SEARCHING FOR AN UNDERLYING MECHANISM GOVERNING PRE-SERVICE TEACHER ASSESSMENT IN THE NORTHWEST OF ENGLAND: AN EXAMPLE OF ADOPTING A CRITICAL REALISM APPROACH FOR TEACHER EDUCATION RESEARCH

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Abstract

Bhaskar [1] proposed and argued for critical realism in natural sciences. Other authors have extended Bhaskar's [1] arguments to include the social sciences [2], and to attempt to translate his philosophical position into useful research methodologies that can compete with positivist, constructivist, and pragmatic research paradigms [3].

Critical realism describes both intransitive and transitive components of human knowledge. It proposes underlying structures and mechanisms in the Real Domain that exist independently of human observers and possess the potential to govern events occurring in the Actual Domain [1]. Events that can be experienced and investigated as phenomena by human observers form a subset that occupies the Empirical Domain where researchers normally operate [1]. For critical realists, this positivist stance is balanced by the constructivist element to knowledge. As research is also a social activity, it results in knowledge regarding external structures and mechanisms that is also undeniably socially constructed [1] [2].

Critical realism [1] [2] claims to provide a philosophical and research paradigm solution to conflicts in ontology, epistemology, and axiology when conducting mixed methods studies [3]. Further, some researchers have advocated adopting a critical realism approach for synthesising the contributions of quantitative and qualitative data collected in such investigations, even in hindsight [4]. This paper considers the adoption of a critical realism approach late in a research project. A mini thesis drew together nine research articles in the field of teacher training and education that were published in peer reviewed journals between 2013 and 2019. These formed part of a PhD by published works submission [5]. The application of a critical realism approach as a triangulation of mixed methods data and findings using stages described by Bygstad and Munkvold [6] was found to be useful in formulating a concluding model for a complex project. However, a major criticism of the approach is also considered: that the same conclusions would have been reached following other research paradigm methodologies.

Keywords: Critical realism, research paradigms, mixed methods, real domain, actual domain, empirical domain, mechanisms, structures, events, pre-service teacher training.

1   CONTEXT

In 2010 an education White Paper in England [7] confirmed the importance that central policy makers placed upon teacher substantive and disciplinary knowledge as a key teaching skill. It linked individual funding for initial teacher training (ITT) applicants to the class of their undergraduate degree. At the same time, one strategy adopted to counter low recruitment in shortage subjects was to fund accredited subject knowledge enhancement (SKE) courses for candidates to teach subjects other than their undergraduate specialism [8]. An initial investigation into the impact of one such SKE course for creating new physical science teachers resulted in four papers published in the School Science Review (SSR), the peer reviewed journal of the Association for Science Education (ASE) [8] [9] [10] [11]. This investigation prompted questions regarding issues with the assessment of pre-service teachers on school experience placements and the relationship between assessment and professional learning. These were the subject of a further five papers published in the Teacher Education Advancement

Network (TEAN) Journal, the peer reviewed journal of TEAN based at the University of Cumbria [12][13][14][15][16].

These nine papers published between 2013 and 2019 were submitted in part fulfilment of a PhD by publication with a synthesis of their findings [5]. The portfolio of papers [5] constituted a mixed methods, practitioner research project with each paper answering its own research questions using quantitative or qualitative data gathering methods as appropriate [17] as well as addressing overarching themes. This reflexive practitioner research journey and synthesis of findings have been reported previously [5] [17]. The current paper focuses on the utility of applying a critical realism [1] [2] perspective in hindsight in order to make sense of mixed methods data and findings.

From a pragmatic research standpoint, the papers demonstrated the complexity of teachers' subject knowledge and its development during and after ITE programmes [10][16]; the success of a particular model of SKE programme in creating new physical science teachers from those with first degrees in other subjects [8] [9] [11]; and factors and issues affecting the assessment of pre-service teachers against The Teachers' Standards in England [18] using number grades [12] [13] [14] [15]. However, adopting a critical realism [1] [2] perspective allowed both quantitative and qualitative data to contribute to theoretical speculation and the identification of a possible underlying mechanism influencing the assessment of pre-service teachers that operated separately to processes associated with compliance and adherence to assessment procedures [5].

