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Cumulative knowledge-building for inclusive education in initial teacher education

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ABSTRACT

Initial teacher education must respond to the demand that newly qualified teachers are able to teach inclusively. This response has been the creation of opportunities for learning in coursework and field experiences. Research has identified the impact of these initiatives and also revealed challenges. One such challenge is the lack of a coherent conceptual framework that leads to a disconnection between coursework and field experiences. We frame this challenge as the need for cumulative knowledge-building as part of developing inclusive teaching as a knowledge-based practice. Drawing on the conceptual repertoire of Legitimation Code Theory, we argue for programme design that systematically develops pre-service teachers' conceptual and contextual understandings of inclusive teaching through a structured interplay between coursework and field experiences. Assessment plays an important role in showing students what is important in a curriculum, so we suggest approaches to assessment of inclusive teaching competence that supports knowledge-building.

Introduction

Achieving an inclusive education system against the backdrop of pervasive exclusionary pressures and practices in education is no small task, but it is one that is central to creating equitable learning opportunities for all. Signatories to The United Nations (UN) Convention on the Rights of Persons with Disabilities are committed to ' … ensure an inclusive education system at all levels' (UN 2007 Article 24(1)). The General comment No. 4 (UN 2006 12 (d)) on Article 24 asserts that a 'core feature' of inclusive education is that, 'All teachers and other staff receive education and training giving them the core values and competencies to accommodate inclusive learning environments'. Despite this, one of the most frequently cited impediments to inclusive education is inadequate teacher education that equips teachers to be able to respond to student diversity (McCrimmon 2015). That teacher education is important in the quest to realise inclusive education systems is uncontested. What is contested is the impact, form and content of this teacher education, as scholars struggle to show 'benefits for students and developments in inclusion that are linked to particular kinds of teacher education' (Florian 2012, 217).

The *impact* of specific teacher education programmes or courses is often reported in the literature, and research has shown the ways in which the content presented in particular courses is (or is not) taken up by teachers in their classroom practices (Forlin and Chambers 2011). Given that attitudes are seen as predictors of successful inclusion (Sharma and Sokal 2015), researching the impact of courses on attitudes has also been a fruitful line of enquiry. In considering the *form* of teacher education for inclusive education, scholars have weighed up the relative merits of infused and explicit teaching on the topic, particularly in initial teacher education (ITE) (Loreman 2010). At in-service levels, form is explored through various programme delivery formats, including workshops, short courses and professional learning and enquiry communities (O'Gorman 2010). The *content* for teacher education courses is usually derived from the knowledge, skills and attitudes seen as necessary for inclusive teaching practices (Walton and Rusznyak 2017).

Despite the recognition of the importance of teacher education for inclusive education, and the proliferation of research on the topic, several issues remain un(der)explored. One such issue noted by the European Agency for Development in Special Needs Education (EADSNE) is that ITE 'programmes lack an organised approach linking courses and field experiences within a conceptual framework' (EADSNE 2012, 35). The consequences of this, according to EADSNE (2010) include a lack of clarity on the purpose and outcomes of the field experience and the potential for pre-service teachers to be influenced by supervising teachers more than their university coursework. The concern about a disconnection between field experience and coursework is not limited to concerns about preparing pre-service teachers for inclusive education but is echoed by others. Zeichner (2010, 89), for example, identifies this as 'one of the central problems' in university-based teacher education.

The recognition of this disconnection has led to various initiatives which provide explicit opportunities for connections to be made between coursework in inclusive education and field experiences. As we review these initiatives, we will show that while they can show benefits, particularly in terms of the development of positive attitudes and self-efficacy, they do not necessarily contribute to building knowledge-based inclusive teaching practices for pre-service teachers.

In this paper, we offer a conceptual framework from Legitimation Code Theory (LCT) (Maton 2014) that advances the possibility of connections between coursework and field experiences that potentially build cumulative knowledge for inclusive teaching in ITE. First, we explain the 'conceptual toolkit' offered by the Semantics dimension of LCT. Then, we review literature on coursework and field experiences in ITE with a focus on inclusive education. We then overlay this with LCT concepts and propose that the assessment of teaching during field experiences points students to the importance of having inclusive education knowledge that is both conceptually complex and contextually relevant.

Legitimation code theory (LCT)

LCT emerged in the 1990s and draws on the work of Basil Bernstein and Pierre Bourdieu in proposing that fields are knowledge-knower structures. The four dimensions of LCT enable 'knowledge practices to be seen, their organising principles to be conceptualised and their effects to be explored' (Maton 2014, 3). While all the dimensions offer ways to understand the knowledge of inclusive education needed for pre-service teachers, we

have chosen to use the dimension of Semantics. This dimension provides a way of understanding inclusive teaching as a knowledge-based practice that has context-dependence *and* complexity in meaning. It helps us to address the concern about the disconnection between field experience (which is context-specific) and university course-work (which traditionally presents condensed and complex meanings in theories and concepts). An analysis of learning afforded by university-based coursework and fieldwork experiences within ITE curricula requires the use of two concepts from LCT's Semantics dimension, namely semantic gravity and semantic density (Maton 2013).

Semantics

Semantic gravity (SG), refers to the extent to which knowledge is bound to the contextual realities that give it meaning. In South Africa, for example, there is a very specific set of hand signals used between taxi drivers and commuters to indicate their intended/desired destination. These hand signals have stronger semantic gravity because their ability to convey meaning is only understood in the immediate context, and would not be understood by taxi drivers or commuters elsewhere. If knowledge can easily be abstracted from the context in which it was generated, the semantic gravity is weaker than knowledge that needs to be understood within its context (Maton 2013). The semantic gravity of knowledge or knowledge-based practices becomes weakened when experiential learning is generalised and becomes transferable across different contexts. The semantic gravity of abstract knowledge is strengthened when concepts are illustrated with contextually bound (real world) examples, experiences, or case studies. Classroom knowledge with relatively stronger semantic gravity (SG+) would be, for example, the knowledge that a specific teaching room has poor board visibility from one angle; or that student A and student B have been rivals for many years and do not work well together. Classroom knowledge with relatively weaker semantic gravity (SG-) could be knowledge of the affordances of different ways to represent a topic, beyond the use of a board; or knowledge of general behaviour management techniques that could reduce friction between students more generally.

