The Academic Discipline of Education: reciprocal relationships between practical knowledge and academic knowledge.

[This is a pre-publication draft that may contain errors. The final version of the paper was published in the British Educational Research Journal **46**(1):6-25 05 Feb 2020 .]

Abstract

This paper explores the nature of education as a vital part of human knowledge. The argument that is presented addresses the critique of education as having epistemological weaknesses as an academic discipline. The argument is framed by scholarship that has categorised the discipline of education as derived from three main traditions of knowledge. In order to explore the coherence of education as a discipline contrasts are made with other disciplines such as mathematics and sciences. The paper also reviews scholarship in relation to the concept of education research that is *Close-to-Practice*, and the relevance of this to understanding education as an academic discipline. The paper concludes by suggesting a new model that shows the relationships between practical knowledge and academic knowledge that are an intrinsic part of education. A more confident portrayal of education as an academic discipline is also advocated.

Introduction

Education has been a feature of human development for many thousands of years, enacted in informal ways through human interaction and, increasingly over time, formally organised ways. Informal and formal educational processes, practice and theory, contribute to the way that education thinking and education knowledge has developed, ultimately as an academic discipline in universities.

This paper, prepared for my BERA Presidential Address, focuses on the nature of education as a vital part of human knowledge. The relatively recent establishment of education as an academic discipline in universities can be linked with the criticism that education has epistemological weaknesses. Such criticisms are addressed in the paper through a consideration of the knowledge traditions that are part of the development of education in universities. The perception that education is weak because of its multidisciplinary origins and characteristics is also challenged, on the basis of comparison with some other academic disciplines that have been established in universities much longer than education. Another alleged weakness, but one I argue is actually a defining feature of education, is the place of practice in relation to theory and research. Reference is made to a new research project that investigated the concept of close-to-practice research. Overall, it is argued that although education as an academic discipline in universities has a relatively short history, the longer history of educational thinking more generally is an important part of understanding education. As a result, simple notions that education is an immature and weak discipline need qualification.

The paper is organised into five parts:

1. Education in history – a brief outline that highlights some key developments starting with the earliest humans.
2. Framing the development of education in universities through three clusters of knowledge traditions: 1. Academic knowledge traditions; 2. Practical knowledge traditions; 3. Integrated knowledge traditions.
3. Comparing education with other disciplines: mathematics and science including evidence from the UK's Research Excellence Framework reports.
4. The place of educational practice in relation to education research – the Close-to-Practice Research Project
5. The contribution of education and education research going forward.

The approach in the paper to addressing the contribution of education is intentionally broad. While incremental more tightly focused scholarship continues to add to educational knowledge in a range of important topics it is also necessary to consider the breadth of human existence in relation to education. Therefore the paper accommodates a long history of human activity, and takes a multidisciplinary perspective. Consideration of broader landscapes of thinking is an important way to augment current knowledge, and is an approach that has seen attention in other disciplines (e.g. Christian, 2018; Reich, 2018). To conclude the paper, I suggest a layered continuum as a model showing the relationships between practical knowledge and academic knowledge. I also argue that greater confidence in the multidisciplinary features of education, coupled with a more confident outward facing portrayal of education research, is justified.

1. Education in history

Scientific evidence from DNA analyses, corroborated by evidence from fossils, shows that the most recent shared ancestor of all present-day humans lived about 320,000 years ago (Reich, 2018). The DNA evidence also reveals that although all modern humans originate from Africa the story is much more complicated than previously imagined. As David Reich says:

> In the last few years, the genome revolution – turbocharged by ancient DNA – has revealed that human populations are related to each other in ways that no one expected. The story that is emerging differs from the one we learned as children, or from popular culture. It is full of surprises: massive mixtures of differentiated populations; sweeping population replacements and expansions; and population divisions in prehistoric times that did not fall along the same lines as population differences that exist today. It is a story about how our interconnected human family was formed, in myriad ways never imagined. (Reich, 2018, p. 22)

In spite of important advances in DNA science, Reich likens the level of our understanding of the human genome to the level of development of a young child learning to read. Although genetic scientists have learned how to 'decode' the proteins that represent DNA, i.e. the 'words', they still can't "parse the sentences". One of the few areas of DNA science where there is a relatively clear picture is the genetic mutation that resulted in the evolution of human language, and hence differentiated us from other animals. The evidence lies in the proteins of the gene called *FOXP2* which is strongly suspected to be related to language. Whereas the

protein produced by the FOXP2 gene has remained identical in mice and chimpanzees over a 200,000,000 year period, three changes, or mutations, occurred only in the human lineage. Corroborative evidence has been found in the different squeaks made by mice if the FOXP2 gene is manipulated. However, the question of precisely when and how oral language started is very difficult to answer not least because the only historical sources are indirect ones such as the study of the anatomy of the jaw in skeletal remains, and indeed in the study of DNA.

The broad scope of Reich's attention to human development, for example in his book "A Big History of Everything", is matched by the work of David Christian a historian who has addressed human development on a vast scale. From Christian's perspective the uniqueness of human language is similarly recognised and, crucially for my argument in this paper, humans' capacity for *teaching*, a fundamental element of education. Christian makes a clear distinction between humans and other animals on the basis of humans' capacity for teaching:

> No animal can swap stories about the future or the past, or warn about the lion pride ten miles to the north, or tell you about gods or demons. They may be able to think about such things, but they cannot talk about them. And that may be why it is hard to find any evidence for teaching within any other species, even among our closest relatives, the monkeys and apes. (Christian, 2018, p.173, underline added)

Humans' use of language was at first only oral language but another key historical milestone in relation to education, and an important source of historical evidence more generally, lies in the development of written language, another facet unique to human animals and their cognition. Historically the origins of writing lie in cave art. The figurative depiction of an animal, a Babirusa or 'Pig-Deer', and a handprint is the earliest example of human mark-making currently known (Aubert, et. al. 2014). The images were created by humans about 40,000 years ago in a cave on the Island of Sulawesi, in Wallacea, a zone of oceanic islands between continental Asia and Australia.

The first alphabetic signs did not appear until many thousands of years later, between 2,000 and 1,500 Before the Common Era (Darnell et. al. 2005). It is possible to date some of the first teaching of writing to the same period. Clay tablets, inscribed with the written script cuneiform, have been found in Mesopotamia (modern day Iraq). The cuneiform characters were practised by pupils practising their cuneiform letters by imprinting the clay tablets using the end of a piece of reed. Excavations have produced hundreds of these school exercise tablets. Advanced students copied more elaborate texts, others practised the cuneiform equivalents of ABC lettering. Not only are the tablets evidence of pedagogy and education but of note is the fact that the decipherment of Cuneiform was begun by a high school teacher, the German Georg Grotefend (1775-1853). Written language not only enabled humans to communicate over greater distance, and create the concept of 'history' as a phenomenon and practical reality, written language was the essential component in the formation of systematic human thinking and rationality (Olson, 2016).

