

How Can School Leaders Establish Evidence-informed Schools: An Analysis of the Effectiveness of Potential School Policy Levers

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Chris Brown and Dell Zhang

Abstract

This article has three aims: first, it examines the notion of evidence-informed practice and its benefits, as well as recent educational policy designed to promote schools' use of evidence. Second, it examines four distinct but overlapping and interdependent factors that school leaders need to consider if they wish to establish evidence-informed practice within their school. These factors are: 1) the existence of teacher capacity to engage in and with research and data; 2) school cultures that are attuned to evidence use; 3) schools promoting the use of research as part of an effective learning environment; and 4) the existence of effective structures, system and resource that facilitate research-use and the sharing of best practice. Third we describe how the article's authors undertook a survey of 696 practitioners in relation to these factors. Also how, with the resultant data we built a *Gradient Boosted Tree* predictive model to examine the potential policy levers available to school leaders wishing to promote evidence use in their schools. We conclude the article by setting out which of these factors is most likely to increase both support for evidence informed change within schools as well as boost instances of evidence informed practice by teachers.

Keywords

evidence-informed practice, evidence use, knowledge mobilization, prediction models, school leadership, self-improving school system

Introduction

There is a now an impetus, internationally, for teachers to engage in research activity and with research evidence in order to enhance their practice (Cain, 2015; Greany, 2015; Hammersley-Fletcher and Lewin, 2015). Typically, the engagement of teachers in and with research evidence

Corresponding author:

Chris Brown, London Centre for Leadership in Learning, UCL Institute of Education, 20 Bedford Way, London WC1H 0AL, UK.

Email: christopher.brown@mac.com

can take two forms. The first is ‘action research’, traditionally viewed as an investigation by an individual teacher as a means through which to instigate change in their classroom (Bubb, 2014; Roberts, 2015). The second can be described as teachers engaging in ‘research informed teaching practice’ (RITP). Here teachers employ existing research with the aim of improving or innovating current pedagogic practices. Of these, it is the latter that is currently dominating the discourses of both policy and practice and as such provides the focus for this article.

Perspectives

Evidence-informed Practice

Although a number of definitions of evidence-informed practice (EIP) abound, for the purposes of this article we adopt that provided by England’s Department for Education, who suggest EIP may be thought of as: ‘a combination of practitioner expertise and knowledge of the best external research, and evaluation based evidence’.¹ This definition serves to position this article in relation to a number of the controversies and debate surrounding evidence use (Hargreaves, 1996; Maclure, 2005; Biesta, 2007; Goldacre, 2013; Brown, 2013; 2014). For example, it (hopefully) illustrates that we are proponents of evidence informed expert judgment rather than evidence-based, top-down instruction. Correspondingly within this article we focus solely on the substantial benefits associated with practitioners using research² to enhance their practice and acknowledge, but do not revisit, the critique (well reported elsewhere) on the potential issues associated with teacher evidence use (see references above and Brown, 2014). Such benefits, for instance, include growing correlational evidence that where research and evidence are used effectively as part of high quality initial teacher education and continuing professional development, with a focus on addressing improvement priorities, it makes a positive difference in terms of teacher, school and system performance (Sebba et al., 2012; Mincu, 2013; Cordingley, 2013; Godfrey, 2014a; 2014b). Furthermore, the experience of ‘research-engaged’ schools that take a strategic and concerted approach in this area is generally positive, with studies suggesting that research engagement can shift a school from an instrumental ‘top tips’ model of improvement to a learning culture in which staff work together to understand what appears to work, when and why (Godfrey, 2014b; Sharp et al., 2006; Handscomb and MacBeath, 2003). In addition, it is also noted by Godfrey (2014b: 2) that schools which have made a commitment to evidence informed practice report increased numbers of applications for teaching posts, high levels of teacher job satisfaction and increased staff retention (also see Godfrey, 2009 and Sharp, 2007).

Recent Policy Drivers in Relation to EIP

The direction of travel of recent educational policy in England has also focused on promoting/ requiring teachers to better engage with evidence. In particular the significant investment in initiatives aimed at connecting practitioners with educational research that was undertaken by the 2007–2010 New Labour government (Greany, 2015; Saunders, 2015). After New Labour, the UK’s recent (2010–2015) Conservative/Liberal Democrat Coalition government changed tack and pursued a ‘self-improving school-led school system’. Nonetheless evidence use has still been front and centre, with Greany (2014) suggesting that the core characteristics of self-improvement comprise: 1) teachers and schools being responsible for their own improvement; and 2) teachers and schools being required to learn from each other and from research so that effective practice spreads. Greany (2014) also notes that teaching schools, outstanding schools with a designated role

to (among other things) co-ordinate research and development across an alliance of partner schools, played a prominent part of Coalition education policy.

Data Sources

There is very much then an impetus for school leaders to ensure they and their staff seek out and engage with quality evidence in relation to issues of teaching and learning (both in terms of content and pedagogy). Brown and Greany (forthcoming) argue that to do so requires them to focus on and address four distinct but overlapping and interdependent factors. These factors are: 1) the existence of teacher capacity (that is, ability) to engage in and with research and data; 2) school cultures that are attuned to evidence use (that is, that make research-use a cultural norm); 3) schools promoting the use of research as part of an effective learning environment; and 4) the existence of effective structures, system and resource that facilitate research-use and the sharing of best practice. These factors are now explored in more detail below.³

Capacity to Engage Both in and with Research Evidence and Data

Being evidence-informed can result both from teachers actively engaging in their own practitioner-enquiry to investigate an issue, and from teachers seeking out research, or evidence on 'tried and tested' approaches from elsewhere. For practitioners to be able to do either, however, will require them to have capacity (ability) in the following areas:

- An understanding of research approaches and methods and the strengths and limitations of each as well as knowledge of associated core aspects of the research process (sampling, analysis, measurements of validity and reliability, and so on). This enables teachers to be able to ascertain the robustness of any given study and the types of inference or understanding they may draw from it (Goldacre, 2013; Bennett, 2015). Importantly, it will also enable teachers to engage in their own action research projects (Roberts, 2015).
- The ability to understand how the findings of any given study can be effectively recontextualized to their own setting, so ensuring approaches are likely to lead to the same types of 'cause' and 'effect' as in the original case (Argyris, and Schön, 1974; Cartwright, 2013; Moss, 2013; Brown, 2014).
- The ability to ensure research evidence adds to rather than replaces existing effective practice. Similarly, that research is engaged with in deep rather than superficial ways. Because both lead to the development of expertise they are dependent on practitioners understanding how to engage in 'learning conversations' (Schuck et al., 2008) that result in 'knowledge creation' (Stoll, 2012) (the idea of knowledge creation is discussed in more detail in the section below entitled 'A Learning Culture - Using Research as Part of an Effective Learning Environment').

Also required is that schools have:

- Access to a robust evidence base, for example that held in academic journals or research databases AND access to accessible high quality research syntheses (Goldacre, 2013). These requirements are linked but distinct and depend on the model for evidence use being proposed.

