

# **A CRITICAL EVALUATION OF CRITERIA-BASED ASSESSMENT OF SUBJECT KNOWLEDGE AND OTHER COMPETENCIES OF TEACHERS IN TRAINING: A PRACTITIONER RESEARCH JOURNEY**

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## **Abstract**

This paper draws together a portfolio of nine peer reviewed papers investigating the assessment of teacher competencies conducted as practitioner research at a Higher Education (HE) provider of initial teacher education (ITE) programmes working in partnership with schools in the North West of England. These were published between 2013 and 2019 and lead or co-authored by the presenter. The papers encompass a research journey in terms of the focus and methodologies utilised.

Earlier papers studied the effectiveness of a particular model for delivering a subject knowledge enhancement (SKE) course in creating new physical science teachers from those without chemistry or physics first degrees. SKE courses are employed in England as one strategy for increasing recruitment to teacher shortage subject areas in schools. This programme was attended, year-long, full-time and higher education accredited. However, later papers widened the scope to include the assessment of teacher subject knowledge and other competencies in a range of school subjects in the English education system and focused on the issues associated with the practice adopted by some providers of number grading individual competencies and overall teaching ability for formative and summative assessment of trainee teachers on school experience placement.

The portfolio adopted a mixed methods approach with an emphasis on quantitative analysis. In considering the body of research, a critical realism perspective was adopted to describe and interpret the findings in terms of many demonstrable phenomena concerned with assessment as an event. An underlying mechanism is proposed to explain these in terms of the assessment behaviours of teacher practitioners who also act as teacher educator practitioners and may experience role conflict: conflicted role, professional judgement. This approach locates the portfolio's contribution to new knowledge against pre-existing work, identifies unifying and coherent themes and establishes the papers' individual and combined methodological rigour.

The research had great local utility in initial teacher education in England. It also demonstrated issues with criteria-based assessment of teaching described through competencies and the problems with adopting number grades to aid quality assurance and accountability. Findings have relevance and may be applicable to similar assessment systems in any profession.

Keywords: ITE, QTS, criteria, teacher competencies, assessment, school experience, partnerships, subject knowledge, mixed methods, critical realism

## **1 INTRODUCTION**

The nine papers reviewed in this article, [1] to [9], constitute a portfolio of research papers submitted to Liverpool John Moores University in partial fulfilment of the requirements for the conferment of Doctor of Philosophy by Publication [10].

The research was located in initial teacher education (ITE) partnerships between schools and a Higher Education (HE) provider in the northwest of England accrediting qualified teacher status (QTS). It begins with a tight focus on evaluating the effectiveness of one type of science subject knowledge enhancement (SKE) course in creating new physical science teachers from those without chemistry or physics first degrees. SKE courses have been employed in England as one strategy for increasing recruitment to teacher shortage subject areas in schools. The SKE programme evaluated was attended in person, year-long, full-time and accredited by the HE provider.

The studies highlighted issues associated with the practice adopted by some QTS providers in England of number grading individual teaching competencies and overall teaching ability for the formative and summative assessment of trainee teachers on school experience placement. This approach was one way of complying with current QTS requirements in England [11], and ITE programme quality assurance inspections by the Office for Standards in Education Children's Services and Skills (OfSTED) [12]. The scope of the studies then widened to include other subjects, the range of teacher competencies described by the Teachers' Standards [11] and a general consideration of the issues associated with the current assessment of teachers' professional learning.

The papers, [1] to [9], constitute a body of practitioner research with a high degree of local utility, and wider implications for teacher educators practicing in systems that use competency-based assessment and grading. Four papers were published in *The School Science Review (SSR)*, the Association for Science Education's (ASE) peer reviewed international journal. This is read by science teachers and science middle managers who might encounter science teachers with SKE qualifications and want to be better informed about them. The other papers were placed in the peer reviewed international *Teacher Education Advancement Network (TEAN) Journal* and aimed at teacher educators in school and other institutions. The articles submitted to both journals were subject to anonymous peer review.

The papers link to two main research questions:

1. How successful in creating new physical science teachers was a particular model for delivering SKE courses (attended, year-long, full-time, higher education accredited), for non-subject specialist graduates?
2. What were the factors influencing the assessment of teachers in training whilst on school experience placement?