Written language also resulted in another phenomenon, the dictionary. The different dictionary definitions of education provide further evidence of the distinctions and relationships between education in practice and more formally organised education. The first definition of the English word 'education' in the Oxford English Dictionary (OED) is: "**1.** The process of bringing up a child, with reference to forming character, shaping manners and behaviour, etc.; the manner in which a person has been brought up; an instance of this." An example for a use of education in the sense of this definition is taken from an edition of The Century Magazine in 1883: "1883 *Cent. Mag.* Aug. [p.] 635/2 That neglected class who may have learned how to think … but who have never learned one accomplishment, indispensable to a liberal education,—how to laugh!" (Oxford English Dictionary, 2019)

Another of the definitions in OED represents more formally organised education - the idea of scholastic instruction over the lifetime is an important element of this definition: "**4. a.** The systematic instruction, teaching, or training in various academic and non-academic subjects given to or received by a child, typically at a school; the course of scholastic instruction a person receives in his or her lifetime." (*op. cit.*)

The evolution of word and meanings provides another way to understand the development of education as a phenomenon. The etymons of the word 'education' are from Latin and French. In classical Latin (75 BCE to AD 3rd century) the word meant rearing, upbringing and nurture. In the period of Middle French the word education referred to bringing up a child, in particular their physical, mental and spiritual development (a1380 but rare before 1527. Spanish 1499; Portuguese 17th century; Italian 1498).

The invention of books was another profound moment in human development, a development that enabled education theory to develop. One of the most famous printed popular accounts of educational theory in the English language, published in 1582, was written by the headmaster of Merchant Taylors' School in London: Richard Mulcaster's 'Elementarie' titled in full as: *THE FIRST PART OF THE ELEMENTARIE WHICH ENTREATETH CHEFELIE OF THE right writing of our English tung, set furth by RICHARD MULCASTER* (Mulcaster, 1582). Mulcaster explained that the purpose of the *Elementarie* was to inform teachers working in Elementary schools to help young children learn on the basis of educational principles. Not only did the book advance Mulcaster's theory of education, perhaps the first systematic theory of primary education ever written, but it also was significant because of its role in the acceleration of the standardisation of written English, in line with the historical development of printing. Mulcaster argued that the principles of the Elementarie were warranted "by general autoritie of all the grauest writers" (p 6). And his theory was multidisciplinary: he reminded readers that Plato stressed the importance of gymnastic for the body and music for the mind, noting that music was considered much more important in Plato's time than Mulcaster perceived it to be in the school curriculum of the 16th century. Other ancient writers were also cited in the Elementarie: for example Pamphilus' views on drawing as part of liberal science; Quintilian's mastery of rhetoric in support of reading, writing and music. The connection between Mulcaster's role as a headteacher but also in publishing educational theory is another example of the connections between practice and education knowledge.

These reflections on some key moments in the history of education bring me to the point in time when universities were first established, places where belatedly education was to be represented as an academic discipline. The oldest university in the world is regarded as the one established in Fez, Morocco in the 8th century (UNESCO, 2019). The origin of the modern university as a formal institution, that is one that continuously operates from its establishment and has a corporate structure, is said to be the University of Bologna (probably 1088 - the University of Oxford was established in 1167). Right from its inception the University of Bologna had multidisciplinary roots. At the end of the 11th century the scholars of grammar, rhetoric and logic applied themselves to the study of law. A controversy arose in relation to the laws of the Empire compared to the laws of other political bodies. Four scholars ruled, on the basis of Roman law, that the laws of the Empire were preferable. As a result the Empire undertook to protect scholars from the intrusion of all political authorities (Università di Bologna, 2019) – the concept of academic freedom was born.

The roots of the academic discipline of education in universities can be traced to the training, or education, of teachers. In Europe the first 'ecole normale' (normal school for the training of teachers) was established at the end of the 17th century in Reims (Moon, 1998). At around the same time in Germany the first *Lehrerseminar* (training seminars) were established. In England, unlike the subjects of law, medicine or theology, education at first had no university tradition. Instead education's roots began in 1798 with teacher-training in "a small college in the slums of Southwark", London (Hencke, 1977). Finally in the 20th century education began to be recognised as an academic discipline in nearly all universities.

A discipline is defined not only as an area of knowledge but also as a community of scholars with a shared heritage which includes an infrastructure and traditions of published outputs and other modes of communication that underpin the discipline (McCulloch and Cowan, 2018). Hence, an important aspect of any academic discipline is its learned societies. Education's major learned societies are now only a little over hundred years old: the American Educational Research Association 1916; the Australian Council for Educational Research 1930; The Australian Association for Research in Education 1970; the British Educational Research Association (BERA) 1974; and the World Education Research Association 2009. The start of the BERA was at a time when teacher training was being reassessed by government including proposals for its integration in university departments of education (Gardener and Cunningham, 1998).

Education, not least through teaching and learning, is a fundamental aspect of human existence with a very long history that includes the interactions of the earliest human beings. Education's formalisation in schools and then as an academic discipline in universities was to come later. But the connection between these histories is an essential part of understanding education as a specialised way of thinking. Recognition of the long history of education is also a way to counter-balance simplistic perceptions that education is an immature discipline.

2. Framing the development of education in universities

Education as an academic discipline has been described as having epistemological weaknesses. The weaknesses have been attributed to a lack of "the consensus and indeed the coherence of some of the more established disciplines" (Furlong, 2013, p.2). As John Furlong noted,

> before we consider some of these arguments in more detail, it is important to ask again what a discipline is. As I said, using the term discipline to refer to the university-based study of education will be seen by some readers as inappropriate. The most common term used to characterise education is as a 'field'. Because the study of education covers so many different educational contexts (from early years to lifelong learning), so many different topics (from the teaching of reading to the management of higher education), **because it draws on so many other disciplinary perspectives (from neuroscience to economics and philosophy)** and because it is studied by using so many different approaches to research and scholarship (from history or literary studies to ethnography or randomised control trials), because of all of this diversity, how could it be anything else but a 'field'? By definition, it must fail the first test of a discipline, which demands some coherence, distinctiveness and rigour in terms of epistemology … (Furlong, 2013, p. 5, bold font added)

What's more, when compared to traditions of educational research in other countries, such as France and Germany, rather than being conceived as a science, with a focus on theory and basic research, education in the UK is,

> built on an enduring but unstable pragmatic compromise, a compromise between theory and practice, between knowing that and knowing how, in the commitment of the academy to make both an intellectual and a practical contribution to the advancement of the field. (op. cit.)

Theory depicting the origins of education in different countries has looked at the emergence of the discipline in relation to professional practice. Geoff Whitty and Furlong (2017) identified three main origins of education:

Cluster 1. Academic knowledge traditions - those traditions that foreground academic knowledge. Academic knowledge traditions include the idea of education built on the 'founding subjects' of philosophy, history, sociology and psychology.

Cluster 2. Practical knowledge traditions - based primarily in the world of practice: this includes the ideas behind competences and standards, and ideas that are part of networked professional knowledge;

Cluster 3. Integrated knowledge traditions - those traditions that explicitly attempt to bring academic and practical knowledge into some kind of relationship with each other: (*op. cit.*). Examples of Integrated knowledge traditions include "practitioner enquiry/action research" [sic].

Whitty and Furlong acknowledge that the categorisation has considerable overlaps and is a heuristic device.

One of the challenges of layering countries onto these clusters and types of knowledge traditions is that different knowledge traditions coexist in the history of development of education in any one country or region. And there are the ever-present difficulties of accurately summarising traditions as objectively 'national' while allowing for sufficient nuance in the categorisations. For example, in the UK education in universities was initially strongly influenced by academic knowledge traditions through the so-called founding disciplines of psychology, philosophy, history and sociology (Tibble, 1966) but at the same time teacher-training was also an influence, as was shown earlier in this paper.