The second concept, semantic density (SD) describes the extent to which complex meaning is condensed within a symbol, term or idea, and the extent to which that idea is nested within a complex web of knowledge. The more complex an idea (either in terms of its condensation of meaning, or in terms of its connections within a web of ideas) the stronger is its semantic density (Maton 2014). While appearing straightforward, Einstein's equation, $e = mc^2$ is a symbolic condensation of a consequence of his theory of special relativity. The semantic density of knowledge becomes stronger when an observation, experience or finding is theorised. It becomes weaker when the complexity of a concept is simplified and made more understandable through the use of everyday words that have fewer meanings (Maton and Doran 2017). Common-sense understanding has weaker semantic density (SD-), as it is neither systematically theorised nor conceptually complex. Cooperative learning, as we discuss later in this paper, is a concept with relatively strong semantic density (SD+) because it represents a complex network of theories about social and observational learning and interdependence, together with a substantial body of codified principles of practice. The semantic density of cooperative learning can be weakened by simplifying it into a less complex form with the well-known 'Think-pair-share' teaching technique.

LCT asserts that all knowledge practices have both semantic gravity and sematic density, which can be stronger or weaker on a continuum. The concepts of semantic gravity and semantic density can (but need not necessarily) work in tandem with one another. Knowledge acquisition that takes place over time can be represented by positions on graph, where time is on the horizontal axis, and the vertical axis represents knowledge with semantic gravity and semantic density of varying strengths. The semantic gravity and semantic density of knowledge can be represented as being relatively weaker (-) or stronger (+) along an axis (see vertical axis in Figure 1).

It is possible to analyse knowledge-building opportunities afforded by different learning experiences by plotting how the intended knowledge to be acquired strengthens and weakens its semantic gravity and semantic density over time. In Figure 2, knowledge acquisition, represented by Line A, is described as a 'high semantic flatline' (Maton 2013, 12). It is characterised by a very small semantic range, with little change in its semantic gravity or semantic density over time. It has relatively weak semantic gravity (SG-) because the knowledge is abstracted and decontextualised in nature. It has relatively strong semantic density (SD+) and represents complex knowledge that is embedded within a theoretical network of ideas. A 'low sematic flatline' (Maton 2013, 12), depicted by line B in Figure 2, depicts the learning of knowledge with stronger semantic gravity (SG+) because it is experiential, personalised, so its meaning cannot be divorced from the context in which it was generated. This kind of knowledge is often characterised by weaker semantic
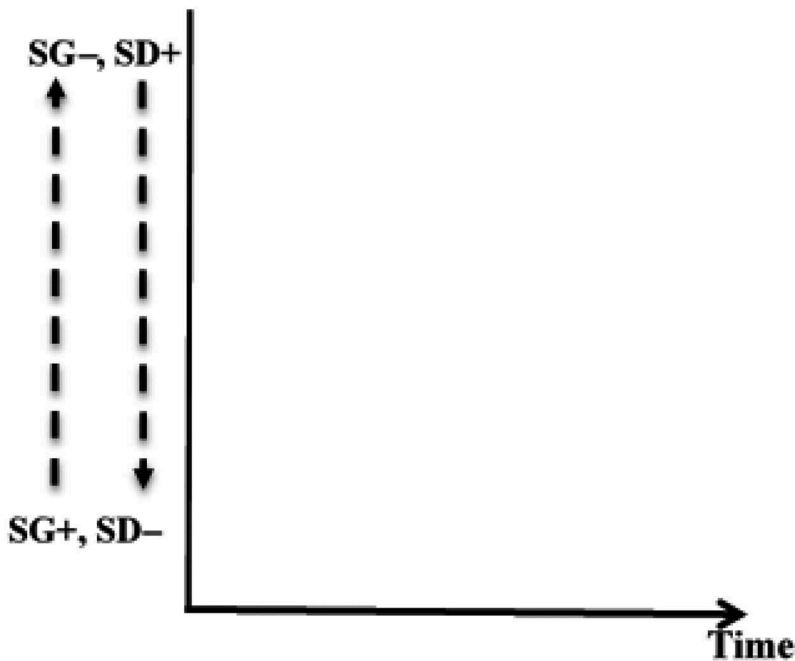

Figure 1. Axes for a semantic plot for representing the relative weakening and strengthening of semantic density and semantic gravity over time (from Maton 2013, 13).
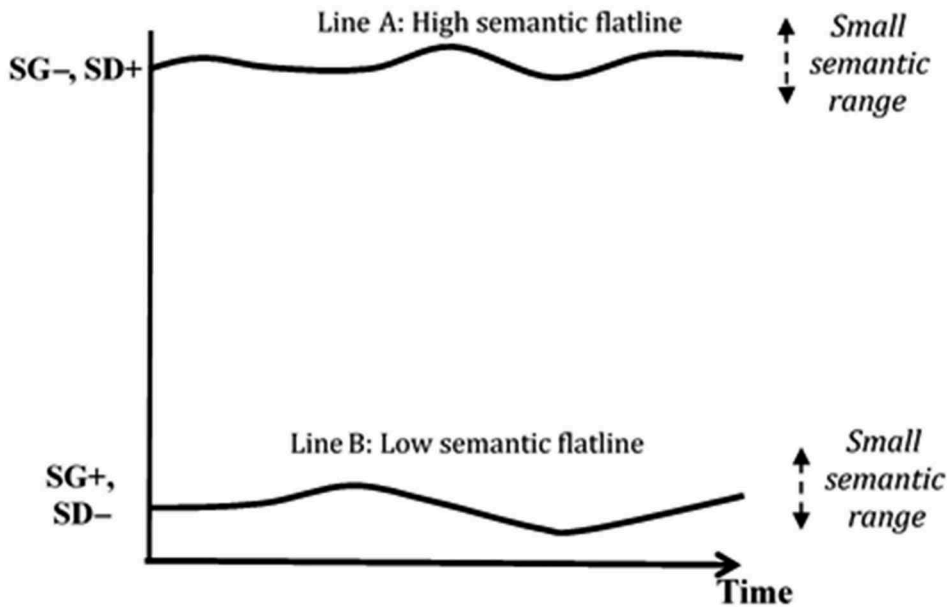
Figure 2. High and low semantic flatlines have small semantic ranges (from Maton 2013, 13).