The context for the research was an assessment system ascribing number grades against either the Professional Standards for Teachers [13] or the Teachers' Standards [11]. This system was used across all programmes at a large ITE provider in the northwest of England.

Together the papers contribute to a wider understanding of:

- mixed methods research
- the importance of professional subject knowledge for teachers
- the complexity of professional subject knowledge
- the assessment of teacher competencies during initial ITE programmes
- the influence of quality assurance and accountability management on assessment
- the critically reflexive journey towards research informed practice

Drake and Heath [14] wrote about the generation of new knowledge through practitioner research. They argued that practitioner research results in unique additions to knowledge by combining understanding from research, professional practice, and the individual's reflexive project. The purpose of this paper is not to argue the merits or otherwise of individual pieces of research and their findings but to describe a reflexive practitioner research journey that led to overall conclusions not found in the individual papers.

## **2 METHODOLOGY**

Taken together, papers [1] to [9] demonstrate a mixed methods approach that emphasises quantitative analysis. The research paradigm was initially pragmatic [15]. Each paper was subject to rigorous peer review according to journal editorial policy and was accepted upon the basis of the validity and rigour of each paper's individual methodology. This was argued from a positivist or constructivist perspective as required, adopting the pragmatic perspective that ontological considerations may be set aside temporarily whilst trying answer what it means to conduct research and experience the consequences [15].

However, the portfolio of papers was later considered from Zachariadis, Scott and Barrett's [16] perspective. They argued that adopting a critical realism perspective [17] permits both qualitative and quantitative data to contribute to the overall methodological rigour of mixed methods investigations and validity of the findings. Whilst investigating some very specific practitioner research questions, new knowledge was generated that suggested an underlying mechanism regarding the assessment of teachers.

Full details of data gathering, ethical considerations and analyses can be found in each paper [1] to [9] and are discussed in [10].

### 3 FINDINGS

The central themes for papers [1] to [9] were subject knowledge for teachers, teachers' competencies described in The Teachers' Standards [11] and the assessment of trainee teachers on school experience placement. Tynan and McLain [8] described the requirements that aspiring teachers must satisfy in England to be recommended for QTS. In short, they must evidence that they have reached minimum performance levels in eight standards describing teaching competencies and descriptors for professional conduct [11]. Since the adoption of The Teachers' Standards [11], OfSTED [12] has held QTS providers in England accountable for the number of teachers trained that surpass minimum expectations utilising a four-point scale to grade partnerships and QTS providers. Some providers responded by adopting number grades linked to OfSTED categories to assess trainee teachers. The QTS provider studied within papers [1] to [9] ascribed numerical grades at both formative and summative review points for all its ITE programmes [8].

#### 3.1 Subject knowledge and Subject Knowledge Enhancement

The early research focused upon the effectiveness of one type of SKE course (attended in person, year-long, full-time and accredited by the HE provider) in creating new physical science teachers from aspiring teachers without first degrees in chemistry or physics. Inglis *et al.* [1] reviewed ideas about subject knowledge for teachers and introduced SKE courses as one approach adopted in England to filling vacancies for teacher training in shortage subjects such as the physical sciences. Inglis *et al.* [1] described the design and thinking behind one course developed at one HE QTS provider in the northwest of England. Participant observation and document analysis were used to review lessons learned from the early cohorts. Early indications were that SKE trainees were positive about the course and were not hampered in any way by their lack of a chemistry or physics first degree during the next stage in their teacher training, their Post Graduate Certificate in Education (PGCE) year. This paper developed the researchers' understanding of subject knowledge for teachers based upon Shulman's [18] influential model. It helped identify the elements of subject knowledge for teachers covered by the performance descriptors at that time as subject specialist knowledge, pedagogy and curriculum knowledge. At that time these were mainly covered two standard descriptors [11][13]. Shulman's model continued to be relevant throughout the research conducted in the papers [1] to [9].

Tynan *et al.* [2] was an impact analysis of the SKE programme outcomes for students. It dealt quantitatively with student perceptions of their experience reported through in an anonymous end of programme feedback questionnaire. It also compared assessment grading data and early employment returns. This paper included statistical analysis used to remove subjectivity from the conclusions reached about the quantitative data. This confirmed more rigorously and objectively that assessors and employers in the study had not perceived a difference between physics and chemistry graduate trainees and their SKE counterparts when grading their subject knowledge, teaching, or when offering jobs.