2   LITERATURE REVIEW

2.1   Research standpoint

During this reflexive research project [5] [17] the investigation adopted the standpoint of mixed methods practitioner research. The portfolio of papers demonstrated [5] the attributes of practitioner research described by Goodfellow [19]. The papers describe systematic and critical investigations by initial teacher education (ITE) practitioners intending to improve their professional practice, but who also took the responsibility to share their new knowledge in peer reviewed journals. Drake and Heath [20] have argued that practitioner researchers must maintain flexibility, acting sometimes in the role of practitioner and at other times as a researcher. For Drake and Heath [20] useful new knowledge derives from the synthesis of these, sometimes conflicting, roles during the practitioner researcher's reflexive research journey.

Research paradigms make certain philosophical assumptions about the nature of reality (ontology), our knowledge of reality (epistemology), and research methods and ethics (axiology) [5] [17] employed to generate knowledge. Using different terminology, Aliyu *et al.* [21] and Kivunja and Kuyini [22] considered major research paradigms. They categorised positivist methodologies as the investigation of realities existing independently of the researcher and normally associated with quantitative data, and constructivist methodologies as employing qualitative data to create and amend knowledge internally through social interaction. These authors [21] [22] identified critical realism as a potential solution to the philosophical issues associated with mixed methods research and adopting the pragmatic approach [23] to conflicting philosophical perspectives associated with positivist and constructivist research paradigms. Bhaskar [1] and Archer *et al.* [2] had argued that critical realism provided a philosophical standpoint distinct from positivist, constructivist, and mixed methods pragmatist perspectives, which nevertheless explains how they can be successful research strategies in many contexts. At the same time, adopting a critical realism approach generates new knowledge about reality from a new perspective by using both qualitative and quantitative data to look for underlying influences on events [1] [2].

Individual papers in the study adopted positivist or constructivist perspectives to satisfy rigorous peer review, but for the overall portfolio the initial research paradigm was initially pragmatic, setting to one side ontological considerations temporarily whilst attempting to answer questions about what it means to conduct research and experience the consequences [23]. Later, Zachariadis, Scott and Barrett's [24] standpoint was adopted, that a critical realism [1] perspective changes how the design, measurement and inferential validity of positivist and constructivist research can be evaluated. Both can then contribute to the methodological rigour of mixed methods investigations. Downward and Mearman [4] argued that, as a critical realism [1] approach requires a type of inference that is neither inductive nor deductive (retroduction), it could be used to triangulate mixed methods research. This permits a change in perspective from seeking causal relationships between phenomena to trying to identify the underlying structures and mechanisms governing the events that produce them [24].

2.2   Critical Realism

Bhaskar [1] proposed critical realism as a solution to the philosophical implications of conflicting positivist and constructivist views of reality, knowledge and ethics for researchers engaged in quantitative, qualitative, and mixed methods research. Bhaskar [1] initially applied critical realism to the natural sciences. Archer *et al.* [2] applied critical realism to social science research and Danermark, Ekström and Karlsson to research methodologies [3].

Bhaskar's critical realism [1] proposes that reality is layered and can be described using three domains: Real, Actual and Empirical. The real domain contains underlying structures and mechanisms that have, at least, the potential to govern events occurring in the actual domain. Events can have outcomes that are beyond a human researcher's ability to sense or detect with instruments. However, the outcomes of events that can be detected or measured are termed phenomena and associated with the empirical domain. This is the domain where research is conducted and leads to human knowledge about reality. So knowledge has an intransitive component based upon underlying structures and mechanisms in the real domain external to the observer. However, research is also a social activity dependent upon human senses, communication, and sociological processes and structures, so knowledge about reality will also have a transitive or constructed component [1].

2.3   Philosophy to research methodology

The steps necessary to apply critical realism [1] to mixed methods research were described and discussed by Bygstad and Munkvold [6]:

1. Description of events

2. Identification of components

3. Theoretical redescription (abduction)

4. Retroduction: Identification of candidate mechanisms

5. Analysis of selected mechanisms and outcomes

6. Validation of explanatory power   [6, page 5]

Description of events, the identification of components and, to some extent, theoretical redescription (abduction) can be found throughout the portfolio of papers [5] [17]. These are associated with measurable phenomena in the empirical domain [1]. The phenomena described and discussed [5] [17] identified the assessment of pre-service teachers' subject knowledge and other teaching competencies as a process that was difficult to investigate and impossible to know completely. This identified assessment as an event in the actual domain [1]. This assessment was required for formative feedback and ultimately for recommending pre-service teachers for qualified teacher status (QTS) in England [18], but the phenomena identified indicated that factors beyond the required or agreed assessment procedures were contributing to this process. Once a critical realism approach was adopted it was possible to use pre-existing theoretical models for redescription and the proposal of a socio-psychological underlying mechanism [5]. Bygstad and Munkvold [6] described underlying mechanisms as invisible, interacting in open systems, and highly contextual. They proposed that they are better utilised in hindsight for explaining phenomena, rather than trying to predict future outcomes of events [6].

Counterfactual reasoning [2] [3] was usefully employed in the processes of abduction and retroduction, requiring thought experiments that challenged the assumptions associated with the models utilised to offer explanations for the papers' empirical findings. This involved omitting elements and theorising speculatively on alternative potential consequences and outcomes [2] [3]. The portfolio papers [5] [17] repeatedly utilised a specific model for describing teacher subject knowledge [25] and a process for professional development and assessment [26] applied to teacher education in England [27]. These models suggested there should be many opportunities for assessors to demonstrate subjective differences and that this would cause variability in assessment outcomes between programmes and over time. Such variability was not observed in quantitative studies [12] [13] despite quantitative [13] and qualitative [15] studies indicating that subjective differences between assessors could be demonstrated. Using counter factual reasoning [2] [3], elements of the model were left out, and factors external to the models that could suppress those omitted in certain contexts identified [5] [17]. This led

to an improved appreciation of the interaction between models and guided the search for possible underlying mechanisms and structures [5] [17].

3   METHODOLOGY

Synthesis of the practitioner research with an emphasis on the application of critical realism approaches was based upon a document analysis of the portfolio of papers [8-16], PhD mini-thesis [5] and any subsequent papers associated with the original papers [17]. The methodologies, data gathering methods and ethical considerations for the portfolio were reported for each paper [8-16] and summarised in the PhD mini-thesis [5]. Literature review, document analysis, statistical analysis (not inference) and thematic analysis were the main data-gathering methods, but one paper employed Q-methodology, a quantitative approach to qualitative analysis [15]. Ethical considerations were discussed in individual papers and this current synthesis poses no additional issues.

Fig. 1 is a diagram used in introductory research master's level ITE modules at a higher education (HE) institution in the northwest of England to represent the dichotomy between positivist and constructivist research paradigms. It is meant to show the co-existence of the two research paradigms and their combination to generate new knowledge in terms of predictive models of reality when a pragmatic view of their different assumptions about the nature of reality is put aside during mixed methods research [23]. Fig. 1 is an oversimplification of the situation, but it serves to illustrate the way in which individual papers were originally synthesised.
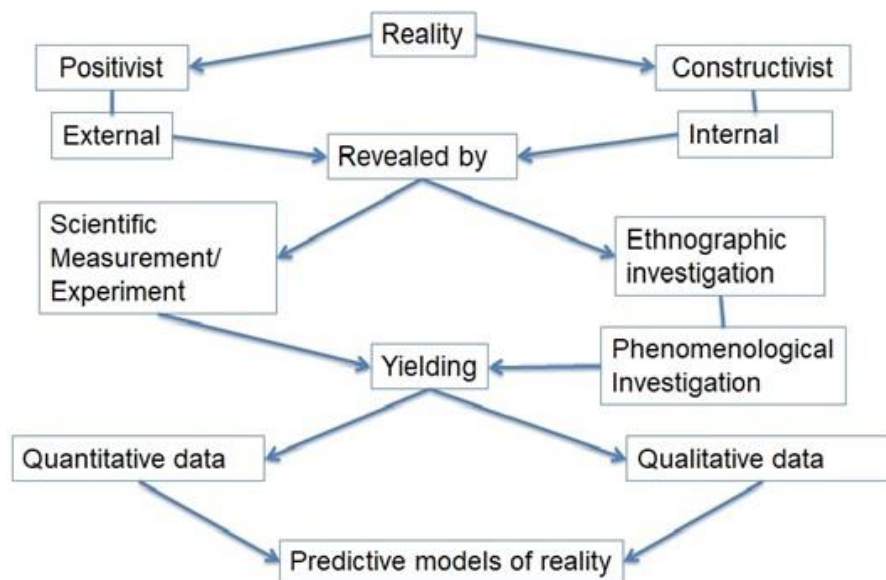

