 2012). So why is it that mathematics teachers are not using it effectively? It could be argued that it is the examination system which is restricting teachers' use of DGS in the classroom as with so many assessment criteria, teachers may not feel they have the time to dedicate a series of lessons to investigating scale factor when enlargement may only be worth a few marks in the learners' final exam. However, examination boards in the UK have reported weaknesses in learners' understanding of scale factor (e.g. OCR, 2012), with some candidates using different scale factors on each dimension of the shape given (Edexcel, 2012). The most common incorrect scale factor used is 2 (*ibid*.), which could be because traditional methods use this much more than others (e.g. Payne *et al.*, 2006), possibly because learners are restricted by space to perform large scale factors by hand. There is also a lack of understanding that fractional scale factors produce a reduction (Edexcel, 2012) and that negative scale factors do not (OCR, 2012). Some learners do not

even appreciate that scale factor is multiplicative and they simply add it to each side (Edexcel, 2010; 2011) and the language used by learners to describe an enlargement will often not involve the term scale factor at all (Edexcel, 2010; OCR, 2011), perhaps as a result of traditional methods not allowing for rich discussion. Issues surrounding the role of the centre of enlargement are exposed when learners describe enlargements, as many describe an enlargement followed by a translation (OCR, 2011), suggesting no understanding of the effect of the centre on the position of the image. It is not surprising that with these misconceptions regarding simple enlargement, learners continue to struggle with the concept of similarity (Edexcel, 2016), for example "few could explain why two rectangles were **not** similar and almost none mentioned scale factors or ratios" (OCR, 2015, p.8). It is also common for learners to apply the linear scale factor to areas or angles, even if the solution is unreasonable (OCR, 2012) and "the understanding of area and volume scale factors continues to elude many" (OCR, 2015, p.19).

Proportional reasoning "is both the capstone of elementary arithmetic and the cornerstone of all that is to follow" (Lesh *et al.*, 1988, p.94) and appreciation of scale factor connects number and geometry (Cox, 2013), therefore understanding this concept in its entirety should support learners to solve enlargement and similarity problems as well as solving other problems involving ratios (e.g. map scales, best buys, proportional division, trigonometry). These connections however are often not explicit in textbooks (Lamon, 1995), which often devote entirely separate chapters to each (see Baston *et al.* 2010; Payne *et al.*, 2006; Banks & Alcorn, 2003). Dragging and measurement with DGS could help address issues with transformations (Hollebrands, 2003), facilitating discussion and enabling generalisations and connections to be made. However, assessment in the UK has been a barrier to teaching with technology (JMC, 2011), something which has not seemed to change with the current GCSE 9-1 specifications, where only one digital technology is alluded to: the calculator (Edexcel, 2015; AQA, 2014).

Many researchers, including Piaget, have described proportional reasoning as a global ability (Lesh *et al.*, 1988), implying it is a general cognitive strategy, transferable to any situation. However, as learners are often not consistent in their level of reasoning, Lesh *et al.* (1988) argue that it is a more local competence which is "initially mastered in small and restricted classes of problem settings" (p.102). Exploring enlargement and similarity within the set parameters of a DGS microworld could support learners to test out their own conjectures in a mathematically consistent space, allowing the construction of new knowledge locally from the multitude of examples given through dragging. The measurement facility could then support learners to recognise and build-with their prior knowledge of ratio, adding to their proportional reasoning *web*, with the intention of eventually leading to more global problem solving.

THE CLASSROOM BASED PROJECT

Research Design and Methodology

A small scale classroom based project was conducted on enlargement and similarity using Geometer's Sketchpad (GSP) as the dynamic geometry software, with the aim of improving this area of teaching in my school at the time. The following research question was investigated:

How can dynamic geometry software enhance and strengthen the teaching of transformational geometry, in particular in making connections between enlargement and similarity?

The project was conducted by means of a case study approach to allow for depth of study into the learners' mathematical thinking and how this learning might occur; however, this approach has the limitation that any findings could be unique to the case study group (Denscombe, 2007). The group selected consisted of 31 girls aged 13-14 from an 11-16 girls' school where the proportion of students who are from minority ethnic backgrounds or speak English as an additional language (EAL) is above average. The school is non-selective and located on the south coast of England in a town where two out of the 10 secondary schools are grammars. In order to be as representative as possible of the whole school, purposive sampling was used to select this class, as the girls had a similar proportion of EAL, were the median age group in the school and had an average level of attainment in mathematics. There are limitations to this strategy including: the small size of the group; from only one school and hence the same geographical area; the fact that the setting was single-sexed; and there was no control group to give quantifiable evidence that any conceptual improvements were as a result of the DGS. Although it is not possible to generalise from this case study (Denscombe, 2007), due to the purposive sampling from within the school, it was intended that any findings could be used to inform planning across the school's mathematics department. The context of the school also provides the reader the opportunity for comparison with similar schools.

The class worked in pairs on transformation geometry for six lessons, three of which were in the computer room:

> **Lesson 1:** Recap of how to perform reflections, rotations and enlargement using traditional pencil and paper methods
>
> **Lesson 2:** Transforming Dance activity on GSP (see Appendix 1, available online)
>
> **Lesson 3:** Recap on enlargement by a positive integer scale factor using traditional pen and paper methods
>
> **Lessons 4 and 5:** Exploring enlargement and similarity on GSP (see Appendix 3, available online)
>
> **Lesson 6:** Solving similarity problems in the classroom

In part the programme of lessons was dictated by access to the school's computer rooms, however the learners had previously met pen and paper methods for simple transformations so the earlier classroom based lessons were an opportunity to remind learners of these methods before seeing how working with GSP could enhance and extend that prior learning.

Responses to the GSP activities were recorded on task sheets by the students and some of their discussions were observed first hand by the author. These discussions were recorded by scribing the dialogue observed while at the same time questioning learners to help move learning forward. There is the limitation that I both facilitated the activities and observed the interactions (BERA, 2011), which could have an effect on the validity and objectivity of the data collected, however the findings are only intended as a means of improving the learning environment in this school rather than an attempt to generalise beyond this. To follow the *Ethical Guidelines for Educational Research* (*ibid*.), the class were informed of the purpose of the project and how their written responses and scribed discussions would be used to form my research. Permission was obtained in loco-parentis from the Head Teacher to conduct the study. Furthermore, to maintain confidentiality and anonymity, the students referred to in this report are done so by initials only (*ibid*.).

Getting to Grips with GSP

The learners used a desktop version of GSP, however since the classroom based project, which was conducted in 2012, touchscreen technology has developed widespread usage. The learners had previously only seen the software used on an interactive whiteboard, which ironically relates more closely to how DGS is used on handheld touchscreen technology, although the latter allows for manipulation with both hands simultaneously (Arzarello *et al.*, 2013), so learning the basic functions needed to be incorporated into the activities. This was achieved by using GSP to explore combinations of transformations after performing reflections, rotations and translations on paper the previous lesson. The activity designed for this was entitled 'Transforming Dance' (see Appendix 1, available alongside the online version of this article), adapted from a task by Olive (2000) in which learners produce stickmen with GSP and then, using the transformation functions, make their stickmen dance. To address purpose, a physically active dancing 'starter' was devised using translations, reflections and rotations, which may have increased motivation in the GSP task as students seemed to enjoy recreating the dance moves with their stickmen. The task prompted learners to discuss the effects of combining transformations on their stickmen, with the intention of constructing new knowledge. This was then extended with an activity on performing multiple transformations on polygons and describing their equivalent single transformations (see Lack, 2011), with the intention of enabling learners to recognise how they needed to apply the knowledge from the stickmen activity, providing the utility of the task (Ainley *et al.*, 2006).

I noted several differences between the introduction to GSP lesson and performing transformations by hand the previous lesson. Firstly, students were generating and testing conjectures in just one session, perhaps because GSP acted as an amplifier, allowing students to perform combinations of transformations at a speed which on paper would not have been achievable with this class. Secondly, I observed that AF, a particularly artistic student, was more engaged in the lesson than usual, creating intricate figures which would have been too time consuming, and perhaps too difficult, to transform on paper. Papert (1971) argued that microworlds aid pupil involvement; for AF her level of engagement and creative response to the task could indicate that the dynamic geometry environment acted as a motivational aide. GSP also provided more accuracy than many could achieve on paper, which was particularly true for GB, who the previous lesson had struggled with drawing transformations by hand, was able to produce quick and accurate diagrams. This could have supported learning for GB as she was able to use her accurate results to describe the effect of double reflections in parallel lines. Finally, the dragging facility allowed students to physically move the original object to see the changing effect on the image, allowing them to see many examples as opposed to just one. The conjectures students made, on the effect of double reflections for example, could be attributed to this movement away from specific concrete examples, indicating that GSP acted as a reorganiser for performing transformations, which may have allowed more abstract generalisations to be made.

According to Pratt and Noss (2010) it is important to design tasks which allow for abstraction. During the introductory task, students may have primarily made abstractions as a result of the dragging feature allowing them to move from the particular to the general, so it was important to incorporate this into the main task on enlargement and similarity. I also decided to see how the measurement facility could support learners to conceive abstractions by establishing connections between scale factor and ratio. I designed four activities (see Appendix 2, available alongside the online version of this article) for the class to work on in pairs over two lessons:

1. Exploring enlarging a triangle from a given centre
2. Exploring corresponding angles in similar triangles

3. Exploring corresponding sides in similar triangles
4. Exploring areas of similar triangles

The activities were piloted prior to the lessons with two students, JC and SA, and as a result modifications were made (see Appendix 3, available alongside the online version of this article) before carrying out the task with the rest of the group. JC and SA then acted as *Lead Learners* (Stewart, 2009), using their new knowledge to support the rest of the class, affording me time to scribe interactions between the pairs. Herschkowitz *et al.* (2001) believe that the construction of knowledge is most likely to be observed in a social setting, so to facilitate the observations of possible abstractions in this project, each task was designed to prompt peer-discussion. The tasks were also designed to encourage explanation, justification and reasoning which is considered important when designing tasks using GSP (Jones, 2011) and indeed in the learning of mathematics in general. Initially there was only one context, the task itself in the dynamic geometry environment, however Pratt & Noss (2002) discuss the importance of applying knowledge in different situations, so following these sessions, students solved enlargement and similarity problems in the classroom to see if they could apply their knowledge.

Dragging from the Particular to the General

In the pilot task, the following dialogue ensued when discussing the effect of dragging the centre of enlargement:

> SA: When you move the point further away, will the triangle follow?
> JC: No, it will end up further over there…yes I'm right.
> SA: Oh, because the distance is further away it ends up further away in the other direction.
> Teacher: What happens if you move the centre to the edge or inside the original?
> SA: The copied image is spread around.
> JC: The distances are still doubled.

SA started the session unaware of the effect of the centre of enlargement, however after this activity, and with support from JC, she could see the how the centre dictated the position of the image, this could have been supported by dragging, as she was able to move from the specific example they started with to a whole set of examples. After the activity both were able to correctly predict the position of the image when I pointed to possible centres, indicating an abstraction may have been made. A similar discussion was observed between AO and RT in the whole class session:

> RT: If I move the point of enlargement…
> AO: The closer…oh, it overlaps with the original!
> Teacher: What effect is the centre having?
> RT: Changes where the new one is.
> AO: If the point is far away the new one is far away too and if closer it overlaps.
> Teacher: If the centre of enlargement was above the original triangle, where would the image be?
> AO: Here [points below]
> Teacher: And if the centre was to the right?
> AO: On the left.
> RT: So if here [points to left side] would be here [points to right]. Let's check!

On analysing written responses to the activity, all students discovered that the centre of enlargement affected the position of the image and most could describe roughly where the image would be depending on that position. Literature shows that feedback from DGS "is not only quick, but also reliable, non-judgemental and impartial" (Becta, 2009, p.2). AO and RT seemed to value this feedback and appeared to gain in confidence in their understanding of enlargement, making generalisations just ten minutes into the activity. Papert (1987) describes a microworld as an environment which is "created and designed as a safe place for exploring" (p.80), in this respect the use of GSP in this project could be considered a microworld.