Tynan *et al.* [4] explored qualitatively the attitudes of SKE students to their programme. SKE courses were introduced to address subject discipline knowledge issues but inevitably looked forward to subject specific pedagogies that would be covered in the PGCE year. As they looked forward to teacher training, most students accepted the challenge that would be involved in the expansion of their professional subject knowledge, but they valued the inclusion of pedagogical considerations in the SKE programme. The confidence they expressed would be important as they engaged in self-evaluation, sought to convince assessors that they had sufficient subject knowledge and competed for science teacher jobs.

Tynan *et al.* [3] explored the nature of subject knowledge for science teachers through an opportunistic investigation of a particular science pedagogy (the socio-economic approach) and the possible sources of evidence that allowed ITE students to demonstrate subject knowledge. It observed that the anonymous voting behaviour of student teachers during the activities associated with modelling this science pedagogy, and their subsequent discussions, suggested evidence about the relationship between pedagogical and subject discipline knowledge that seemed more nuanced than number grades on a four-point scale could summarise.

Inglis *et al.* [1] and Tynan *et al.* [2][4] had established that the SKE course design investigated was perceived as appropriate by participants, who expressed confidence in their ability to teach their SKE course subject. Tynan *et al.* [2] also demonstrated parity of outcomes for SKE and physical science degree route trainees. This paper introduced Martin and Cloke's [19] application to teaching of Hager and Butler's [20] model of professional learning. This model proposes that the adoption of a qualitative and judgmental assessment models based upon observation is necessary at later stages of professional development and training. This perspective raised the possibility that similar assessment outcomes for

teachers with SKE and subject specialist degree qualifications did not necessarily reflect equal subject knowledge. In fact, it was unlikely that a one-year SKE programme could develop the same depth and width of subject discipline knowledge as a three or four year undergraduate programme. However, Martin and Cloke's [19] application explained how assessors may have been evaluating additional aspects of subject knowledge for teachers such as pedagogical knowledge [18]. The findings might also be explained by the adoption of qualitative, judgmental assessment approaches in the later stages of professional learning [19][20]. Papers [1] to [4] had answered the first research question. The SKE course had been successful in creating new physical science teachers from those without first degrees in chemistry or physics. However, it was not clear how that could be explained, and assessment practices and outcomes were central to choosing between the plausible alternatives.

### **3.2 The factors affecting assessment of trainee teachers on school experience placement**

Tynan and Mallaburn [5] investigated several statistical checks for monitoring consistency in assessment grades between partnerships across and within ITE programmes at a large HE QTS provider. It also investigated claims that quick, and convenient parametric tests of significance could sometimes be used for monitoring purposes, even with potentially non-parametric data. The paper recommended the use of a non-parametric test to compare grade distributions across programmes, and a parametric correlation coefficient to investigate mean grades for individual standards and the overall teaching grade ascribed by assessors within programmes. This paper evidenced and enabled the annual monitoring of consistency between programmes using the statistical tests identified. Pragmatically, this was useful in preparing for OfSTED [12] inspection of ITE partnerships.

Tynan and Mallaburn [5] also demonstrated high levels of consistency in the distribution of number grades awarded for overall teaching across five ITE programmes for the final summative assessment before recommendation of QTS. Findings suggested that this might be linked to HE interventions implemented to improve consistency in assessment practices. In particular, the practice of confirming the final summative teaching grade at a rigorous and structured meeting chaired by a HE liaison tutor may have been highly influential. Further, Tynan and Mallaburn [5] found that the correlations between grades ascribed for individual standards and overall teaching for five ITE programmes during the study year were almost always positive and statistically significant. This was predictable, as a negative correlation would have indicated that the grades for a particular standard were always low when the grades for overall teaching were high. For this to happen, assessors would have to consider performing well in that teaching standard as irrelevant to overall teaching performance and *vice versa*. A non-significant positive correlation would be an indication that it was so small that there was a good chance that it was just random occurrence. When monitoring consistency either outcome would raise potential concerns about the assessment process.