- An understanding of cycles of enquiry and an approach to measuring impact (for example, those set out in Halbert et al., 2011; Harris and Jones, 2012; Schildkamp and Ehren, 2012; Timperley et al., 2014). This is because engagement with research evidence should not be something that occurs in isolation, rather it should be undertaken within the context of a wider iterative ‘cycle’ of enquiry and improvement: here goals are set (via the analysis of data), the current situation or issue(s) ascertained, hypotheses developed, new approaches implemented and their success measured (with approaches refined, scaled up or dropped as a result: Taylor and Spence-Thomas, 2015).

Making Research Use a Cultural Norm

If it is to be ‘the way things are done around here’ (Stoll and Fink, 1996), research-use needs to become a cultural norm. As such, it must stem first and foremost from a full commitment to EIP from school leaders (Galdin-O’Shea, 2015; Roberts, 2015). School leaders (that is, senior leaders such as headteachers or principals) are able to exert influence in their schools in a number of ways, including:

1. providing vision;
2. developing, through consultation, a common purpose;
3. facilitating the achievement of organizational goals and fostering high performance expectations;
4. linking resource to outcomes;
5. working creatively and empowering others;
6. having a future orientation;
7. responding to diverse needs and situations;
8. supporting the school as a lively educational place;
9. ensuring that the curriculum and processes related to it are contemporary and relevant;
10. providing educational entrepreneurship. (Day and Sammons, 2013: 5.)

In themselves these qualities can be divided into the ‘transformational’ aspects of leadership and ‘pedagogic’ or learning-centred leadership (Day and Sammons, 2013). The former is described as a process based on increasing the commitment of those in a school to organizational goals, vision and direction (Bush and Glover, 2003), and has been shown to have positive impact in relation to the introduction of new initiatives, the remodeling or restructuring of school activity or in affecting school cultures (Leithwood, 1994). The latter is seen to relate to the efforts of principals in improving teaching in their school and their focus on the relationships between teachers as well as the behaviour of teachers *viz-a-viz* their work with students (Timperley and Robertson, 2011).

It is apparent then that true research-engagement within and across schools will require school leaders to address both the ‘transformational’ and ‘learning centred’ aspects of becoming research and evidence engaged (Brown, 2015). In other words, school leaders should both set the vision for and develop the culture of being a research engaged school (including the promotion of the values required for learning communities to operate – see the section below entitled ‘A Learning Culture - Using Research as Part of an Effective Learning Environment’). Also that they are required to provide the resource and structures (for example, time and space) for sustained and meaningful research-use to become a reality (Stoll and Fink, 1996; Leithwood et al., 2006) – see the section below entitled ‘Structures, Systems and Resource’. More than this, however, is that senior leader

involvement in research-use is also vital because having first engagement ensures that research-use remains top of mind and so a priority. In addition, it enables senior leaders to ‘walk the talk’: not only to demonstrate their commitment but also to engage in learning-centred leadership practices such as ‘modelling’, ‘monitoring’ and ‘mentoring and coaching’ (dialogue), thus ensuring wider buy-in to research across the school (Southworth, 2009; Earley, 2013). Of these practices (of ‘modelling’, ‘monitoring’ and ‘mentoring and coaching’) Stoll (2015) argues that a key characteristic for senior leaders to model is having an ‘enquiry habit of mind’: senior leaders actively looking for a range of perspectives, purposefully seeking relevant information from numerous and diverse sources and continually exploring new ways to tackle perennial problems.

A Learning Culture – Using Research as Part of an Effective Learning Environment

Within evidence-informed schools, school leaders and teachers must also establish and build effective learning environments in which the development of research-informed practice can flourish. We suggest that such environments are best represented by professional learning communities (PLCs). This is because meaningful practitioner engagement with research is most likely to originate from a process of learning and the development of expertise (and correspondingly confidence) in relation to the research in question (Brown, 2014; Datnow and Hubbard, 2015). Learning that leads to expertise in research-use tends to be constructivist/sociocultural in nature (Brown, 2014) and this is exemplified by the learning and application activities undertaken in the type of collaborative communities represented by PLCs. This specific process of learning has been encapsulated by the notion of knowledge ‘creation’; here the producers and users of formal knowledge, who are, respectively, also the users and holders of ‘practical’ knowledge, come together to create ‘new’ contextually/situationally specific knowledge and understanding (Nonaka and Takeuchi, 1995; Virtanen and Tynjälä, 2008; Rexvid et al., 2012; Brown, 2014; Finnegan et al., 2015). It should also be noted that this type of learning has been shown to lead to improvements in both teachers’ practice and student outcomes (Stoll et al., 2006; Veschio et al., 2008; Harris and Jones, 2012).

Stoll et al., (2006) also note additional characteristics of PLCs that make them suitable learning environments for research-use, including: 1) a shared vision and sense of purpose, centred on improving outcomes for children (Hord, 2004; Andrews and Lewis, 2007); 2) collective responsibility for student learning (Kruse et al., 1995; King and Newmann, 2001); 3) PLC participants collaborating in ways that go beyond mere superficial exchanges of help, support, or assistance (Louis et al., 1995); as well as 4) the promotion of both group and individual learning. Successful PLCs will also possess the capacity to both identify and harness external support. Successful external input includes providing multiple and diverse perspectives, and challenging orthodoxies, and successful external facilitators can act as coaches and/or mentors. This suggests then that, rather than representing boundaries, successful PLCs are open to external opportunity and the creation of ties and additional relationships (Daly and Finnegan, 2012).

Underpinning these characteristics is the need for PLCs to be promoted by leaders as an environment that supports collaborative learning, rather than an imposition linked to accountability (Datnow et al., 2013). This means then that trust, respect and the ability to depend on each other at all levels become important relational dimensions of the PLC and correspondingly, school improvement more generally (Provan and Kenis, 2008); for example Stoll and Brown (2015) highlight the pivotal role of school middle leaders (MLs) as catalysts for evidence informed change but suggest that this role can only function when MLs are able to act in ways that engender trust

and provide support. More generally, high levels of trust are associated with a variety of reciprocal efforts, for example, where collaboration, learning, complex information sharing and problem solving, shared decision making, and coordinated action are required (Bryk and Schneider, 2002; Tschannen-Moran, 2004; Cosner, 2009; Bryk, et al., 2010): in other words, efforts such as the development of new and effective practice, including that based on evidence.

Structures, Systems and Resource

Underpinning capacity and culture are the structures, systems and resource required to support research-use. First and foremost, it is paramount that school leaders make available and coordinate time and the space and budget required for teachers to engage in the capacity and learning related activity outlined above. For instance, they must: free up time within the school day to enable teachers to spend quality time engaging with evidence or in action research activity; ensure the school timetable facilitates collaboration between teachers (and importantly between subgroups of teachers, such as those within subject departments); ensure there is access to evidence in its myriad of forms – from data to academic research (see endnote 1); ensure experienced facilitation and appropriate protocols exist to enable discussion around evidence; and ensure there are formal and informal processes for upskilling teachers so that they are able to engage critically with research, data and evidence, including opportunities for postgraduate training (Datnow et al., 2013; Goldacre, 2013; Micklewright et al., 2014). This last point is especially important given the potential for PLCs that comprise practitioners lacking in experience to misinterpret or misuse research or data or work to perpetuate poor pedagogic practice (Datnow et al., 2013; Katz and Dack, 2013). Partnerships between schools and research providers can be effective here (Greany, 2015). The aspects detailed above can also be actively rewarded or incentivized, as they are in other education systems such as Singapore (Wilkins, 2013).