density (SD-), as it tends to be less theorised, and less complex. It may include the description of routines, procedures, or the generation of rules and practical tips that are discovered by trial-and-error. It too, has a small semantic range because there is little change in its semantic gravity or its semantic density over time.

A greater range over the vertical axis is represented in Figure 3, as the relative semantic gravity and the relative semantic density of knowledge strengthens and weakens over time. Line C represents a 'downward escalator' (Maton 2013, 14) profile, beginning with a theoretical
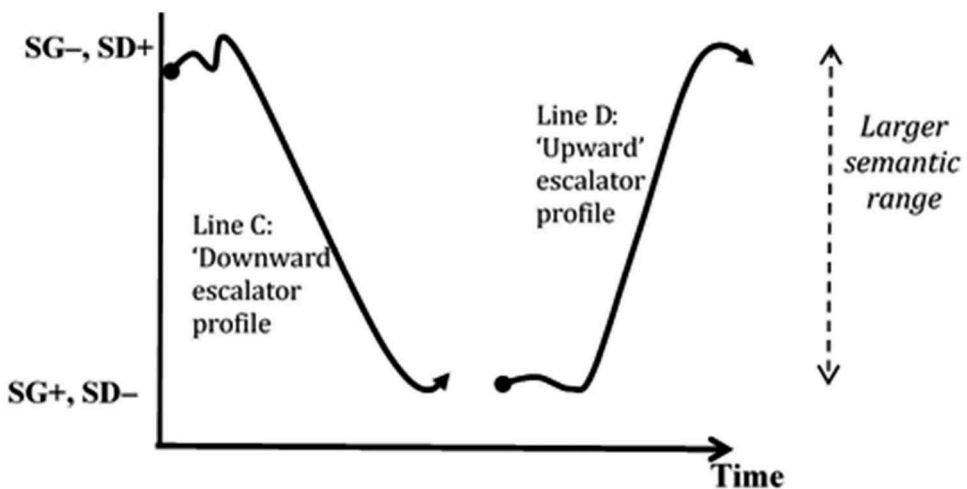

Figure 3. Profiles of learning over time as 'downward' and 'upward escalators' showing larger semantic ranges (from Maton 2013, 14).

idea (SG-, SD+) which is then weakened over time as the concept is unpacked and explained in everyday terminology (becoming less complex and theoretical). Simultaneously, its semantic gravity is strengthened (to become more contextually relevant) when it is linked with real life experiences or examples that would be familiar to the students. By way of contrast, Line D shows an 'upward escalator' profile, where learning over time starts with experiential knowledge (SG+, SD-). The sematic gravity is weakened when learning is lifted out of its contextual specificity, and the semantic density is strengthened by locating experience in a network of theoretical ideas, and describing it with more specialist terminology. This occurs in situations where learning in and from a context is generalised, and informs a conceptual understanding that can then be transferred across contexts.

Knowledge-building

The semantic profiles, as illustrated here, allow analysis of the extent to which knowledge-building can be segmental or cumulative. Segmental knowledge-building is characterised by an accumulation of contextually-bounded experiential knowledge, discrete ideas or new conceptual frameworks that do not integrate with existing knowledge. While segmental knowledge-building may add to breadth of knowledge, it can limit pre-service teachers' capacity to integrate and extend previous learning, and then apply it to new and changing contextual realities. Cumulative knowledge-building refers to learning that extends previous knowledge and integrates it with knowledge produced in different contexts and at different points in time (Maton 2014). This can happen when experiential knowledge is extracted from the context in which it was produced and then conceptualised so that the knowledge is applicable beyond the specific context in which it was created. The abstracted concepts can then be drawn on to yield relevant and useful insights in future or changing situations (Maton 2014). Alternatively, concepts can be drawn from theory to inform action in practice. Their relevance and applicability are then critically considered in terms of contextual relevance. Where necessary, the concepts can be challenged and reconsidered in response to the demands of the context. In both cases, there is interaction between localised, personal or experiential knowledge with knowledge that is complex, abstract and transferable. It is thus the processes of abstraction and complexification of knowledge, and its transferability across different contexts that creates potential conditions for cumulative knowledge-building.