A pre-constructed file using a slider was created to investigate the effect of scale factor to support seeing the general as well as the particular, which could be less likely if you type in specific scale factors into the dialogue box:

> JC: Move the slider to 3
> SA: It's not equal [points to distances between the centre and corresponding vertices]
> JC: That's because it's twice the distance here and once here so three times in total. Scale factor 3.
> SA: Ah, ok.
> Teacher: What do you think would happen for scale factor 4?
> SA: Will that be three times the distance [points between corresponding vertices] so four times in total?
> Teacher: And what can you say about the sides?
> SA: They're four times bigger
> Teacher: What happens if the scale factor is less than one?
> SA: Move the slider to ½
> JC: The original triangle is the enlargement and the image is the original if that makes sense!
> SA: Instead of enlarging, it shrunk!
> JC: It's de-larged…is that a word?
> Teacher: Has it reduced in size?
> JC: Yes reduced!

The language JC and SA were using had evolved since the start of the session, using the terms image and scale factor confidently, perhaps as a result of rich discussion. They seemed to recognise the general effect of the scale factor and appeared to construct scale factors less than one into their 'web' of knowledge, perhaps building a new, more complex structure from the simpler structure of positive integer scale factors. Their initial conjecture was that the triangles had swapped positions, however through their discussion and further dragging they reorganised their knowledge of scale factors in order to deal with multiplying by a proper fraction. Due to the new language developed and the construction made, this could be considered an abstraction (Herschkowitz *et al.*, 2001). JC and SA even accidentally discovered negative scale factors when the slider moved past zero which they also attempted to connect to their scale factors web in response to the new knowledge:

> JC: It's flipped!
> SA: Wow!
> JC: So if you change it to -1 it would be exactly the same distance apart [as +1] but over there. What about -2?

Perhaps as a result of dragging, a deeper understanding of scale factor had been developed and GSP seemed to spark a real interest, which could be why they were able to make higher level conjectures than their current level of attainment. AO and RT were also observed discovering negatives, attempting to generalise in the same way as for positive scale factors and on analysis of the written responses, so had other pairs despite not being prompted. The class had not been expected to deal with negative scale factors until GCSE, so dynamic geometry could have allowed them to make abstractions beyond their supposed ability, agreeing with Ruthven (2012) that unexpected results can be a positive element of DGS. For CM and SS, dragging the slider from 2 to ½ also gave significance to scale factor 1:

> CM: It gets smaller. If you did it at one it'd be exactly the same.
> SS: So you're like halving it. When it's smaller than one you halve it, when at one it stays the same.
> CM: You only halve it for scale factor ½

Measurement and Accuracy

When exploring corresponding angles, CL and MH started with the misconception that scale factor also applies to angles; however the angle measurement facility gave the pair immediate feedback from this incorrect conjecture and some additional support from me appeared to allow them to readjust their thinking and further develop the concept:

> CL: What happens to the angles?
> MH: They're getting bigger
> Teacher: All of them? What if you compare corresponding angles? [Indicates on screen]
> [MH measures angles]
> Teacher: What do you know about angles in a triangle?
> CL: They add up to 180°.
> Teacher: So can all the angles get bigger when you enlarge?
> MH: No they get smaller. No, stay the same [laughs]. You're not changing the angles, it's the edges getting longer. You can't double the angles. You'd get 360 which is a circle.
> Teacher: Which shape has interior angles adding to 360°?
> MH: Oh, a square!

In past GCSE examinations, "better candidates instinctively knew that enlargement preserved angle but far too many multiplied by the scale factor to get an unreasonable angle" (OCR, 2012, p.20). On analysis of the written responses, most pairs appreciated that the scale factor had no effect on the angle size, which could be attributed to the angle measurement facility and the ability to drag; only one pair had not understood that angles are preserved. This indicates that these students could have conceived an abstraction using DGS that many learners do not make by the end of secondary school. In addition, it was observed that using GSP with support from the teacher, helped one pair of students (PW and LT) understand angle notation, which at the start of the session they were not secure with, as they needed to be shown how to click on the vertices in the correct order to measure the required angle.

Clements (2002) highlights the importance of the role of the teacher to ensure learners see the mathematics and make the abstractions intended. Both the conversation with CL and MH above and the support needed for PW and LT demonstrate this importance; however, with a class of 31 students,

time for such a rich discussion with every learner is limited. Research has shown that managing time during lessons with DGS needs development (Jones, 2011) and this was certainly found to be the case with this project, even with the addition of two lead learners.

Although there is a facility for calculating ratios of sides in GSP, using the calculator function instead seemed to reinforce the multiplicative nature of scale factor and the importance of corresponding sides, which could be overlooked by learners if the process of this calculation is removed:

> SA: The ratio is the same as the scale factor
> JC: Only if you do the right sides. If you do k' divided by j it won't as the sides are different.

For JC and SA, the measurement facility may have both amplified and reorganised the exploration of corresponding sides in similar triangles, enabling this comparison of ratio of sides to scale factor.

Olivero and Robutti (2007) warned that although helpful to aid abstractions, accuracy in measurement using GSP could also be an issue. Here, the activity had been designed for abstraction using a slider to enable students to see the general rather than just amplifying the particular, however when it came to comparing area scale factors, the slider proved to be a problem as although it displayed 2.00 for the scale factor, GSP stores numbers more accuracy than it displays (*ibid*.), so when JC and SA calculated the area ratio they got 3.98 instead of 4.00. This made it difficult to spot patterns and so the class were advised to change their area ratios to be correct to the nearest unit. When students tabulated these results, most students were able to quickly spot the connection between the length ratio and the area ratio and JC appeared to make connections with squaring and area, building on her web of knowledge on proportional reasoning:

> SA: Oh I get it, it will be 36. It's squaring it.
> JC: Yes, because it's area.

Transferable Abstractions

The class were asked to anonymously complete a feedback questionnaire (see Appendix 4, available alongside the online version of this article), to allow students to be honest about their experiences using GSP (Denscombe, 2007). The feedback was generally very positive, with students indicating that they found the activities enjoyable and interesting with most students feeling they had progressed in their understanding of enlargement. The negative comments focused on difficulties using the software, perhaps supporting Jones' (2011) assertion that "even with carefully designed tasks, sensitive teacher input, and a classroom environment that encourages conjecturing and a focus on mathematical explanation, it can take quite some time for the benefits of using DGS to emerge" (p.40).

The following lesson the transferable nature of any abstractions they may have made was investigated through two activities: a sorting activity (see French, 2012) where students matched similar triangles and their scale factors, which demonstrated that students could apply their knowledge of preserved angle by identifying pairs of similar triangles and most could then calculate the scale factors and missing lengths; the class then completed a 'rally coach' activity, where students took turns to support each other to solve similarity problems. In the written responses, all students could find linear scale factor and use it to find missing lengths, suggesting an understanding of the multiplicative nature of scale factor. The area scale factor proved to be too challenging for some who needed prompting that the linear scale factor did not apply to area, this could however be attributed to lack of time spent on the last GSP activity rather that the potential of DGS to support this concept.

CONCLUSIONS

Dynamic geometry can act as a microworld to support concept development, which is achieved through the dragging and measurement facilities acting as both amplifiers, speeding up processes and as reorganisers, moving the learner from the particular to the general, in a way that is not achievable using pencil and paper alone. As evidenced by the literature review, these factors, along with others such as non-threatening, accurate feedback and peer-discussion, can facilitate pattern spotting and making connections, enabling situated abstractions more likely to be conceived. DGS can increase confidence, motivation and understanding when managed effectively by the teacher, however this is the element that needs greatest development to ensure the potential of dynamic geometry is realised, therefore further research is needed into strategies teachers can use to manage the learning of large classes using DGS, which was found to be an obstacle in my empirical research.

The findings from the classroom based project, although small-scale, support the existing literature in terms of the amplification and reorganisation effects of both dragging and measurement in DGS. Furthermore, the findings suggest that teaching transformations with GSP has great potential to improve learners' ability to make and test conjectures in transformation geometry and to make connections between scale factor and ratio. The literature review suggests proportional reasoning is local competence, which through constructing and webbing knowledge can lead to more global problem solving. To make these situated abstractions more likely to occur, a combination of designing minimally pre-constructed tasks, peer-discussion and utilising the dragging and measurement facilities are paramount to allow movement from the concrete to the abstract.

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To What Extent do Reading Strategies have an Impact on Students' Reading Motivations?

Laura Meyrick [1] *

[1] President Kennedy School, Coventry, CV6 4GL, UK
* Correspondence: meyrick@pks.coventry.sch.uk

Abstract This study investigates the relationship between employing extrinsic reading motivations and the impact they have on students' intrinsic reading motivations. Within this study, two rewarding motivations were introduced in a secondary school over a period of three months where in the final month there were no rewards implemented. This study particularly focused on Year Seven students and how their motivations to read have been influenced by the set rewards or motivations employed. Evidently, through the student questionnaires and teacher interviews, these motivations may not have the same effect on students' motivations to read on a long-term basis as when the motivations were taken away, some students were de-motivated. Interestingly, both teachers and students seem to play a role in reading for pleasure. Using teachers to support reading through promoting and encouraging it in their classroom had its benefits, yet it is down to the individual student to choose to work towards the rewards in place by reading. There is evidence that employing these motivations does play a part in motivating students intrinsically to read, however only to a short-term degree as when the motivations had been removed, the students' intrinsic motivation to read declined slightly. Throughout this study, it was clear that these motivations had some impact on encouraging students to read even when these motivations were taken away. This study also provides scope for further, long-term study.

Keywords: Education; Literacy; Practitioner Research; Reading

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INTRODUCTION

The National Literacy Trust's Manifesto for Literacy (2009) states that within England, 1.7 million adults have an expected literacy level of an eleven-year-old; with this in mind, the government introduced a teaching framework to help teach and improve reading during primary education. This meant that there was a renewed focus upon reading during primary education; however, there is a need for secondary schools to continue to pay greater attention to developing the reading abilities of students (Lewis 2001). Without sufficient reading ability, adults will struggle to live in a world with a necessity to read, therefore it is vitally important that adolescents' reading instruction should be continually implemented in secondary schools and not lost in their transition from their primary education.

Reading should be continually instructed to suit the curriculum, but it is also important that reading for pleasure should be valued too. According to Clark (2006, p.5) 'reading for pleasure refers to reading that we do of our own free will anticipating the satisfaction that we will get from the act of reading'. It can be quite arduous to teach students to read for pleasure, especially if they do not enjoy it or have

never seen the need to. Most people can be forced to read, but once a student does not need to read just to pass an examination their reading motivation may substantially decrease. However, Nell (1988) suggests that reading for pleasure allows people to experience other worlds. Despite this source being quite outdated, it is important for people to be subjected to other worlds as these worlds can be interpreted in a variety of ways. Exploring these other worlds are extremely beneficial to students as it can help shape their knowledge of worlds they have never come across before, learn new key words and potentially enhance their own creativity. Likewise, others have described reading for pleasure as an interpretive activity which is shaped by the reader's expectations and experiences (Clark, 2006). Some students will naturally enjoy reading, thus will be motivated to do so. Nevertheless, research has highlighted that teaching reading for pleasure can be motivated through the use of rewards. For instance, Clark (2006) implemented some 'reading-targeted rewards', such as books or book vouchers to try and encourage students to read more. Students enjoyed receiving the rewards but it was unclear whether it meant they enjoyed reading more. However, when the students were reading more, their reading attainment improved slightly.

Clarke (2006) states that there are benefits to reading for pleasure such as: text comprehension and grammar, positive reading attitudes, pleasure in reading in later life and increased general knowledge. Likewise, Clark and De Zoysa (2011) suggests that there is a link between children who read at or above the expected level for their age as they seem to hold more positive attitudes towards reading than children who do not.

PURPOSE AND RESEARCH AIMS

Taking into account the research into rewards to promote reading for pleasure, the purpose of this study is to examine the extent that "reading strategies" impact on students' reading motivations in a secondary school, including free book offers and a 'Reading Challenge' competition, as well as a period in which no motivations are active. The aim of this study is to examine the effect of these rewarding motivations on students' intrinsic motivations to read whilst these are in place and when they are taken away, as well as considering the long-term effects on students' intrinsic motivation to read. Extrinsic motivation refers to behaviour that is driven by external rewards such as money, fame, grades, and praise. This type of motivation arises from outside the individual, as opposed to intrinsic motivation which refers to behaviour that is driven by internal rewards.