Figure 1 A pragmatic approach

Fig. 2 shows how this can be modified to implement a critical realism approach. Quantitative and qualitative research can establish phenomena in the empirical domain and causal relationships between them, and predictive theoretical models refined [1] [2] [3]. However, only a critical realism approach looks for structures and mechanisms underlying a layered reality to explain the outcomes of events leading to phenomena [1] [2] [3]. It also allows for structures and mechanisms to be identified in different ontological layers [2] [3]. For this portfolio of papers, the event is sociological, but the mechanism is socio-psychological, perhaps physiological [5] [17]. Fig. 2 is an oversimplification but illustrates the process adopted during the synthesis of the findings from the mixed method practitioner research discussed here.
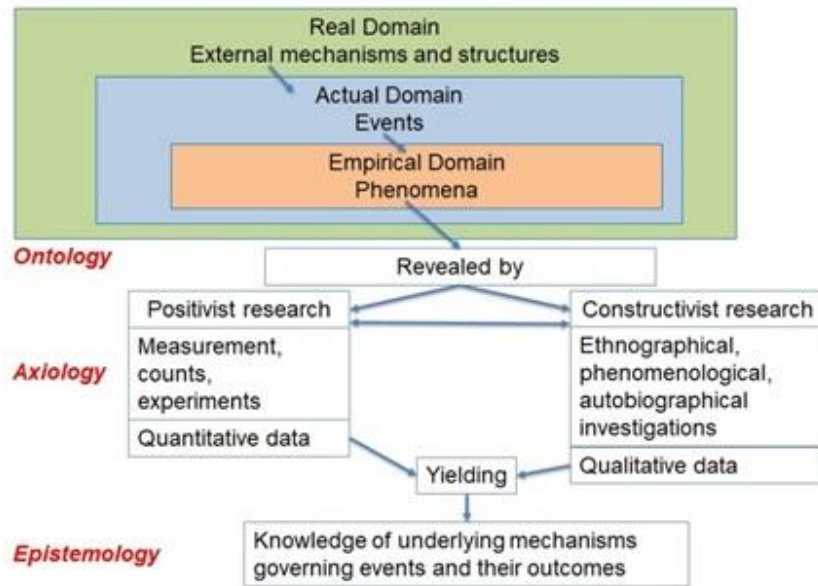
Figure 2 A critical realism approach

4   FINDINGS AND DISCUSSION

Fig. 3 summarises the mixed methods findings in the portfolio of papers [8-16] synthesised after adopting a critical realism approach [5].
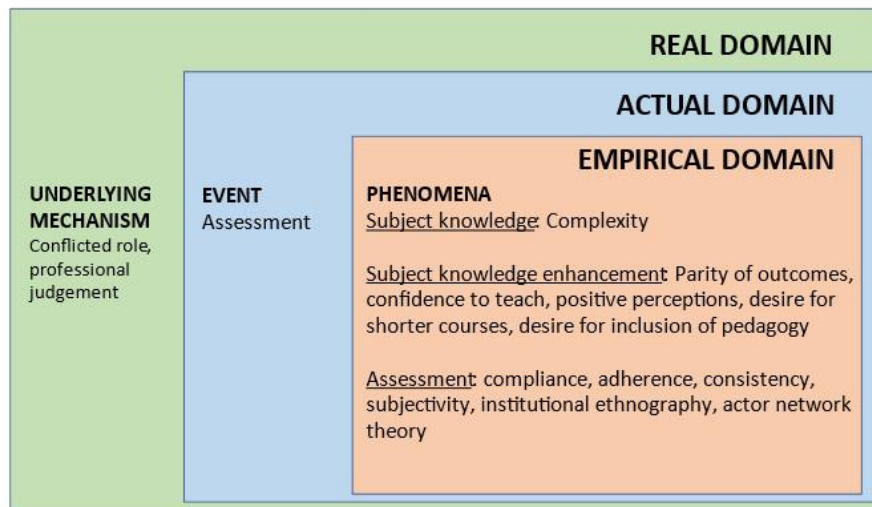