An example given of 'Cluster 1. Academic knowledge traditions' is Germany, where education in universities was established earlier than many other parts of the world. Whitty and Furlong suggest that "German educational theory has not been concerned with influencing the world of practice in a direct way; its concerns historically have been primarily philosophical and ultimately moral … with most researchers focusing on what Stokes (1997) would characterise as 'pure basic research.'" (Whitty and Furlong, 2017). But German educational theory can also be linked with an 'integrated knowledge tradition'. The important concept of *Didaktik* has been fundamental to thinking in Germany since the emergence of public schooling in the fifteenth century (Hillen, Sturm & Willberg, 2011). Hudson (2016) argued that *Didaktik* places the professionally autonomous teacher at the heart of the learning process and provides a frame for teachers to ask questions about their professional practice. Hence the roots of Didaktik in Germany lie both in the origins of public schooling but also in hermeneutics. Education in Germany could perhaps be seen as related to *two* traditions of knowledge: academic knowledge traditions deriving from Didaktik's roots in German hermeneutics but also the practical knowledge traditions of public schooling reflecting autonomous teachers making decisions in relation to curriculum derived from their selections of knowledge embedded in their conceptions or beliefs about education.

The interplay between traditions of education thinking in practice versus education thinking in the academy are an important characteristic of the development of education as an academic discipline.

3. Education and other disciplines

The critique of education as having epistemological weaknesses can also be explored through comparison with features of some other disciplines. For example, mathematics and natural sciences are often seen as having greater consensus and coherence than education. This coherence is attributed to aspects such as: strongly bounded areas of theory; a limited range of methodologies; clearly defined substantive research topics, and as a consequence less influence from, and fewer connections with, other disciplines.

Mathematics is usually regarded as one of the most coherent disciplines. However, multidisciplinary connections are rooted in the history of the development of mathematics. During the Renaissance period aesthetic thinking was an essential component of mathematical thinking, and had its origins in pre-Socratic philosophy. For example, the influence of aesthetic thinking in relation to the beauty of architectural shape and structure reflected in the *Golden Ratio* or the *Fibonacci*

Sequence (Lähdesmäi & Fenyvesi, 2017). With regard to science, and its history, aesthetics and artworks have been sources of inspiration and conceptual tools used as part of "the natural interaction between arts, mathematics, and science … practiced by the scientists, mathematicians and artists themselves." (*Op. cit.* p.7).

Aesthetic sensibility and other varied connections and influences can also be seen in maths and science through their world-leading discoveries, including in the dissemination and reception of such discoveries. An example of a world-leading discovery in maths was initially rooted in a historical perspective, namely the philosophy of Pythagorean logic of geometry. This resulted in a problem being posed by the French mathematician Pierre de Fermat three hundred years prior to its ultimate solution. The origin of the problems was the tantalising remark written by Fermat alongside a solution to a different problem he had worked on:

> Cuius rei demonstrationem mirabilem sane detexi hanc marginis exiguitas non caperet.
> [I have a truly marvellous demonstration of this proposition which this margin is too narrow to contain.] [1]

Fermat's proposition, or theory, was that there is no whole number solution to $x^n + y^n = z^n$. In other words that although we can find solutions to Pythagoras' theorem $x^2 + y^2 = z^2$ it is not possible to solve the equation if ^{n} is a whole number greater than two.

The solving of 'Fermat's last theorem' by the British mathematician Andrew Wiles resulted in Wiles winning a major international prize that had remained unclaimed for more than 300 years. Wiles had to bring together, for the first time, several previously unrelated major branches of mathematical thinking as part of his work. Also of note, in relation to multidisciplinary influences, is the narrative quality of Wiles' published mathematical proof:

> Let f be an eigenform associated to the congruence subgroup $\Gamma_1(N)$ of $SL_2(Z)$ of weight $k \geq 2$ and character χ. Thus if T_n is the Hecke operator associated to an integer n there is an algebraic integer c(n,f) such that $T_n f = c(n,f)f$ for each n. We let Kf be the number field generated over Q by the {c(n,f)} together with the values of χ and let Of be its ring of integers. For any prime λ of O_f let $O_{f,\lambda}$ be the completion of O_f at λ. The following theorem is due to Eichler and Shimura (for $k = 2$) and Deligne (for $k > 2$). The analogous result when $k = 1$ is a celebrated theorem of Serre and Deligne but is more naturally stated in terms of complex representations. The image in that case is finite and a converse is known in many cases. (Wiles, 1995, p. 445)

Aesthetic considerations, namely beauty and elegance, were evidently part of Andrew Wiles' understanding of mathematics, seen in his reflections about the moment when he realised that he had finally solved the problem:

[1] An image of the original text can be seen here: http://commons.wikimedia.org/wiki/File:Diophantus-II-8-Fermat.jpg#/media/File:Diophantus-II-8-Fermat.jpg

> So out of the ashes of Kolyvagin-Flach [a mathematical model] seemed to rise the true answer to the problem … It was so indescribably beautiful; it was so simple and so elegant. I couldn't understand how I'd missed it and I just stared at in disbelief for twenty minutes. (Singh, 1997, p.298, underline added)

And a reason why wider society knows about the ways in which Wiles solved the problem is due to another type of mathematical contribution, the narrative of communicating a fascination for mathematics to a lay readership, in Simon Singh's (1997) brilliant book. Aesthetic considerations are also aspects of work in the mathematics of cosmology, as a PhD student of the world renowned physicists Stephen Hawking memorably explained in relation to the day-to-day work with mathematical equations: 'part of the work is just a search for beauty and prettiness' (BBC, 1970).

An example of another world-leading discovery, this time in science, that shows the profound importance of multi-disciplinarity is the break-through called the *evolutionary synthesis*, that brought together Darwinian evolutionary theory with Mendelian genetics to definitively establish genetic variation as the mechanism for evolutionary change. This discovery was presented in the book *Tempo and Mode in Evolution* by Gaylord Simpson (1944). The break-through did not only reside within the experimental methods of natural science but to become accepted drew on other disciplinary influences:

> In particular, narrative has been critical in helping philosophers, rhetoricians, and scientists to differentiate what are some-times called historical sciences from what are termed experimental/predictive or functional sciences. … Specifically, historical sciences offer narrative accounts of the past. They do so not simply by describing the past but by selecting and organizing events deemed to be significant into chronological and causal sequence, and by endowing them with such qualities as coherence, direction, and closure. The resulting historical narrative thus interprets the chaos of the past and provides it with meaning. (Journet , 1995, p.128, underline added)

The important general point here is that even in the 'hard' or natural sciences, other disciplinary factors are part of the identification of research problems and their solutions. And in an epistemological debate that is familiar in education, Journet noted that historical sciences work against the grain of what many see as the hegemony of 'hypothesis-prediction-experiment'. This process of "looking backward to the past to establish causal relations and infer patterns is [done through] the construction of narrative argument." (op cit. p.130)

Another way to analyse the characteristics of academic disciplines is through more focused consideration of the types of research that are carried out. Large scale assessments of research provide evidence not only of research quality but also the nature of disciplines. How we define research, and how such definitions are contextualised in the assessment of the quality of different kinds of research in different disciplines, is a necessary part of the following analysis. The Frascati definition has been used to define research in assessments of research across whole countries and other large regions.