This study focuses on a population of 70 Year Seven pupils within the school and centres predominantly on how extrinsic reading motivations impact on students' intrinsic motivations. There are three English teachers for Year Seven. The questionnaires were given to the 70 students to complete, whilst the three English teachers were all interviewed. It was anticipated that most of the students would agree to complete the questionnaire and that the three English teachers would consent to be interviewed.

RESEARCH QUESTIONS

1. To what extent do the two extrinsic motivation strategies have an impact on intrinsic reading motivations?
2. How might teachers' influences impact on students' intrinsic reading motivations?
3. Did the extrinsic reading motivations have a long-term effect on students' intrinsic motivations to read?

THE RESEARCH STUDY

It is important to note here all participants were given a consent form to sign before this study to ensure that full consent is given to make sure that this study follows ethical guidelines (see Appendix 1, available in the online version of this article). This study was conducted across a three-month period with a different extrinsic motivation being implemented each month.

Before the three-month study, all Year Seven students were issued with a reading log which allowed both students and teachers to keep track of their reading progress. Students were informed of how to use the log booklets over the three-month period. These log booklets allowed students to complete a log each time they read, but also to complete book reviews after they had finished a book. Here it is important to mention that the reading logs were not used as data in the study. Even though they could have offered some qualitative data to measure against the other data collected to increase the reliability of results in terms of the impact on the number of books read during each month. However, as the reading logs had only recently been introduced prior to this study, it felt like students were not too familiar with their use, making it problematic for teachers to judge how honestly reflective these logs were. With this in mind, using the reading logs as a reliable data resource could have impacted negatively on the validity and reliability of the results.

In the first month, with the help from the library, one free book was offered to all Year Seven students, for which they could choose from a variety of genres. Students were reminded at this point to record their reading progress whilst reading their chosen book. Once they had finished reading their first book, they could then go and get a new book and so on. There was no limit to the number of free books students could get during the month. The extrinsic motivation during this month was the number of free books students would gain by the end of the motivation.

During the second month, the 'Reading Challenge' competition was introduced. The 'Reading Challenge' was introduced as a reading-related competition for students. During this month, students recorded their reading progress in these booklets and they gained five points per reading log and 25 points per book review in their log booklets. Students were rewarded with certificates when they achieved a certain number of points. Students were also informed that at the end of the month, there were prizes for the top 10 students in the year – these prizes were reading-related rewards. Each week, the top-ten readers were published on the 'Reading Challenge' board so that the Year Seven students could track their progress in relation to their peers. Prizes for first, second and third place were Amazon Kindle Fires and prizes for fourth to tenth places were Amazon vouchers.

During the third month, there were no extrinsic motivations present. However, students were still informed to complete their logs and book reviews and to continue to read.

This study focused on the relationship between using extrinsic rewards and the impact on students' intrinsic motivation to read for pleasure, but it is important to consider that extrinsic motivations may have short-term effects as it is questionable whether students would still continue reading for pleasure when these extrinsic rewards were removed.

Students' reading ages were not considered for this study. From previous experience, the reading ages of students are not exactly reflective as they may have been predicted incorrectly during the transition from primary to secondary or may be wrongly represented in reading tests. Therefore, this would have been another dependent variable to consider throughout the study as a before and after reading age measurement may not have been entirely reliable for the reasons previously stated. As this study was short-term over a three-month-period it did not seem fit to include this variable. This study focused predominantly on the age group of Year Seven students, however if a similar study was conducted in the future on a more long-term basis then reading ages could be taken into account.

RELIABILITY AND VALIDITY OF THE RESEARCH STUDY

Prior to the study, teachers were informed that there would be a three-month trial of motivations to encourage Year Seven students to read. Teachers were not informed in advance of what the motivations were. Likewise, the Year Seven students were only introduced to the extrinsic motivation on a month-by-month basis with the hope that this would increase validity in the study, thus leading to more reliable results as no prior preparation could be made by either teachers or students.

Once the three-month study had finished students were given a questionnaire to complete in a classroom to ensure that they were all handed back in. Students were informed that it was anonymous, in the hope that they would answer honestly. All students completed the same questionnaire and were given as much time as they needed to ensure that they were not filled out hurriedly (Cohen, 2007) leading to more reliable and valid results.

Similarly, the three teachers were interviewed after the study and all were asked the same questions to ensure validity in the data collection method and in turn, gain reliable results. Before the interview was conducted, the interviewer explained the purpose of the interview, the format, confidentiality and asked the interviewee if they had any concerns before starting. This pre-discussion ensured that the interviewee still gave consent to be interviewed and understood why they were being interviewed, thereby ensuring that the interview could attain as accurate results as possible. As the triangulation method has been used in this study, the results from the student questionnaire were compared and contrasted with the three teacher interviews. This should increase the validity of this study, especially if the student questionnaire results correspond to those of the teacher interview results to hopefully balance out the potential weaknesses in both methods of data collection (Gray, 2004).

ETHICAL CONSIDERATIONS

Firstly, in any study it is important to ensure that ethical implications are considered, otherwise it could result in penalties and liabilities for the individual or institutions involved (Cohen, 2007, p.71). Research is a voluntary activity and 'most social research necessitates obtaining the consent and cooperation of subjects' (*ibid.*, p.52); as such, a consent form was completed by all participants (see Appendix 1, available in the online version of this article). The privacy and psychological wellbeing of participants is paramount, therefore all research was anonymised so that participants as well as the

school involved remained anonymous throughout. Any data collected in this study was kept anonymous to abide by safeguarding and ethical considerations. As this study took place in an educational establishment it was also imperative to abide by the school's data protection policy.

During the interview, asking questions about teachers' practice needed to be done sensitively as this study did not intentionally want to add more pressure to teachers if they feel like they are not doing something they should be. It also needed to be expressed to teachers that these are possible practices for teachers to try, not a list of things they should be doing. On this note, it was also crucial that the researcher did not judge existing practice but improved their understanding of practice along with the situation in which the practice takes place (Carr, 2003). This needs to be considered when analysing the results as the participants, particularly the teachers, should not be judged or criticised about their pedagogy but it should be used as a way of improving practice within the school.

RESEARCH METHODS

This research study has taken into account factors in and beyond the scope of a conducted literature review to determine an interesting research study to help encourage reading motivations during the transition from Primary to Secondary school. The chosen education establishment already encourages reading by making it high-profile but it will be interesting to implement some extrinsic strategies to study the impact on students' intrinsic reading motivations.

This study implemented some extrinsic motivations to give students a desired outcome to achieve a reading-related reward over a two-month period, followed by no rewards for one month and consider the impact these have on students' intrinsic motivations to read.

Additionally, the 'triangulation method' (Gray, 2004) was used to measure the independent and dependent variables. Both the qualitative and quantitative data were analysed alongside one another as Jick (1979) states that they should be perceived as complementary rather than rival. Therefore, using the triangulation method was beneficial as it combines qualitative and quantitative methods to help "balance out any of the potential weaknesses in each data collection method" (Gray, 2004, p.24) to try and maintain high-levels of reliability and validity.

The use of multiple methods is beneficial as it helps build confidence and validity in the study if the results of one method correspond to those of another. The independent variable will be the intrinsic motivation of students, whereas the dependent variable will be the extrinsic motivation that is put into action. It was important to consider that the independent variable may change depending on other external factors, such as commitments outside of school, therefore the dependent variable may affect students differently. There will be two extrinsic motivations being employed over a three-month period, with the motivation differing each month: 1) free books and 2) 'Reading Challenge', followed by a third month with no extrinsic motivations.

After the study, Year Seven students completed a questionnaire and teachers were interviewed with the research questions as a focus for both methods of data collection:

- To what extent do the two extrinsic motivation strategies have an impact on intrinsic reading motivations?
- How might teachers' influences impact on students' intrinsic reading motivations?

- Did the extrinsic reading motivations have a long-term effect on students' intrinsic motivations to read?

METHODS FOR DATA COLLECTION

Student Questionnaire

The first method of data collection was a questionnaire. Questionnaires can be useful to elicit the impact of the extrinsic motivations on Year Seven students to gain an insight into how students perceive the impact of extrinsic motivations on their own motivation for reading with a balanced variety of open and closed questions. Questionnaires are reliable because they are 'anonymous' thus, students may feel more comfortable answering honestly, resulting in more reliable data. Questionnaires are also easy and quick to complete, provide direct responses and the information is quantifiable. On the other hand, it needs to be considered 'whether respondents who complete questionnaires do so accurately, honestly and correctly' (Cohen, 2007, p.157) as some are 'often filled in hurriedly' (*ibid.*, p.158). Thus, the question of reliability can be raised as some students may rush filling it in or copy their peers to just finish it so not actually think about the questions being asked. The results of questionnaires can usually be quickly and easily quantified by the researcher and these results can be used to compare and contrast other research and to measure change.

Considering all aspects of using questionnaires, this study used questionnaires to allow students to express their opinions on the use of extrinsic motivations (see Appendix 2, available in the online version of this article). There was a balance of open- and closed-ended questions to allow for both qualitative and quantitative data to complement one another. The questionnaire consisted of 17 questions – 9 closed-ended questions and 8 open-ended questions. For instance, the closed-ended questions used the 5-point-likert-scale to establish some quantitative data to see how often students read and how often extrinsic motivations are used in their lessons or by their teachers. Along with questions to see when motivations are used in the classroom and how they are used. The 5-point scale was used as it normally provides sufficient discrimination among levels of agreement as they typically balance favourable and unfavourable statements (Goodwin, 2009, p.477). The range of questions should allow for a measure of how well integrated the extrinsic motivations are in the classroom. Open-ended questions were used to explore students' opinions on: the benefits of extrinsic motivations; their favourite motivation; how their own motivation to read differs when these extrinsic motivations are in place as well as when they are absent, and the use of these motivations in and outside of the classroom. Questions have been carefully worded so as to avoid leading questions or judgemental language (Cohen & Manion, 1989). Furthermore, the questionnaires were anonymous and were issued to be completed in a room to ensure that they all get handed back in to not affect the reliability of results.

Teacher Interview

Teacher interviews were also used in this study on three Year Seven English teachers. To ensure that the interviews were reliable it was important to make sure that they were structured and the same questions were asked to each respondent (Cohen & Manion, 1989). However, interviews can be time-consuming as the researcher has to think of the questions, conduct the interview and interpret the responses. Also, some interviewees may 'feel compelled to present opinions they feel will be acceptable to the interviewer' (Cohen & Manion 1989, p.319). There can be biases of the interviewer present as the questions could influence the interviewee to respond in a particular manner, along with the fact that the interviewer is also scribing the responses, which may affect reliability.

The purpose of the teacher interviews was to explore the relationship between teachers' perceptions of reading and their impact on increasing students' reading motivations, their perceptions on the extrinsic motivations, how they implemented them and their thoughts on the effect on students' intrinsic motivations.

This interview followed a semi-structured format with pre-determined open questions and sub-questions (see Appendix 3, available in the online version of this article). This format allowed the interviewee the freedom to express their interpretations whilst still allowing for narrowing down the specific issues identified in advance. The interviewees did not have the questions in advance as the reliability of the study could have been affected if the teachers could have prepared their responses to say what they believe the interviewer wants to hear. The respondents, however, were informed that they will be interviewed on reading motivations so that they can reflect on this topic before the interview took place. The preliminary interview schedule in the appendix material (available online) highlights the form the interview took along with indicating the pre-determined topics. The teachers' views were measured with regard to which extrinsic motivations were successful and why they thought this. The interview also allowed scope for contemplation of the unsuccessful methods of extrinsic motivations and permitted the interviewee to explore why this may have been. To help ensure reliable results, it is important for the respondent to have reflected on these issues themselves before the interview.

With all of this in mind, there could be an issue of power in an interview situation. In this particular study, the interviewer and the interviewee were colleagues. Also, the discussion of English subject topics could be a charged area for the interviewees as they will be partially experts in the areas of questioning. Despite the possible bias, these factors cannot be changed; nevertheless, they need to be acknowledged and the results need to be interpreted with awareness of this. The interviews were transcribed by hand by the interviewer while the interview was taking place. At the end of the interview, the interviewee could read what was written to ensure that they agreed with it.

DATA ANALYSIS

The students responding to the questionnaire were all from the same school and of the same age. The responses to the open-ended questions on the student questionnaire and teacher interviews were analysed using a thematic approach to gain qualitative data in relation to the research questions. The anticipated themes to identify will be:

- The relationship between the extrinsic motivation strategies on intrinsic motivations – both from students and teachers.
- How the teachers' perceptions on reading motivations affect students' intrinsic motivations.
- The long-term effect of these extrinsic motivations on students' intrinsic motivations to read.