Figure 3 The presentation of the portfolio of papers [5] mixed methods findings having adopted a critical realism approach [1]

In the context described in the portfolio of papers [8-16], using a critical realism approach in hindsight [5], suggested an underlying mechanism consistent with the anomalies between findings and the models used for theoretical explanation and redescription. It was proposed that this had influenced the assessment of pre-service teachers using number grades and minimum performance descriptors in The Teaching Standards in England [18]. It appeared that grading might have been affected by factors overriding those prescribed in QTS requirements and agreed ITE partnership assessment procedures. Abduction and retroduction suggested that a possible governing mechanism was socio-psychological, and assessors were using their professional judgement as teachers, teacher educators and teacher assessors to make assessment decisions, whilst simultaneously complying with QTS requirements and agreed partnership procedures to ensure validation of their decisions. Compliance with QTS requirements was paramount for the continuation of the ITE partnerships and the accreditation of their QTS provider. Further, the roles necessary for mentors to carry out their responsibilities to learners in

schools and their pre-service teachers were potentially conflicted and required the exercise of expert professional judgement to reach appropriate assessment outcomes.

4.1 The phenomena

The phenomena listed and categorised in Fig. 3 were identified or measured using quantitative and qualitative research methods and qualify as phenomena in Bhaskar's empirical domain [1] [2]. Locating these with respect to existing literature allowed explanations using several existing models [8-16] [5] [17]. Shulman's influential model for teacher subject knowledge [25] was utilised repeatedly [8-15] when considering teacher subject knowledge as referenced in the standard descriptors [18] and SKE findings [8] [9] [11]. Hager and Butler's model for professional development and its assessment [26] applied to ITE by Martin and Cloke [27] and mapped to the context for the assessment studies by Tynan and Jones [14] (Fig. 4) was a model that increased in influence as the studies proceeded. Both models predicted opportunities for assessor subjectivity that were not observed in assessment outcomes [12] [13], an anomaly later explored during abduction and retroduction involving counter factual reasoning. A third conceptual model used to explain phenomena associated with assessment involved institutional ethnography (IE) and actor network theory (ANT) [14]. Some subjectivity between assessors could be demonstrated quantitatively and qualitatively [13] [15] but was not expressed as variability in graded assessment outcomes across programmes [12], subjects [13] and time [14]. Also, it appeared that assessors were prepared to make the assessment system work to support their assessment decisions and that this could be facilitated by information transfer that could be explained using IE and ANT [14]. Adopting a pragmatic approach [23] reached this point and demonstrated that, in the context of the studies discussed [5] [17], the pre-service teacher assessment procedures worked consistently to admit suitable pre-service teachers to QTS and complied with QTS. Within a framework of QTS compliance and adherence to agreed partnership assessment practices subjective differences between assessors were possible and could be demonstrated qualitatively but not were reflected in number grading outcomes, suggesting that there were other factors at work [5] [15] [17].
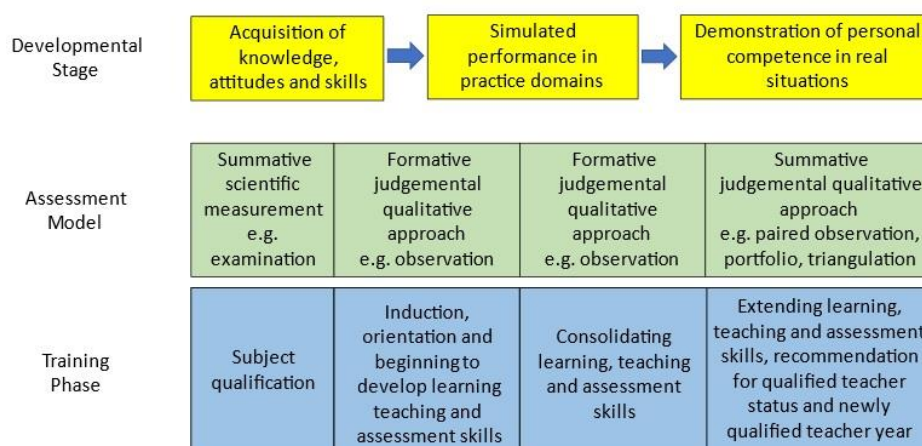