At the same time, it is likely that information will be both believed and acted on if its source is a trusted peer, who may or may not be as well versed in the practice being disseminated as those involved first hand in the PLC/JPD activity. In other words, knowledge in relation to best practice often flows informally and interpersonal relationships and social interactions within a school are key (Daly, 2010; Greany, 2015). This implies that ‘relying strictly on formal mechanisms to diffuse information and knowledge may thus leave critical practice gaps in the organization, potentially leading to a lack of depth and fidelity . . . or even threatening the sustainability of the effort’ (Daly, 2010: 3). Analysis of such informal information flows require school leaders to grasp new ways to consider the functioning of their school. Specifically, they must understand how to ensure the informal social networks within their school operate effectively and efficiently and are working towards the distribution and take-up of effective practice (both within and outside of PLC activity). To achieve this school leaders must be able to: 1) identify who within their school (and sub groups such as departments) possesses the highest levels of explicit ‘practitioner-based social capital’ (PBSC) – PBSC can be thought of as the ‘resources, information and support for effective teaching available through a teacher’s network’ and teachers with the highest levels of *explicit* PBSC will be those their colleagues are most likely seek out for advice (Baker-Doyle and Yoon, 2010: 118); 2). By also ensuring those involved in PLC/JPD activity also possess high levels of explicit PBSC and have their roles within PLC/JPD activity allocated accordingly, leaders can ensure these ‘central actors’ become key drivers for the flow of best practice information within PLCs and around schools (in instances where PLCs only comprise sub-groups of staff) (Baker-Doyle and Yoon, 2010; Finnegan and Daly, 2010; Moolenaar and Slegers, 2010). This approach has some

precedence: for example, Datnow and Hubbard (2015: 19) describe how school leaders have adapted policies and practices in New York City public schools in order to ‘structure social interaction and professional discourse’ in relation to evidence use. Similarly how other case study schools address ‘teacher groupings and subject matter subcultures’ (Datnow et al., 2013: 357).

Methods

The four factor areas outlined above are vital to meaningful and effective research use, but it is also clear that they each comprise a number of elements and of these some are more likely to be effective in driving research use than others. Correspondingly the authors of this article set out to understand, in relation to these factors, where school leaders should be focusing their efforts in order to facilitate evidence use within their schools. To do so we analysed the findings of a survey focused on each of the four areas above, plus additional questions to examine key overarching factors such as trust and the strength of interpersonal relationships within schools. In all cases questions were designed to provide an indication of the base state of individual schools. The design of the survey was undertaken in conjunction with Professor Alan Daly, University of California, San Diego, who is experienced in examining the movement of evidence within and between schools in Californian school districts (Daly, 2010; Finnegan and Daly, 2012; Finnegan et al., 2015). Before it was distributed, the survey was also piloted with teachers from the primary sector (not involved in the project) in order to test ‘face’ and ‘construct’ validity. Feedback from the pilot was then incorporated into the final questionnaire. The final survey questions for this aspect of the survey are set out in Table 1.

Each question in Table 1 employed a five-point Likert scale which ranged from ‘strongly agree’ to ‘strongly disagree’. The survey itself was developed using survey monkey and distributed electronically to 79 primary schools via their principal/headteacher. The survey period lasted from 2 October to 19 October 2014. In total we achieved 797 responses to the survey. Of these, 696 were analysed, with these 696 representing those who had joined the school before September 2014, since it was reasoned that three to five weeks into a school term wouldn’t provide sufficient time for teachers new to a school to reflect on its longer term research-use activity.

Analysing the Data

Our aim in analysing the data was to ascertain the effectiveness of potential school policy levers for the promotion of EIP. To begin with the variables represented by the survey questions were divided into *cause* and *effect* type variables; the latter representing teacher’s own experiences in relation to evidence informed practice, while former refer to the external factors that potentially influence these experiences. It should be noted here that the terms ‘cause’ and ‘effect’ are grounded in Argyris and Schön’s (1974) notion of a theory of action. That is, we have made assumptions as to the direction of flow of impact, derived from our review of the literature above – with variables associated with these factors viewed as driving views on and behaviour in relation to evidence use. The list of variables and their allocation into cause and effect are set out in the last column in Table 1. In essence then, for the four survey questions viewed as representing *effect* variables we determined that, while they are indicative of the presence of capacity, cultures, structures, and so on they also represent actions or beliefs likely to result from the presence of other factors. For example, the presence of teachers discussing research findings indicates that there are likely to be structures, in place that are facilitating research-use and the sharing of best practice; but

Table 1. Baseline survey questionnaire employed by the Research Learning Communities Project.

Factor	Survey questions	Shorthand reference	Cause or Effect
Capacity to engage both in and with research evidence	Information from research plays an important role in informing my teaching practice	R-practice	Effect
	I have found information from research-useful in applying new approaches in the classroom	R-approaches	Effect
	This school has a formal process for evaluating programs or practices	Evaluation	Cause
School cultures that are attuned to evidence use (that is, make research-use a cultural norm)	I do not support implementing a school-wide change without research to support it	R-support	Effect
	My school encourages me to use research findings to improve my practice	Encouragement	Cause
	Research and evidence is used to inform staff here about potential improvement strategies	R-strategies	Cause
	People in this school are eager to share information about what does and does not work	Sharing	Cause
	This school frequently discusses underlying assumptions that might affect key decisions	Key assumptions	Cause
Schools promoting the use of research as part of an effective learning environment	Staff at my school use research and evidence to stimulate conversation/dialogue around an issue	R-conversation	Cause
	In this school, people value new ideas	New Ideas	Cause
	This school experiments with new ways of working	Experimentation	Cause
	In the last year, I have discussed relevant research findings with my colleagues	R-discussion	Effect
The existence of effective structures, system and resource to facilitate research-use and the sharing of best practice.	This school has forums for sharing information among staff	Forums	Cause
	In this school time is made available for education/training activities for school staff	Training	Cause
	Even in difficult situations, staff in this school can depend on each other	Depend	Cause
Other factors associated with school culture, such as trust and the strength of interpersonal relationships	Staff in this school trust each other	Overall trust	Cause
	When senior in this school tell you something you can believe it	SL Trust	Cause
	When /middle leadership in this school tell you something you can believe it	ML trust	Cause
	When teachers in this school tell you something you can believe it	Teacher trust	Cause
	Staff in this school respect each other	Respect	Cause