   Studies (for example, Maton (2013), Blackie (2014) and Macnaught et al. (2013)) have found that cumulative knowledge-building is characterised by the learning process with large semantic ranges (ranging between knowledge with stronger semantic gravity and knowledge with stronger semantic density). Cumulative knowledge-building requires a structured learning process that weaves together knowledge with stronger semantic density with knowledge that has stronger semantic gravity. Learning opportunities for cumulative knowledge-building should therefore not remain at abstract decontextualised knowledge (represented in Figure 2 by the high semantic flatline of Line A). Nor should it provide access only at the idiosyncratic level of personal experiential knowledge (represented in Figure 2 by the low semantic flatline of Line B). A learning path that enables cumulative knowledge is one that makes 'semantic waves' (Maton 2013, 2014) between knowledge with stronger semantic density and that with stronger semantic gravity (see Figure 4). It could, for example introduce a concept with strong semantic density, then
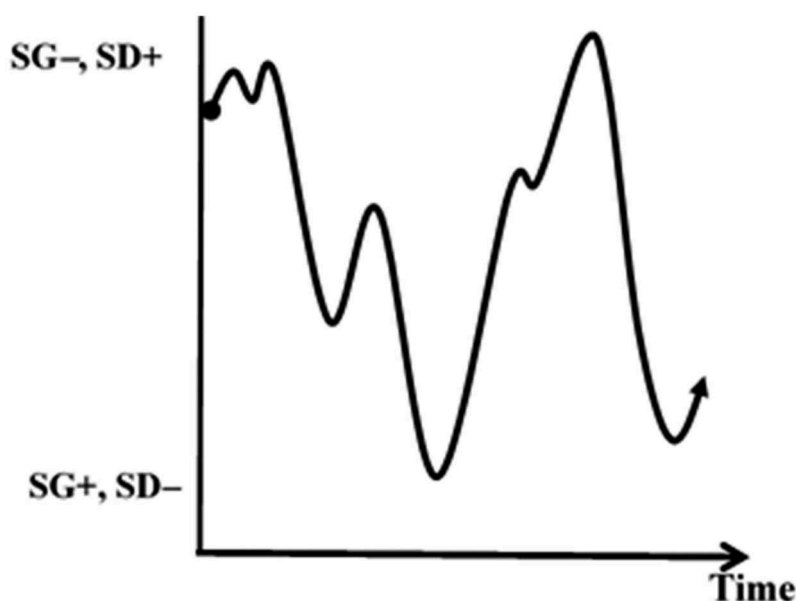
Figure 4. A profile of semantic waves (adapted from Maton 2013).

'unpack' (Maton 2013) it, simplifying it and converting into more accessible language (thus weakening semantic density), then link it with familiar examples (strengthening semantic gravity) and then repack it by building up its complexity and nesting it within a broader conceptual framework (strengthening semantic density again). The successive use of semantic waves is called semantic weaving (Maton 2013) and it is the means by which the semantic range of knowledge is extended and abstract concepts become both accessible and meaningful within different contexts.

Our thinking about knowledge in teacher education for inclusive teaching is informed by Maton's (2013) assertion that '[a]ll practices are characterized by both semantic gravity and semantic density'. We find this a more useful schema than thinking of inclusive education in terms of a theory and practice binary in which either theoretical or practical knowledge is valorised and the other denigrated. We argue that it is more productive to see that teaching inclusively demands knowledge that has both stronger semantic density and stronger semantic gravity. The 'Profile of inclusive teachers' published by European Agency for Development in Special Needs Education (EADSNE) (2012) describes the competencies of inclusive teachers. These competences exemplify the stronger semantic gravity *and* stronger semantic density of inclusive education knowledge. Some of the listed competencies require teachers to have knowledge very specific to a context, like 'the possible strengths and weaknesses of the educational system that they work in' (12). Other EADSNE competencies have stronger semantic density, like 'theoretical knowledge on the way [students] learn and models of teaching that support the learning process' (14). Most competencies though, require both stronger semantic density and stronger semantic gravity, like 'differentiation of curriculum content, learning process and learning materials to include students and meet diverse needs' (14).

The concept of differentiation and knowledge of the curriculum content would have stronger semantic density, as both arise from a complex field of disciplinary knowledge, and are embedded within a systematised body of theoretical knowledge. Knowledge of the diverse needs of students in a classroom would be characterised by stronger semantic gravity. The task for ITE is to develop these competences in beginner teachers and to do so in a way that begins to cumulatively build knowledge-based inclusive teaching practices.

In the next section of this paper, we focus on the contributions that coursework and fieldwork offer for building knowledge for inclusive teaching that has stronger semantic gravity and stronger semantic density. We then consider the affordances that different combinations of coursework and field experiences offer to build the knowledge needed for inclusive teaching. We deliberately focus on the knowledge dimension of inclusive teaching, not because we think that values, beliefs and attitudes are unimportant in teacher education. The extensive and ongoing work on the affective dimension shows that inclusive teaching is dependent on positive attitudes towards inclusive education and towards students with disabilities (Varcoe and Boyle 2014; Tiwari, Das, and Sharma 2015). We also acknowledge that building the capacity for inclusive teaching is not determined by knowledge alone. Professional learning for teachers is complex, operating at the confluence individual teachers, who bring their own identities and dispositions; school-level factors, which could include organisational structure, professional relationships and policy strictures; and the learning activity (Opfer and Pedder 2011). Within this complexity, we focus on developing the knowledge basis of inclusive teaching for pre-service teachers, an aspect which has received relatively less attention in the scholarly literature.

Knowledge-building in inclusive teaching through field experiences and university-based coursework

ITE must provide pre-service teachers with a strong foundation so that with time, they are able to develop the full range of competences needed for inclusive teaching. Inclusive teaching, as we have shown, requires both knowledge with stronger semantic gravity (SG+) and stronger semantic density (SD+). Knowledge with stronger semantic density is best learnt through systematic engagement with a range of ideas, and knowledge with stronger semantic gravity is appropriately learned within the complexity of classroom life.

Coursework in inclusive education

We use the term 'coursework' as a generic term to indicate the content of university-based learning relevant to inclusive education. Research (Forlin and Chambers 2011; Swain, Nordness, and Leader-Janssen 2012; Allday, Neilsen-Gatti, and Hudson 2013; Sharma and Sokal 2015; Hopkins, Round, and Barley 2018) has pointed to various topics that coursework might include. Student diversity is one such topic, and coursework might cover knowledge about disability categories relevant to teaching and the debates about the medical and social models of disability. Other topics would be instructional and curricular adaptations and modifications; cooperative learning and peer teaching; behaviour management or support; collaboration with colleagues and other support professionals; and relevant policy and legal frameworks.