Figure 4 A model of professional development and assessment [25] applied to initial teacher education [26] and mapped to a common programme structure [13]

4.2 Identifying assessment as an event

Four portfolio papers [8-11] evaluated the impact of an attended, HE accredited, one-year SKE programme on the subject knowledge of aspiring pre-service physical science teachers and their subsequent performance on an ITE programme. From an education practitioner perspective, findings [9] that assessment and early employment outcomes were the same for pre-service teachers with SKE or first-degree qualifications in physical sciences indicated that the course was successful. However, it seemed unlikely that the subject knowledge of pre-service teachers from the two routes were equal even if their overall teaching performances were equal [8] [9] [11].

Further, subject knowledge for pre-service teachers appeared to be a complex concept [10] [16] for supervising teachers to assess, especially if summarised as a number grade on a four-point scale. Confidence in the accuracy, consistency and validity of the assessment tools used was key to accepting the SKE findings [9] [11]. The next set of papers [12-15] set about investigating the required and agreed elements of the assessment of pre-service teachers on school experience placement and the factors affecting the practice of number grading against standards criteria [18]. In this process, a number of phenomena were demonstrated associated with assessment processes for pre-service teachers' subject knowledge, other teaching skills and overall teaching ability [12-15] (Fig. 3). Assessors in schools were required to assess against minimum performance standards in order to recommend pre-service teachers for QTS [18]. Working in partnership with an HE QTS provider, there were ITE partnership agreed assessment processes and procedures [12]. However, findings illustrated the difficulty researchers experienced demonstrating the factors contributing to assessment in this context [12] [13] [14]. Some of the psychological processes contributing to individual assessors' assessment decisions may be beyond identification or measurement, and this qualified assessment in this context as an event in Bhaskar's [1] [2] actual domain (Fig. 3).

4.3 Adbuction and retroduction

The accuracy and consistency of assessment outcomes were quality assured by internal partnership procedures [12] and externally monitored for QTS compliance against inspection frameworks [28]. Inspectors had significant power over the QTS provider and partnerships. The high levels of consistency demonstrated in assessment outcomes [12] suggested that assessors took compliance issues seriously to ensure their assessment decisions were validated externally [15]. However, some assessors may not have been convinced of the usefulness of agreed partnership assessment processes [14] [15], tweaking the system to ensure it fully supported their grading decisions. It was not possible to fully investigate how they ascribed assessment grades, but there was a strong indication that internal and external quality assurance processes ensured compliance and adherence to assessment procedures [12] [15] but could be influenced by factors operating outside the mechanistic guidelines provided by the HE QTS provider [14].

Shulman's model of teacher subject knowledge [25] distinguishes between Subject Matter Content Knowledge (SMCK), Pedagogical Content Knowledge (PCK) and Curriculum Knowledge (CK). Although it can be argued that teacher subject knowledge contributes to all eight teaching standard descriptors used in England [18], SMCK with CK are clearly described by Standard 3, and PCK by Standards 4 [18]. Schulman's and other teacher subject knowledge models demonstrate that this is a contested and complex conceptual framework [8] and this was supported by the portfolio of papers [10] [13] [16]. The assessors participating in this study were responsible for summarising pre-service teachers' subject knowledge and other teaching skills using a four-point number scale linked to minimum performance criteria described in the teaching standards in England [18] and using these to ascribe a grade for overall teaching ability. They followed agreed partnership assessment protocols [12] but there were no national descriptors for grades above minimum performance levels to help them, nor were any assessment tools prescribed in legislation [12] [13] [14]. Shulman's model for subject knowledge [25] also suggests many opportunities for assessors to demonstrate subjectivity. Assessors might place more emphasis on one aspect of subject knowledge than another when assessing trainees. Tynan and Jones [13] found a high degree of consistency across subjects when mentors assessed SMCK, CK and PCK and overall teaching skill. However, there were small but significant differences between core subject assessments, with Mathematics and Science teachers more likely to associate PCK than SMCK/CK with overall teaching ability. This was not static over the two-year study period.

