Chapter 5
The Social Administration of Mathematics Subject Knowledge Through Teacher Education

5.1 Introduction

Understandings of mathematical subject knowledge for teachers inevitably respond to changing environmental conditions. Specifically, school mathematics is a function of the administrative constraints prevailing in the given educational context. Such situations will be characterised by preferred styles of presentation, specified targets, etc. As we have seen in the previous chapter, teachers are typically obliged to follow curriculum guidance within such constraints in deciding how to teach or otherwise meet the customary practices in their place of work. Meanwhile, their understandings of themselves are a function of the demands that they perceive being made on them. What is expected of them in their given professional role? Student teachers and new teachers are especially susceptible to the guidance of others. They may not, however, be fully aware of how their actions are shaped by their identifications with the discursive landscape. How then might we make sense of the mathematics that takes place in the classroom when it is enacted, perhaps unreliably, through the teachers' mediation of external demands? This chapter addresses this question by considering some of the ways in which mathematics is discursively produced by Student teachers working towards meeting the demands of externally produced definitions of practice. A key assumption of the chapter is that mathematics as understood in mathematics education research cannot be understood separately to the way in which it is processed by teachers and students in the given situation. Mathematics is a function of its location and the way in which people are working mathematically in that location.

This chapter draws on material from the following publications:
Smith, K., Hodson, E. and Brown, T. (2013). The discursive production of classroom mathematics. *Mathematics Education Research Journal. 25*: 379–397. By kind permission.
Brown, T. (2017). The political shaping of teacher education in STEM areas. In J. Clandinin and J. Husu. *Sage international handbook of teacher education.* New York: Sage.

T. Brown, *A Contemporary Theory of Mathematics Education Research*,
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The chapter is referenced to a sequence of recent empirical studies of teacher education carried out by the author, reported in two books that were not specifically about mathematics education (Brown 2018; Brown et al. 2019). Some models of school-based teacher education in England were considered in terms of how they generated understandings of teaching and learning mathematics and some other subjects. Prescriptive policies prevalent in that country have resulted in ever-changing pressures on teachers to meet centralised criteria targeted on developing the practical skill needed to implement a detailed curriculum. This has led to some very specific interpretations of mathematics and its teaching. Teacher professional identity has been referenced to skill development within this frame and the wider assessment culture. The teacher's capacity to exercise professional autonomy has been shaped by these constraints. This scenario was discussed in detail in the context of primary mathematics education in an earlier book by Brown and McNamara (2011).

For nearly two decades now, student teachers in England have typically spent much of their training period in schools. An early government-initiated "employment-based" model of teacher education begun a decade ago and had student teachers located primarily in schools "learning from our best teachers" (DfE 2010, p. 23). In this development, student teachers who were more mature or highly qualified worked in a paid professional capacity from the outset of their "training". These newer models coexisted with the then mainstream established models where more time (but not much more time) was spent in university in line with government requirements for time spent in school. This chapter specifically discusses how student teachers participated in that employment-based model but references this discussion to wider conceptions of teacher education now prevalent within the country and beyond. The two recent books depict a more contemporary situation. The purpose of this discussion here for a wider mathematics education audience is to consider how conceptions of learning and teaching mathematics change through training being located primarily in schools. It is not being suggested that readers try this model at home. That is, the purpose of the chapter is to explore in this instance how mathematics is a function of the discursive environment in which it is encountered. The chapter investigates how student teachers identify with specific discursive framings of mathematics teaching pertaining to this model of training. It asks how school mathematics is understood, *empirically*, by student teachers following this route into teaching. These issues are contemplated through the eyes of university teacher educators who were obliged to conceptualise their professional contribution from within a rather marginalised role. From this perspective, the chapter provides a window on how teacher educators and student teachers variously conceptualised school mathematics and how these conceptualisations were influenced by multiple prescriptions, interventions and environmental constraints. It analyses the resultant conceptions of mathematics revealed by student teachers in their understanding of the challenges they faced.

This attention to a specific example, however, is directed at opening a more general discussion. That is, the chapter addresses the much wider question of how school subjects in any situation are a function of discursive parameters and how the

language being used formats activity in those subject areas. In the case to be discussed here, the way in which mathematics is administered in the specific pedagogical environment determines what mathematics is. Having been determined in this way, those conceptions of mathematics can police the practices that have been developed in the name of mathematics. Nevertheless, we shall consider how teachers can develop the capacity to engage critically with this discursive environment in their place of work and beyond through building reflective research within their practice.

5.2 The Discursive Shaping of Research in Mathematics Education

Earlier work on the theme of mathematics education and language often addressed how mathematical language is spoken or written in everyday life or more particularly within a classroom environment (e.g. Brown 1997, 2001; Morgan 1998; Pimm 1987). Later studies have taken a range of perspectives on how language filters or produces mathematical understanding. Barton (2008) showed how mathematical meanings are a function of the specific language or culture. Another New Zealand study looked at how computer media impact on the hermeneutic processing of mathematical ideas (Calder 2012; Calder and Brown 2010). Brown and Clarke (2013) conducted an international survey of how mathematical understanding is shaped by its institutional context. Much research has focused on how discursive formulations shape conceptions of classroom practice and of the people working within them. For example, professional teacher identities are a function of how teachers understand themselves fitting in (Black et al. 2009; Klein 2012; Walshaw 2010). Conversely, Nolan (2016) asked how prospective secondary mathematics teachers were subject to official pedagogical discourses embedded in classrooms. Walshaw and Brown (2012) conceive subjectivity in terms of participation. Walls (2009) and Llewellyn (2018) each focused on children's subjectivities. Discursive elements also underpin conceptions of identity centred on "legitimate peripheral participation" in "communities of practice", derived from the work of Lave and Wenger (1991). For example, Solomon (1998) examines mathematics as a community of practice and the teacher's role as epistemological authority in inducting pupils into such practices. Goos (2005) provided a sociocultural analysis of the development of pre-service and beginning teachers' pedagogical identities as users of technology. Jaworski (2019) incorporates the notion community of practice into her discussion of inquiry-based practice in university mathematics teaching development. Watson and Winbourne (2008) edited a collection of work on this theme. Brown and McNamara (2011) considered student teachers as *subjects* in accounts of their own practices and how policy discourses were articulated through these accounts. The authors sought to understand how mathematics, primary pupils and teachers were shaped by policy initiatives and how they were included in the world depicted by the policy apparatus. For example, the government, rather than

mathematicians or teachers, determined the constitution of mathematics within a legislated curriculum. Pedagogical discourses have been shown to govern the choice of teaching devices, which in turn condition mathematical learning. For example, mathematical texts conceal conceptions of the pupils and teachers for whom they are created. Dowling (1998) showed how tasks designed for "less able" students in a teaching scheme were different to those given to "more able" peers. For any given topic, the emphasis in instruction varied between the texts, resulting in exclusion for the "less able" from the real business of more abstract mathematical learning. Instead, they were caught in the discourse of "less able" mathematics characterised with associated styles of illustration, questioning and assumed perspectives. The activity materialised the children as "less able" as they were doing the things deemed suitable for "less able" children. Meanwhile, Cooper and Dunne (1999) showed how "realistically" contextualised test items designed for greater accessibility (and with a certain sort of pupil in mind) in fact produce greater class and gender differentiation. Working class children were less able to spot the "game" of school. Wagner (2012) considered how students are constructed in school texts but also how the texts replicate teacher positioning and voice.