All of these topics have relatively strong semantic density. Cooperative learning, according to Putnam (2009) condenses theories such as Vygotsky's work on cognitive development, Johnson and Johnson's theory of interdependence and Bandura's theory of social cognitive learning. Differentiation condenses subject content knowledge and pedagogical knowledge as well as knowledge about student difference and cultural background (Mills et al. 2014). Student diversity condenses concepts from a range of fields, potentially including knowledge from medicine and psychology (diagnostic categories and profiles), and macro- and micro-sociological traditions. In other words, none of the topics presented in courses necessarily demand context-specific knowledge for comprehension, and all are located within a systematised body of disciplinary knowledge. Learning about inclusive education through the study of theory in university-based coursework alone could be profiled as a 'high semantic flatline' (see Line A in Figure 2).

Theoretical perspectives are useful because they give pre-service teachers the conceptual tools needed to recognise and think about pedagogical options that might be responsive to the learning needs of students. However, this knowledge (characterised by SG-, SD+) is not necessarily easily translated into enacted practice in contextually appropriate ways. To develop their teaching practices, pre-service teachers require 'not only the ability to think like a teacher, but also to put what they know into action' (Hammerness et al. 2005, 359). While an essential part of teacher education for inclusive teaching, a 'high flatline' on its own potentially constrains prospective teachers in enacting inclusive teaching in the contextual realities of diverse classrooms.

Field experiences in teacher education for inclusive teaching

Field experiences offer the potential to develop the contextual knowledge necessary for inclusive education in practice. Most, if not all, initial teacher education programmes have a practical component as a requirement for certification. This practical component gives pre-service teachers the opportunity to learn from others and show that they can enable learning in authentic teaching contexts (Cochran-Smith and Lytle 1999). In some countries, like the United Kingdom, school-based ITE is a pathway to qualification, with the field experience being the primary site of learning.

Inclusive education scholars have long emphasised the importance of context in understanding the instantiation of inclusive education, and it is vital that pre-service teachers know how the context enables or constrains possibilities for inclusive teaching. Robinson (2017, 175) emphasises this contextual specificity saying, 'Inclusive practice … demands compromise and dexterity in highly localised contexts where bespoke approaches are required in response to very specific challenges'. In other words, pre-service teachers need knowledge of how inclusive teaching may be effectively enacted within the contextual challenges and possibilities. This requires knowledge of individual students, their interests, learning profiles and their readiness to learn (Tomlinson et al. 2003). The human and material resources in a school and wider community impact inclusive teaching, as does the school climate and culture. This knowledge is crucial, but it is also firmly embedded in its context and likely to be only meaningful in that context (Maton 2013).

The potential for field or clinical experiences to build knowledge for inclusive teaching with stronger semantic gravity is evidenced in various studies. Hopkins, Round, and Barley (2018) report on pre-service teachers who tutored young people with learning disabilities

as a supplementary fieldwork experience. The pre-service teachers developed strategies for differentiation. Significantly, the authors note that, 'these strategies were not learned from books but were *developed through experience*: trial-and-error, and peer modelling' (12) (emphasis ours). In the study reported by Swain, Nordness, and Leader-Janssen (2012, 77), students were required to complete 'a case study on the *basis of experiences* during their special education field experiences' (emphasis ours).

Knowledge for inclusive teaching learned through personal experience is important but it is limited. Many schools do not yet enact inclusive principles and teaching inclusively may not be expected or modelled (McIntyre 2009; Robinson 2017). Although some aspects of teaching can be informed by prevailing practices and routine responses, many decisions are contingent and made in relation to the prevailing and competing priorities for learning in the moment (Kennedy 2004). Maton (2013, 14) reminds us that, 'knowledge characterized solely by relatively strong semantic gravity and relatively weak semantic density may be too related to specific contexts and too disconnected to either build upon previous knowledge or be built upon in the future'. In other words, learning knowledge with stronger semantic gravity for inclusive education through field experience on its own does not have the potential for cumulative knowledge-building and results in learning with a low semantic flatline profile (see Line B in Figure 2).

Neither university-based coursework nor field experiences alone are sufficient to enable prospective teachers to develop knowledge with both stronger semantic gravity and stronger semantic density needed for inclusive teaching. We now turn to analyse the extent to which combinations of coursework and field experience enable cumulative knowledge-building for inclusive teaching.

Developing competence for inclusive teaching through combining coursework and field experiences

We see two main ways in which coursework is combined with field experiences in the literature. The first is a simple *adding* of a field experience relevant to inclusive education to a programme (like incursions, or a practicum in a special school). The problem here, as we will show, is that the learning for inclusive teaching can simply result in a series of alternating high and low flatlines, where the links between the knowledge with SG-, SD+ and SG+, SD- are co-incidental, and expected to be made by students. The second is where there is an *intentional linking* and students are explicitly expected to apply coursework concepts into field experiences, or they are expected to theorise from their practical experience. The problem here is that learning for inclusive teaching becomes a series of 'downward' or 'upward escalators', rather than cumulative knowledge-building.