> The term R&D covers three types of activity: basic research, applied research and experimental development. Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view. Applied research is original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific, practical aim or objective. Experimental development is systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes. ('Frascati definition', OECD, 2015, p. 45, underline added)

Of note in the Frascati definition is the straightforward acceptance that applied research that has a practical aim can be *original* investigation, an important reminder in the context of this paper's argument about practice in relation to theory.

In 2014 the UK's *Research Excellence Framework* (REF, previously *Research Assessment Exercise*) allocated academic disciplines to different 'panels'. Panel C included education as meeting the inclusion criterion that specified disciplines that, "do not have firm or rigidly definable boundaries, and that aspects of research are naturally interdisciplinary or multi-disciplinary or span the boundaries between individual UOAs" [Units of Assessment] (p. 63). The REF *descriptor* for education research clearly showed its multi-disciplinary character:

> **UOA [Unit of Assessment] 25: Education**
> 26. **Descriptor**: Research in education is multi-disciplinary and is closely related to a range of other disciplines with which it shares common interests, methods and approaches. (REF, 2012, p.62)

This multi-disciplinary characteristic was shared by 11 units of assessment in Panel C, including Law (one of the oldest university subjects, as the University of Bologna story demonstrates); sociology; and economics and econometrics.

Education in the REF 2014 report was also described as consisting of work in four areas: 1. sectors of educational provision, 2. substantive issues, 3. theoretical frameworks and methodologies drawn from disciplinary traditions, and 4. other related fields of activity, such as pedagogy in higher education (HE). Although multidisciplinarity was a characteristic of all the disciplines in Panel C the division of education into the four areas marked it as atypical when compared to other disciplines.

The comparison made earlier in this talk between education and maths and science can be augmented by consideration of the information available as a result of the REF. Perhaps the discipline with a REF descriptor showing the strongest contrast to education was Physics (one of the areas in the Panel B group of subjects):

> 7. The UOA includes all areas of physics encompassing, but not limited to, theoretical, computational and experimental studies of: quantum physics;

> atomic, molecular and optical physics; plasma physics; fusion and energy; particle physics; nuclear physics; surface and interface physics; condensed matter, materials and soft matter physics; biophysics; semiconductors, nanoscale physics, lasers, optoelectronics and photonics; magnetism, superconductivity and quantum fluids; fluid dynamics; statistical mechanics, chaotic and nonlinear systems; astronomy and astrophysics, planetary and atmospheric physics; cosmology and relativity; medical physics; applied physics; chemical physics; instrumentation; pedagogic research in physics. (REF, 2012, p.39)

The expectation of the panel was that physics research would have made a direct contribution to the discipline in the areas listed, but it was acknowledged that the list was not finite. As can be seen, the idea that research can be theoretical as well as empirical is part of the characterisation of the discipline of physics. The short entry which was the descriptor for physics briefly acknowledged the increasingly interdisciplinary nature of research.

The REF descriptor for Mathematical Sciences (REF, 2012: the title of the descriptor itself clearly signalling the major multidisciplinary connection between mathematics and sciences) was as succinct as the one for physics however the interdisciplinary character of mathematics was explicitly recognised in several ways. First and foremost was the recognition that mathematics, statistics and operational research includes the application of these three aspects in "the study of biological, physical and social sciences, commerce, engineering, finance, government, health, industry, information science, medicine and elsewhere." (p. 39, underline added)

The specified areas of mathematical sciences research included more than 35 topics, and acknowledged that this list was necessarily incomplete (you will recall that the argument about weakness in education as a discipline includes the high numbers of topics of research). In recognition of interdisciplinary research it was expected that outputs on the "history of mathematical sciences" would be received – further evidence that the 'historical sciences' mentioned earlier in the paper have a recognised place in the discipline.

Outputs in mathematical sciences describing "purely pedagogical research" (for example research looking at teaching and learning in university mathematics programmes) were to be referred to the Education Sub-panel. It is worth noting that in these two well established and coherent disciplines of mathematical sciences and physics there is a lack of consistency in the placing of what the REF called pedagogic or pedagogical research. Whereas pedagogic research in physics was to be included in the REF assessment, for mathematical sciences pedagogical research was to be referred to the Education Sub-Panel.

Another science discipline relevant to my consideration of research and practice was life sciences, and in particular clinical medicine. It is interesting to compare the ways in which the place of professional practice in relation to research is summarized in clinical medicine research compared to education research. Contrary to some downbeat appraisals of the influence of professional practice on education research, the REF 2014 report from clinical medicine was more positive about aspects of such

links. In the UK, medical practitioners work mainly in the National Health Service (NHS). The REF sub-panel found:

> the beneficial effects of the increasingly close working relationship between UK academia and the NHS, almost certainly enhanced by the National Institute for Health Research funding awarded to the NHS partners. From identifying research problems and producing high quality research, to ensuring that this research is translated into bedside care, the unique partnership working between academia and the NHS in the UK clearly underpins a significant proportion of the excellence the sub-panel found in the submissions. (REF, 2015, p. 26)

And of relevance, when considering the work of university colleagues mainly focused on the practice of teacher training, the panel for medicine found that:

> whilst outputs from basic science-led teams were well represented at the highest level, fewer were received from the scientifically trained investigator clinician. The sub-panel identified that fostering and maintaining a cadre of such individuals equipped to deliver experimental medicine studies in their clinical disciplines was important for the future UK biomedical vitality. (REF, 2015a, p. 26)

It may be that education research could learn from the beneficial effects of the close working relationships between academia and the professionals working for the NHS found in clinical medicine. In addition, the importance of fostering scientifically trained investigator clinicians in such research may have a parallel with the need to continue to engage teacher training staff in university departments with education research.

Other nation state surveys of research have been undertaken internationally. In Australia and New Zealand the “State of Australian University Research” report based its categories of academic disciplines on guidelines established by the Australian Bureau of Statistics in 2008. Unlike the UK’s REF, the Australian “Division 13 Education” explicitly *excludes* “Sociology of education; Educational psychology; Educational linguistics; and History and philosophy of education” (Australian Bureau of Statistics, 2008, p. 94). Division 13 Education in the Australian report consists of four groups.

1. *Education systems* includes, for example, the phases of education from early years to continuing education and workplace education.
2. *Curriculum and Pedagogy* includes aspects such as creative arts; English and literacy curriculum and pedagogy; and Economics, Business and Management Curriculum and Pedagogy.
3. *Specialist Studies in Education* including Comparative and Cross-Cultural Education; Education Assessment and Evaluation; and Ethnic Education.
4. *Other education* is only for education research that is not classified in the other three groups. (*op. cit.*)

Across the four groups that education research is organised into it can be seen that a focus on teaching and learning is applicable to all four groups. The structure of the

Australian categorisation perhaps gives a more coherent picture of education than the UK's REF. The focus on four groups of research in the Australian report is more consistent with the REF's presentation of the common topics in physics research, other sciences, and in mathematics. However, overall the emphasis of the Australian state of research report is on presentation of statistics of research performance, and is limited by its minimal narrative commentary which could have given an even more useful interpretation of the state of, and nature of, the disciplines.