5.3 International Changes in Teacher Education

Many recent policy initiatives in teacher education have been consequential to the recasting of mathematics as a subject conceived as an aid to economic development, rather than, say, social welfare (Atkinson 2018) or epistemic emotions (Muis et al. 2015). A review of research in mathematics education covering the last two decades identified two prominent lines of research, one more theoretical concerned with identifying and codifying practices of teaching in general and the other more specifically practice-based pedagogies (Charalambous and Delaney 2019). There have been at least two very different state-led responses to changing teacher preparation designed to "improve" achievement. In some countries teacher education increasingly comprises a vocational employment-based model of training located primarily in schools. England is a prominent example (Brown 2018), with similar models being introduced in New Zealand and the United States. This approach is in sharp contrast to models followed in continental Europe, where student teachers spend much more time in university. "Almost all [European] countries introduced reforms in initial primary teacher education after the initiation of the Bologna Process (1999)" (ENTEP: Dimitropoulos, online), similarly for secondary subject teachers and half of pre-primary sectors of education. The model was motivated by sharing good practices and creating mutual trust in the teaching qualifications awarded across member states with a view to enabling shared accreditation and greater mobility across European countries. For example, in Spain, all primary teachers study at university for 4 years, including short periods in school, or 5 years in Finland where a master's degree is required for secondary teachers. The lengthy academic training often conducted by people with relatively little experience of

schools, however, can seem distant from the more practical challenges ahead. In Germany, for example, teachers need to get through 4–5 years prior to being admitted to the school practicum phase of 18 months to 2 years. Yet this investment of time in university retains wide support across European nations. As one German primary mathematics teacher educator put it, "The university is a space to question. What for? Why? How could it be different? Rather than being in a state of permanent emergency (as in school-based work) … A teacher is not just a craftsman". This intensification of the academic component is a further distancing from practical concerns for student teachers in those countries (Hudson and Zgaga 2008). Once qualified, however, following an extended school placement after the academic component has been completed, rather more professional autonomy can be asserted by classroom teachers in Germany in making local decisions and setting the curriculums than in the policy-dominant approach in England.

These two approaches, school-based and university-based, reveal radically different conceptions of how teacher quality might be improved in the name of international competitiveness. In the first, teacher education has been wrested from its traditional home within the academy where universities play a support role to what has become "school-led" training where government funds for teacher education have been diverted to schools. Teacher professional identity has been referenced to skill development within this frame and the wider assessment culture. The second model, meanwhile, is similarly concerned with "raising teacher quality … (but specifically) in a way which responds to the challenges of lifelong learning in a knowledge based society" (Dimitropoulos, Ibid). It is characterised by reinvigorated faith in academic study and promotion of individual teachers, where a pedagogical dimension is included from the outset of undergraduate studies, but with relatively brief periods spent in school.

5.4 Changes to Mathematics Teacher Education in England

University mathematics teacher education in England has been redefined through new priorities determined by, among other things, budgetary constraint, problems with teacher supply (Rowland and Ruthven 2011; Williams 2008) and perceived school performance as compared with other countries (DfE 2010). The teacher education function has been redistributed to include professional and subject mentors within the school setting (cf. Jones and Straker 2006). These mentors are themselves classroom teachers with their own classes to teach. This arrangement is thought to provide immediate opportunity for student teachers to develop classroom skills (DfE 2010). The student teachers spend much less time at university with tutors, where they have some limited scope to reflect on their practice and to consider educational theory. Some research, for example, has focused on the importance of teacher reflection in university settings and providing the resources for teachers to creatively generate mathematics in productive classroom exchanges (e.g. Brown and Coles 2012). Space for such activity has been greatly reduced.

Hitherto, little research has been carried out on how increased school-based training supports the mathematical aspects of teacher education and how they are conceptualised, prioritised and enacted, so that further interventions could be better informed. We know little about how new teachers understand mathematics following training across school and university settings and how student teachers conceptualise their own teaching of mathematics in schools.

My own study provides an up-to-date overview of the current state of affairs (Brown 2018). Teacher education provision has become largely dictated by market conditions with some institutions better able to retain control over the content of their courses. But within many courses, something of the order of 30 days[1] is spent at a university during a 1-year postgraduate "training" course, where the chief university responsibility is oversight and accreditation for a process primarily administered by schools. University teacher educators and school mentors, however, may have very different priorities for their roles in teacher training, such as those relating to how subject knowledge is understood, meeting the demands of testing, effectively using materials, learning a range of pedagogical strategies or building personal involvement in the subject. There are different ways of understanding the disciplinary knowledge that teachers need. Schools may prioritise the immediacy of classroom practice or following centralised guidance; some (but not all) universities may prioritise the more intellectually based elements such as pedagogical subject knowledge, building professional autonomy or meeting the demands of formal qualification (Hobson et al. 2009; Hodson et al. 2010). Hitherto, relatively little research has been carried out on how increased school-based training supports the pedagogical subject knowledge aspects of teacher education and how they are conceptualised, prioritised and enacted, so that further interventions could be better informed. Meanwhile, the tendency in some countries to take charge of school practices through a multitude of regulatory devices, such as through frequent testing, prescriptive curriculum and school inspection (Askew et al. 2010; Brown 2011), has resulted in mathematics subject knowledge becoming understood through a culture of performativity (Pampaka et al. 2012). This insistence on following centralised "masterised" documents (doing what they *should* be doing) has deflected attention from knowing how the redistribution of teacher education has resulted in student teachers *actually* understanding and meeting the professional challenges they face. These changing policies affect the challenges faced by teacher educators and "school mentors" and in turn influence student teachers' conceptions of subject knowledge and its teaching. The policies also impact on the identity of the student teachers. Are they student teachers engaged in an educative process developing the ability to lead curriculum initiatives as they later become professional teachers? Or

[1] As a mathematics educator, one might like to estimate how many hours within these 30 days in university are spent on specifically mathematical themes for (a) primary trainees and (b) secondary maths trainees. The answer will be revealed on the next page. The government insists on a certain number of days in school during the year leaving relatively little space for universities to expand their provision. Meanwhile, it also insists on some of the time in university being spent on more generic themes such as safeguarding and British values.

are the trainees fulfilling the requirements of training, working to the current models of school practice, as specified by the government? That is, are teachers curriculum makers or curriculum implementers (Clandinin and Connelly 1992; Schwab 1983)? One is moved to suggest that school-based trainees are being prepared primarily for the latter and will take their chances in being carried along in the future rather than having been prepared directly to address changes in professional circumstances.