Adding field experiences to coursework

In the additive model, programme conceptualisation typically starts with the design of coursework, and the field experience is placed where logistically suitable. This means that the coursework and field experience build knowledge independently of one another. Students are left to figure out for themselves the connections that potentially exist between different components of coursework, and between the coursework and their practicum learning (Hoban 2005). A number of programmes add field experiences specific

to the concerns of special or inclusive education. Sometimes these are optional. Australian students in Forlin and Chambers' (2011) study could choose opportunities for social interaction with people with disabilities. PGCE students in Ireland undertook an eight-week placement in a 'non-selective school' where they could be expected to encounter students with diverse abilities (Lambe and Bones 2008). In the USA, one special education course was paired with a 20-hour practicum experience during which students observed and worked with students with disabilities (Swain, Nordness, and Leader-Janssen 2012). The impact of these opportunities is mostly discussed in terms of attitude, and the results are varied. Some showed improved attitudes to people with disabilities (Swain, Nordness, and Leader-Janssen 2012), while others showed increased concern about teaching in inclusive classrooms (Lambe and Bones 2008; Forlin and Chambers 2011). While the students have access to opportunities to build knowledge for inclusive education, formal knowledge (learnt through coursework) and contextual knowledge (learnt through field-work) are not necessarily brought into explicit relation with one another. As a result, this additive model offers segmental learning about inclusive teaching.

Learning through coursework focusing on abstract ideas and organising principles (knowledge with SG-, SD+) alternating with learning in the realities of classroom life (knowledge with SG+, SD-) is represented in Figure 5. This results in alternating high and low semantic flatlines, without intentional or explicit linking between the two learning opportunities. Connections between the two flatlines (indicated by the broken vertical lines in Figure 5) are likely to be incidental and highly dependent on the capacity of
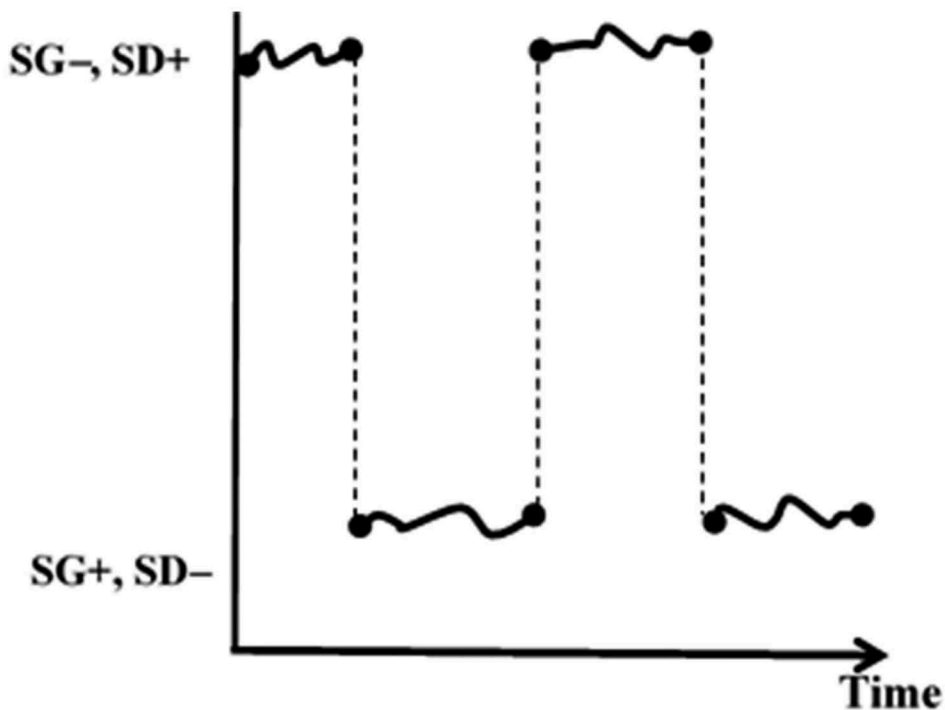

Figure 5. An additive model of connecting sessions of fieldwork experience to sessions of university-based coursework (after Maton 2013).

individual pre-service teachers themselves to make the 'critical theoretical' (Robinson 2017, 176) links necessary for cumulative knowledge-building. As such, the potential for cumulative knowledge-building for inclusive teaching may exist only for some students who figure out links between the coursework and field experience, where these exist. However, the learning would be segmental for others, leading to a body of fragmented knowledge.

Intentional linking of coursework with field experiences

Intentional linking of coursework with field experiences is advocated to overcome the shortcomings of the additive model. The importance of 'strong links between practice and theory' are emphasised so that pre-service teachers 'have opportunities to *enact* the pedagogical-content knowledge explicitly taught in coursework units' (Hopkins, Round, and Barley 2018, 3) (emphasis ours). Salend (2010) argues for field-based experiences in inclusive educational settings that enable students to 'link theory and practice' and '*apply* the program's competencies' (emphasis ours). With this principle, the University of Utah redesigned its teacher preparation programme to the effect that, 'Field experiences are viewed as an extension of university courses in which students *translate* research and theory into practice' (Hardman 2009, 586) (emphasis ours). In Hopkins, Round, and Barley (2018) study into the supplementary field experience of pre-service teachers tutoring young people with learning disabilities, the researchers were specifically interested to see how pre-service teachers, '*apply* knowledge and skills learned in coursework units to differentiate tasks' (14) (emphasis ours). In LCT terms, the learning moves from SG-, SD+ (knowledge for inclusive teaching) to SG+, SD- (knowledge of inclusive teaching). Through this model, students have opportunities to develop knowledge with stronger semantic gravity and knowledge with stronger semantic density. Their learning spans a larger semantic range than through fieldwork or coursework alone.

In the extracts quoted in the previous paragraphs, we have emphasised words that show the expected direction of learning, i.e. coursework principles systematically applied to classroom practices. Many university-based teacher education programmes have sought to develop collaborative partnerships with inclusive schools to support this application of knowledge (Waitoller and Kozleski 2013). While not wanting to discount the value of these initiatives, or the importance of supportive field placements where good inclusive practice is the norm, we suggest that this is still not the optimum approach to knowledge-building for inclusive teaching. The downward shift from knowledge with stronger semantic density to knowledge with stronger semantic gravity is a 'down escalator' profile (Line C in Figure 3). Although it links knowledge learned through coursework (SD+) to knowledge in the field (SG+), it does not demand a move back up to build an increasingly more condensed and integrated knowledge of the practice.