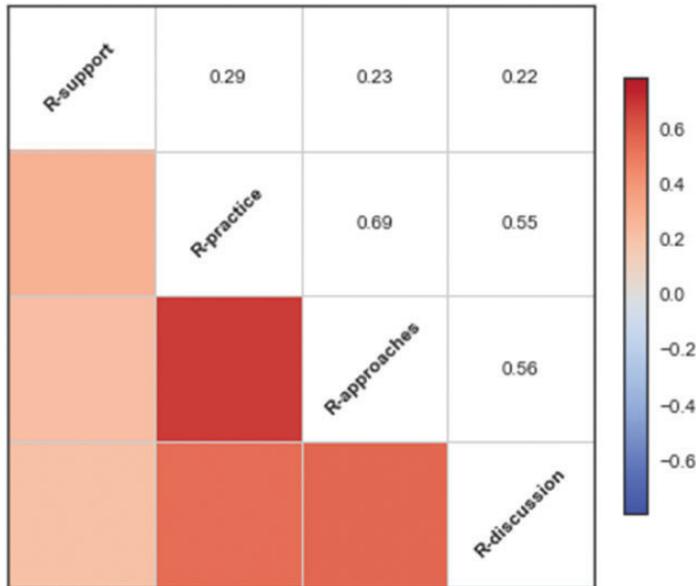


Figure 1. Correlation between the effect variables.

research-related discussion is also likely to be a function of whether such conversation is encouraged and/or whether time is made available for it to take place, (and so on). In summary, the four *effect* variables are regarded to be.

- Q1: Information from research plays an important role in informing my teaching practice (*R-practice*)
- Q2: I have found information from research-useful in applying new approaches in the classroom (*R-approaches*)
- Q4: I do not support implementing a school-wide change without research to support it (*R-support*)
- Q12: In the last year, I have discussed relevant research findings with my colleagues (*R-discussion*)

The remaining 16 variables were thus deemed as influencing (causing) changes in these four effect variables.

To analyse the data, we employed a data mining approach. To begin with all of the Likert-scale points were transformed into numerical integers, with values ranging from -2 ('strongly disagree') to +2 ('strongly agree') with the neutral response represented as zero. Because Likert scale values are ordinal in nature, we then employed nonparametric statistical methods for data analysis and modelling (rather than standard parametric techniques such as Student t-test which assumes a normal distribution of data) (Field and Hole, 2003; Agresti, 2010). For the effect variables, we measured their pairwise associations using a nonparametric method: Kendall's τ rank correlation coefficient (the tau-b version which accounts for ties). As shown in Figure 1, the correlation between the normative variable *R-support*, which reflects teachers' beliefs about the general use of evidence

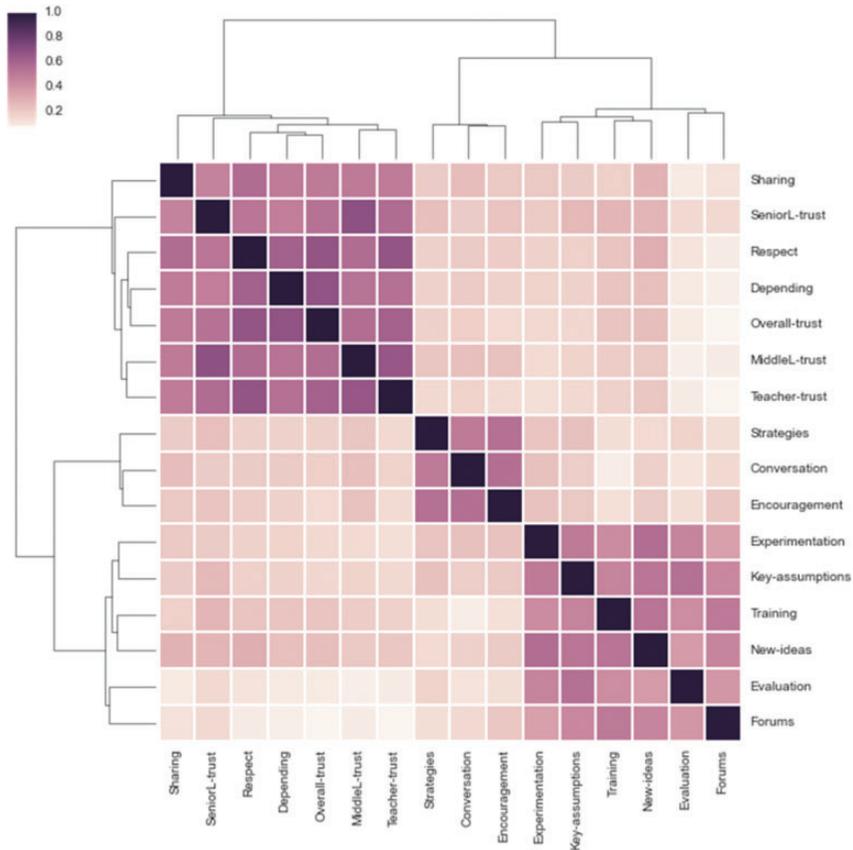


Figure 2. Pairwise correlations between the cause variables.

within school, and the three other behavioural effect variables (*R-practice*, *R-approaches*, *R-discussion*) is quite low (< 0.30). This suggests that there is a gap between supporting the idea of evidence informed practice and its enactment. In particular, according to the nonparametric Wilcoxon signed-rank test, the discrepancy between R-support and R-practice is significant (with a p-value $1-^{25}$: far less than the 0.01 threshold, not to mention the more lenient threshold of 0.05).

For the cause variables, we perform hierarchical agglomerative clustering (the average-linkage version) based on their pairwise Kendall's τ rank correlation coefficient. As shown in Figure 2, the cause variables are clearly grouped into three clusters (that is, the three groups coloured in the darkest shade), so representing particular 'bundles' of variables or 'intervention' areas that are likely to have reciprocal and mutually reinforcing effects. These clusters are set out in detail in Table 2.

Building Predictive Models

Basic analysis of the survey data highlights that 50 per cent of respondents 'agreed' or 'strongly agreed' with survey question 4: 'I do not support implementing a school-wide change without research to support it' (with 38 per cent neither agreeing/disagreeing and 12 per cent disagreeing

Table 2. Clusters of correlated factors likely to increase research use.

Cluster	Survey question	Shorthand reference
1: wider professional community culture within the school	7) People in this school are eager to share information about what does and doesn't work	Sharing
	15) Even in difficult situations, staff in this school can depend on each other	Depend
	16) Staff in this school trust each other	Overall trust
	17) When senior in this school tell you something you can believe it	SL Trust
	18) When /middle leadership in this school tell you something you can believe it	ML trust
	19) When teachers in this school tell you something you can believe it	Teacher trust
	20) Staff in this school respect each other	Respect
2: the promotion of research use within an effective learning environment	5) My school encourages me to use research findings to improve my practice	Encouragement
	6) Research and evidence is used to inform staff here about potential improvement strategies	R-strategies
	9) Staff at my school use research and evidence to stimulate conversation/dialogue around an issue	R-conversation
3 systems and culture which facilitate the development and testing new ideas and the mobilization of resulting knowledge	3) This school has a formal process for evaluating programs or practices	Evaluation
	8) This school frequently discusses underlying assumptions that might affect key decisions	Key assumptions
	10) In this school, people value new ideas	New Ideas
	11) This school experiments with new ways of working	Experimentation
	13) This school has forums for sharing information among staff	Forums
	14) In this school time is made available for education/training activities for school staff	Training