Such lower-cost school-based teacher education may appeal to an increasing number of governments in building and influencing the practice of their teaching forces. But three questions immediately present themselves: Does it provide a viable alternative to university-based teacher education? Does it alter the composition of the pedagogical subject knowledge it seeks to support? Is it low cost or at least good value for money? The impact on different school subjects through these contrasting approaches relates to the way in which conceptions of the subjects derive from where understandings of them are developed, whether in schools or in universities. For those in schools, little more may be done than enable teachers to work through commercial schemes as implementers of curriculum, much appreciated by those seeking to profit through the provision of such apparatus. For those following university-intensive courses, relatively low attention is given to the practical school aspects during the university element. In some countries, the approach has provoked some concern through its lack of connection to school practice.

5.5 An Empirical Study

I conducted empirical research in connection to recent changes in teacher education models. This research included a focus on a 1-year employment-based teacher education programme linked to my university but following the practices of a regional teacher education network comprising universities and associated schools (Brown 2018). The programme offered two routes that have transformed markedly during the course of the research, as a result of the models now being adopted in most schools. One route was for primary student teachers planning to teach mathematics as part of the broader primary curriculum to children aged 5–11. These student teachers would typically have studied mathematics at school until the age of 16 and later completed a university degree in any subject. All student teachers are required to pass a mathematics skills test administered by a government agency. The other route was for secondary student teachers specialising in teaching mathematics to students aged 11–18. These students would have completed a mathematically oriented degree. In the first few years of the research, in each of the two routes, the student teachers spend a total of 40 hours in university (e.g. a 5-hour day once a month for 8 months). The primary school student teachers spend about 6 hours of that total on the topic of teaching mathematics. The secondary school student teachers spend about 25 hours on the same topic. Yes those are annual totals on a 1-year course! For the rest of the programme, students work in paid positions full time in schools for the school year. The student teachers involved typically would have

spent some time working in other jobs prior to teaching. They often chose the employment-based model as an alternative to university study. Many have expressed a preference for "wanting to learn on the job and receive a salary as they train" (DfE 2010, p. 23).

Our practitioner research on the programme, where I worked alongside the regular course teams, started some 10 years ago with an interest in the role of educational theory in this model of training. Theory had been part of university-based training in the past. Did it still exist as part of employment-based training? If so, what did it look like? Where was it located? In the early stages of the course, "theory" was often seen by student teachers as the stuff that was written in books and thus a bit distant from the immediacy of practice. Their priority was to get on with the job of teaching. Early experience in the first placement school was often very positive, but a number of the student teachers started to find working with just one mentor rather restrictive (see Jones and Straker 2006).

All student teachers moved to a second school 3 months into the course where they found that expectations and practices could be rather different. A new role began to emerge for the university component as the course progressed. Rather than focusing so much on what worked in a specific placement *school*, the issue was what worked for students more generally in *schools*. That is, the university sessions became redefined as venues where more generic teacher knowledge was created. Theory became the creation of analytical writing by the student teachers themselves, to support their practice across different schools. The university sessions initiated and responded to the student teachers' own classroom-based research as part of their getting to know how they might successfully work within a school classroom. They became a place in which their classroom practice could be critically evaluated against broader educational concerns.

For 4 successive academic years, on successive 1-year courses, the research team collected data through practitioner research methods. The longitudinal data collected within each year comprised examples of student reflections from regular recordings of university sessions, interviews, writing integral to course participation, assignments, correspondence between students and to tutors, reflective writing by the course team and interviews with students and with other staff responsible for mathematical content. Two extended interviews were held with tutors responsible for the mathematics element. Each session on each course included an element where progress was reviewed in terms of the changing ways in which the student teachers understood their professional challenge. These reviews incorporated regular reappraisals by the students of their own earlier writing as evidence of how they were changing.

Methodologically, a specific conception of "actor" was pursued within an action research model (Brown and Jones 2001). Research comprised active participation in wider cultural adjustments to new ways of being, in this case the move to different understandings of theory in new models of teacher education. A contemporary theory of the subject was introduced where the individual identifies with broader moves to new circumstances (e.g. Althusser 1971). These identifications produced changes in conceptions of the researched landscape and of the individual carrying out the

research. "Knowledge" here relates to a specific state of knowing that prevails in given circumstances. In that sense it is not universal. Yet, the imperative would be to constantly revise the narratives that guide our actions. Through living a story and becoming aware of its limitations, participants endeavoured to change to a new story. Or rather, endeavoured to keep the story of who "we" are ongoing and alive, as "we" adjust to ever-new conditions. Fail, but learn to fail better!

The third and fourth years of the data collection further included a specific focus on mathematics seen as a specific instance of our work on theory. In addition to individual interviews at later stages of the course in both years, nine secondary student teachers took part in a group meeting chaired by their university mathematics tutor, and eight primary students shared an extended discussion with the three tutors, which included the two course managers. These discussions were designed to review where the student teachers were up to in terms of their development as mathematics teachers on the programme and how the schools and the university had contributed variously to this. Analysis focused on how their understandings had changed. This involved sifting the interview transcripts to find instances of the student teachers' analytical connections to their teaching situations, such as evidence of their building an understanding what could work in schools generally rather than just in their current school placement. As we shall see, the earlier parts of the study reported on such shifts and specifically on how students looked back on their earlier reflections on theory. This was less possible in any detail with the mathematics focus as, given the course structure, the students were only in university for 8–10 days during their year's course with many demands being placed on their time. In the later interviews, the intention was to capture conceptions of classroom mathematics, empirically, as it was being understood by the students at later stages of the course but also through the recorded reflections of university staff either managing or teaching the course generally or specifically the mathematical elements. That is, echoing our work on theory, the research sought to avoid supposing that there was a correct version of school mathematics to which the teachers were supposed to subscribe. This chapter is guided by the more open research question: *How do student teachers discursively produce school mathematics?* In posing this question, there was an assumption that the student teachers could work on the ways in which they conceptualised mathematics towards revising these conceptualisations. In addition to data providing insight for the research team, the student teachers themselves looked at past writing to consider how their conceptualisations had changed. By better understanding their own past conceptions of mathematics, they would be able to move forwards.

Teachers then are *subject* to a specific models of teacher education, and our task here is to better understand how the assumptions implicit to the given model are articulated through the teacher accounts of their practices. This subjection restricts but also empowers the student teachers concerned. Individual and group interview data were analysed to assess the sources of influence or power referred to by the various parties and documents and cultural models governing conceptions of practice: inspection procedures, the school apparatus, the curriculum, the former governmental *Numeracy Framework* (or new school schemes or textbook choices),

teacher education models, professional development initiatives, the parents, the children, etc. Transcripts of interviews and student work were examined in relation to how identifications with mathematics were understood (Bibby 2010; Solomon 2008). This analysis looked for evidence of how the mathematics curriculum was being progressively reconceptualised and re-characterised, in response to regulative apparatus (Brown, T. 2011), in relation to the wider curriculum (Alexander 1990) and to wider public conceptions of mathematics (e.g. Chap Sam 2012). The analysis sought to pinpoint how school-based training supported teacher subject knowledge. It further considered how university based teacher educators conceptualised changes to their earlier ambitions consequential to greatly reduced contact with the students.