The quantitative data from the student questionnaire and teacher interviews were gathered from the scaled-questions in order to be analysed for the relationship between the two extrinsic motivations and the effect they had on students' motivations to read.

Additionally, it is important to note that extrinsic motivations may only have a short-term effect as when they are no longer present students may choose not to read. Therefore, it is interesting to analyse if and how students' intrinsic motivation changed during the third month when there were no extrinsic motivations present.

Moreover, both the qualitative and quantitative data were measured on a complementary level (Jick, 1979) to present the correlation between the extrinsic motivations and students' intrinsic motivations to read along with the teacher motivations and impact on intrinsic motivations.

FINDINGS, ANALYSIS AND DISCUSSION

In terms of collecting data and documenting the findings, a range of techniques were used to gain the best possible picture of the effects of the intervention on the pupils. The quantitative results of the student questionnaire could be seen more as a self-reflection of how the students felt towards the extrinsic motivations they were introduced to. When looking at the results it is important to consider the bias they will naturally portray as it must be considered whether students and teachers have responded with what they believe to be the correct or desired answer (Cohen, 2007). The qualitative data from the questionnaire thematically correlates to the qualitative data from the teacher interviews. Yet, it is important to note that there were 70 students to complete the questionnaire, yet only three English teachers. Thus, considerations need to be sought for the reliability and validity of the interview results in comparison with the questionnaire results; so the triangulation method was used a way of improving the authenticity of the research.

Findings in the Quantitative Data

Table 1: *Results from the closed-ended questions in the questionnaire. The responses for each question are shown as percentages of the responses from 70 students.*

Response	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
1 = not at all	21%	10%	0%	0%	10%	0%	0%	8%
2 = rarely	29%	10%	0%	6%	17%	0%	17%	19%
3 = occasionally	36%	47%	6%	9%	37%	14%	33%	33%
4 = mostly	0%	12%	56%	38%	19%	19%	37%	30%
5 = all of the time	14%	21%	38%	47%	17%	67%	13%	10%

The questions in the questionnaire were as follows:

1. Before the last three months, to what extent did you feel motivated to read?
2. When the free books were on offer, to what extent did this make you read more often?
3. When there were reading related prizes available for reading during the Reading Challenge, to what extent did this make you read more often?
4. Whilst in the classroom, how much did your teachers encourage you to read?
5. Whilst outside the classroom, how much did your teachers encourage you to read?
6. How often were these motivations used in the classroom?
7. Across your weekly four English lessons, were these motivations used in every lesson?

8. Once these two motivations had stopped, to what extent did you stay motivated to read?

Table 1 shows the distribution of responses regarding students' perceptions on the reading motivations in place over the three-month period (see questionnaire in Appendix 3, available in the online version of this article). The results clearly indicate that after the three-month period of extrinsic motivations, more responses were appearing at the 4-5 end of the scale in the questionnaire. This makes it clear that there was at least some impact on the students' reading motivations. To ensure the reliability of these results, it is important to examine the correlations between the teacher interviews and the questionnaire results. It is also important to note that there could be other factors contributing to this increase in motivation, such as teacher influence, the class the student was in as well as their own personal intrinsic motivation (which may differ between students). Whilst looking at the results for question one, which was questioning students on their incentives to read prior to the extrinsic motivations; it is clear that around 15% of students were motivated to read 'all of the time' beforehand. In spite of this, when looking at the results for question two, which was to explore how the free-book-swap motivation worked, the results increased by nearly half, as around 20% of students claimed that this made them read 'all of the time'. In comparison, after introducing the Reading Challenge, the percentage of students reading 'all of the time' increased to 40% which was an increase of 20 percentage points from prior to the implementation of these extrinsic motivations. This said, it is interesting to note that once the motivations had stopped (question eight), the percentage of students who were motivated to read 'all of the time' fell to only 10%, which was less than before the study. These quantitative results clearly indicate that the two extrinsic motivations may have had some impact on increasing students' intrinsic motivations to read, however it is important to triangulate this quantitative data with those results from the qualitative data.

Findings in the Qualitative Data

The qualitative data from both the student questionnaires and teacher interviews follows a thematic correlation which links to the research questions. The qualitative data expresses links between both students' opinions on the impact of these extrinsic motivations on their intrinsic reading motivations along with teachers' opinions too. Most of the opinions between the students and teachers were alike in their responses. These responses further supported the literature previously reviewed. The qualitative data allows for a greater insight into the impact of the extrinsic motivations in place.

From triangulating the qualitative data alongside the quantitative data, there were three common themes established:

- The end outcomes of reading i.e. types of rewards
- Impact of teachers on students' intrinsic motivations
- Dearth of long-term effects

ANALYSIS OF THE DATA

The research findings relate to the research questions following a general assessment of the questionnaire and interview results highlighting some overarching themes. These conclusions were drawn when it was triangulated across more than one of the interviews and the questionnaires, along

with being compared with current literature on the extrinsic motivations in order to attain a greater potential for reliability and validity.

The End Outcomes of Reading i.e. Types of Rewards

Firstly, it became quite clear that most of the students and teachers felt quite positive towards having reward in place to encourage students to read. The feelings of the teachers towards having extrinsic motivations in place to try and increase students' intrinsic motivations to read were quite optimistic:

> *"I think that students became much more motivated to read when there was a reward at the end of it. Not every student will appreciate a book case of free books, so I think the rewards were a more successful manner of increasing motivations"* – Teacher 01.

This said, it would be open to debate whether this applies to all of the students in Year Seven as it would be difficult to determine whether this is the case for every student in the year group, considering that the quantitative data suggests that only 30% of students felt motivated to read 'mostly' or 'all of the time' when the free-book-swap was offered. Similarly, another teacher expressed:

> *"I have never seen some of the students this motivated to read books before, some of the students in my class were reading on a weekly basis – this is something which I have struggled to enthuse before"* – Teacher 02.

This is a point of view that is supported by Marinak (1997) who argued that the appropriate use of incentives lead learners to engage in reading. This opinion also supports Clark (2006) who implemented reading-related rewards to try and increase the intrinsic motivations of students to read more. Evidently, the student questionnaire responses correlate to that of the responses from the teachers. Quantitatively, it was evident that students' motivations to read increased due to at least one, if not both, of the motivations being put into place. Prior to these motivations, only 15% of the year felt motivated to read either 'most' or 'all of the time'. When the free-book-swap was introduced this figure amplified to 30% of the year feeling more motivated to read. Additionally, when the Reading Challenge was implemented this figure magnified to 95% of the year group feeling determined to read 'most' or 'all of the time'. Whether a little increase or a greater increase occurred it is clear that the motivations may have had some impact on students' intrinsic reading motivations.

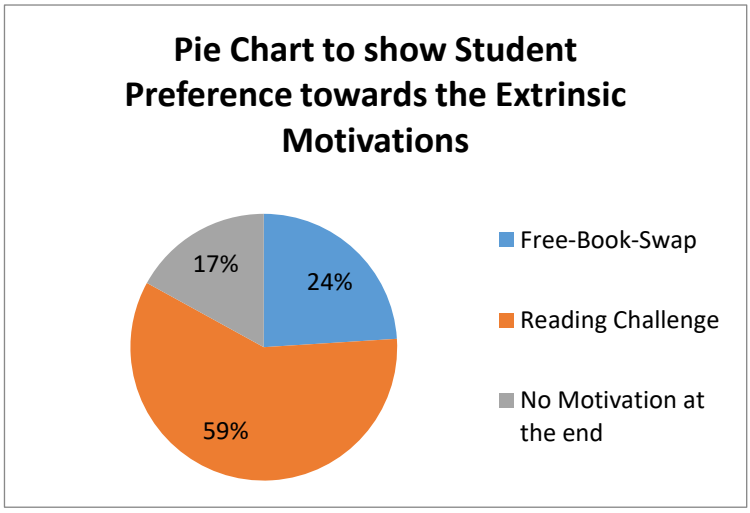

Figure 1: *Student preference towards the three extrinsic motivations in play.*

Figure 1 identifies the number of student responses to question nine, which asks them to determine which of the extrinsic motivations increased their motivation to read more. It is clear that the majority of students preferred the Reading Challenge to the free-book-swap and no motivations at all. Nevertheless, it is interesting that 17% of students still felt motivated to read with the absence of the extrinsic motivations. This could be due to many reasons as these particular students could be naturally intrinsically keen and motivated readers, thus the extrinsic motivations might not have much impact on their motivation to read. Alternatively, it could be argued that of these 12 students, some of them may not have been naturally enthused readers, but after being motivated to read they have found a new value to reading. There could be many factors behind contributing to the students reading motivations, so it is hard to determine the true reason behind this result.

Similarly, through analysing the qualitative data the bar chart below portrays that there was a more significant increase in students' intrinsic motivations when the Reading Challenge was on offer rather than the free book swap:

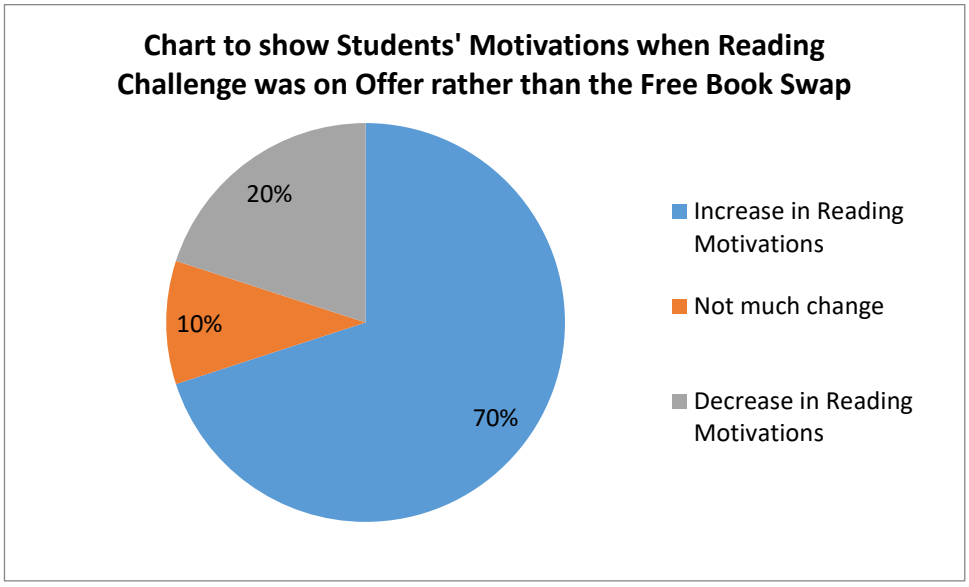

Figure 2: *Students' motivations when the Reading Challenge was on offer compared to the free-book-swap.*

Figure 2 suggests that more than half of the students' motivations increased when the Reading Challenge was in play, rather than the free book swap. Likewise, it was evidently clear that most students felt that gaining a reward had more of an impact than just swapping free books:

> *"I never got a big reward like the Kindles that were on offer but I did win some bookmarks and book vouchers – which was great as I don't really like reading because I struggle with it sometimes so having lots of free books would have put me off reading more than doing more of it, so that's why I liked the reading rewards"* – Student 43.

This further supports Strickland (2004) who argued that students can be strongly influenced by their previous performance. Thus, if students are being rewarded for their accomplishments, they may believe that they can continue to achieve more of these rewards, in turn increasing their intrinsic motivations to read. Similarly, Marinak (1997) argued that if appropriate incentives are offered for reading performance it can enhance intrinsic motivation to read. Some of the teachers' interview responses corresponded with the concept of the Reading Challenge rewards being the more successful manner of raising students' intrinsic motivations:

> *"One of the most gratifying elements of the Reading Challenge was witnessing the new-found value of reading across the year group, but more so it was lovely seeing students discussing what they had spent their vouchers on" – Teacher 03.*

It could be argued that with either of the motivations in place, the opportunity to keep a free book or earn a reward meant that students were completing the reading because they felt like there was a reason behind doing so as they expected to gain something from it. Therefore, implementation of the Reading Challenge could be an effective strategy to motivate students to read more.