The process model of professional development and assessment (Fig. 4) utilised throughout the portfolio of papers suggested a shift from scientific quantitative to judgemental qualitative assessment strategies as the ITE programmes progressed. This also suggested many points at which subjective differences between assessors should be demonstrated. The major formative and summative assessment tool for mentors and supervising teachers was classroom observation focussing on targets set after previous observations. Observations and their quality assurance through paired observations with peers and HE tutors were subjective processes even when located in evidence-based assessment with agreed partnership assessment guidelines. An anomaly between the subjectivity predicted by subject knowledge and professional development/assessment models and research findings was that these opportunities for assessor subjectivity were not reflected by variability in the assessment grades ascribed across large ITE programmes or within subjects over time. These demonstrated high levels of statistically significant consistency [12-14]. On the other hand, subjective differences could be measured and described [13] [15], even if they did not contribute to variation in graded assessments. Subjectivity

observed as variability would have been reduced by the clear documentation that existed to ensure compliance with QTS requirements and adherence to agreed partnership assessment practices (IE), and the training and quality assurance procedures mentors participate in (ANT) [14] but not to the extent observed in the number graded outcomes [12] [13]. Counterfactual reasoning, speculated upon the possible effects of removing the IE and ANT influences. This suggested that, given the poorly defined assessment tools in place, the nature of teacher subject knowledge and qualitative assessment approaches, an additional factor influencing assessment was operating underneath the assessment process and influence of IE and ANT.

Assessment was the responsibility of mentors in school whose primary function was the teaching of school age learners. When acting as teacher educators, their role changed during the ITE programme (Fig. 4) from mentor and formative assessor to coach and summative assessor with responsibility for recommending their trainee (or withholding that recommendation) for QTS. It is not difficult to speculate that this could result in conflicts of interest in the minds of mentors at the end of ITE programmes. As there were no agreed practices nor central guides as to how they should do this, they would need to balance the requirements of their several roles using their professional judgement. Compliance with QTS requirements would be uppermost in their minds [15] but adherence to agreed partnership practices might be more open to interpretation. Once an assessment decision was reached there is evidence that the assessment procedures could be used to strengthen the evidence for this [14] [15]. Assuming a model of teacher attributes such as Korthagen's onion model that considers context and underlying attributes and motivations of teachers [29] and models of teacher educator professionalism [30] these decisions would be influenced by experience, education, and the underlying attributes of individual assessors.

5 CONCLUSIONS

Structures and mechanisms operate in dynamic open systems and are highly contextual [6], making further validation of the proposed mechanism (Fig. 3) problematic. Comparison with other research findings is challenging. The context for the mechanism was the assessment of pre-service teachers on ITE programmes whilst on school experience placements. The approach to assessment involved criteria-based judgements reported as number grades on a 1-4 scale, and was quality assured internally and externally. The system evolved into something different soon after the research was published and cannot now be investigated further, and finding research on pre-service teacher assessment in an identical context is unlikely. As such the findings are not directly repeatable. However, comparisons with other approaches to assessment of teaching capability that have some degree of similarity would be illuminating by stimulating counter factual reasoning. As would comparison with approaches that intend to be norm referenced, scientific and statistically moderated. These considerations support Bygstad and Munkvold's [6] suggestion that the main role of underlying structures and mechanisms should be to explain phenomena in hindsight rather than to predict future outcomes. This does not mean that they have no validity for making wider generalisations but that these must always be appropriately contextualised.

The proposed underlying mechanism, conflicted role professional judgement (Fig. 3), is a speculative theoretical explanation that future investigations may support or undermine. It provides a theoretical explanation consistent with its analysis against the phenomena demonstrated [6], namely those demonstrated by the portfolio of papers listed in Fig. 3 and discussed in previous works [5] [17]. It explains how professionals acting as both teachers and teacher educators with further dual roles of pre-service teacher mentor and summative assessor coped with their situation. Participants in the studies were responsible for both their school age and pre-service teachers' learning and development within a system involving compliance with QTS requirements [18] and adherence to agreed partnership procedures [17] that were internally and externally monitored [28]. They were ultimately responsible for the summative assessment that resulted in pre-service teachers' recommendation for QTS and entry to the teaching profession in England. This was a qualitative, judgemental assessment based upon minimum performance criteria but reported as a number grade. They needed to exercise all their professional judgement and make sure this system worked to admit pre-service teachers to teaching when they were ready, with a profile that reflected their strengths and areas for development. Compliance and adherence were their first priorities followed by ensuring the system reflected their assessments accurately.

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