In the USA, consistent with the cultural context of the influence of states in America, versus federal government, there is no USA-wide research survey. However, one influential document at Federal Government level is a report that was compiled by the Institute of Education Sciences, US Department of Education and the National Science Foundation. The report describes six types of education research that are described as creating "a 'pipeline' of evidence" (Institute of Education Sciences U.S. Department of Education and the National Science Foundation, 2013, p.8): 1. *Foundational Research*; 2. *Early-Stage or Exploratory Research*; 3. *Design and Development Research*; 4. *Efficacy Research*; 5. *Effectiveness Research*, and 6. *Scale-up Research*. The emphasis of all the types of research is on "improving learning or another related education outcome" (*Op. cit*.). However, although type 1. Foundational Research includes the aim to "refine theories of teaching and learning" (*Op. cit.*) there is not a single mention of qualitative research or even mixed methods research that combines qualitative and quantitative methods. All the exemplar studies towards the end of the report are experimental research studies, or ones that include an experimental component. The only non-experimental method used is a *design research* phase in one of the exemplar studies which developed and refined an oral reading and language development intervention by using feedback from teachers and observational data, although these were combined with testing of receptive measures of vocabulary. Perhaps this depiction of education research should not be too surprising in view of the role of the National Science Foundation as one of the authors, particularly when this quote that starts the document is taken into account:

> *At its core, scientific inquiry is the same in all fields. Scientific research, whether in education, physics, anthropology, molecular biology, or economics, is a continual process of rigorous reasoning supported by a dynamic interplay among methods, theories, and findings. It builds understanding in the form of models or theories that can be tested.*
> ***Scientific Research in Education***
> National Research Council, 2002
> (op. cit)

The idea, for example, that anthropology is at its core the same as scientific inquiry in physics is at the very least a moot point. However, the acknowledgement that inquiry in different disciplines is "*supported by a dynamic interplay among methods, theories, and findings*" is further support for my argument that all disciplines have multiple influences on their research.

A historical understanding of academic disciplines and their development, and the analysis of research assessments at nation state level, reveals that multidisciplinary thinking has been and continues to be a central feature of academic disciplines. And

as Barry and Born noted: “it is not as if in the past knowledge production took place in autonomous and unified disciplines and that it no longer does so” (Barry and Born, 2013, p.3,). The criticism of education as relatively weak because it draws on so many other disciplinary perspectives can be challenged in the light of the multidisciplinary influences that are part of all disciplines.

4. Educational practice and education research

Another of the arguments about the alleged weakness of education as a discipline is the attention to educational practice as part of its research. and in particular the quality of this research. There are of course issues in relation to the quality of research in all disciplines, and it is true that in education the issues of quality of research and attention to education practice are a consideration. The REF education panel report noted that “Some studies, close to practice, lacked originality, significance and rigour” (Research Excellence Framework, 2015b, p. 195, underline added) and “Less strong research in the submission was often the small-scale professional research or action research which was frequently insufficiently theorised to make a contribution to knowledge and/or was low in rigour with poor use of statistical data or inappropriately selective reporting of qualitative data.” (p. 107)

The BERA Close to Practice research project (Wyse, et al, 2018) investigated the nature of education research that is close-to-practice, and aspects of the quality of such research. The project’s Rapid Evidence Assessment (REA) initially identified a range of traditions of CtP research including ‘practitioner inquiry’ and ‘action research’, two traditions that were linked with the highest numbers of research outputs found in the REA. Practitioner inquiry was the more diverse tradition. In the UK the most well-known example of practitioner inquiry was the teacher-as-researcher movement typified by the work of Lawrence Stenhouse and John Elliott, however other trends, such as those related to work on the social construction of knowledge, were part of practitioner inquiry in the UK as Rosemary Webb’s account showed (Webb, 1990). In the USA, diversity also characterised practitioner inquiry, noted in various trends: for example teacher-research in teacher education; the development of theories of teacher research; the development of critiques of teacher research; and the potential of teacher research to influence some aspects of university culture (Cochrane-Smith and Lytle, 1999).

Action research however has a longer tradition, dating back in particular to a paper by Kurt Lewin in 1946. The main focus of Lewin’s work was how groups interact, in particular the interactions of minority and majority groups, or “Intergroup Relations” the subject of the 1946 paper. In view of the many different interpretations of action research it is worth reminding ourselves of some of Lewin’s ideas from the time. The key quotation where the phrase action research is first used by Lewin is this:

> The research needed for social practice can best be characterized as research for social management or social engineering. It is a type of action-research, a comparative research on the conditions and effects of various forms of social action, and research leading to social action. (Lewin, 1946, p.35)

Lewin made the point that action research need not be any less 'scientific' than "pure science in the field of social events." With reference to another discipline rooted in practice, namely engineering, Lewin argued that these kinds of disciplines had turned more to "basic research" (pre-dating the more recent claims that education has not moved sufficiently towards basic research). And rather than see action research as somehow separate from social science, because of its use in close to practice research, Lewin saw action research as an ideal methodology:

> In regard to social engineering, too, progress will depend largely on the rate with which basic research in social sciences can develop deeper insight into the laws which govern social life. This "basic social research" will have to include mathematical and conceptual problems of theoretical analysis. It will have to include the whole range of descriptive fact-finding in regard to small and large social bodies. Above all, it will have to include laboratory and field experiments in social change. (op. cit.)

The REA identified a majority of papers that had used variants of action research methodology as part of research that we defined as close to practice. Our analyses of the final selection of CtP studies in education found that the best close to practice research addressed research problems that were rooted in the practical realities of education (including policy), was well theorised, methodologically rigorous, and disseminated in a way that ensured significant impact even if relatively small scale research.

The CtP research project also carried out interviews with people who had expertise in the issues of quality in CtP research who noted both the merits of such research but also the challenges, particularly in the context of the UK's REF. A number of respondents expressed views about the distinction between researcher and practitioner activities, arguing for a more collaborative and horizontal partnership in which both partners contribute relevant knowledge.

> **Val:** 'I'm particularly interested in how knowledge is created and translated within different communities, and my view is that actually they're both practice communities in fact. So the idea that one is and one isn't [research] is misleading, but they're different practices which intersect.' (Wyse, et al, 2018, p. 28)

With regard to the three clusters of knowledge traditions, action research is not synonymous with practitioner enquiry as the categorisation suggests. Action research was an influential *methodology*, and adopted widely by many university-based educationists in the UK because of its perceived relevance to research problems rooted in practice. However its disciplinary roots, such that they are, come from other disciplines such as in social psychology, for example through early research on productivity in factories as a result of democratic participation by workers (Adelman, 1993). As a result action research, and practitioner enquiry, could be categorised as part of the practical knowledge traditions in the UK.

The need to address problems in practice is common to many disciplines. Attention to practice is not in itself a reason for weakness in a discipline. Research is judged as relatively higher or lower quality by the criteria of the discipline. Some of these

criteria are more universal than others. The need to make an original contribution to knowledge requires research that is carried out in a methodologically robust way and that is deemed to be significant. These characteristics are true of research in any discipline, whether that research is CtP or not.