and strongly disagreeing). A higher percentage (76 per cent) 'agreed' or 'strongly agreed' with survey question 1: 'information from research plays an important role in informing my teaching practice'. This perhaps suggests that the discrepancy between beliefs and practice detailed in Figure 1 is not caused because practitioners believe in using evidence but struggle to implement it; rather it results because research-use does not exist as a school-level cultural norm. Correspondingly, research-use, when it does occur, tends to materialize as an individual endeavour undertaken by some teachers within their classrooms. In itself, the data may also therefore be symptomatic of one of the major issues for knowledge mobilization in a self-improving system: school accountability. That is, the argument that England's regime is flattening the very freedom and autonomy that the self-improving school system is designed to encourage: these figures perhaps highlighting that schools are looking to second guess what they think (England's school inspectorate) Ofsted wants to see rather than wholesale engagement with the evidence base (Finnigan and Daly, 2012; Greany, 2015). This problem may also be exacerbated by central government policy which serves to incentivize against research use. For instance, as Greany (2015) notes, hanging over Teaching Schools is the removal of their teaching school designation if they lose their 'outstanding' Ofsted grade. As a result this potential loss of status can serve to hamper the extent to which schools wish to take risks in experimenting with innovative practice (Greany, 2015).

In the light of these initial findings, our analysis began with an examination of how support for evidence informed practice might be increased: specifically, we sought to ascertain which of the cause variables were most likely to positively influence *R-support*. Because, as noted above, our Likert data was ordinal in nature, to analyse it we employed the decision tree learning algorithm, CART (Breiman et al., 1984). Unlike commonly used predictive models (such as linear regression, naive bayes, and support vector machines), decision tree is a nonparametric supervised learning algorithm that can handle ordinal value features for classification and regression. The standard version of the decision tree learning algorithm is still not able to handle ordinal targets directly, however. To counter this, our solution was to: 1) treat the ordinal targets as numerical interval values; 2) run the decision tree learning algorithm for regression; and 3) to translate the regression output back into a discrete class label in a post-processing step (for example, rounding to the nearest ordinal target value). The prediction performance of our model is measured by both its root mean squared error (RMSE) and also mean absolute error (MAE) and we were able to enhance the prediction accuracy of our model by using the *gradient boosted tree* (GBT) approach. This meant we were able to employ an ensemble of decision trees rather than just one (Hastie et al., 2009; Seni and Elder, 2010).

It can of course be argued that the most desirable position for schools to be in is when practitioners both fundamentally believe in and engage in evidence informed practice. Assuming the *ceteris paribus* position that beliefs are a function of leadership (both formal and informal – see the section entitled ‘Making Research Use a Cultural Norm’), and that sustained and meaningful evidence use at a whole school level is most likely to be successful when built on the foundations of leadership buy-in, the next stage for school leaders for leaders who have established a culture of research-use is to understand how to support/increase levels of evidence informed practice. To examine potential policy levers in this area, we repeated the approach above to build a predictive model for respondents who ‘agreed’ or ‘strongly agreed’) with the *R-support* question in order to examine how their responses to the *R-practice* question were contingent on their perceptions of the influencing external environment (as represented by their responses to the cause factor questions). More specifically, we formulated the research question as follows: for any given example of responses to the survey, represented as a vector of the sixteen cause variables, (and with *R-support*>0) what do we predict will be the corresponding value of the effect variable, *R-practice*? The results for both models are discussed in section 5, below.

Results

Data for each of the two predictive models is set out in Tables 3 and 4 below. For each cause variable, GBT predictive model indicates an importance score. This score indicates how useful a *cause* variable is within the model for the purpose of making predictions about the *effect* variable. Specifically, the relative rank of a variable used as a decision node in a tree can be used to assess the relative importance of that variable with respect to the predictability of the *effect* variable. Looking first at Table 3, it can be seen that while a number of factors do influence support, they are concentrated in three groups. The cause variables with by far the highest levels of importance when predicting a positive response to *R-support* are: *Encouragement* (0.221) (‘My school encourages me to use research findings to improve my practice’), *R-conversations* (0.149) (‘Staff at my school use research and evidence to stimulate conversation/dialogue around an issue’) and *R-strategies* (0.113) (‘Research and evidence is used to inform staff here about potential improvement strategies’). Following these variables, it is apparent that the level of trust teachers have in senior and middle leaders within their school as well as the overall trust within their school also

Table 3. The importance of cause variables for 'R-practice'.

Cluster	Cause	Importance for r-support
1: wider professional community culture within the school	Sharing	0.018
	Depend	0.032
	Overall trust	0.042
	SL Trust	0.059
	ML trust	0.046
	Teacher trust	0.045
	Respect	0.054
2: the promotion of research use within an effective learning environment	Encouragement	0.221
	R-strategies	0.113
	R-conversation	0.149
3 systems and culture which facilitate the development and testing new ideas and the mobilization of resulting knowledge	Evaluation	0.033
	Key assumptions	0.036
	New Ideas	0.043
	Experimentation	0.037
	Forums	0.030
	Training	0.040

Table 4. The importance of cause variables for 'R-practice'.

Cluster	Cause	Importance for r-practice
1: wider professional community culture within the school	Sharing	0.012
	Depend	0.025
	Overall trust	0.035
	SL Trust	0.052
	ML trust	0.049
	Teacher trust	0.007
	Respect	0.012
2: the promotion of research use within an effective learning environment	Encouragement	0.164
	R-strategies	0.318
	R-conversation	0.270
3 systems and culture which facilitate the development and testing new ideas and the mobilization of resulting knowledge	Evaluation	0.007
	Key assumptions	0.003
	New Ideas	0.014
	Experimentation	0.013
	Forums	0.009
	Training	0.006

matters. Finally, comes school leaders making time for training around evidence use ('In this school time is made available for education/training activities for school staff') and the receptiveness of teaching staff to new ideas ('In this school, people value new ideas'). The importance of these variables, however, is relatively low.

Relating these findings to the literature in the 'Data Sources' section, it can be seen that in order to boost support for evidence use, school leaders may wish to consider engaging in approaches to

make evidence-informed practice a cultural norm, first by exhorting (that is, by engaging in acts of transformative leadership which encourage staff to participate) and then, to a lesser extent, by learning centred leadership acts to show how this might be done (for example, by showcasing how research can inform school improvement strategies). Nonetheless as the *R-conversations* and the myriad of trust-related scores show, encouragement cannot be undertaken in isolation and an underpinning learning environment (which will be reliant on trust to operate effectively: Stoll et al., 2006) will be paramount. In order of importance, providing elements of capacity and resource and structure comes last, this perhaps implying that that in an environment where teachers are encouraged, where concrete effort is made to support them learn in relation to research, and where there is trust between staff (horizontally and vertically) this can overcome some of the traditionally assumed issues associated with research use including the provision of specific training.