In terms of the answering the first and third research questions, it can be argued that the implementation of these rewards did have an impact on students' intrinsic motivations with a more significant impact highlighted from instigating the Reading Challenge more so than the free-book-swap. Both students and teachers felt that reading-related rewards were more successful in increasing students' motivations to read. However, it must be taken into account that this study can only determine the short-term effects of these extrinsic motivations; it would be interesting to study the long-term effects of implementing these extrinsic motivations in a school.

Impact of Teachers on Students' Intrinsic Motivations

Secondly, it became apparent that teachers had quite a substantial effect on influencing students to read. It is noteworthy that the three teachers all had different opinions on what reading means to them:

> *"To me, reading is a way of escapism – discovering new worlds, new characters and letting my imagination run wild"* – Teacher 01.

> *"Reading is a way of developing my own vocabulary, writing and understanding deeper metaphorical meanings"* – Teacher 02.

> *"Reading is what you make it out to be – there is no definitive answer"* – Teacher 03.

These three responses are thought-provoking as they all see reading in a different light. It could be interesting to note here that these varying perceptions of reading could impact their influence on students' motivations for reading. Thus, it could be argued that the teachers in this study may have

used different strategies to motivate the students in their class to read during the free-book-swap or Reading Challenge. This needs to be taken into account when testing for reliability and validity in these results. During the interview the teachers were asked how they implemented the reading motivations during the monthly periods. Linking in to the different views on reading above, the teachers' responses were quite similar:

> *"I kept score of points in the Reading Challenge and free-book-swap and tallied them in front of the whole class. This way it had turned more into a competition between the students in my class to achieve the most points"* – Teacher 02.

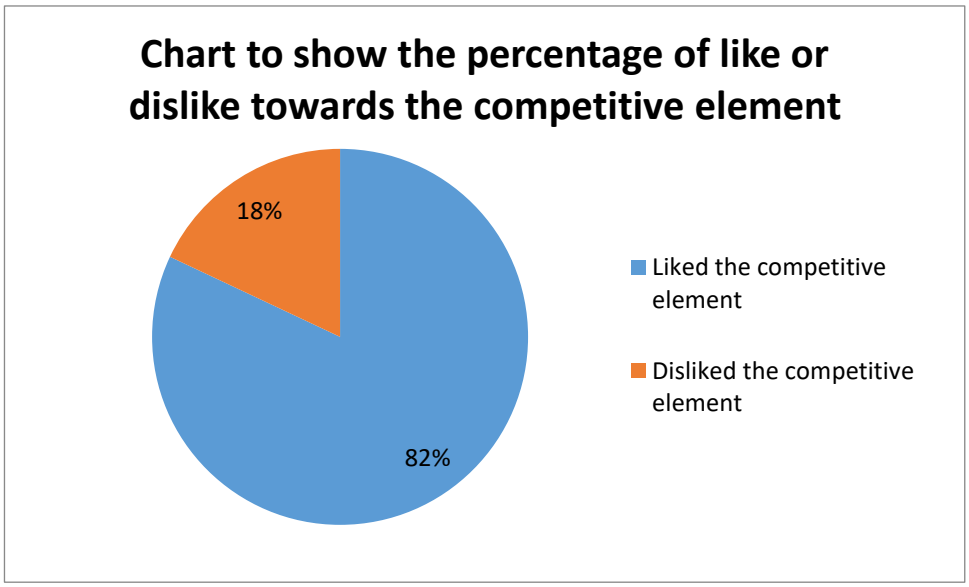

Figure 3: *Students' like or dislike of the competitive element designed by teachers.*

Figure 3 clearly shows that 82% of students enjoyed the competitive element; one particularly moving response from a student suggests that this may have also helped their progress in reading:

> *"I'm not a fast reader and at one point I was doing the worst out of everyone in my class so I decided not to bother reading the next week. When my teacher noticed I wasn't reading she decided to spend time at lunch with me to do some reading aloud. I liked this as it meant I could get help with words I didn't know and my teacher also read some of my book to me. Now I feel more confident"* – Student 29.

The support from this teacher appeared to increase this particular student's motivation to read. Therefore, the teacher intervention may have helped support that student to continue to read and take part in the free-book-swap and Reading Challenge. Thus, highlights that teachers can have an influence on students motivations to read.

Evidently, teachers have played a part in motivating students to read whilst in the classroom. It is notable that the quantitative data reinforces the qualitative responses. In the questionnaire, students were asked about the motivations in the classroom.

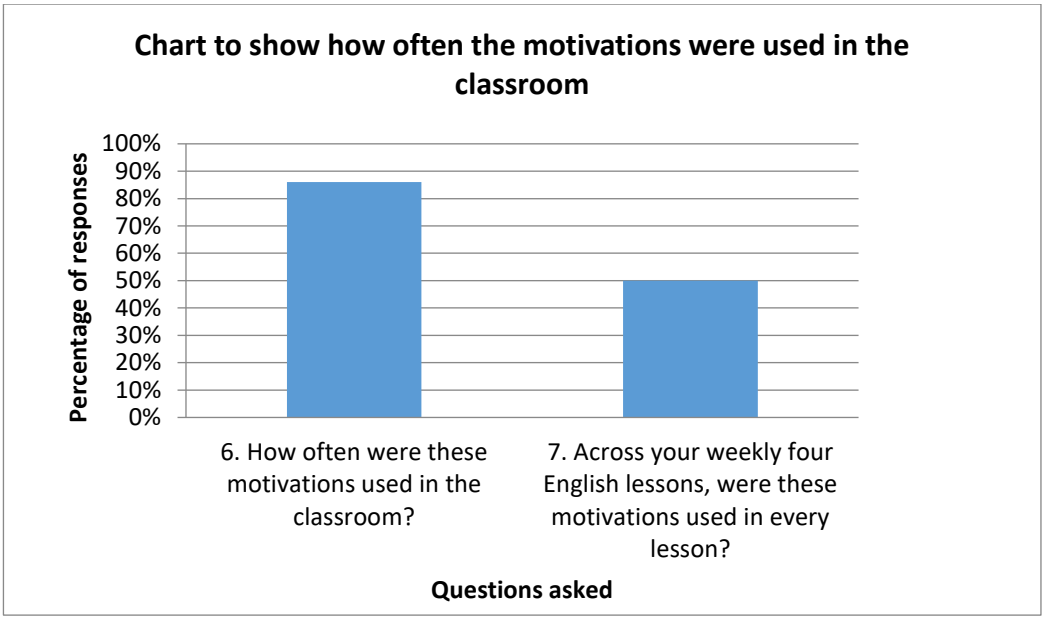

Figure 4: *Graph to show how often the motivations were used in the classroom.*

Figure 4 conveys that 86% of students agreed that these motivations were referred to in the classroom either 'mostly' or 'all of the time'. Despite this, when students were asked if the motivations were used in every lesson they had each week, only 50% of students responded 'mostly' or 'all of the time' which could indicate that maybe they were referred to more in some lessons than others.

This idea that teachers were referring to reading and the rewards on offer could have played a considerable role in enthusing students' intrinsic motivations to read. However, the fact they were not referring to these motivations in every lesson needs to be taken into account as there is an inconsistency in terms of teacher impact; some weeks there could have been a strong level of motivation, yet in other weeks there could have been very little. This could be due to other factors depending on what had to be completed in their English lessons at the time. It is worth contemplating that all students are in control of their own motivation to read which needs to be considered when taking into account the full extent of teacher influences on students' intrinsic motivations to read.

In relation to research question two, it could be determined that teachers could play a role in the influence of students' motivations to read, however these influences would have been governed by the teacher themselves and their views towards the meaning of reading as well as catering for the needs of the individual students. Correspondingly, it is clear that all of the teachers did articulate that they thought all students were more motivated to read whilst there were extrinsic motivations on offer whether it was the free-book-swap or the Reading Challenge.

Dearth of Long-Term Effects

Aside from the positive qualitative data received about the extrinsic motivations put into effect over the two-months, it is questionable as to whether students' intrinsic motivations have been affected long-term:

> *"I enjoyed these rewards but now they're gone I'm not going to read as much because I don't see what I'll get out of it"* – Student 34.

This response indicates that students will still read but not to the extent that they had previously been reading. The rewards in this case have been used as a desirable outcome for students to do a specific task, yet when these desired outcomes became non-existent, students' motivation to read decreased; with only 10% of students feeling motivated to read 'all of the time':

> *"In all fairness, since the rewards have stopped, I haven't been motivating students to read as much as I did as I felt like I would be forcing them to read more so, than encouraging them"* – Teacher 03.

With these responses in mind, some of the teachers felt like they were forcing students to read once the rewards had been taken away, it could be argued that the long-term effects are quite small. Likewise, Metsala (1997) expressed that engaging students in reading is a continuing challenge for teachers, especially based on the responses to question eight: Once these two motivations had stopped, to what extent did you stay motivated to read?

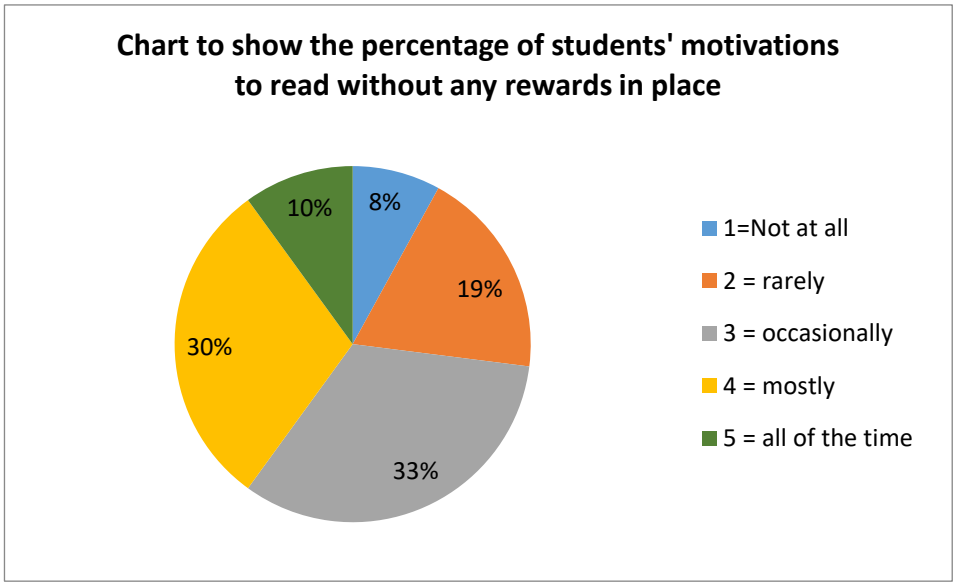

Figure 4: *Students' motivations to read without any rewards in place.*

This is supported by the student questionnaire as when the extrinsic motivations were taken away 60% of students felt 'not at all', 'rarely' or 'occasionally' motivated to read. This is a huge increase in responses scaling in the 1-3 range, as when the free-book-swap and Reading Challenge were employed only 30% of students scaled 1-3. This suggests that the short-term effects of employing extrinsic motivations outweigh the long-term effects.

Furthermore, during the one-month where there were no motivations present; it is interesting to witness how this affected students' intrinsic motivations to read. The National Literacy Trust (NLT) argued that using rewards could be a good method to increase students' intrinsic motivations to read for pleasure, but they also considered the notion that they could only have short-term effects as they questioned whether students would continue to read when they were removed. The qualitative results conveyed some negative opinions towards reading when there were no motivations proposed:

> *"I didn't understand the point in reading if I wasn't going to achieve anything out of it"* – Student 39.

> *"I feel annoyed that there were only two-months where we could get something out of reading to then saying that there are no rewards at all"* – Student 58.

These two responses reflect the short-term impact of extrinsic motivations which correlates to that of Koestner (1999) who considered that when the rewards are taken away, students may no longer pursue the activity.