Robinson (2017) echoes some of our concern with the 'downward escalator' approach to teacher learning for inclusive teaching. Noting the limitations of the theory to practice approach, she advocates a 'practice to theory' approach which, 'offers scope for teacher educators and collaborating communities to centre their development on improvements to instructional techniques and outcomes for students whilst sustaining opportunities for drawing on wider theory as a means of countering insider bias' (176). A practice-to-theory approach can be found in other teacher preparation programmes. Gravett (2012) for

example, advocates for a teacher preparation model where students are expected to articulate their own personal practical theories in making meaning of a real-life situation or dilemma that they have observed or experienced. The role of a teacher educator is to facilitate reflections, provide case studies and then draw pre-service teachers' attention to some pertinent aspects of their experience and then introduce relevant theoretical perspectives.

Practice to theory models have 'upward escalator' profiles (see Line D in Figure 3) which are also not optimal for cumulative knowledge-building. Because practice is the point of departure, theory is necessarily encountered as a collection of discrete ideas rather than a networked body of knowledge that enables systematic consideration of possible conceptually informed options. To build the kind of expertise where pre-service students learn to draw on appropriate conceptual knowledge to inform their practice, their initial teacher education programmes need to enable them to build a 'clear conceptual map' of the field of knowledge (Winch 2013, 138). Such a conceptual map is not obtainable through the contingent inclusion of theoretical perspectives to address dilemmas that arise in classroom life.

In the next part of this paper, we offer some suggestions for knowledge-building for inclusive education as we focus on requirements and assessment of pre-service teachers during field experiences. Clearly, this is not the only means by which teacher educators can promote knowledge-building, and we fully appreciate the role that the full raft of teaching and learning activities play in ITE. But, as we have argued elsewhere (Walton and Rusznyak 2016), assessment has been relatively underexplored in the literature on teacher education for inclusive education. We will show that assessment is one of the ways in which semantic weaving is made possible.

Cumulative knowledge-building for inclusive education: the potential of assessment in field experiences

Assessment in higher education has a direct link with the quality of student learning, and focuses student attention onto what is perceived as most important in a course. Various claims have been made for the role of assessment in students' learning and their engagement with content. Assessment impacts perceptions of courses (Murphy 2006) and indicates what the course designers value in learning (Sambell, Mcdowell, and Montgomery 2013; Gibbs 1999). Biggs (1999, 141) proposed a 'backwash' effect of assessment, which suggests that student learning is primarily driven by assessment, not by the curriculum. Put differently, assessment is where learning is not left to chance. For this reason, we argue that to promote cumulative knowledge-building, assessment needs to reflect the expectation that the developing inclusive teaching practices of pre-service teachers demonstrate knowledge with stronger semantic gravity (SG+) and stronger semantic density (SD+). We also suggest that assessment of inclusive teaching practices during field experiences has the potential to make the semantic waves needed for cumulative knowledge-building. In the following section, we describe how the requirements and assessment of two teaching artefacts (lesson plans and reflective journals) might contribute to the realisation of this potential.

Lesson plans

Pre-service teachers are expected to plan their lessons during field experiences, and their lesson plans are often scrutinised as part of the assessment of their teaching. If the expectation of semantic weaving (waving iteratively between knowledge with SG-, SD+ and SG+, SD-) is built into the expectations of their lesson planning, we argue that it can contribute to knowledge-building for inclusive teaching.

Lesson plan requirements could produce artefacts characterised by a low semantic flatline, where stronger semantic gravity and weaker semantic density predominate. This occurs when pre-service teachers are assessed as if lesson plans merely are a technical exercise in producing a written account of their intentions for a lesson. In such lesson plans, pre-service teachers would be expected to describe available resources, and explain how these resources will be used in executing a learning process. Knowledge of students would be reflected in everyday terms and based on observation, intuition and experience. The lesson plan would not be expected to make any explicit reference to concepts from coursework.

An alternative is to require that lesson planning includes a rationale for pedagogical decisions made with reference to both conceptual and contextual knowledge (i.e. knowledges that have both SD+ and SG+). This would require pre-service teachers to move iteratively between what they have learnt in coursework (about subject knowledge, learning theory, student diversity, and appropriate options for inclusive instructional strategies) and the knowledge they have of the context as they plan their lessons. In other words, they need to show evidence of semantic weaving as they consider what they teach, who they teach, where they teach, and how these factors inform the design of their lessons. Expecting pre-service teachers to answer a series of questions in a rationale for their lesson design would promote this semantic weaving. Suggestions for questions are offered below, with an indication of the semantic range demanded of each question.

- What are the big ideas, important information and peripheral information selected for this lesson (SD+) (Wiggins and McTighe 2005), and what would be these students' prior learning or experience with this topic (SG+)?
- Which aspects of this topic (SD+) might be misunderstood by these students (SG+), and how can the selection of pedagogical approaches (SD+) pre-empt such misunderstanding (Shulman 1987; Grossman, Schoenfeld, and Lee 2005)?
- What theories or concepts (SD+) deepen an understanding of these students' learning needs and challenges (SG+)?
- Which aspects of student difference (SD+, SG+) will be pedagogically significant in this lesson (SD+, SG+)?
- In the light of answers to the previous questions, what evidence-based pedagogical approaches (SD+) are suited to this content (SD+) and these students (SD+, SG+) in this context (SG+) to ensure access to learning for everybody?

Experienced teachers who are inclusive in their teaching practices probably ask themselves these questions tacitly. But pre-service teachers need the explicit expectation that they engage in this kind of thinking as they plan individual lessons or units of work. Following

Biggs's (1999) backwash logic, if pre-service teachers know that their planning will be assessed for evidence of their ability to use knowledge of inclusive teaching with SD+ and SG+, then they are more likely to do so.