Martin and Cloke's [19] application of Hager and Butler's model [20] for professional development and assessment suggested that the system for assessment under investigation would provide many opportunities for subjective differences between assessors to be expressed as variation in number graded data. There was further scope for variation inherent in the criterion based approach associated with assessment against the Teachers' Standards [11]. However, the high level of consistency in assessment outcomes across partnerships, and across and within five ITE programmes [5] suggested that the potential for subjective differences between assessors was suppressed by another factor. These findings [5] were an early indicator of the possible influence of institutional ethnography (IE) and actor network theory (ANT) suggested as important in HE ITE assessments by Tummon [21].

Tynan and Jones [6] reported the further use of the most sensitive statistical test identified in Tynan and Mallaburn [5] to look for subjective differences in the grading of different aspects of teacher subject knowledge covered by Standards 3 and 4 [11] and Overall teaching grades. This started to explore assessors' application of agreed partnership guidelines for arriving at grades for standards and overall teaching that required grades for individual standards to be ascribed first. The profile of grades obtained was then used to arrive a grade for overall teaching. The study compared grades ascribed in all subjects, English, mathematics and science for one large ITE programme at an HE QTS provider in the northwest of England. Although not a linear study, data from two consecutive years were analysed.

There was a high level of consistency between the subjects in the distribution of grades ascribed for standards 3, 4 and overall teaching but in mathematics and science there were some differences [6]. In these instances, assessors were more likely to give higher grades for the standard associated with subject matter content and curriculum knowledge than for overall teaching or the standard associated

with pedagogy. So, where there was subjectivity, teacher assessors were more likely to associate the grade for pedagogy with the overall judgement of teaching ability than with the grade for subject and curriculum knowledge. For English the grades for both aspects of subject knowledge were equivalent to those for overall teaching over both years. This suggested that subjective differences between assessors in different school subjects were possible, although difficult to demonstrate.

Tynan and Jones [7] used an r-family effect size metric, proportion of variance (POV) expressed as a percentage, to explore more deeply the correlations between grades for individual standards and overall teaching. It analysed assessment data from a single large ITE programme over three consecutive years. The use of POV as a percentage can be interpreted intuitively. The larger the POV percentage, the more shared variation between grades ascribed by assessors for a particular standard [11] and overall teaching ability. This would be congruent with the idea that assessors had closely associated a good grade for that standard with a good grade for overall teaching. A pattern emerged, consistent over all three years, linking grades for the same standards with grades for overall teaching. These were standards that mentors were advised, during training and quality assurance meetings, should be graded similarly to overall teaching. This suggested once again that IE and ANT were influencing grading [19]. The POVs for the grades for overall teaching and Standard 3 [11], associated with subject and curriculum knowledge, and were consistently the lowest. The use of number grades in the absence of central guidance other than the pass/fail descriptors was questioned in this paper [7].

Tynan and McLain [8] used Q-methodology to look for subjective differences in attitudes to the assessment of trainees on school experience placement, amongst a small group of ITE participants at a secondary school. This is a quantitative approach to analysing qualitative data. Although no wider utility or application was claimed, the method successfully identified a group of 4 and a pair with markedly different profiles of responses that were statistically significant. These were not associated with the participants' roles within the ITE programme but were linked to how closely participants worked together. Two mentors shared similar profiles of responses with their own trainee teachers but not with each other. Two other respondents fitted neither profile nor formed a third cluster of subjectivity. This supported a social model of professional learning where mentor and mentee working together might adopt similar perspectives on assessment.

All the respondents agreed on the importance of compliance with QTS requirements and following agreed partnership guidelines when assessing teaching [8]. However, the pair differed by emphasising the importance of all the individual standards [11] and OfSTED criteria [12] almost exclusively and perceived assessment as a matter for mentors and mentees that only other teaching practitioners could usefully contribute to. The larger group perceived assessment more in terms of process and fairness and were more amenable to quality assurance interventions within and external to the school [8]. They were also more in agreement with the use of evidence from alternate school placements and even university training days when arriving at grades [8].