5. Education and its contribution to knowledge now and in the future

Historically, humans' use of language to teach represented the earliest form of education, and it was an education rooted in practical problems to be solved. Much later in human history, but before the establishment of education as an academic discipline in universities, ways of thinking about education became formalised in the language of writing. In contrast to the long history of human language and interaction, education as a formal academic discipline in universities, and in organisations like BERA, has a short history. But these different histories of education are linked through a reciprocal relationship represented by trajectories of practice and theory.

The reciprocal relationships that are part of the modern conception of education as an academic discipline can be seen diagrammatically as continua and layers. Figure 1 shows a range of elements that are part of knowledge in education.

Figure one here

The positioning of the elements on the continuum are relative rather than categorical. For example in continuum layer one action research and teacher training are embedded in both practical and academic knowledge. The interplay of practical knowledge and academic knowledge also applies in layer two, the local contexts of early years settings, schools and Further Education settings. Teaching which is a vital component at all levels of the continuum can be seen specified in detail in level three.

Assessments of research quality reveal that education is not the only discipline with multiple influences and connections. Rather than see education's history of disciplinary connections as representative of a lack of cohesion, we should more confidently equate such multidisciplinarity with more well established disciplines. With the renewed emphasis on multi-disciplinarity and inter-disciplinarity in relation to the world's 'grand challenges', education researchers are well placed to contribute as a result of familiarity with working in interdisciplinary ways.

The idea that the link with practice represents a weakness in education as a discipline should now surely be dispelled. Of course there are examples of research that is not as original, robust or significant as other research, both in education and in other disciplines. But this is consistent with variations in quality in all human endeavours. My argument is not that there aren't areas of improvement for education research. Benchmarking against comparable disciplines can be helpful but this benchmarking must be done taking full account of histories of thinking, and the establishment of key institutions. A more confident outward-facing attitude is needed in the representation and portrayal of education research, including for research organisations such as BERA. Part of this renewed confidence should include further engagement with the opportunities that multidisciplinarity presents. It also requires

determination to communicate more effectively the benefits to society of educational research underpinned by its close connection with and understanding of education practice.

Important advances in thinking continue to be made from what have been called the founding subjects of education (Tibble, 1966), for example psychologically oriented work on the dialogue of classrooms such as that done by Neil Mercer (Mercer, 2000), or from philosophy, such as Gert Biesta's account of the *risk* of education (Biesta, 2013). Education research is also sometimes framed by more specific theoretical ideas derived from other disciplinary perspectives, for example Margaret Archer's theories of *agency* (Archer, 2000). Education research can also draw from a range of disciplinary bases to inform thinking, as I have done in my work on writing (Wyse, 2017) and indeed in this paper. The multidisciplinary orientation of some education research has similarities with the way that, for example, Lev Vygotsky's frames of reference had the breadth that in the end contributed to his status in relation to socio-cultural theory which has come to be one of the dominant theoretical orientations in education and social sciences. The introduction to Vygotsky's book *Thought and Language* summarised the importance of multidisciplinarity to Vygotsky's approach to research:

> Vygotsky argued that psychology cannot limit itself to direct evidence, be it observable behaviour or accounts of introspection. Psychological inquiry is *investigation*, and like the criminal investigator, the psychologist must take into account indirect evidence and circumstantial clues – which in practice means that works of art, philosophical arguments, and anthropological data are no less important for psychology than direct evidence. (Vygotsky, 1986, p. xvi)

The evidence suggests, from major surveys of research activity, from scholarship about education as a discipline, and from consideration of individual studies, that the influence of multiple theories, methodologies and methods is an important part of the way that education knowledge has developed and will continue to develop in future.

A particular concern of this paper has been to consider the coherence of education as an academic discipline. Through a range of comparisons I have argued that education shares many of the aspects that characterise coherence in other disciplines. It was argued, in another BERA President's Address, that a defining characteristic of research that typifies the discipline of education is a focus on *learning* (Gardener, 2011). The addition of 'teaching' to learning, or the concept of 'pedagogy', could be seen as a defining characteristic of education, and another way to see coherence in education as a discipline. Research studies that focus explicitly on learning and teaching are of course a very large part of educational research, for example in experimental trials and qualitative analyses of teaching interventions. Even in education research where the focus on pedagogy is less explicit, there are often important implications for pedagogy. For example in statistical analyses of international comparisons of education systems (e.g. Jerrim, 2011) there are key questions about the effectiveness of curricula in relation to pupils' progress as a result of the pedagogy they encounter. In sociological studies of social disadvantage the implications of contesting what is seen as neoliberal hegemony, is connected to improvement of education policies to enhance equity in learning for children from disadvantaged backgrounds compared with peers from more advantaged

backgrounds (e.g. Reay, 2017). Most of all, education and its research in diverse topics using a wide range of methods, influenced by a multitude of theories, is seeking to find ways that inequalities in learning, or we might say 'inter-group learning', can be addressed through appropriate teaching. As the *Sustainable Development Goals* (United Nations, 2014) explicitly recognise, education is a foundation for societal advancement within which teaching and learning, research and theory are fundamental to the progress of nations and their communities across the world. The multiple emphases of education are given coherence through attention to teaching, learning and pedagogy: this is the case historically, as evident in education debates in society, and is the case in education departments in the universities of the 21st century.

References

Adelman, C. (1993). Kurt Lewin and the Origins of Action Research. *Educational Action Research, 1*(1), 7-24.

Archer, M. S. (2000). *Being Human: The Problem of Agency*. Cambridge: Cambridge University Press.

Aubert, M., Brumm, A., Ramli, M., Sutikna, T., Saptomo, E., Hakim, B., . . . Dosseto, A. (2014). Pleistocene cave art from Sulawesi, Indonesia. *Nature, 514*, 223-227.

Australian Bureau of Statistics. (2008). *Australian and New Zealand Standard Research Classification (ANZSRC)*. Belconnen: Australian Bureau of Statistics.

Barry, A., & Born, G. (2013). Interdisciplinarity: Reconfigurations of the social and natural sciences. In A. Barry & G. Born (Eds.), *Interdisciplinarity: Reconfigurations of the social and natural sciences.* London: Routledge.

Biesta, G. (2013). *The Beautiful Risk of Education.* Boulder: CO: Paradigm Publishers.

British Broadcasting Company. (1970). Professor Hawking's Universe. *Horizon*. London: BBC.

Christian, D. (2018). *Origin Story*. London: Allen Lane.

Cochran-Smith, M., & Lytle, S. (1999). The Teacher Research Movement: A Decade Later. *Educational Researcher, 28*(7), 15-25.

Darnell, J., Dobbs-Allsopp, F., Lundberg, M., McCarter, P., Zuckerman, B., & Manassa, C. (2005). Two Early Alphabetic Inscriptions from the Wadi el-Ḥôl: New Evidence for the Origin of the Alphabet from the Western Desert of Egypt. *The Annual of the American Schools of Oriental Research, 59*, 63-124.

Furlong, J. (2013). *Education - An Anatomy of the Discipline: Rescuing the university project?* London: Routledge.

Gardener, J. (2011). Educational research: what (a) to do about impact! *British Educational Research Journal, 37*(4), 543-561.

Gardener, P., & Cunningham, P. (1998). Teacher Trainers and Educational Change in Britain, 1876-1996; 'a flawed and deficient history'? *Journal of Education for Teaching, 24*(3), 231-255.

Hencke, D. (1977). The Government and college reorganisation. *Higher Education Review, 9*(3), 7-18.