As can be seen in Table 4, for those schools where there is already agreement or strong agreement with the *R-support* question ('I do not support implementing a school-wide change without research to support it'), the three most important features, or *cause* variables, for then improving *R-practice* are once again: *R-strategies* (0.318), *R-conversations* (0.270) and *Encouragement* (0.164); although the order of the importance and their relative values changes with *Encouragement* and *R-strategies* swapping places. In other words, for schools where leaders have engendered support for evidence-informed change more generally, our model suggests that approaches for then increasing practice should comprise a continuation of the following.

- School leaders engaging in learning-centred activity, such as showcasing or demonstrating how research and evidence can form key aspects of school improvement strategies.
- School leaders ensuring staff engage with research as part of their ongoing PLC activity, such as when engaging in discussion in relation to teaching and learning.
- The continued active encouragement by school leaders for teachers to engage in evidence use.

Referring back to the literature, it is interesting to note that once support for research use is established, the leadership influenced factors that help develop actual instances of practice are also those most likely to lead to tangible and positive benefits for pupils. This is because, as demonstrated by Robinson (Robinson et al., 2009; Robinson 2011) it is the learner-centred approach which has substantial benefits for student outcomes, more so in fact that any other approach to leadership: as Robinson et al. (2009: 201) conclude '[t]he more leaders focus their relationships, their work and their learning on the core business of teaching and learning the greater their influence on student outcomes'. Although lower in terms of their importance (with scores in the range of 0.05), it is clear that teachers having trust in school leaders and their colleagues too will continue to influence whether teachers engage in the (potentially risky) activity of experimenting with evidence informed practice. Again, high levels of trust within a school are also likely to lead to positive impacts for pupils. For instance Bryk and Schneider (2002), Mintrop (2004) and Mintrop and Trujillo (2007) all note that where social relations are steeped in high levels of trust, this has positive benefits for pedagogic effectiveness (required for pupil outcomes to increase); with Stoll et al., (2006) suggesting that, in part, this benefit materializes because of the effective learning environment that trusting relations helps create. This implies that when the encouragement phase is well established, the real benefits of using evidence can emerge. This is because it is likely that, when leaders build a trusting environment, when they ensure there is PLC related

activity and themselves engage in acts of learning centred leadership, that the result will be a reinforcing cycle of pupil and practice improvement.

Significance

In this article we have explored data in relation to the key factors likely to determine whether schools can and will engage in meaningful evidence use. The results outlined above naturally come with a number of caveats in relation to how they should be interpreted. First, the 79 schools surveyed are all primary schools, correspondingly no relationship can be made between this analysis and England's 3,200+ secondary schools. Second, it is likely that the schools involved are more predisposed to research engagement than the majority of England's primary schools: of the schools involved in the survey, 20 were in a formal teaching school alliance and a further 20 in a similar relationship (but had not applied or were in the process of applying to be teaching school alliance). As is highlighted above and noted elsewhere (for example, Author 1 and Greany, in press) teaching school alliances form a key driver of England's self-improving school system and there are clear expectations that they act as leaders in relation to evidence use.

Nonetheless, despite these caveats, our analysis does provide useful indicators as to where school leaders might focus their efforts should they wish to establish their school as one engaged with and in evidence. Specifically that there is a set of policy drivers that will both influence overall support for the use of evidence to inform school level change and also encourage evidence informed practice once support is established. What is key, however, is that these solutions do not appear to be either resource intense or complex to implement, relating as they do to school leaders to: 1) promote the vision for evidence-use (that is, encourage its use); 2) engage in actions such as 'modelling', 'monitoring' and 'mentoring and coaching' in order to demonstrating how evidence can be employed to improve issues of teaching and learning; and 3) establish effective learning environments in which learning conversations around the use of evidence can flourish. Considering *R-Support* and *R-Practice* together, in terms of the aspects of leadership described in the section entitled 'Making Research Use a Cultural Norm', it can be seen that to begin the process of making evidence-use a cultural norm within schools, leaders are required to engage primarily in 'transformational' modes of leadership. To embed it however, they must switch focus and in engage in more 'pedagogic' or learning-centred leadership aspects. This flags the importance of school leaders having the capacity to engage in both modes of leadership if evidence-informed schools are to become a reality.

Finally, the underlying importance of trust is apparent in both predictive models. Given that effective evidence use is dependent on capacity (ability) to use evidence, this perhaps reinforces other findings (Finnegan et al., 2012) where it is argued that trust mediates between those with and without such capacity. In other words, where teachers feel they do not have the knowledge or skills to challenge a research-informed position, trust is required if that position is to be widely adopted. It also reflects the notion that in high trust schools, individuals feel supported in engaging in the type of risk taking associated with efforts at developing or trialling effective practice in a 'safe' learning environment and so are more likely to do so (also Bryk and Schneider, 2002; Mintrop, 2004; Stoll et al., 2006; Mintrop and Trujillo, 2007). Vitaly, Finnegan and Daly (2012) also argue that reciprocal relations underpinned by trust can form a bulwark against one of the key challenges facing self-improvement – high stakes accountability. That is, rather than respond to such accountability by playing safe and sticking to 'tried and tested' methods – with low trust environments thus serving to dampen innovation – in high trust schools, individuals feel supported to innovate. This

then also spotlights the importance of school leaders facilitating a culture of trust, with their role in doing so highlighted by to Tschannen-Moran and Hoy (2000: 573) who note that ‘creating an organizational culture of cooperation rather than competition is likely to have a significant impact on the trusting and trustworthy behavior of participants’. The likely result of doing so, as we argue above, is seemingly positive outcomes for both teachers and pupils.

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Notes

1. See: <http://www.education.gov.uk/childrenandyoungpeople/families/b00203759/evidence-based-practice>, accessed on 10 January 2014.
2. Following Author 1 (2014) our definition of evidence is as follows: 1) use of formal research produced by researchers; 2) practitioner enquiry such as action research; and 3) the interpretation of routinely collected data. More specifically we are taking the notions of formal research and practitioner enquiry (1 and 2) to comprise the collection of data that has been gathered via a process of research, that has been interpreted and that subsequently has or could be used to address a particular issue facing practitioners. Routinely collected data (3) would include that already captured by systems within schools such as pupil assessment data. As with previous work, we use the terms research and evidence interchangeably throughout and treat them as synonymous. Where we refer to ‘data’ specifically, this means un-interpreted data. A detailed explanation of our reasoning here can be found in Author 1 (2013).
3. For the purposes of this article we concentrate on what these issues are rather than provide a detailed response to them.

References

- Agresti A (2010) *Analysis of Ordinal Categorical Data*, 2nd edn. Hoboken, NJ: Wiley-Blackwell.
- Andrews D and Lewis M (2007) Transforming practice from within: The power of the professional learning community. In Stoll L and Louis KS (eds) *Professional Learning Communities: Divergence, Depth and Dilemmas*. Maidenhead: Open University Press.
- Argyris C and Schön D (1974) *Theory in Practice: Increasing Professional Effectiveness*. San Francisco, CA: Jossey-Bass.
- Baker-Doyle K and Yoon SA (2010) Making expertise transparent: Using technology to strengthen social networks in Teacher Professional Development. In Daly A (ed.) *Social Network Theory and Educational Change*. Cambridge, MA: Harvard Education Press.
- Bennett T (2015) Evidence and Quality. In: Brown C. (ed.) *Leading the use of Research & Evidence in Schools*. London: IOE Press.
- Biesta G (2007) Why ‘what works’ won’t work: evidence-based practice and the democratic deficit in educational research, *Educational Theory* 57(1): 1–22.
- Breiman L, Friedman J, Stone C and Olshen R (1984) *Classification and Regression Trees*. Belmont, CA: CRC Press.