Papers [5] to [8] demonstrated that the subjectivity between assessors inherent in the assessment process [19][20][11] could be established by interrogating assessment data and the responses of those involved in the ITE process. However, the overall conclusion reached was that this was not reflected in the consistency demonstrated by number graded outcomes. Pratt and Tynan [9] investigated the way teachers develop and how they can demonstrate their professional subject knowledge as they transition from ITE trainees to newly and recently qualified teachers. It explored the transformational professional associated with the early completion of a master's qualification in education practice. It maps one way of developing teachers' professional subject knowledge beyond ITE. Throughout this series of papers [5] to [9], a theme developed questioning the validity of number graded assessments of teacher competencies as described in the Teachers' Standards [11], particularly when it is known that they will be also used for quality assurance and accountability purposes.

## **4 DISCUSSION AND CONCLUSIONS**

Downward and Mearman [22] argued for the understanding of mixed methods triangulation made possible when a critical realism perspective is adopted and attempting to identify underlying mechanisms governing events rather than causal relationships between phenomena. The process adopted with papers [1] to [9] for this approach was described and discussed by Bygstad and Munkvold [23], p5, under these headings:

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

This application of a critical reality perspective [17] to papers [1] to [9] was discussed fully by Tynan [10]. Bhaskar [17] proposed that, for the natural sciences, the development of new knowledge could be explained by considering reality as layered and made up of underlying structures and mechanisms with the power to influence events. These structures and mechanisms exist externally and independently of observers and are, therefore, intransitive [17]. However, research is a social activity and depends upon human senses and communication, Knowledge about the measurable phenomena associated with events is, therefore, also negotiable, constructivist and transitive [17]. Archer *et al.* [24] extended these arguments to include social science research. For critical realists, the phenomena observed in the Empirical Domain can illuminate our knowledge about events in the Actual Domain and lead to the identification of the underlying structures and mechanisms that govern them in the Real Domain [17][24].

Fig. 1 summarises a critical realism interpretation of the contents of papers [1] to [9] found in Tynan [10].

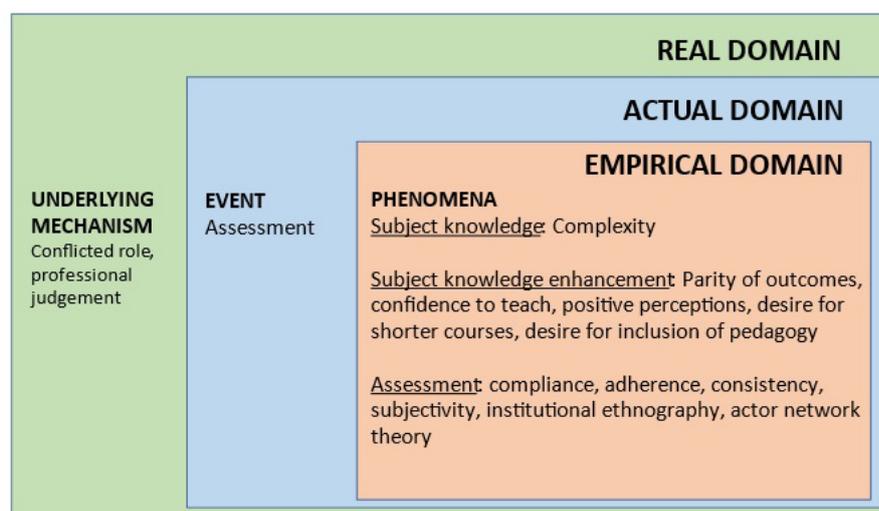


Figure 1. Proposed critical realism perspective [17] on the assessment of trainee teachers on school experience placement [10].

Despite the apparently transparent and evidence-based system for accrediting QTS in England, it is difficult to understand exactly how school and HE based teacher educators use Standards and minimum performance descriptors [11] to assess aspiring teachers. This qualifies the assessment of trainees on school experience practice as an event in Bhaskar's Actual Domain [17]. Papers [1] to [9] identified a wide range of observable phenomena associated with the practice of assessment in the context of number grades and standards descriptors used to describe teacher competencies. Papers [3] and [9] suggested the constraints placed upon assessors by reducing teacher subject knowledge and other competencies to minimum criteria for performance. Papers [1], [2] and [4] established the parity of outcomes and confidence to teach between aspiring teachers who followed the SKE route and those with first degrees in chemistry or physics.