5.6 General Findings

I now turn to how training for secondary and primary education produces the conceptions of school mathematics that govern teacher practice. The detailed government-produced "non-statutory" assessment framework for how the curriculum was to be covered had now been abandoned. Yet many schools still had schemes of work closely tailored to this framework. The schemes were typically staged according to the levels in the main curriculum. The student teachers, therefore, found themselves in schools where the curriculum structure was ever present in the shaping of classroom activity and of mathematics. Many student teachers felt coerced into teaching to the textbook or scheme of work. One secondary school mathematics student teacher described what she perceived as the relentless overseeing of the content and methodology of her teaching by her head of department: "The other day I was doing something a bit different and then he's going, 'You can't do the end of chapter tests on that because you haven't done exercise 5b!' I feel as though he wants me to do every single question in the textbook". Another extract from a discussion held with secondary school student mathematics teachers suggests that some freedom to apply the teacher's own ideas could be derived from following the school's scheme of work. However, this had to be assessed using the government Assessing Pupils' Progress (APP) framework, which the school followed: "I will plan my lesson, I use the scheme of work and I do this by myself. I don't have anyone to tell me what to do—no one checks that. There's no textbook to follow. I just teach my lessons so that they can do that, can use these words. At the end of topic, they have to do the APP".

Findings from the primary teachers demonstrated a similar exertion of school influence on what counted in mathematics. One student teacher, for example, in reflecting on a question posed about how he would decide to teach mathematics had this to say: "We have a policy, certainly for the four rules … I was doing ratio … and they were coming up with methods and I was looking at the class teacher asking, 'Shall we go down this route?'"

In English primary schools, mathematics is most usually taught with much whole class input, where the teacher must react to children's responses. This can be a risky business for student teachers when under the watchful eye of their mentors. In these situations, it was most important for student teachers to be seen to use the "correct" method. One student teacher described how moving from whole class teaching to individual activity, where children could experiment on their own ways of reaching solutions to mathematical problems, enabled him to "really see what the children could do". Ironically, he still needed to check the validity of the method used by a child with his mentor. She confirmed, with some hesitation due to the apparent deviation of the method from the more typical school approach, that if the children "got there, we'd probably support that [method]".

In short, we found that many student teachers learn to teach mathematics by participating in current school practices that closely follow the curriculum and the demands of national tests. Furthermore, schools and government agencies set criteria as to how this engagement was validated. Periodic national tests influenced the forms through which mathematical ideas were encountered. The consequence of these framings is that mathematics encountered in schools has a tendency to focus on those areas relating to the tests.

A significant aspect of the change in student teachers' understanding of mathematics related to how university mathematics teacher educators conceptualised their roles. They had been accustomed to spending a significant amount of time with student teachers in the university. Later, as increasing responsibility for training was relocated to schools, the content that had been previously covered in the university was condensed. The number of topics being covered was reduced, and those that remained were dealt with at a brisker pace. At first we, as university teacher educators, found this new arrangement quite stressful, compressed as our previous role now was into an increasingly small amount of time with the student teachers. Ironically, however, student teachers, thrust as they were into the hurly burly of school classroom activity, found the university sessions altogether more relaxing. Close pursuit of the curriculum in school framed their conceptions of mathematics, whilst university sessions provided reflective space. For primary school student teachers, the 6 hours at university early on in the course that provided a guide to the curriculum that they would be following were soon forgotten. Later in the course, mathematics was discussed as just one of the subjects that they were responsible for teaching. For secondary school student teachers, the 25 hours largely tackled issues relating to their teaching in schools.[2]

The orientation of the university component of the programme had shifted from one of input to one of response. Its role in supporting the student teachers had

[2] The time spent in university varied greatly between universities and had a lot to do with the market position of the specific university. Universities who needed to recruit more students were much more ready to abide by school demands to have students in school more of the time and to follow the school's preferences in terms of university input. Universities in stronger market positions were better able to insist on their preferred form of input but still within government limits that required most time be spent in schools.

relatively little to do with introducing broader issues in mathematics education, research in the field, subject knowledge being rethought as pedagogical content knowledge and so forth. More experienced university-based mathematics teacher educators found themselves subject to a very different conception of their practice to the one to which they had become accustomed earlier in their careers. The traditional content of mathematics teacher education, insofar as it was still addressed, was distributed across school and university settings. Many of the earlier ambitions advocated for teacher education (e.g. Askew 2008; Rowland 2012) or for subject knowledge (e.g. Ball et al. 2005; Davis and Simmt 2006) had been deleted from the list of training priorities. Askew and Venkat (2019) have carried out a recent review. If mathematics education research still influenced the practices of the student teachers, then the route through which this influence was achieved is not entirely apparent. It is also unclear how, within this model, one would seek to influence practice through mathematics education research. To whom would research about classroom practice be addressed and how would knowledge derived from this research filter into teacher knowledge?

5.7 Student Teacher Experience of School Mathematics: Some Data

This section provides data on the mathematical aspects of the teacher education process. Secondary and primary student teachers are looked at in turn with a view to highlighting how mathematics and its teaching are variously framed within the conceptions of their own professional practice in this area. In both cases the research strategies doubled as attempts to encourage the students to describe the worlds of their teaching, which so often would have been relatively private. The descriptions were seen in terms of making sense of their practice towards transforming that practice.

5.7.1 Secondary Student Mathematics Teachers and University Tutors

Issues relating to the university element were initially seen as peripheral ("*Reflective Account Two*? Whatever! It'll get done") or disdain ("It's paperwork…I hate X"). The dominant theme in discussions was the immediacy of practice ("The teaching's going fine - if I could just focus on that, it would be ok!"). It becomes clear, however, that the students feel that the teaching is not always "fine". In significant ways, it is not fine and the discussions sought to dig deeper.

There was much talk about the vagaries of the assessment of the mathematics curriculum in relation to the performance of those taught. It is now increasingly common for those pupils taking public 16+ examinations to be entered early.

Obtaining a prized pass at grade C[3] at this level was seen by some student teachers as introducing significant problems in subsequent pupil motivation and knowledge levels in the remainder of compulsory schooling in the subject:

> I've got the most bizarre class, a top set [16+] who have all passed [at C and above] and who've all got a different history. … [They] don't want to pay any attention at all to what's going on unless it's directly relevant to them. The theory is that they are an improvement class, trying to better their grade, so it's been really tough. I think it's a natural consequence of early entry and promising them all if they pass early, then they don't have to worry about maths anymore. Some of them have done it … purely on common sense and ability, in my view. They've turned up, done no work and got a C on the paper because it's pretty easy - don't know any of the higher [level] content [included within the exam] and don't want to know it. Others have managed a B or an A … and covered a lot of it – got one or two gaps in order to improve. Deciding what strategy to do with them has been really tough. You can't do thirty different lessons can you?