- Brown C (2013) *Making Evidence Matter: A New Perspective on Evidence-Informed Policy Making in Education*. London: IOE Press.
- Brown C (2014) *Evidence Informed Policy and Practice: A Sociological Grounding*. London: Bloomsbury.
- Brown C (2015) Introduction. In: Brown C (ed.) *Leading the use of Research & Evidence in Schools*. London: IOE Press.
- Brown C and Greany T (forthcoming) The Evidence Informed School System In England: Where Should School Leaders Be Focusing Their Efforts? *Leadership Policy in Schools*.
- Bryk A and Schneider B (2002) *Trust in Schools: A Core Resource for School Improvement*. New York: Russell Sage Foundation.
- Bryk A, Sebring P, Allensworth E and Luppescu S (2010) *Organizing Schools for Improvement: Lessons from Chicago*. Chicago: University of Chicago Press.
- Bubb S (2014) Bringing evidence into teaching. *ldr: The National College Online Magazine For Teachers*. Available at: <http://www.nationalcollege.org.uk/index/resources/ldr-magazine/ldr-latest-articles/bringing-evidence-into-teaching.htm> (accessed 11 January, 2016).
- Bush T and Glover D (2003) *School Leadership: Concepts and Evidence*. Nottingham: National College for School Leadership.
- Cain T (2015) Teachers' engagement with published research: addressing the knowledge problem. *Curriculum Journal* 26(3): 488–509.
- Cartwright N (2013) Knowing what we are talking about: why evidence doesn't always travel. *Evidence & Policy* 9(1): 97–112.
- Cordingley P (2013) 'The contribution of research to teachers' professional learning and development'. Available at: <https://www.bera.ac.uk/wp-content/uploads/2013/12/BERA-Paper-5-Continuing-professional-development-and-learning.pdf> (accessed 22 November, 2014).
- Cosner S (2009) Building organizational capacity through trust. *Educational Administration Quarterly* 45(2): 248–291.
- Daly A (2010) Mapping the terrain: social network theory and educational change. In Daly A (ed.) *Social Network Theory and Educational Change*. Cambridge, MA: Harvard Education Press.
- Daly AJ and Finnigan KS (2012) Exploring the space between: social networks, trust and urban school district leaders. *Journal of School Leadership* 22: 493–530.
- Datnow A and Hubbard L (2015) Teachers' use of data to form instruction: lessons from the past and prospects for the future. *Teachers College Record*, early online access.
- Datnow A, Park V and Lewis B (2013) Affordances and constraints in the context of teacher collaboration for the purpose of data use. *Journal of Educational Administration* 51(3): 341–362.
- Day C and Sammons P (2013) *Successful Leadership: A Review of the International Literature*. Reading: CfBT Education Trust.
- Earley P (2013) *Exploring the school leadership landscape: changing demands, changing realities*. London: Bloomsbury.
- Field A and Hole G (2003) *How to Design and Report Experiments*. London: SAGE.
- Finnegan K and Daly A (2012) Mind the gap: organizational learning and improvement in an underperforming urban system. *American Journal of Education* 119(1): 41–71.
- Finnigan K, Daly A, Hylton N and Che J (2015) Leveraging social networks for educational improvement. In: Brown C (ed.) *Leading the Use of Research & Evidence in Schools*. London: IOE Press.
- Galdin-O'Shea H (2015) Leading 'disciplined enquiries' in schools. In: Brown C. (ed.) *Leading the use of Research & Evidence in Schools*. London: IOE Press.
- Godfrey D (2009) How action research changed our lives. In Lawson A (ed.) *Action Research. Making a Difference in Education*. Slough: NFER.

- Godfrey D (2014a) Creating a research culture – lessons from other schools. Available at: <http://www.sec-ed.co.uk/best-practice/creating-a-research-culture-lessons-from-other-schools> (accessed 22 November 2014).
- Godfrey D (2014b) Leadership of schools as research-led organizations in the English educational environment: cultivating a research engaged school culture. *Educational Management Administration & Leadership*. Epub ahead of print 20 February 2014. doi:10.1177/1741143213508294.
- Goldacre B (2013) Building evidence into education. Available at: <https://www.gov.uk/government/news/building-evidence-into-education> (accessed 27 January 2014).
- Gough D (2013) Knowledge mobilisation in education in England, in: Levin B, Qi J, Edelstein H and Sohn J (Eds) *The Impact of Research in Education*. Bristol: The Policy Press.
- Greany T (2014) *Are We Nearly There Yet? Progress, Issues and Possible Next Steps for a Self-improving School System*. London: IOE Press.
- Greany T (2015) How can evidence inform teaching and decision making across 21,000 autonomous schools? Learning from the journey in England. In: Brown C (ed.) *Leading the use of Research & Evidence in Schools*. London: IOE Press.
- Halbert J, Kaser L and Koehn D (2011) Spirals of inquiry, building professional inquiry to foster student learning. Paper presented at ICSEI 2011, Limassol, Cyprus.
- Hammersley-Fletcher L and Lewin C (2015) *Evidence-Based Teaching: Advancing Capability and Capacity for Enquiry in Schools*. Interim report, Nottingham: National College for School Leadership.
- Handscomb G and MacBeath J (2003) *The Research Engaged School*. Forum for Learning and Research Enquiry (FLARE), Essex: Essex County Council.
- Harris A and Jones M (2012) Connect to learn: learn to connect. *Professional Development Today* 14(4): 13–19.
- Hargreaves D (1996) The Teaching Training Agency Annual Lecture 1996: Teaching as a research based profession: possibilities and prospects. Available at: <http://eppi.ioe.ac.uk/cms/Portals/0/PDF%20reviews%20and%20summaries/TTA%20Hargreaves%20lecture.pdf> (accessed 14 January 2013).
- Hastie T, Tibshirani R and Friedman J (2009) *The Elements of Statistical Learning: Data Mining, Inference and Prediction*, 2nd edn. New York: Springer.
- Hord S (2004) Professional learning communities: an overview. In Hord S (ed.) *Learning Together, Leading Together: Changing Schools through Professional Learning Communities*. New York: Teachers College Press.
- Katz S and Dack L (2013) *Intentional Interruption: Breaking Down Learning Barriers to Transform Professional Practice*. Thousand Oaks, CA: Corwin Press.
- King M and Newmann F (2001) Building school capacity through professional development: Conceptual and empirical considerations. *International Journal of Educational Management* 15(2): 86–93.
- Kruse S, Louis K and Bryk A (1995) An emerging framework for analysing school-based professional community. In Louis KS and Kruse S and Associates (eds) *Professionalism and Community: Perspectives on Reforming Urban Schools*. Long Oaks, CA: Corwin.
- Leithwood K (1994) Leadership for school restructuring. *Educational Administration Quarterly* 30(4): 498–518.
- Leithwood K, Day C, Sammons P, Harris A and Hopkins D (2006) Successful school leadership: what it is and how it influences student learning. Research report 800. London: DfES.
- Louis KS, Kruse S and Bryk AS (1995) Professionalism and community: what is it and why is it important in urban schools? In Louis KS and Kruse S and Associates (eds) *Professionalism and Community: Perspectives on Reforming Urban Schools*. Long Oaks, CA: Corwin.
- MacLure M (2005) ‘Clarity bordering on stupidity’: where’s the quality in systematic review? *Journal of Educational Policy* 20(4): 393–416.