On widening the study to other competencies and subjects it became clear that there were high levels of consistency in number graded outcomes between and within ITE programmes and partnerships [5] [6]. This was not predicted by abducted (redescribed) theories [18][19][20] that indicated more variability in outcomes should be observable due to assessor subjectivities. Subjectivities between assessors were detectable [6][8] but these were masked in the number graded assessment data investigated [5][6]. IE and ANT were useful abducted theories when attempting to explain assessors' overriding emphasis on compliance with QTS requirements and adherence to partnership agreed assessment practices [7][9]. As previously suggested by Tummons [21], it appeared that the management of assessment, quality assurance and accountability were influencing the number graded assessment outcomes for the trainee teachers on school experience placement during the period of these studies.

In England, school-based teacher educators are currently responsible for assessing aspiring teachers. QTS providers quality assure the process and OfSTED [12] ensure compliance with QTS requirements. However, school-based teacher educators are, first and foremost, teachers of young learners in schools and colleges. When acting as teacher educators, they also have a dual role as mentors (or coaches) to trainee teachers and also their final assessor [11][12]. Logic dictates that there is potential for the teacher, teacher educator and assessor roles to conflict during the process of trainee assessment. As professionals, teacher educators have a duty to satisfy the different needs and requirements of young learners, new teachers and other stakeholders responsible for quality assurance or accountability. To do so they must enact a synthesis of potentially conflicting roles to ensure best outcomes for all. This theorisation suggests an underlying mechanism with the power to govern assessment as an event in the context of the studies [1] to [9]: conflicted role professional judgement. Fig. 1 demonstrates the relationship between this proposed mechanism and the phenomena demonstrated using a critical realism perspective. Zsargo and Palmer [25] considered factors involved in the conflicted roles of teachers acting as ITE mentors assessing trainees in primary schools in England and theorised a 'mentor assessment identity' (p79) that guided judgements. This resonates with the idea of the underlying psychological and social-psychological mechanism proposed. Conflicted role, professional judgement, based upon self-perceptions of status and professionalism would drive assessment decisions in this context and recognises the multiple roles of mentors as teachers and teacher educators and assessors.

The reflexive research journey described in Tynan [10] raised many new questions. Arising from the early research, it would be useful to know the impact in England of shorter on-line SKE programmes on outcomes for students and trainee teachers. Associated with this, what has been the impact of shorter on-line SKE programmes on student and trainee teacher perceptions and attitudes towards their ITE programmes?

The later research highlighted the need for further research into the impact of different assessment strategies on the design and conduct of ITE programmes. Further, what is the effect on teaching and learning in schools of describing teachers solely in terms of competencies whilst ignoring the impact of teaching environments and teacher attributes such as their self-knowledge and underpinning values [26]? Can assessment systems of professional learning effectively serve multiple purposes – particularly if accountability is one of them?

Finally, considering the underlying mechanism identified by this thesis, the next area for study would be the impact of role conflict on teacher educators practicing both as teachers and teacher educators with a mentoring role that includes assessment.

## REFERENCES

- [1] Inglis, M., Mallaburn, A., Tynan, R., Clays, K., & Jones, R.B., "Insights from a subject knowledge enhancement course for preparing new chemistry and physics teachers," *School Science Review*, vol. 94, no. 349, pp. 101-107, 2013
- [2] Tynan, R., Mallaburn, A., Jones, R.B. and Clays, C., "Subject knowledge enhancement (SKE) courses for creating new chemistry and physics teachers: do they work?" *School Science Review*, vol. 95, no. 353, pp. 85-94, 2014
- [3] Tynan, R., Jones, R.B., Mallaburn, A. & Clays, K., "Working towards evidence-based practice in science teaching and learning," *School Science Review*, vol. 97, no. 361, pp. 109-115, 2016
- [4] Tynan, R., Jones, R.B., Mallaburn, A. & Clays, K., "Subject knowledge enhancement courses for creating new chemistry and physics teachers: the students' perceptions," *School Science Review*, vol. 98, no. 363, pp. 109-114, 2016
- [5] Tynan, R. & Mallaburn, A., "Consistency counts – or does it?" *Teacher Education Advancement Network Journal*, vol. 9, no. 1, pp. 90-99, 2017
- [6] Tynan, R. & Jones, R.B., "Assessing trainee secondary teachers on school placement: Subject knowledge and overall teaching grades," *Teacher Education Advancement Network Journal*, vol. 10, no. 1, pp. 20-34, 2018
- [7] Tynan, R. and Jones R.B., "Can effect sizes give any clues to the way mentors ascribe numerical grades when assessing secondary trainee teachers against the Teachers' Standards in England?" *Teacher Education Advancement Network Journal*, vol. 11, no. 1, pp. 4-14, 2019
- [8] Tynan, R. and McLain, M., "Attitudes to assessing trainee teachers on school experience placement within a group involved in an initial teacher education partnership at an 11-16 academy: a Q-methodology approach," *Teacher Education Advancement Network Journal*, vol. 11, no. 4, pp. 3-20, 2019