Attempts by a university mathematics tutor to explain pupil behaviour as symptomatic of an assessment system driven by performance, rather than the intrinsic worth of learning, were not, at first, readily taken up by the students. That some pupils were differently motivated was acknowledged, however. The students themselves appeared to reduce the level of challenge that they faced personally in mathematics. One saw it as a need to "going back and remembering things", to reaching a solution to a pupil's (and their) immediate problem, rather than any inherent lack of understanding about teaching and learning on their part and a need to develop this. In arriving at a "quick fix" to the challenge faced in their learning, and nothing more, the students' behaviour seemed to mirror the behaviour they witnessed in their own pupils:

> 1/3rd into 1/5ths? I don't understand it numerically - I *can* do it.

> I'm challenged …whenever I teach [post 16+]. I'm always there and they're going, 'So is this right?' and I'm like, 'Ermmm - I'll just get a bit of paper'. But I try and do them beforehand, if I've got time, you know, work out all the answers myself and then I've got my work and I can go, 'Hang on a minute. Yeah, that's right'.

> I think it's a question of refreshing your memory sometimes. I've got histograms tomorrow and I think, 'How do these work?' And you just go through and … I remember.
> I find the [statistics] hard. When I was doing the [16+] stats, I thought, 'I'm going to have to teach myself how to do this.'

> [Vectors]…they're *my* nemesis!

[3] Grade C is widely recognised as the pass grade in national 16+ examinations. Occasional footnotes will act as a guide to time- and context-specific terminology, but the point being made is that it is very complex to the extent that it rarely achieves substantial meaning. An earlier version of this chapter appeared in an Australian journal where demands for clarity were hard to meet in the straightforward way that might have been hoped for. In an earlier study (Brown and McNamara 2011), we interviewed student teachers over 4 successive years of a teacher training course where students in each year were asked the question "What is mathematics?" It was intriguing that students in successive years gave answers in which the mathematical ideas were cladded in ever denser locally specific administrative descriptions.

A second area of difficulty for the students related to a pragmatic and superficial approach of getting the mathematics lesson done, rather than teaching for learning. The lesson was easier when explicit teaching did not have to take place:

> I find it harder at the lower end…bottom set Yr 7 (11+). How do I know how to write pounds and pence…so much of it seems instinctive…I find that end more difficult. You can take it [understanding] for granted [with the top sets]. [The bottom sets] question it more – the top sets are just in kind of, in the mode of, we learn the method and do things. We do it for the exam, like little robots - quite happy. Whereas the bottom sets can't do it that way. They want to know why it is and they don't understand what's going on and they're mixing up different things they can remember. Some [pupils] just understand it without you delving into it. Some [pupils] discover it for themselves …and some don't and they're the ones who get it wrong and that's why they don't get it. Even if you try to drill them, because they don't understand it, they're not going to remember it…what about the ones who've never discovered it? We teach those that already understand it and knew it and they practice it, and they do well. And I think my challenge is how to move some [pupils] on who didn't understand it first time, who haven't got their head around it. How do you move them on?

Some of the student teachers recalled helpful materials issued by the university, which delved into such topics as pupil misconceptions, strategy games and "scripted lessons". However, one of them talked of being "swamped by other (training) agendas" as an excuse for not referring to the materials as much as she would have liked. Now spurred to "get underneath what the maths is about", during a group interview, a tutor asked some students how they decided what mathematics they would teach and how they would teach it. In responding, the students became very animated. The slavish adherence to textbooks was contrasted with the supposed liberty of following a scheme of work. There was little to support them in either in their quest to teach mathematics in ways that might encourage interest and understanding:

> At my school, it's just a textbook basically you're working through the textbook and do X number of chapters per half term. My head of department is really hung up on it. … Literally you follow page after page …and you just did it in the order of the textbook … These are our schemes of work written up by the head of department for Yr 7 (11+). It tells us what topic we are doing, when …what they should be doing, what are the key words. We sign up to an APP [*Assessing Pupils' Progress*] programme,[4] which we can use if we want to … All our kids will start a lesson with this. They'll identify stuff they can already do …what they have to do to get to [National Curriculum] level 5.[5] I will plan my lesson, I use the scheme of work and I do this by myself. I don't have anyone to tell me what to do - no one checks that. There's no textbook to follow. I just teach my lessons so that they can do that, can use these words. At the end of topic, they have to do the APP at the end of that.

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[4] *Assessing Pupils' Progress* (APP), administered by the government's *Qualifications and Curriculum Development Agency*, has been developed for optional use in schools in England and Wales to enable teachers to assess pupils' work consistently across both the secondary and primary National Curriculum. Many schools have abandoned this scheme as a result of its excessive demands.

[5] Pupils would start their primary schooling at level 1 and transfer to secondary school at 11+ where the average level would be 4 but where pupils would be spread over a range typically between levels 3 and 6. Formal tests take place for children aged 7+ and 10+ where the later test results are published. There are informal tests at the end of each primary school year referenced to National Curriculum levels.

5.7.2 *Primary Mathematics Student Teachers and University Tutors*

Towards the close of a group interview, some primary student teachers were prompted about the extent to which assessment was an issue in their development as teachers. Unlike their secondary peers, they had neither introduced nor, as we are to see perhaps, spoken about a dilemma concerning performativity in tests and external assessments, at least not on the surface. Some more persistent primary voices showed, however, their developing sense of skill in assessment practice and the multiple filters through which it needed to be understood:

> I find assessment quite difficult sometimes … For example, if I'm doing "direction" with the lower ability [pupils] that might be my [National Curriculum level] 2bs or 2cs. They just need to know a quarter turn and a half turn, whereas the higher ability need to know quarter, half-turns and three-quarter turns as well as clockwise and anticlockwise. … Sometimes I'll come to the assessment sheet and there'll be nothing in there for whatever it might be and that's when I get flummoxed with it… Am I doing the right thing here? … Sometimes you won't find it … It just won't be there … I never really thought that in first half of the year. I just was differentiating because I knew 'that was harder'.