- Micklewright J, Jerrim J, Vignoles A, Allen R, Ilie S, Jenkins E, Bellarbre F and Hein C (2014) *Teachers in England's Secondary Schools: Evidence from TALIS 2013 Research Report*. London: Department for Education.
- Mincu M (2013) Inquiry paper 6: teacher quality and school improvement – what is the role of research? In the British Educational Research Association/ The Royal Society for the encouragement of Arts, Manufactures and Commerce (Eds) *The Role Of Research In Teacher Education: Reviewing The Evidence*. Available at: <https://www.bera.ac.uk/wp-content/uploads/2014/02/BERA-RSA-Interim-Report.pdf> (accessed 8 November 2014).
- Mintrop H (2004) *Schools on Probation: How Accountability Works*. New York: Teachers College Press.
- Mintrop H and Trujillo T (2007) The practical relevance of accountability systems for school improvement: a descriptive analysis of California schools. *Educational Evaluation and Policy Analysis* 29: 319–352.
- Moolenaar N and Slegers P (2010) Social networks, trust and innovation: the role of relationships in supporting an innovative climate in Dutch schools. In Daly A (ed.) *Social Network Theory and Educational Change*. Cambridge, MA: Harvard Education Press.
- Moss G (2013) Research, policy and knowledge flows in education: what counts in knowledge mobilization. *Contemporary Social Science: Journal of the Academy of Social Sciences* 8(3): 237–248.
- Nonaka I and Takeuchi H (1995) *The Knowledge Creating Company: How Japanese Companies Create the Dynamics of Innovation*. New York: Oxford University Press.
- Provan K and Kenis P (2008) Modes of network governance: structure, management and effectiveness. *Journal of Public Administration, Research and Theory* 18(2): 229–252.
- Rexvid D, Blom B, Evertsson L and Forssen A (2012) Risk reduction technologies in general practice and social work. *Professions and Professionalism* 2(2): 1–18.
- Roberts C (2015) Impractical research: overcoming the obstacles to becoming an evidence-informed school. In: Brown C (ed.) *Leading the use of Research & Evidence in Schools*. London: IOE Press.
- Robinson V, Hohepa M and Lloyd D (2009) *School leadership and student outcomes: identifying what works and why: Best Evidence Synthesis*. Wellington, NZ: Ministry of Education.
- Robinson V (2011) *Student Centred Leadership*. San Francisco, CA: Jossey-Bass.
- Saunders L (2015) 'Evidence' and teaching: a question of trust? In: Brown C (ed.) *Leading the use of Research & Evidence in Schools*. London: IOE Press.
- Schildkamp K and Ehren M (2012) From 'intuition'- to 'data'-driven decision making in Dutch secondary schools? In: Schildkamp K, Lai M and Earl L (eds) *Data-based Decision Making in Education: Challenges and Opportunities*. Dordrecht: Springer.
- Sebba J, Tregenza J and Kent P (2012) *Powerful Professional Learning: A School Leader's Guide to Joint Practice Development*. Nottingham: National College for School Leadership.
- Sharp C (2007) Making research make a difference. Teacher research: a small scale study to look at impact. Essex County Council Forum for Learning and Research/Enquiry – FLARE.
- Sharp C, Eames A, Saunders D and Tomlinson K (2006) *Leading a Research Engaged School*. Nottingham: NCSL.
- Seni G and Elder J (2010) *Ensemble Methods in Data Mining: Improving Accuracy Through Combining Predictions*. Chicago, IL: Morgan & Claypool Publishers.
- Southworth G (2009) Learning centred leadership. In Davies B (ed.) *The Essentials of School Leadership*, 2nd edn. London: SAGE.
- Stoll L and Brown C (2015) Middle leaders as catalysts for evidence-informed change. In: Brown C (ed.) *Leading the use of Research & Evidence in Schools*. London: IOE Press.
- Stoll L (2012) Stimulating learning conversations. *Professional Development Today* 14(4): 6–12.

- Stoll L (2015) Using evidence, learning and the role of professional learning communities. In: Brown C (ed.) *Leading the use of Research & Evidence in Schools*. London: IOE Press.
- Stoll L, Bolam R, McMahon A, Wallace M and Thomas S (2006) Professional learning communities: a review of the literature. *Journal of Educational Change* 7(4): 221–258.
- Stoll L and Fink D (1996) *Changing Our Schools: Linking School Effectiveness and School Improvement*. Buckingham: Open University Press.
- Taylor C and Spence-Thomas K (2015) Understanding impact and the cycle of enquiry. In: Brown C (ed.) *Leading the use of Research & Evidence in Schools*. London: IOE Press.
- Tschannen-Moran M (2004) *Trust Matters: Leadership for Successful Schools*. San Francisco, CA: Jossey-Bass.
- Tschannen-Moran M and Hoy WK (2000) A multidisciplinary analysis of the nature, meaning and measurement of trust. *Review of Educational Research* 71: 547–593.
- Timperley H, Kaser L and Halbert J (2014) *A Framework for Transforming Learning in Schools: Innovation and the Spiral of Inquiry: Seminar Series 234*. Melbourne: Centre for Strategic Education.
- Timperley H and Robertson J (2011) Establishing platforms for leadership and learning. In Robertson J and Timperley H (eds) *Leadership and Learning*. London: SAGE.
- Veschio V, Ross D and Adams A (2008) A review of research on the impact of professional learning communities on teaching practice and student learning. *Teaching and Teacher Education* 24(1): 80–91.
- Virtanen A and Tynjälä P (2008) Students' experiences of workplace learning in Finnish VET. *European Journal of Vocational Training* 44: 199–213.
- Wilkins R (2013) Practitioner research and professional identity. *Professional Development Today* 15(1/2): 40–47.

Author biographies

Chris Brown, DPhil, is a senior lecturer in the London Centre for Leadership in Learning (LCLL), UCL Institute of Education (London). With a long-standing interest in how evidence can aid the development of teaching practice, Chris has written two books (including *Making Evidence Matter*), several papers and has presented on the subject at a number of international conferences both in Europe and North America. Chris has extensive experience of leading a range of funded projects many of which seek to help practitioners to identify and scale up best practice, and was recently awarded a significant grant to work with 100+ primary schools in England, where he employs Social Network methodology to increase their use of research

Dell Zhang has a BEng and a PhD in Computer Science. He was a research fellow at Singapore-MIT Alliance (2002–2005). He became a Lecturer at Birkbeck in Sep 2005. His research interests include information retrieval, data mining and machine learning.