Reflective journals

Reflection is recognised as an integral step in the development of professional expertise (Pollard et al. 2014). Journals or other documents are often required by teacher educators as evidence of the process of reflection, and these may contribute to the assessment of the pedagogical reasoning that is condensed within their teaching. As with lesson plans, the requirements for journals can make explicit an expectation for semantic weaving.

Requirements for reflection on lessons taught could produce artefacts characterised by a low semantic flatline, where stronger semantic gravity (SG+, SD-) predominates. This would occur if reflection focuses on routine and technical aspects of the lesson taught, and emphasises personal experience and self- evaluation of teaching performance. In our experience, these reflective journals often read like diaries in which pre-service teachers make observations about 'what worked' in terms of apparent student 'enjoyment' of lessons and their behaviour, as well as their own feelings about incidents.

The alternative is to require pre-service teachers to reflect on their lessons by iteratively drawing on their conceptual knowledge, their classroom experiences and their personal observations. In other words, they need to show evidence of semantic weaving as they reflect on their field experiences. As with the lesson plans described above, expecting answers to a series of questions in a reflective journal promotes this semantic weaving. Suggestions for questions are offered below, with an indication of the semantic range demanded of each question:

- What concepts or theories (SD+) help me to understand incidents, successes or failures that occurred in the lesson (SG+)?
- How is my conceptual knowledge of this topic (SD+), learning theory and diversity (SD+), and this pedagogical approach (SD+) extended by what I have observed and experienced in the classroom (SG+)?
- What aspects of teaching and learning in this context or to these students (SG+) require further research (SD+), observation or discussion with others (SG+)?
- How is what I learned while reflecting on this lesson related to what I learned from previous lessons, and how will it influence my planning and teaching of future lessons?

Again, we argue that if pre-service teachers know that their reflective journals will be assessed for evidence of an emerging ability to move between the contextual and the conceptual towards building their knowledge for inclusive teaching, they are more likely to do so.

Caveats

A few issues require clarification as we advocate for the use of lesson plans and reflective journals as ways to promote knowledge-building for inclusive teaching. We have not focused on the assessment of pedagogical action (Shulman 1987) during field experiences and it

could be argued that this is more important in promoting inclusive teaching. We suggest, though, that developing pedagogical reasoning is as important as pedagogical action in pre-service teacher education, and because pedagogical reasoning is less visible, it can be underemphasised in assessment. Second, as we have suggested questions that might promote the semantic weaving needed for knowledge-building in lesson plans and reflective journals, we are not denying the value of other components of these artefacts. Lesson plans do need certain routine information, and it is important to prepare a systematic and coherent series of steps that will realise the intended outcomes for a lesson. Similarly, we acknowledge the value of critical introspection that reflection offers, and do not dismiss the importance of pre-service teachers reflecting on their personal assumptions, struggles and successes as they seek to learn from their experiences. We also recognise the value of the many heuristic devices to promote reflection that are presented in the literature on this topic (Bassot 2013; Pollard et al. 2014). Finally, we are not proposing these questions as an exhaustive list of the issues that pre-service teachers should be considering in their planning and reflection. Other crucial areas include consideration of the organisational, collaborative and relational aspects of the field experience context, and how these impact teacher decisions.

Time is a crucial component of cumulative knowledge-building (see the horizontal axis in Figure 1). Our third caveat is to make clear that individual lesson plans or reflections on individual lessons or even units of work cannot achieve the kind of knowledge-building that effective inclusive teaching demands. In fact, we recognise the potential for each lesson plan or entry in a journal to be a segmented piece, even if it contains evidence of internal semantic weaving. There is thus a need for holistic evaluation of teaching performance and the reasoning embodied in the artefacts across the entire field experience. This would require an overall rubric or statement of expectations that makes clear to students that their knowledge of inclusive teaching is expected to complexify and become more nuanced over time. Finally, we take seriously the notion of 'initial' in ITE and argue that the most we can expect is that pre-service teachers begin to build connections between knowledge with SD+ and SG+ for inclusive teaching, with an orientation towards building this further through their professional careers.

Conclusion

Ensuring that pre-service teachers have theoretical knowledge for inclusive teaching is necessary if they are to understand the content of the subjects they teach, the processes of learning, the ways in which student diversity can impact learning, and their pedagogical options. This knowledge is best learnt formally, outside of the complex and often unpredictable space of real classroom contexts. However, on its own, conceptual, decontextualised knowledge is insufficient for pre-service teachers to develop inclusive teaching practices. They also need to observe and understand how principles underpinning inclusive teaching can be enacted within actual lessons taught in real classroom contexts to provide equitable learning opportunities to all members of the class. This kind of contextually grounded, experiential knowledge is best acquired through engagement and interaction within authentic sites of practice.

Resisting a theory/practice binary, our paper has framed the demand for both conceptual and contextual knowledge as the imperative for pre-service teachers to have knowledge for inclusive teaching with both stronger semantic density and stronger

semantic gravity. As each is best constructed in very different settings, an ongoing challenge for teacher educators is how to organise a process for knowledge-building that is not merely segmental, but also allows for cumulative learning. We agree with Robinson (2017) who recognises the need for 'careful and complex pedagogic design' in ensuring effective teacher education for inclusive teaching. Using the conceptual toolkit of LCT, we have shown how assessment expectations can be designed to enable opportunities that prompt pre-service teachers to make explicit connections between the conceptual learning from university-based coursework, and their pedagogical decision-making in the context of the lessons they teach. It is through explicit and intentional semantic weaving that pre-service teachers can learn to develop the interconnectedness of the core competencies required for inclusive teaching. This has the potential to establish a secure 'foundation for ongoing professional learning and development' of pre-service teachers (European Agency for Development in Special Needs Education (EADSNE) 2012, 7).

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