Hillen, S., Slum, T., & Willberg, I. (2011). Introducing didactic perspectives to contemporary challenges. In S. Hillen, T. Slum, & I. Willberg (Eds.), *Challenges Facing Contemporary Didactics* (pp. 9-25). Münster: Waxmann Verlag.

Hudson, B. (2016). Didactics. In D. Wyse, L. Hayward, & J. Pandya (Eds.), *The SAGE Handbook of Curriculum, Pedagogy and Assessment.* London: SAGE.

Institute of Education Sciences U.S. Department of Education and the National Science Foundation. (2013). *Common Guidelines for Education Research and Development*. Washington DC: Institute of Education Sciences.

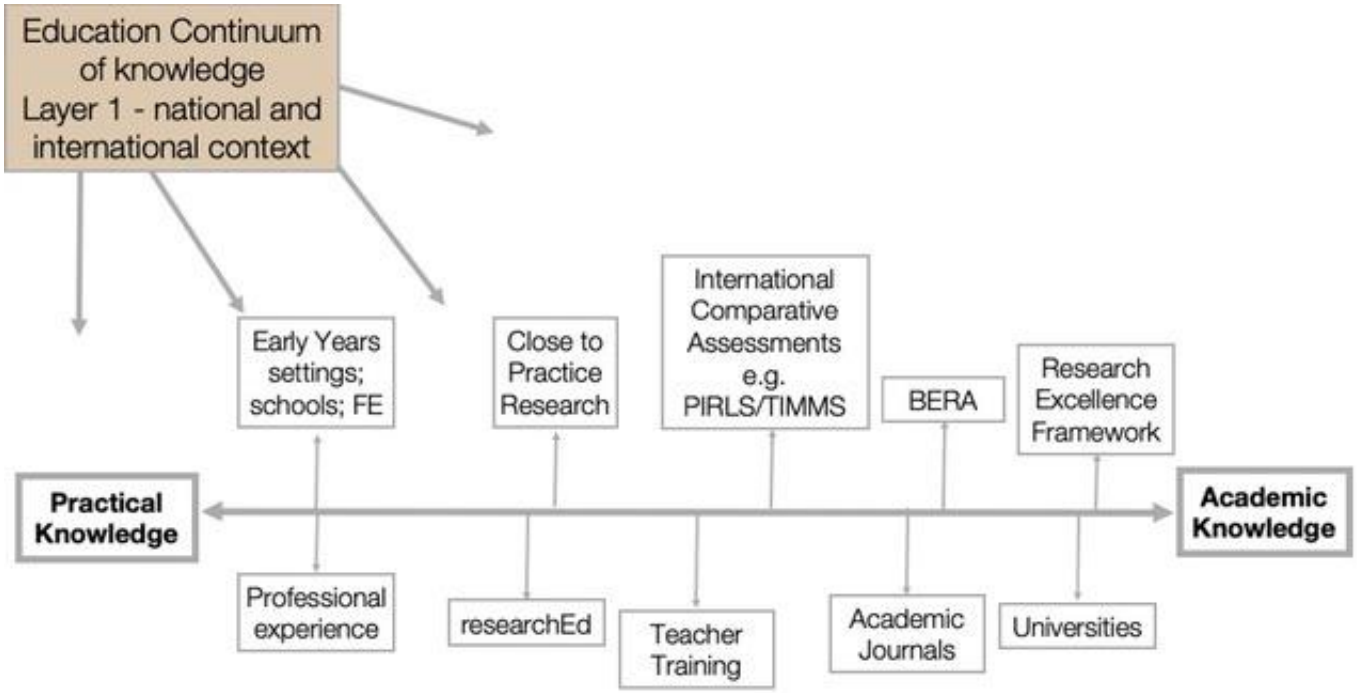
Jerrim, J. (2011). *England's "plummeting" PISA test scores between 2000 and 2009: Is the performance of our secondary school pupils really in relative decline?* London: DoQSS Working Paper No. 11-09, Institute of Education, University of London.

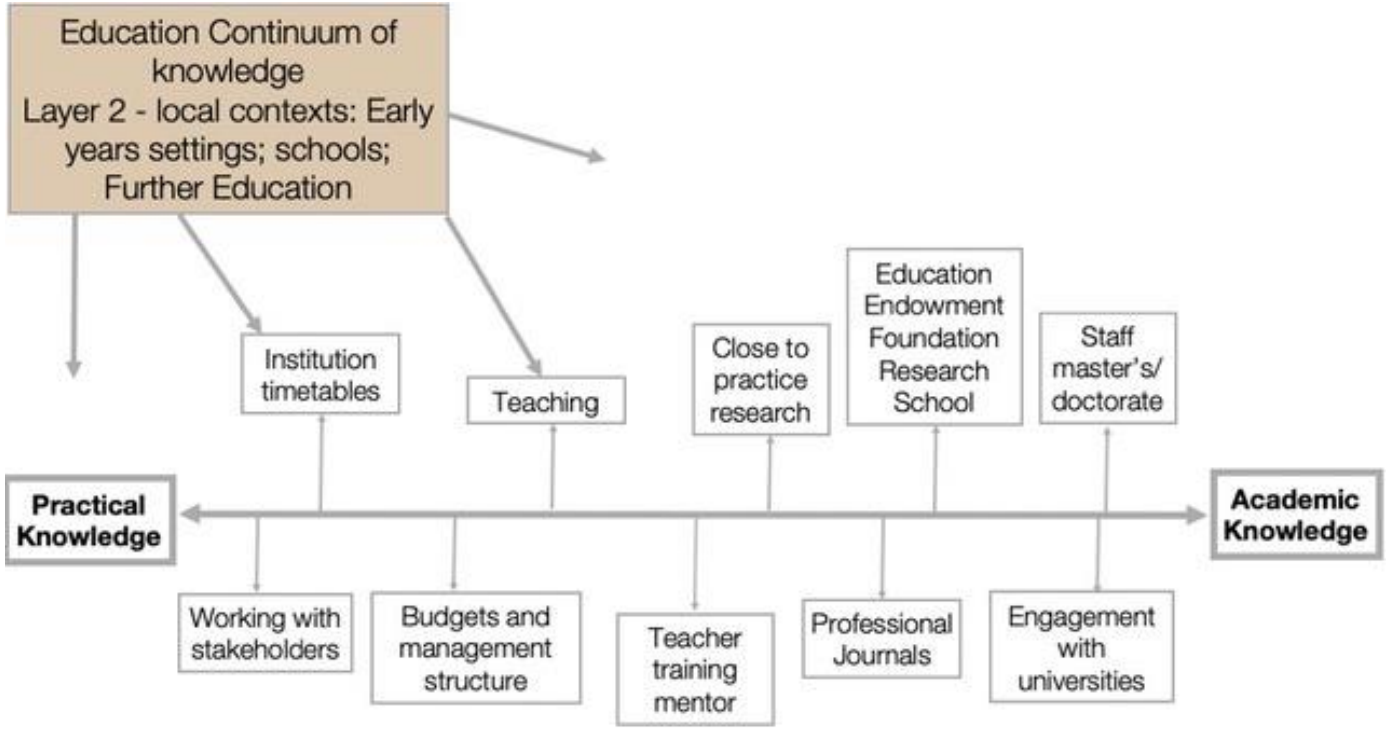
Journet, D. (1995). Synthesizing disciplinary narratives: George Gaylord Simpson's tempo and mode in evolution. *Social Epistemology, 9*(2), 113-150. doi:10.1080/02691729508578781