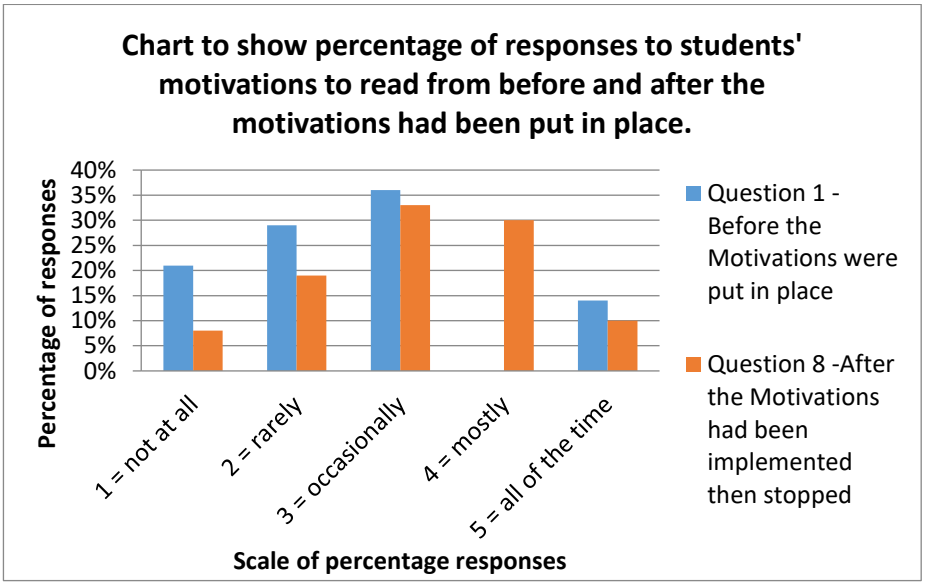

Figure 6: *Students' motivations to read, before and after the motivations had been put in place.*

Figure 6 clearly shows that motivations to read have decreased since the motivations have been taken away. However, this is not the case for all students:

> *"I was never one to read for pleasure but after being enthused to read by the Reading Challenge, I actually found a genre of books I enjoy. I cannot wait to pick up the next dystopian novel!"* – Student 37.

This response slightly supports the idea that these extrinsic motivations can influence students' motivations to read more for pleasure. Even though the quantitative results showed only a minor increase in reading with no motivations, this is still a positive result.

With regards to the research questions, the data has portrayed that a range of reading strategies should be employed to appeal to a range of potential 'abilities' and 'motivations' to try for more long-term effects. To some extent these two extrinsic motivations did affect students' reading motivations, but it is debatable for how long they will continue reading with the absence of the extrinsic motivations. Nonetheless, if this study was longer, there would have been more scope to examine this factor more deeply to draw more conclusive results on the long-term effects and ultimately these results might have differed to a more significant degree.

LIMITATIONS OF THIS RESEARCH

The results presented have indicated that the use of extrinsic motivations to increase students' motivations for reading should not be disregarded; there is certainly scope to continue to use rewards even if they may only be effective in the short-term. There were limitations to this small-scale study which should be addressed to improve future studies in this field and to help enhance the improvement of literacy in this particular school.

To provide a greater scope for analysis it would be beneficial to implement this study at a much larger scale to confirm whether the data presented in this study would be representative of that in a larger-scale study. In such a small-scale study it is difficult to determine the extent of how these rewards can be translated into improvement in reading motivation. A larger scale study could allow for more conclusive results as to the impact of extrinsic motivations on students' reading abilities and whether these motivations may help students to progress in this area.

Furthering on from this, the two motivations in this study offered similar outcomes of reading-related rewards. It would be interesting to see how other, more contrasting motivations may affect students' motivations differently to those in this study. This could offer scope to reach a more significant conclusion over which type of motivations are more effective and possibly draw further conclusions as to why certain types are more successful than others.

On this note, it may have been useful to compare student motivations to their current reading ability level however, for this particular study it seemed appropriate to maintain student anonymity for ethical reasons. If the inclusion of the students' reading data was implemented then the questionnaire responses could be analysed against ability levels and their perceptions on the extrinsic motivations in place. This would have allowed for more numerical data to be correlated to the qualitative responses which could have offered more validity to the results of this study.

The research methods selected to use in the study were largely appropriate. Both interviews and questionnaires were deemed an effective method for data collection. Although, if this study was completed over a longer period, then it could be spread across other year groups and more teachers could have been interviewed to allow for more depth and breadth of teacher responses. This study could have benefitted from interviewing more teachers across the school to allow for a wider spectrum of results to then compare with the student questionnaire results.

With regards to the teacher interviews, it is important to note that teachers can be scrutinised in their careers. Therefore, knowing that the results would be published in a study the teachers may have articulated what they thought people would want to hear and it may not truly reflect their opinions. Nonetheless, this could be the case with any study and so the qualitative results could be questionable for reliability.

Similarly, it needs to be taken into account that the quantitative data obtained from the student questionnaire may not be reliable as students may have responded with what they believed to have been the desired response or may have copied their peers. Likewise, some of the qualitative responses in the questionnaires were not as detailed as hoped which, at times, could make it difficult to see links between answers. For that reason, it might be a consideration that there could have been too many open-ended questions for the age of the participants to answer effectively.

With both of these methods of data collection in mind, it is noteworthy that there were 70 student questionnaires being compared against three teacher interviews. When comparing this ratio of responses, reliability and validity are questionable as it would have been ideal to have more teachers to interview. However, when conducting research in a school it will mostly be more than likely that more students will participate than teachers. Therefore, if this study or a similar study was to be conducted again it might be an idea to expand the participant range to include more year groups, a variety of subjects or even a cross-over between other schools for comparison. This would hopefully provide a wider spectrum of data to compare and analyse; leading to more reliable results and conclusions.

CONCLUSIONS

This research study could be seen as beneficially contributing to the subject field as it has offered a potential approach for increasing students' intrinsic reading motivations which hopefully will increase their reading abilities. This study has clearly identified that employing reading motivations does have an impact on students' motivations to read more, as they felt like they were attaining something beneficial. However, when there were no motivations in place, students' motivation deteriorated.

Even though this study was small-scale and took place over a three-month period, the findings stress the importance of approaching reading motivations through offering extrinsic motivations (such as a desirable reward), even if the outcome is only short-term. The results indicate that a small number of students were influenced to read with no extrinsic motivations in place, which highlights that there has been some impact on students' intrinsic motivations to continue reading. Nonetheless, this study has mainly emphasised the short-term effects more so than the long-term effects. However, to reach more conclusive results of long-term effects, a future study in this field would need to be conducted over a longer time period and to be able to assess more thoroughly the long-term effects once the extrinsic motivations have been withdrawn.

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A Personal Reflection on Establishing a New Multi Author Blog and its Role in Developing Research-Informed Teachers

Kate Mawson [1,2] *

[1] Centre for Professional Education, University of Warwick, Coventry, CV4 7AL, UK
[2] Centre for Education Studies, University of Warwick, Coventry, CV4 7AL, UK
* Correspondence: K.Mawson@warwick.ac.uk

Abstract In 2016 a Multi Author Blog was established to engage student participation in the community of research-informed teachers. This reflection discusses the reasons for its conception and some of the opportunities the Multi Author Blog could provide to schools. In a time when developing teachers as researchers is a priority for ITT providers and schools and when there is a national drive towards a research-informed profession, it is suggested that the use of new technology could be a way to satisfy both professional development and general teacher engagement with research in a sustainable and affordable way.

Keywords: Community of Practice; Identity; Legitimate Peripheral Participation; Multi Author Blog; Research; Technology Enhanced Learning

Peer review: This article has been subject to a double blind peer review process

WHY THE DRIVE FOR RESEARCH-INFORMED TEACHERS?

Currently there is significant guidance from the Department for Education (DfE) and government reports that schools and Initial Teacher Training (ITT) providers should aim to produce and support research-informed teachers (RITs). The 2017 ITT criteria report states that:

> Training may be delivered in schools or other settings and is likely to include a combination of unobserved and observed teaching, taught sessions, seminars, workshops, tasks and assignments, and engagement with academic/professional research. The content of professional programmes might include, for example: (…) the use of evidence and research to inform teaching. (DfE, 2017, p.17)

The 2016 standard for teachers' professional development advises that:

> Professional development is most effective when informed by robust evidence, which can be from a range of sources. In particular, effective professional development: develops practice and theory together; links pedagogical knowledge with subject/specialist knowledge; draws on the evidence base, including high-quality academic research, and robustly evaluated approaches and teaching resources; is supported by those with expertise and knowledge to help participants improve their understanding of evidence; and, draws out and challenges teachers' beliefs and expectations about teaching and how children learn. (DfE, 2016, p.8).

Additionally, Sir Andrew Carter in his review of ITT in 2015 wrote that "…it is critical that ITT should teach trainees why engaging with research is important and build an expectation and enthusiasm for teaching as an evidence-based profession" (Carter, 2015, p.22). Sir Andrew's comments also suggest that ITT should provide a foundation for ongoing development and provide access to experts and engagement with and experience of relevant research. An additional focus of the report was on producing teachers who are reflective and professionally-engaged, who research their own practice and develop throughout their careers (*ibid.*).

My own doctoral research is based in professional development and identity; as such, the drive to create research-informed teachers who are well equipped to develop continually throughout their career is of specific interest to me. I have previously completed postgraduate research in the field of technology enhanced learning (TEL) and so the Multi Author Blog (MAB) project was an ideal vehicle to promote a research-informed teacher identity for the trainee teachers with whom I work.

MULTI AUTHOR BLOGS

A MAB is a blog hosted online, usually with an accompanying Twitter account that is set up by an organisation or individual which includes posts written by a range of contributors. The benefits of a MAB over a single author blog include having a variety of topics to engage a range of readers as well as a continual supply of blogs to ensure continuity of content. Some issues that create challenges when running a MAB include the varied quality of blog posts received in the early stages and some of the time taken to edit the contributions. In the early stages of the project, funding from the Warwick International Higher Education Academy (WIHEA) student participation grant allowed payment of editors and so the effects of this challenge on the blog quality were reduced.

Why Develop a Multi Author Blog?

The aim of the MAB project was to engage trainee teachers as contributors to a TEL project to increase their participation, and support their identity as a teacher researcher community. The MAB was established by the Warwick Centre for Professional Education (CPE) and provided a platform for trainees to reflect on their research journey, specifically on how their engagement with research affected their practice as teachers. The blog played a significant role in the development of critical engagement with the research they were being exposed to. It also contributed to a public discussion through the use of social media which proved influential for the students who engaged with it.

The blogs were informal, reflective pieces of around 500 words (carrying no academic credit) that were submitted on a voluntary basis. Some funding was allocated from WIHEA for payment to trainees who contributed material in the first iteration. This meant that the number of students able to engage with the blog for the purposes of writing posts was limited, although numerous trainee interactions with the blog have been recorded. As of this year (2017) the MAB has been opened for all students and teachers in schools to contribute, as Gilson and Dunleavy (2012) suggest that "blogging is quite simply, one of the most important things that an academic should be doing right now". The teaching community uses MABs and other online dissemination of ideas as standard, students then need to be supported to engage with this community of practice (CoP) in order to feel that when they enter the profession they are a legitimate contributor to this community with a teacher researcher identity. Blogging in MABs is a great way to build wider knowledge of one's own research within a CoP, to grow readership of useful articles and research reports, and to accrue citations.

Engaging in this form of activity allows trainees to begin to view themselves as engaged in the teaching profession and with activities that are valued in the research community. "The accessibility of new media, such as blogs, helps create a multi-way dialogue and exchange of ideas so as to complement traditional communication avenues used in research, teaching, learning" (Powell *et al.*, 2012, p.280).

At university, trainees are exposed to research and are encouraged to engage with and critique published research from the early stages of their training. The aim is that they are supported to develop into Newly Qualified Teachers (NQTs) who have the capacity to become accomplished teachers. Shulman and Shulman argue that "an accomplished teacher is a member of a professional community who is ready, willing, and able to teach and to learn from his or her teaching experiences" (2004, p.259).

A MAB provides opportunities for beginning and established teachers to experiment freely without the constraints of a peer reviewed research paper. Increasingly, blogging is being recognised as a legitimate professional and academic publication which means one's blog profile can lead to wider recognition. We only have to look at the likes of Tom Bennett http://teachertoolkit.me/ to see this in action for the teaching profession and to the BERA blog https://www.bera.ac.uk/blog to see how the platform has been harnessed by researcher educators. The new standards for teachers' professional development states that teachers should "Seek expert support and challenge." it also states that schools should provide professional development which "includes opportunities for experimentation, reflection, feedback and evaluation" (DfE, 2016, p.9). Reflecting on teaching after engaging with research via a MAB is one way that ITT providers and schools can harness new technology to support trainees, NQTs, and established staff in their professional development without significant financial implications.