At the group meeting, the primary student teachers were pressed directly about whether performance identified in the secondary discussion was indeed an issue for them. About a third of the group talked about overhearing the Year 6 (10+) colleagues in conversation about things "coming up on the test". Tests were held for pupils at the end of their primary schooling. Some felt that assessment was much more relaxed for the learners in a primary setting with no real "pushing" of performance. Seven year olds often remained unaware of the interim tests that they completed. Others felt that the extent of accountability was dependent on the ethos of the specific school. In one school, it was normal to maximise levels of performance, "as soon as a piece of work was finished, wham, it was levelled" [according to National Curriculum level]. It was enough to maintain a standard in a second school. Most student teachers recognised a key difference between their own experiences of assessment and that of the secondary student teachers. For a higher proportion of primary student teachers, the presence of National Curriculum levels was a continual process, formative rather than summative, as was the case for most secondary student teachers with their focus on tests and exams. The primary students agreed that this led to an ongoing pressure to monitor progress and not simply react at the end of the year. Nevertheless, as the discussion continued, it gradually became clear that these students were developing an awareness of the spectre of accountability haunting their teaching. Mention was made of the "expected 2 sub-levels of progress" (e.g. moving from National Curriculum Level 2c to 2a) learners were expected to make in the year and an awareness that if this was not the case, "you're (the student) going to be questioned". The students voiced their growing concerns about perceived lack of progress, "why is this cohort not scoring is constantly in your mind" others spoke of the impact of children being inaccurately assessed by colleagues, claiming, "it'll look as though I've taken them backwards".

Interestingly, one primary student teacher wanted to address children's understanding of concepts and distanced himself from governmental expectations graded as successive "points", which he saw as unattainable for children in his setting. This extract is revelatory of just how immersed student teachers become immersed in the regulative discourses that define their practice:

> They're expected to get Point 9[6] by the end of [4+]. We have kids who are on Point 2 or 1. They're not going to get to a Point 9 and if we have two or three children on Point 9 at the end of the year then that's average. … We have interventions … in place for the highers [higher ability pupils] and the middles and the lowers …There's only so many of us…90 kids and three teachers … It's often the Teaching Assistants[7] who deliver the interventions and they often haven't had the training… It is in our interest to raise our understanding and keep this in mind but I almost think it's an impossible job, impossible to get to expectations… If [government inspectors come, they are] not interested in why. They wouldn't take that into account.

Reflecting on the primary student teachers' discussion, one of the tutors made the following supporting observation:

> They are not making the connection between the children's very closely targeted learning and the assessment processes that are informing and driving this quest. Levels and targets have just become part of their professional dialogue. They are not asking what makes a child [National Curriculum] Level 2a and how the teacher knows that it is reasonable for that learner to have progressed to Level 2c by the end of the year. They operate currently by planning lessons that allow children to progress with their individual targets without knowing clearly where these came from or where they go to, just that's what they are required to do. So, like the goldfish in the bowl being unaware of the water, they are unaware of the assessment driven process. It just is.

That is, the student teachers are not always aware of how the regulative discourses were *shaping* their practices. As with their secondary peers, however, primary students were very aware of the policies and associated apparatus *validating* their practice. This was more vivid when the student teachers talked about applying the teaching methods preferred by the school or those featured in the *Framework*, such as in following calculation methods different to those encountered by the students in their own schooling:

> Putting myself in the place of the child is difficult. … The way that I would work it out is slightly different. … I am having to constantly address my own way of dealing with these problems. We have a policy, certainly for the four rules [of arithmetic].

> I was doing ratio… and they were coming up with methods and I was looking at the class teacher asking, 'shall we go down this route?'

Clearly some students felt constrained about following the children's line of enquiry for fear of wasting time, or far worse, confusing learners by moving away from agreed models. However, mathematics was obviously a subject where

[6] This refers to an assessment tool used with children aged from 3 to 5 years. It is pretty meaningless to this author as well!

[7] Teaching Assistants are commonly employed in English schools alongside the main classroom teacher.

they had to actively stand at the front of the class and teach, rather than simply respond to students' individual work:

> That would be my main teaching I'd say here's one method of long division or accounting method, here's one way of doing it, did everyone get the same answer did anyone get it in a different way.

> I've taught [primary maths] and never seen children working out of books and teachers responding. There's an oral starter then shared input, paired or group work then independent work. And it's that shared input is the essential bit for you … to see the differentiation in the class if it's working or if someone needs to move group … Luckily in the first term I was in the Maths co-ordinator's[8] class. She would use three different types of input… to meet the needs of different learners… It was amazing to watch, very hard to do.

Some students, however, did describe points where children were deemed to have reached a point where they could choose their own mathematical processes in an assessment activity where they were told "If you want to use the number line … use which methods you want to … there were no restrictions … which really helped me to see what the children could do". There was an emphasis on the *how* of teaching in each phase. The school scheme was a key part of this. There was, however, room for flexibility depending on the needs of learners, teaching and learning policy. Calculation and method played much larger roles in the regulation of primary students' working practice.

5.8 Discussion of Data

The above descriptions give some insight into the varied ways in which the student teachers map out the territory of their practice. How do they talk about the world that they inhabit? Which points of reference are mentioned most? How are those points of reference probed within the research orientation of the course? The scene depicted is dominated by an ever-present culture of assessment. The teaching of secondary students was a step-by-step targeting of 16+ ambitions. Primary students followed textbooks and schemes where the assessment levels were built into the "goldfish bowl" of their practice. I have spared the international reader much of the frequently changing jargon, of "levels", "key stages" and "points" that dominated student accounts to avoid those details from distracting attention away from our more general concerns. Yet the terminology did much to partition mathematics according to discrete learning objectives and local discursive preferences. Mathematics is defined by alignment with a criterion-referenced listing shaped by the demands of this assessment. Meanwhile, the university element had become quite restrictive in its very brevity, very much so in some universities. Familiar features in many models of mathematics teacher education had become marginalised through demands for compliance with current practices in schools. In the reality of

[8] Mathematics coordinators are teachers in primary schools overseeing mathematics teaching throughout the school.

the training experience for many teachers in England, explicit space for developing the intellectual dimensions of practice has become much reduced. The teacher's conception of his or her own professional identity is tightly referenced to the regulative structure set out in policy documents. Success in teaching her was referenced to the then current model in schools whose achievements had so dissatisfied the government prior to the reforms.

To summarise key issues raised in the data, one might highlight:

5.8.1 Performance-Driven Assessment Affects the Nature of Subject Knowledge

School-based practice has been driven by the need to meet assessment requirements. Trainee teachers are given fewer opportunities to conceptualise other modes of practice. By emphasising the elements that are more likely to be tested, subject knowledge may be diminished. Current conceptions of school mathematics and science, for example, are supported but only in a narrow way if judged primarily by their ease of assessment. Less emphasis is placed on pupils being able to adjust to future demands. This emphasis drives compliance to external demands in which student teachers and their pupils play a smaller part in the construction of the subjects. There is a culture of "getting it done" or "giving the method" rather than teaching for understanding: "Does that make sense… is that realistic?" An occasional decision to "step back" from the formal in the name of building understanding, "light bulbs were going on everywhere", was an exception rather than the norm in the anecdotal material. The thrust in English schools over recent years has been towards supporting skills-based agenda. For example, as mentioned, following a governmental-led "back to basics" campaign, England improved its position in mathematics on TIMSS in 2007 whilst dropping in its rankings on more problem-focused measures within PISA in 2006. This led to new complaints about England dropping its standards with selective reporting by both newspapers and the government. Being a teacher is understood in terms of shaping subject knowledge in line with curriculum specification to meet the required forms to suit the given class composition. This external specification can lead to some issues of continuity in education in England where successive phases (e.g. exams at 16+, 18+ and university degree level mathematics, in England) each work to a different discursive frame as to how teachers, students and mathematics are each understood.