- [9] Pratt, A. and Tynan, R., "The journey from reflection on practice to research informed practice: the contribution of MA practitioner research," *Teacher Education Advancement Network Journal*, vol. 11, no. 4, pp. 35-46, 2019
- [10] Tynan, R., *A critical evaluation of criteria-based assessment of subject knowledge and other competencies of teachers in training*. Doctoral thesis, Liverpool John Moores University. 2022
- [11] Department for Education, *Teachers' Standards: Guidance for School Leaders, School Staff and Governing Bodies*, 2011. Available at: [www.gov.uk/government/publications/teachers-standards](http://www.gov.uk/government/publications/teachers-standards)
- [12] OfSTED, *Initial teacher education inspection handbook*, Crown copyright. 2018
- [13] TDA, *Professional Standards for Teachers*, Training and Development Agency for Schools/gov.uk, 2007
- [14] Drake, P. and Heath, L., *Practitioner Research at Doctoral Level: Developing coherent research methodologies*, London and New York: Routledge, 2011
- [15] Morgan, D., *Integrating Qualitative and Quantitative Methods: A Pragmatic Approach*, SAGE Publishing Inc., 2017
- [16] Zachariadis, M., Scott, S. and Barrett, M., "Methodological implications of critical realism for mixed-methods research," *MIS Quarterly*, vol. 37, no. 3, pp. 855-879, 2013
- [17] Bhaskar, R., *A Realist Theory of Science*, London: Verso, 1997
- [18] Shulman, L. S., "Those who understand: knowledge growth in teaching," *Educational Researcher*, vol. 5, no. 2, pp. 4-14, 1986
- [19] Martin, S. and Cloke, C., Standards for the Award of Qualified Teacher Status: reflections on assessment implications, *Assessment and Evaluation in Higher Education*, vol. 25, no. 2, pp. 183–190, 2000
- [20] Hager, P. and Butler, J., Two models of educational assessment, *Assessment and Evaluation in Higher Education*, vol. 21, no. 4, pp. 367–378, 1996
- [21] Tummons, J., "Institutional ethnography and actor network theory: a framework for researching the assessment of trainee teachers," *Ethnography and Education*, vol. 5, no. 3, pp. 345-357, 2010
- [22] Downward, P. and Mearman, "A. Retroduction as mixed-methods triangulation in economic research: reorienting economics into social science," *Cambridge Journal of Economics*, Issue: 2006, pp. 1-23, 2006
- [23] Bygstad, B. and Munkvold, B. E., *In search of mechanisms. Conducting a critical realist data analysis, Proceedings of the International Conference on Information Systems, 7*, Association for Information Systems, 2011
- [24] Archer, M., Bhaskar, R., Collier, A., Lawson, T. and Norrie, A. *Critical Realism: Essential Readings*, London: Routledge, 1998
- [25] Zsargo, E. and Palmer, J., "Common understanding or 'hodgepodge'? The consistency and accuracy of school based mentors' assessment of trainee primary teachers in England", *Teacher Education Advancement Network Journal*, vol. 11, no. 2, pp. 72-81, 2019
- [26] Korthagen, F. "Inconvenient truths about teacher learning: towards professional development 3.0", *Teachers and Teaching*, vol. 23, no. 4, pp. 387-405, 2017