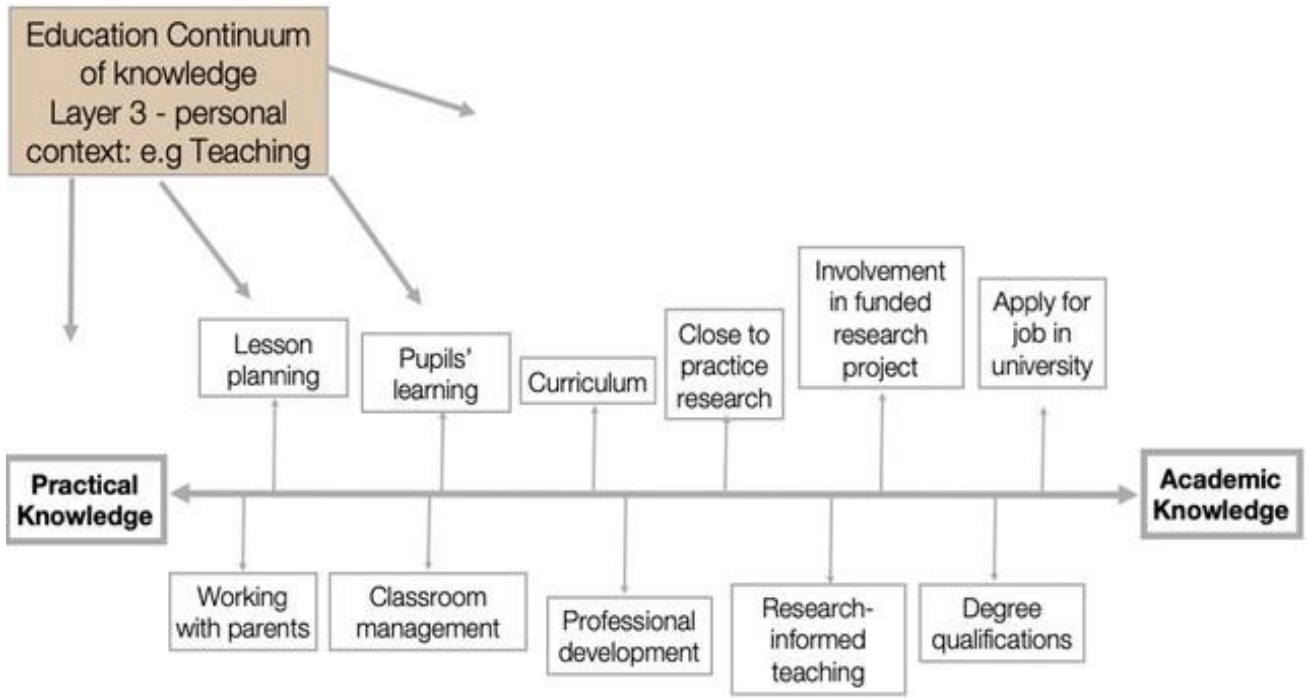
Lähdesmäi, T., & Fenyvesi, K. (2017). Bridging Art and Mathematics: Introduction. In K. Fenyvesi & T. Lähdesmäi (Eds.), *Aesthetics of interdisciplinarity: Art and Mathematics* (pp. 1-24). Cham, Switzerland: Birkhäuser.

Lewin, K. (1946). Action Research and Minority Problems. *Journal of Social Issues, 2*(4), 34-46.
McCulloch, G., & Cowan, S. (2018). *A Social History Of Educational Studies And Research*. London: Routledge.
Mercer, N. (2000). *Words and Minds: how we use language to think together.* London: Routledge.
Moon, B. (1998). *The English Exception? International Perspectives on the Initial Education and Training of Teachers.*
Mulcaster, R. (1582). *Elementarie*. London: Thomas Vautroullier.
Olson, D. (2016). *The Mind on Paper: Reading, Consciousness and Rationality*. Cambridge: Cambridge University Press.
Organisation for Economic Cooperation and Development (OECD). (2015). *Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities.* Paris: OECD Publishing.
Oxford English Dictionary. (2019). Retrieved from http://0-www.oed.com.catalogue.ulrls.lon.ac.uk/view/Entry/11849
Reay, D. (2017). *Miseducation: Inequality, education and the working classes.* Bristol: Policy Press.
Reich, D. (2018). *Who We Are And How We Got Here*. Oxford: Oxford University Press.
Research Excellence Framework (REF) 2014. (2015a). *Overview report by Main Panel A and Sub-panels 1 to 6*. Retrieved from http://www.ref.ac.uk/panels/paneloverviewreports/
Research Excellence Framework (REF) 2014. (2015b). *Overview report by Main Panel C and Sub-panels 1 to 6*. Retrieved from http://www.ref.ac.uk/panels/paneloverviewreports/
Research Excellence Framework (REF) 2014. (2012). *Panel criteria and working methods*. Bristol: REF 2014.
Simpson, G. (1944). *Tempo and mode in evolution.* New York City: Columbia University Press.
Singh, S. (1997). *Fermat's Last Theorem*. London: 4th Estate.
Tibble, J. (Ed.) (1966). *The Study of Education*. London: Routledge and Kegan Paul.
UNESCO. (2019). Medina of Fez. Retrieved from http://whc.unesco.org/en/list/170
United Nations. (2014). *The Millennium Development Goals Report 2014*. New York: United Nations.
Università di Bologna. (2019). The University from the 12th to the 20th century. Retrieved from https://www.unibo.it/en/university/who-we-are/our-history/university-from-12th-to-20th-century
Vygotsky, L. (1986). *Thought and Language.* (A. Kozulin, Trans.). London: MIT Press.
Webb, R. (Ed.) (1990). *Practitioner Research in the Primary School*. Bristol: The Falmer Press.
Whitty, G., & Furlong, J. (2017). knowledge Traditions in the Study of Education. In G. Whitty & J. Furlong (Eds.), *Knowledge and the Study of Education: an international exploration* (pp. 13-57).
Wiles, A. (1995). Modular elliptic curves and Fermat's Last Theorem. *Annals of Mathematics, 142*, 443-551.
Wyse, D., Brown, C., Oliver, S., & Pobleté, X. (2018). *The BERA Close-to-Practice Research Project: Research Report. London: British Educational Research Association.* Retrieved from https://www.bera.ac.uk/researchers-resources/publications/bera-statement-on-close-to- practice-research

Figure 1: Education continuum of knowledge




Education Continuum of knowledge
Layer 2 - local contexts: Early years settings; schools; Further Education
Institution timetables
Teaching
Close to practice research
Education Endowment Foundation Research School
Staff master's/ doctorate
Practical Knowledge
Academic Knowledge
Working with stakeholders
Budgets and management structure
Teacher training mentor
Professional Journals
Engagement with universities


Education Continuum of knowledge Layer 3 - personal context: e.g Teaching
Lesson planning
Pupils' learning
Curriculum
Close to practice research
Involvement in funded research project
Apply for job in university
Practical Knowledge
Academic Knowledge
Working with parents
Classroom management
Professional development
Research-informed teaching
Degree qualifications