5.8.2 School-Based Training Can Nurture Narrow Administrative Conceptions of Teaching

For student teachers on school-based routes, being initiated into teaching by way of their placement schools' insistence on following specific textbooks "page after page" in some instances diverted student teachers from trying out ideas introduced

in university sessions. Taking the case of mathematics: This narrow approach is perhaps unsurprising for primary students (those teaching ages 5–11) who have usually not gone beyond their 16+ examinations in mathematics or science. This narrow approach is perhaps unsurprising for primary students (those teaching ages 5–11) who have usually not gone beyond their 16+ examinations in mathematics or science. Yet even for secondary teachers (those teaching ages 11–16) with formal mathematics backgrounds, there was some trepidation in relation to the mathematical demands of teaching. Many student teachers in mathematics and science now feel the need to follow special courses to enhance their subject content knowledge in advance of commencing formal teacher education.

Yet these occasionally negative assessments of school-based training limiting the development of subject knowledge are countered by some additional pedagogical factors relating to a stronger school role in teacher education that conferred some benefit.

5.8.3 Practice-Centred Learning Can Improve Participation in Schools

Some school practitioners see virtue in employment-based models because of their immediate concern with the demands of the classroom. Mathematics is a function of its location. A mentor responsible for overseeing such students in a demanding inner city location spoke of how the school's greater input allowed more investment of support time aimed at enabling new teachers to survive and function in difficult circumstances (cf. Clandinin et al. 2015). For a school with a well-developed scheme of work, student teachers and pupils alike may benefit from the student working to a clearly defined structure as a shared enterprise with colleagues. Such a *community of practice* (Wenger 2000) may supply genuine opportunity for students to experience an insider perspective on being a teacher. As one student put it: "the behaviour of the students is challenging, but we're encouraged to take risks and try out activities". Some school-based students were offered jobs by their placement schools prior to the course being completed. This was good for the school to have found a suitable teacher in an area of persistent teacher supply issues but could reduce the student's motivation to exceed the already limited academic demands.

5.8.4 The Enforcement of a Centralised Curriculum Supports a Collective Vision of Learning

The motivation behind the somewhat insistent centralised curriculum was centred in administrating the many teachers who lacked adequate subject content knowledge and professional capabilities to work without explicit support towards a collective set of ambitions. Many student involved in training to be secondary mathematics teachers do not have the requisite mathematics-oriented degree. Any collective

arrangement requires compromise, and unnecessary guidance to those teachers who were adequately skilled was seemingly a low price to pay for wider participation in a shared arrangement. Education research is sometimes predicated on finding more refined pedagogical strategies for a teacher to follow whilst neglecting the reality of teacher recruitment in terms of individual skill, where prototypical secondary mathematics teachers were in the minority. Alternatively, student teachers might creatively identify with approaches spanning a larger population of teachers as a mode of support for those with lower confidence or different specialist background.

5.8.5 Research Is Directly Focused on Developing Practice

Many instances of education research are finely tuned on issues unlikely to be encountered in preservice training courses. Within school-based models, however, the students themselves may have the opportunity to participate in forms of practitioner-oriented research made possible by the immediacy of ongoing school practice (e.g. Hanley and Brown 2016, 2017). The university element that had often been irrelevant for many students in the first instance can later become an effective critical platform for inspecting and reflecting on their own school practices. This platform potentially provides an opportunity to articulate the shaping of practice from an alternative location in which everyday demands could be understood against a wider context. Rather than thinking what would work in the current placement *school*, the concern became that of thinking more broadly about what would work for them across *schools* more generally. So rather than student teachers being subservient to a map dictating the format of their practices, they had some influence over how the map was created and how it guided their generic practices as a teacher. These opportunities to connect school with university input featured less in the Bologna Process prevalent in most European countries since university and school phases are sequential.

5.9 Conclusion

As seen, school mathematics is a function of the educational domain in which it is encountered and hence of the discourse that characterises that domain. That discursive structure can shape the actions of those subject to it, yet it may be possible to step outside. This chapter has documented some instances of mathematics teaching practice resulting from modified conceptions of teacher education that are emerging in a number of countries. The teachers' conceptions of mathematics developed without a great deal of explicit instruction from university specialists in the area. Rather, the teacher education function was achieved through the student teachers being immersed like apprentices in the infrastructure of schooling and learning to speak the local languages. In the approach described, the student teachers were

primarily guided by their school mentors through centralised curriculum documentation or by textbooks chosen by head teachers. That is, the students' mathematical pedagogical knowledge is derived from their own practice referenced to existing or required conceptions of mathematical knowledge and patterned on the associated apparatus. Their way of talking about mathematics teaching mirrored the official discourse. Consequently, there was a strong reproductive dimension to the student teachers' understanding of school mathematics and its values. Mathematics is defined within very tight boundaries that give it little space to be something else, such as mathematical constructions generated by the teachers or pupils themselves.

Specifically, in the data presented, mathematics derives from different types of encounter in a model of teacher education.

On the one hand, mathematics was understood in terms of fixed results, levels and following procedures. Little opportunity was provided for the student teacher to develop an autonomous professional attitude to the generation of mathematics in the classroom. Rather, the students were *subject* to an externally imposed curriculum as represented by the mentors to whom they were assigned. They understood their own professionalism and identities in those terms. The "goldfish bowl" of practice denied space to a more externally critical attitude in favour of training through immersion in school. Although there had been some stepping back from the more prescriptive aspects of the curriculum guidance, the student teachers are still subject to a legacy in which conceptions of teacher have little room for manoeuvre, predicated as these conceptions are on specific constructions of mathematics. Some students, however, feel more secure with these arrangements in an area where they may lack confidence. Their own mathematics background may also have been centred on test performance rather than on understanding limiting their capacity to step away from pre-defined pedagogical routes. Such students needed to know the topic in advance as defined by the book or scheme rather than treat the encounter as a process of shared learning.

On the other hand, the new model does provide an avenue through which student teachers and their tutors can experience the teaching of mathematics from new angles. This dimension however is at risk as more teacher education is scheduled to take place outside of university settings. In the model described, student teachers retained some possibility of inspecting their practices in school from an external site so that their insider experience of meeting immediate demands can be reviewed against a more holistic understanding of what they are trying to achieve. University tutors, meanwhile, provided a responsive role in helping students to confront demanding classroom challenges in more creative ways, albeit in terms of administering mathematics to the prevailing model.