Why Contribute to or Engage with a Multi Author Blog?

Engagement with a community and the effect of Legitimate Peripheral Participation (LPP) of students in a research community is essential for the student development. Lave and Wenger (1991) discuss LPP as a way for learners to participate in these communities, moving toward full participation in the sociocultural practices of the community. LPP provides a way for 'newcomers' and 'old-timers' to discuss their activities, identities, artifacts, knowledge and practice. The MAB includes blog posts from Ralph Tabberer (Honorary Professor at the University of Warwick). The inclusion of an established education researcher allows the trainees to view the MAB as a legitimate platform as well as providing an opportunity for all students to learn from the posts that Professor Tabberer has submitted. The more posts that are attracted from experienced teachers and researchers in the future, the more effective the blog will be as a tool for students to learn from. Gilson and Dunleavy (2012) posit that "on a multi-author blog, you often benefit from the content that others provide, and they often benefit from yours".

There are, of course, challenges with posting public reflections of students in the early stages of their careers and this blog is no exception. It is true that some of the reflections lack deep criticality, in some cases due to the word limit or sometimes the author's experience. Students are in the early stages of evaluating both their own practice and the research they are exposed to and should therefore be viewed as such. An example of this can be seen in the blog post titled "Bloomin' Marvellous: Taking my hat off to Bloom" by Lauren Atkins http://blogs.warwick.ac.uk/cpemab/entry/bloomin_marvellous_taking/ . There was public critique of this post by a member of the Twitter community as it did not include discussions of taxonomies other

than Bloom's. This is justified and in fact, spurred the author of this particular blog post to look further into questioning and the use of taxonomies. Geake says, "a more sceptical approach to educational panaceas could contribute to an enhanced professionalism of the field" (2008, p123). Therefore, this critique should not be ignored but openly engaged with, in order to harness the legitimate opportunity for the trainee professional development.

The experience level of the early career teacher should not be a barrier to their ongoing developing engagement with research, reflection or the research-informed teacher community. In fact, continual reflection and the ability to reflect on, learn from and develop their practice are key skills which must begin somewhere. Indeed, Carter in his review tells us that:

> High performing systems induct their teachers in the use, assessment and application of research findings and that schools should be research-rich environments. The use and development of relevant research should be embedded at every level. (Carter, 2015, p.27)

So, whilst they may be novices, their development through this process is essential for students; schools and wider CoPs can support them in this. We should also include experienced staff in these new research rich environments. Many students have displayed significant strengths as reflective bloggers and their blog posts are well worth reading despite their entry level, particularly; http://blogs.warwick.ac.uk/cpemab/entry/trainee_teacher_2/
http://blogs.warwick.ac.uk/cpemab/entry/trainee_teacher_5/

One of the blog posts, http://blogs.warwick.ac.uk/cpemab/entry/tweet_tweet_using/, aligns with Vigurs' (2016) work on Twitter and LPP in Higher Education and highlights Twitter as a form of professional development. This demonstrates that, in some cases, NQTs and trainees can become the expert in these new technological fields of engagement and may well be able to contribute to the school community as a leader of staff engagement, bringing fresh perspectives to the staff room from within these new communities.

There is a need for all teachers to be engaged in research and management to support this kind of activity as a legitimate form of professional development in order to promote a school researcher CoP and to support early career teachers as they enter the profession. When access to journal articles is limited in schools, a fact supported by the Carter Review, engagement with research can occur in ways other than purchasing expensive access to online publishers or subscriptions to journals. Being aware of, reading and contributing to blog sites is one of the best ways to become research-informed. BERA and RSA (2014) recently defined research literacy for teachers as*:*

> ...the extent to which teachers and school and college leaders are familiar with a range of research methods, with the latest research findings and with the implications of this research for their day to day practice, and for education policy and practice more broadly. To be research literate is to 'get' research to understand why it is important and what might be learnt from it, and to maintain a sense of critical appreciation and healthy scepticism throughout. (*ibid.*, p.40)

Universities play an important role in supporting trainees to become early career teachers who take an evidence-based approach throughout their careers. The best practice, however, is where school-based trainers are also actively engaged with research and evidence-based teaching (Sahlberg *et al*., 2014), where mentors, for example, actively demonstrate engagement with research. "Effective mentors are also good role-models in relation to their own engagement with research" (Carter, 2015, p.41). An ambition for the blog is that, in the future, it will include more posts from experienced staff

and ideally from mentors of the trainees who could possibly blog about their own perceptions of the same research, or particularly subject-specific research issues – thus acting as role models and guides through this new landscape.

MULTI AUTHOR BLOG EFFECTS AND NEXT STEPS

Analytics show that there have been over 630 unique visitors to the blog, with over 1500 page views during the period from May to June 2016 and January to March 2017 combined. There is active encouragement of all teaching colleagues at CPE to contribute to the blog with personal reflections on their research activities, critical reflections on research they have read or simply just to engage with the trainees' blogs. In the future, it is anticipated that contribution to the blog will become a key performance indicator for CPE's partner schools' engagement. A critical approach to research in placement schools is a shared goal for excellent research practice in the profession, as reported by Killeavy and Moloney while discussing teachers as researchers, "…the culture of the school has a powerful and at times an overriding influence on the development of beginning teachers (overriding the ITT provider)" *(*2010, p.1071).

The MAB is now in its second year and is accepting reflective blogs from any trainees who wish to submit informal reflections on their research activity. Trainees have reported that it was, and continues to be, a particularly useful project and have commented that:

> *I found it offered me the chance to reflect further on my practice and my academic work which, I think, definitely lead* [sic] *to improvements. Furthermore, it was extremely interesting to read points of views from fellow bloggers and see how the PGCE year and research in education was impacting upon them in different ways. I think starting this type of conversation about a topic can fuel further reflection and help to spark new ideas and engagement with a variety of people on the blog, and away from it. It has definitely inspired me to read more blogs and engage in information through other digital platforms.* (Trainee comment, 2016)

As reported by BERA and RSA "a self-improving education system requires a teaching force that is research-informed and research inquisitive, and this will only be achieved if we can create a research-rich culture in our schools and colleges". Beginning teacher learning is enhanced through engagement with other professionals within the community (Forde *et al.*, 2006). Schools are becoming more research-informed communities, openly discussing and challenging research in their everyday practices. Encouraging staff to contribute to the CPE MAB could contribute to the continued development of a school research community and make discussion of research an observable feature of teachers' dialogue, demonstrating that a research-informed teacher community of practice exists in the school to those who engage with it.

How to Contribute to the Multi Author Blog

If you would like to contribute to the MAB please email the corresponding author with your 500 word reflection. There is no requirement to reference but you are encouraged to provide links to further reading for users of the blog to engage with, or specifically a reference to the research upon which you are reflecting. You can find links to the blog via the Twitter account @warwickCPEMAB or you can visit the blog directly at http://blogs.warwick.ac.uk/cpemab. The blog is freely accessible to anyone, which makes it perfect for self-directed professional development as well as for whole staff engagement with research.

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You get what you came for? A Case Study and Reflections on Applying an English Inspection Model in International Schooling.

Deborah Outhwaite [1] *, Ralph Tabberer [1,2]

[1] Centre for Professional Education, University of Warwick, Coventry CV4 7AL
[2] BBD Education
* Correspondence: D.Outhwaite@warwick.ac.uk

Abstract This article considers the position of international education, and the ways in which it 'borrows' performativity structures from the English education system. Utilising a recent Case Study and analysing Ralph Tabberer's personal reflections on it, the article outlines ways in which we can continue to learn from the socio-cultural dimensions of the English schooling system that are regularly utilised in an international educational context.

Keywords: International Education; Inspection; Leadership; Performativity; Transnational Education.

INTRODUCTION

International education is hugely diverse, from no cost and low cost schools through to the international elite schools that are an overseas reflection of the English independent sector. This article traces some of the recent developments around inspection in international education, both abroad and here at home, and discusses the uses of performativity (Ball, 2003) both inside the English system, and beyond. The article examines a Case Study in an international school context, and reflects on the personal experiences of reviewing a school from a different culture. It draws on the school review, the observations that came from the review process, and the wider use of English originated education systems in an international education context.

The world of education leadership is a rapidly changing one: the demands from national governments upon schools, colleges and other education organisations to 'raise standards' is ever present. National governments though, feel the pressure from supra-national Non-Governmental Organisations (NGOs) such as the Organisation for Economic Co-operation and Development (OECD) compiling league tables, such as the Programme for International Student Assessment (PISA) data. Talk of school leadership has become highly significant in the context of current education policy developments. Discourses in England, as in many parts of the world, have centred on leadership (Barber, 2007) and elements of the English highly performance-based system are regularly copied and emulated (Green, 2013).

THE ENGLISH LEGACY?

The development of leadership inside England's educational institutions, and the leaders' place in bringing in 'change' and 'improvement' in education, is well recognised and documented (Gunter, 2012; Bush and Glover, 2012). School leaders now encompass a wider range of roles in educational centres, as there has been an expansion in the numbers of people involved and the variety of roles that they undertake. This is particularly true of the changes in educational markets that have been created since the 1988 Education Reform Act, but arguably intensified from 1997, when at least one act of legislation on education was passed every year until 2010 (Outhwaite, 2011). This created another leadership layer that has been added to yet again with the significant educational changes that have been witnessed between 2010 and 2014. As Davies (1990) noted, the 1998 Education Reform Act introduced 'a new era' for educational reform and the processes of change, de-construction and re-construction of the forms of schooling have been constant, and contested, ever since (Chitty, 2009).

For example, an apparent crisis of A-Level qualifications took place between 2002 and 2014. Successive Secretaries of State for Education attempted to deal with this in a number of ways. Most recently, these have included 'raising standards' by including the curriculum changes that started from September 2015, including: the (re)introduction of numerical, 9-1, grading (as opposed to alphabetical, A*-G) for public secondary examinations at 16; the reduction in opportunities to re-sit exams at 16, 17 and 18; the (re)introduction of linear exams for A-Level; the return to more traditional curricula content; and substantial reduction in coursework percentages (DfE, 2016). The independent sector have voted with their feet through these crises, with many centres opting instead for the consistency and the international recognition of the International Baccalaureate's Diploma Programme as opposed to A-Levels, and indeed, many have adopted the same approach for GCSEs, by choosing international GCSEs (iGCSEs). International schools are choosing international curriculum modes to ease the change and movement of students, often globally, around the education sector.

TRANSNATIONAL KNOWLEDGE?

Sociologists have long commented on the structures in education. Margaret Archer's renowned writings (2013) on the social origins of educational systems are one such exemplar:

> to understand educational interaction means grasping how structural factors shape action situations and why in turn these are interpreted in particular ways by the people involved. To explain educational change means theorizing about these joint determinants of interaction at their point of intersection. (Archer, 2013, p.89)

This relates precisely to the space in the education system where school Reviews and Inspections are conducted and what the aims and intentions of these are. All national systems have particular determinants that characterise them, but recently theorists have begun to grapple with the concept of transnational knowledge (Gunter *et al*, 2014) and how we are 'sharing' the common elements of a performativity based system inside a global neo-liberal system that is now very much in existence (Ball, 2012).

Research conducted by Doherty *et al*. (2009) in Australia showed that the choices that students take are often to gain access to Higher Education (HE) and global mobility opportunities, even if they originally came from the native community, or if they were not wealthy in comparison to their peers. Inside both a late capitalist system and a neo-liberal system that follows the supply of capital (Piketty,

2013), clearly the greater opportunities for scholarships at global universities come in to play, through having access to routes into other countries' Higher Education Institutions (HEIs), that are unavailable (at a similar level of cost) within their own nation state. This is echoed in the more recent research on university significance, in 'the tale of two campuses' from the Great British Class Survey (GBCS) data by Savage *et al.* (2015, p.219).

Groups of students have become mobile either because their parents are transnational for work, or because their parents have deliberately become geographically mobile for better opportunities for their children's education, as detailed by Doherty *et al*. (2009). Such groups experience a need for specialisation or special treatment and for 'differentiation' from competing groups, as Archer comments:

> Weak differentiation and specialisation will be experienced as major deficiencies in the services received by a number of social groups. The uniform and standardised nature of schooling means that many do not get the type of service they require. Despite differences in aspirations and aptitudes parents and pupils confront a system which provides them with relatively little choice or a forced selection between a prestige mainstream and inferior branching alternatives. Other groups will suffer because specialisation hardly begins to meet their needs… many groups in different parts of the social structure will find themselves experiencing severe deficiencies and among them may number the elites of certain institutions. (Archer, 2013, p.255)

The 'deficiencies' to which Archer refers regarding elite groups accessing education, are based on the industrial model of schooling (Marshak, 2003); schooling on a mass scale does not suit their viewpoint or expectations. It is, as Bourdieu described, almost 'prereflexive' (knowing where the ball is going to land in a tennis match); small public schools suit elite transnational mobile groups that are wealthy because of the process of the international schooling opportunity it affords them to cement their global communities (Khan, 2011).

What type of school parents' choose to send their children to, depends on what is available and affordable, and whether or not the student, parents, and staff involved in the choices are aware of all the different factors that come in to play (Archer, 2013). Choice of school creates types of access to the next layer of education and it is this stratification that teachers, leaders and owners of education systems (whether these are charities, governments or businesses) collude in on a daily basis, consciously or unconsciously. Choosing the 'appropriate' secondary school has long-term implications of transition that can go well beyond the access that it enables to subsequent higher levels of education.

EDUCATION, LEADERSHIP AND CHANGE

Tensions between agency and structure are often discussed in educational change and state formation and re-formation (Green, 2013). The tensions have very well-developed roots in previous literature on organisational theory and educational structures (Archer, 2013), often demonstrating that the context of school leadership has been neglected in this area, particularly concerning the isolation of school leaders created by the internal and external pressures that they face (Townsend, 2015).

Gunter's (2012) work on Knowledge Production in Education Leadership (KPEL), the development of 'professional capital' as analysed by Hargreaves and Fullan (2012), and the adoption (both pre- and post- the 2010 UK General Election) of what Ball (2012) refers to as 'Global Education Inc.' are part of

the picture of the changing education system inside an English context. But education leadership is further developed by the networks that are established as the systems that affect our day-to-day existence in the education sector are developed and mutate (Kadushin, 2012; Townsend, 2015).

It is argued that a new paradigm has evolved in educational leadership by those who are prepared to take risks with their leadership. This risk-taking is varied depending on the socio-political and socio-economic context that these leaders (all variously defined: heads, principals, executive heads, CEOs, and so on) find themselves in (Earley, 2013). Ironically, one of the noticeable factors of the English independent sector is that the teachers have often been the head master or mistress, rather than any other term, even though it is their sector that is often running the biggest 'company' formats. These independent schools are mostly registered charities inside the UK though – not private companies – something that the last Labour government began to tackle with co-operation agreements being encouraged (Ball *et al.*, 2012) to enable links between private and state provision.

THE DEVELOPMENT OF TRANSNATIONAL LEADERSHIP STRUCTURES

Many criticisms have been made of the current neo-liberal political context. Gunter (2012) has particularly highlighted how the leadership rhetoric has become dominant and homogenised, rather than pluralistic and divergent. The arguments are between the democratic versus the bureaucratic elements of the education system, and the elitist versus the egalitarian areas of the system as highlighted in the Compass Report (2015). Systems leadership itself, playing out through the education system under the instruction of both the DfE and the NCTL is very evident (Seddon, 2008; Gunter, 2012). With the creation of the independent National Leadership Foundation (2016) the government direction of policy travel is very much towards increased school-to-school support being delivered within a marketised system (Senge *et al*., 2014).

These various neo-liberal models of performativity (Ball, 2003) are now rolling out across the globe as international schools often use the English curriculum and, therefore, can adopt and adapt which measures are suited to their environment. The following Case Study looks into an exemplar of how schools are expected to be accountable for all of their development: day-to-day teaching; results; leadership; and on-going parental and community relationships.

This Case Study and the reflections that follow, both evidence and exemplify how such a range of homogenised leadership factors can (or cannot) be played out inside an international educational context, depending on the extent to which they are deployed, and the level of thought that is enacted. The voice is that of the second author, Ralph Tabberer; the Case Study and the reflections given are, themselves, an example of structure versus agency.

CASE STUDY

It was the first evening after a day's work on an International School review. The review team was providing feedback to the local Principal and the exchange was not going well. Inspectors will tell you about 'first-night blues': that feeling that after Day One of many an inspection, when you tend to feel overwhelmed by the problems you have found, rather than the positives and highlights. Anyway, this first-day feedback session was going badly. Clearly, the Principal did not feel that the review team were making the right judgments. On the team's side, their leader could not understand why the Principal was hearing the challenges but not the good points he also tried to work into the feedback.

I was not at the meeting myself, but I had arranged the review visit to meet the needs of the school owners, and I had recruited this review team. I felt a great responsibility for getting the interaction right. In particular, I had helped to design the review criteria and framework, and had borrowed quite heavily from a local inspection framework in order to arrive at classroom grades that would be quite familiar to the school.

After the awkward feedback session, both sides called me, trying to find solace or reassurance. I listened to both and the real insights came from listening to my review leader as he gave his account of what had happened. I simply asked him to describe exactly what he had found during Day One. He relayed many points and he told me how he organised the feedback accordingly. What grabbed me, as I listened, were the polarities in the team leader's message. The students were 'exceptional' and he had never met such an 'empowered group'. But despite that, he judged that the teaching was not challenging enough.

Personal Reflections on the Case Study

I have worked for ten years of my educational career as a researcher and I find polarities fascinating. After all, strong polarities in the evidence base are quite unusual. Most of the time, we find patterns of evidence that broadly point in one direction or another. It is always harder, as a researcher, to explain a phenomenon where there are, say, strong positives and strong negatives. I enjoy it when there are polarities in the evidence base. It is usually a signal that I am about to learn something new.

As the review leader relayed his account of events, he explained he had determined to present the positives first, and then the weaknesses. Of course, those Principals who are used to inspection know this approach all too well and they sit waiting for the 'but...'. In this case, the pervading negatives were quite distinctive, so they drowned out the good news. The narrative leaned to the negative. It is important to see every school inspection or school review as a socio-cultural event. Inspection is usually concerned with applying a common template that is designed to apply to many schools, to a single school. A review is not always sensitive to context.

Inspections expect to find minor polarities, not major ones. And they usually find a narrative that downplays the polarities. For example, the story can become that the school is basically weak but the student intake is strong, and it is this innate strength that somehow saves the school from poor results. I felt that we were in danger of treating our review as an inspection, so I asked both sides to give the process more time. And I asked the review leader to *focus* on the polarities. I also gave him permission to do one thing you can never allow an inspector to do: I told him it was fine if he needed to change the review criteria and templates, *if they were the problem* rather than the school. This freedom changed the whole process and the review results.

In truth, the team leader did not change every detail and finding but he did begin to look for the reasons behind the polarities: what was the school doing so well in one area while another area needed work? And, because the school was an Arab international school in the Middle East, this shift in approach and mind-set allowed the review team of mostly Western educators to find and understand strengths that they never knew existed. They discovered that the route to empowering students 'exceptionally' – for that is how they judged the practice in the school – involved many actions on the part of the school. The teachers and school leaders *loved* their students, and they showed that love. They knew them as individuals and they knew their families very well. That involved finding ways to have regular interaction with the families.

The teachers made every attempt to avoid being judgmental about the students and, even when the students could not understand something, they found another way to approach the challenge of

explaining it. Crucially, the teachers convinced the students that they were absolutely devoted to them, they respected them, they wanted them to succeed and they would be on their side, whatever the provocation. From that starting point, the teachers offered activities to the students as opportunities and choices. In return, students began to give the school their loyalty. The combination of all these psychological influences, consistently and repeatedly applied, left students feeling empowered. Even if the class teaching could have been technically improved.

I was struck by some simple messages.

Change the purpose, change the story

This Case Study demonstrates one old and well-known principle, which is that if you change the purpose and frame of reference for an exercise – in this case, choosing to review rather than inspect – you change the result; and you change the narrative. Once the review leader had permission to stand back and question our agreed method, he opened up the possibility that the review team could discover something they had not previously known. Too many inspections position experts as the observers and judges of practitioners, supposedly objectively; they rarely allow for the inspection team to learn something about education that it did not already know.

Adopt the framework, condition the response

This Case Study also showed me that even a minor decision about tools, criteria or frameworks can have a major influence on the outcome. In this example, we used a classroom evaluation framework that was inspection-like. Its impact on the review team was to condition their end-of-day response. It felt as if the outsiders were primed to give inspection, not review, feedback. In the modern era, teams of educators get together sometimes as inspectors, sometimes as accreditation teams and sometimes as reviewers. They carry the habits they learn from one approach into another *unless they are (de-) programmed to change them*.

Reflection Conclusions

In schools, there is scope for many forms of institutional evaluation including self-evaluation, inspection, review and accreditation visits. This Case Study illustrates how easy it is to arrive at different results based on variations in the purpose of the exercise, the team deployed, and the tools and criteria selected. The traditions of scientific research strongly point us to the importance of asking, 'if we had changed something in the process, would we have changed the outcome?'. In this instance, the answer is clear, strong and affirmative.

Consequently, it is crucial that we treat the outcomes of different institutional evaluations not as 'truths' but as varied and partial interpretations of the evidence base. And the evidence base is itself a construct: it is partial and incomplete. Some may feel that this finding helps to invalidate inspection, or any other form of external review, but I prefer to see this as vindication for schools who want to adopt *more than one* approach. In my experience, deeper knowledge tends to come from understanding alternative perspectives.

INTERNATIONAL EDUCATION QUALIFICATIONS AND LEADERSHIP

The importance of effective leadership and management of schools has increased in significance and, as such, there has been much research conducted into the effectiveness of school leadership and its associated impact on school improvement (Barber, 2007). Bush (2015) has also commented that England is the only country in the world to have introduced a mandatory National Professional Qualification for Headship (NPQH) and then dispensed with it again.

Bush argues that there are three dimensions of leadership that assist in defining its concept: influence, values, and vision (Bush, 2011, p.5). Most leaders work towards influencing individuals or groups in order to achieve a desired outcome. The concept of values, however, characterises a leader's self-awareness and personal values together with their moral and emotional capability. It is these characteristics that a leader is required to communicate effectively in order to represent the ethos of their school. Leithwood *et al.* (1999) analysed literature based on leadership and management, and identified six models of management: formal, collegial, political, subjective, ambiguity, and cultural. Bush and Glover (2002) identified nine leadership models: managerial, participative, transformational, interpersonal, transactional, post-modern, contingency, moral, and instructional.

In this Case Study, the perceived strength of the school's leadership was hugely influenced by the context, perspective and processes of the external review. It nearly missed the very strong values systems that pervaded the school, simply because the review team were misled into adopting a performativity approach rather than a more open or questioning approach.

CONCLUSIONS

Whilst theories and models of leadership and management are well established, the emergence of Distributed Leadership in more recent years has removed the idea of leadership being the sole responsibility of one leader and instead recognises the influence of various sources of power and leadership capability (Harris 2010; Torrance, 2013). It is clear (as is reported in the Case Study) that leaders can feel trapped, and responsible, in modern school systems. This is because too often, too little is done to appreciate the wider socio-cultural backdrop of their context.

Hargreaves and Fullan's (2012) ideas of extending professional capital, in schools, where teachers and leaders are allowed to develop their own reflexive ability to change and adapt, suddenly appears an even stronger option. And not solely because teachers want and need to engage in a profession that they are leading and developing themselves. It is also because it proves very difficult to judge a school fairly without opening up to its special characteristics ad context. Clearly, being open to possibilities is easier to do, on an institutional level, in a review than it is in an inspection process.

With regard to both the Case Study and the reflections considered within this article, most leaders in the international school system have a degree of flexibility that is unavailable inside the current English system, from which we can continue to learn about the socio-cultural considerations inside our own educational contexts.

This ability to flex, and put our agency into motion, is an area that is impossible often during inspection, as regimes and timetables have to be kept to, in order to standardise a system effectively. But what we have discussed here begs the question: how much do we miss in English-style inspection through the lack of ability to alter structures appropriately? Conformity is fine perhaps, if it serves a purpose in ensuring some students are not disadvantaged – and compliance is required on issues such as safeguarding – but standardising all systems so that we turn differing education systems into

identikit models reduces the value of national cultures, personal inputs, and ultimately the differences from which we are all able to learn.

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