There is another factor that has become more prominent since the empirical research described here was carried out. In England this is called the National Student Survey. This survey provides students with the opportunity to evaluate their university tutors, rather like the "Rate my professor" site more commonly referred to in the United States. The National Student Survey has become a powerful instrument in regulating university teacher education practice, where university staff find an increasing pressure to be responsive to student demands in connection to styles

of teaching they receive. This restriction on teaching style further undercuts the prioritisation of research-led teacher education practice. My colleague Jonas Thiel carried out an extensive survey of how this infrastructure functioned as regulative apparatus concerned with surveillance, with reference to the work of Foucault and Barad (Thiel 2018a, b, 2019). Such apparatuses might also be, for example, quotas, nominations, accreditations, qualifications, TIMSS, PISA, financial management of teacher education, teacher educators making sense of their practice situation, university assessment/management of its employees, universities specifying job descriptions or recruitment procedures. Ofsted and National Student Survey grading systems, similarly, arbitrarily impose certain values to effect specific distributions of teacher education across providers and shape the human actors involved. "Apparatuses are themselves material-discursive phenomena, materializing in intra-action with other material-discursive apparatuses", … *where apparatuses are not mere observing instruments but boundary drawing practice – specific (re)configurations of the world- which come to matter* (Barad, emphasis in original pp. 203, 206). We cannot "raise" standards but only reconfigure what they are and thus change the way in which those people adhering to standards are noticed or understood. Fears are emerging that such surveillance is becoming an intrinsic dimension of technological development across the world. Griffiths (2019) and Strittmatter (2019) both discuss the case of China.

This chapter has focused on specific themes pertinent to the situation in England where school-based training has become legislated as the norm (Brown 2018). As seen, the government has indicated its preference for expanding this type of provision yet further. Indeed, school-based teacher education can be developed to provide supported participation in communities of practice where mathematics and its teaching are built as more collective enterprises shaped around the needs of mainstream schooling arrangements. This however would be an unpopular move in some quarters. The students' conceptions of mathematics and its teaching on the course described are crafted around the apparatus of administrative control, which are restrictive, expressed in terms of curricula compliance, or fitting in with existing school practices. This administrative restrictiveness in the name of policy implementation is potentially counter both to pupils achieving a positive disposition towards mathematics and functionality in the subject in later study or professional life (see Pampaka, et al. op cit.). These conceptions also diminish the teacher's professional life, reduced as they are to following someone else's model during their formative years as a teacher, where experience across different placement schools is uneven.

In the model described, research carried out by student teachers fuelled a more generative attitude to practice that could be supported and developed in university sessions. That is, a practitioner-oriented reflective approach comprised an integral dimension to practice in school and the university sessions. Here, research is not seen as knowledge confirming a desired state of affairs in the manner of yet more insistent external demand. In the approach described, the university, rather than being the font of knowledge depicting models of good practice, provided a critical platform from where analytical apparatus could be created to support the generation

of knowledge in developing practice, to counter excessive compliance with those external demands. The demands may shape our practice, but perhaps we can develop the capacity to distance ourselves from the discursive parameters that deliver those demands (see, Brown et al. 2019).

"Subjection consists precisely in this fundamental dependency on a discourse we never chose but that, paradoxically, initiates and sustains our agency" (Butler 1997, p. 2). "Power not only *acts on* a subject but …*enacts* the subject into being" (p. 6, her emphasis). That is, the discursive arrangements that define practice can be inspected from outside and then turned against themselves to provide leverage into a new space. For Butler (1997, 2005), the very restrictive positioning as subjects creates a framework for resistance. "For what is it that enables a purposive and significant reconfiguration of cultural and political relations, if not a relation that can be turned against itself, reworked and resisted" (quoted by Davies 2006, p. 425). The more marginalised role for student teachers and their tutors can be re-crafted as a critical platform from which both tutors and trainees can inspect the stories governing their respective practices and the opportunities those stories provide for the development of analytical apparatus.

In a later book (Brown et al. 2019), I have explored possible changes to practice in the light of the empirical study described above. That book had a specific focus on teacher education in the case of secondary English education where student teachers were encouraged to narrate their own path into teaching. They sought to track their transition from being English undergraduates engaged in nuanced discussion of Mrs Dalloway's troublesome day to, 18 months later, confronting real-life 14-year-olds with an attitude problem towards phonics. In keynote lectures to subsequent cohorts of students, I was able to show examples of the personal pathways followed by previous students through their own reflective analysis of their progress through the school-based course into full-time teaching. In an associated paper, we put it thus:

> Working in a Lacanian theoretical perspective, we encouraged students to remain attentive to how desires or wishes influenced their perceptions. In particular, students were tasked with noticing how projected fantasies dictated a sense of what was possible and how language might be used to frame things differently. Students faced difficult choices. If they decided to stick with current interpretations, to suture meaning here and not there (Žižek 1989) what developmental opportunities were being missed? There can be significant risk in a speculative process of inquiry whose outcomes are not guaranteed in advance. Students were asked to remain sensitive to how the desire for certainty influenced narratives of 'what really happened', and how these might be further analysed. (Hanley and Brown 2016, p. 15, see also 2017).

Meanwhile, Chapman (2019) has conducted her own narrative-centred research in mathematics education. Perhaps the new role of universities is to provide a platform from where both tutors and trainees can critically analyse the issues arising in school practice. This new focus would be on building generic analytical capability that supports learning by the trainees in association with their school-based mentors. The challenge would entail supporting trainees in becoming more independent research-active teachers through building a productive critical relationship between university sessions and their developing practice in school. Here universities would assist

trainees in developing practitioner-oriented research and connecting it with the broader body of research knowledge. That is, reflective practice would comprise a creative ongoing process of practitioner research that progressively defined the parameters of teaching whilst negotiating a path through the external demands that trainees will surely encounter. Collaborative, reflexive, practitioner-oriented action research would underpin successive reconceptualisations of practice towards enhancing trainees' abilities to claim intellectual space in these regulative times. New priorities have shifted teacher education towards schools and may require aspirant teacher educators to remain in schools or to change their practice to meet the new demands.

Ultimately, conceptions of improvement are very much a function of the country, or even local community, in which they apply and the state of affairs prevalent there. And it is this sense of contingency that underpins this chapter's focus on adjustments to new paradigms. In particular, it is unhelpful to suppose that we could identify trajectories of improvement that apply across all people and all phases of development:

> Time metaphors abound in the hegemony of educational discourses seeking "improvement" or "progress", [and in England,] towards "greater effectiveness" or even the dizzy heights "outstanding status" or "world leading", thereby sublimely producing standardised modern notions of change, orientation and a correct way forward. But the reflexivity of life can result in us celebrating and protecting our current diversity rather than nurturing futures that might not allow the new to happen. Emancipation, for us, is about enabling a critique of the discursive platitudes that have locked our resolutions into overly familiar pathways. (Sant and Brown 2020)

School subject knowledge has come to be a function of this newly described world, backed up by governments using these conceptions to set their policies. There is always a cost in the form of suppressions resulting from such generalist suppositions. To represent mathematics as universal, spanning nations and generations, comes at a price in terms of teachers' ability to identify with the modes of education privileged in such comparisons.