



Developing equitable elementary mathematics classrooms through teachers learning about children's mathematical thinking: Cognitively Guided Instruction as an inclusive pedagogy



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HIGHLIGHTS

- Teachers developed a clearer insight into children's mathematical understanding.
- Teachers recognised the importance of this knowledge.
- Previous perceptions of children's abilities were challenged.
- Teachers became more aware of their capacity to support all learners.
- Teachers recognised this learning as an ongoing process.

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ABSTRACT

This paper reports on a study carried out in Scotland which involved introducing the principles of Cognitively Guided Instruction (CGI) to 21 mainstream elementary teachers. It considers the effects of developing CGI in classrooms focussing on teacher learning and particularly their capacity to support all learners. The findings demonstrate teachers' awareness of their own learning and how increased understanding of children's mathematical thinking left them better placed to support all learners. The study highlights the importance of developing teachers' knowledge of children's mathematical thinking in order to promote inclusive practices with CGI providing a useful framework for this professional development.

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1. Introduction

Equitable practice in mathematics teaching acknowledges the involvement of all students in making sense of their mathematical learning within classroom communities that are respectful of difference (NCTM, 2000). This position reflects international moves exemplified by the Salamanca Statement (UNESCO, 1994) and driven by legislation that seeks to advance social justice, equity and inclusion. This agenda has been progressed in the United States through No Child Left Behind (2001) and the Individuals with Disabilities Education Act (2004); in the UK, in England through the Special Educational Needs and Disability Act (2001) and the English Code of Practice (DfES, 2001); in Scotland through the Standards in

Scotland's Schools etc. Act (2000), the Additional Support for Learning Act (2004 as amended 2009) and Supporting Children's Learning: Code of Practice (Scottish Government, 2010).

International studies on inclusive education have shown a continuum of educational provision, at a structural level, intended to accommodate all learners through appropriate allocation within that continuum (Armstrong, Armstrong, & Spandagou, 2010; Muskens, 2011; Rix, Sheehy, Fletcher-Campbell, Crisp, & Harper, 2013). A more radical view of inclusion recognises inclusive education as the restructuring of schools so that they become places for all children (Allan, 2010; Slee, 2011). If we are to have schools for all children then we must have classrooms in which everyone is a member of a 'community of learners' (Thomas, 2013). This requires a pedagogical approach intended for everyone. Traditional approaches to meeting the challenge of diversity in classrooms suggest that teachers need to access a specialist knowledge base or even a specialist pedagogy (Florian, 2009; Porter, 2005). An

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alternative view, argued for by proponents of inclusion, suggests that there may be a commonality to effective teaching practice that is of benefit to all learners (Norwich & Nash, 2011). The development of inclusive practice in relation to pedagogy becomes crucial if one considers the classroom as a place for everyone (Hart, Dixon, Drummond, & McIntyre, 2004). This is in contrast with the identification of some learners as requiring something additional and different frequently beyond the classroom and sometimes beyond the regular school (Florian & Black-Hawkins, 2011).

The application of the concept of inclusive pedagogy to the teaching of mathematics in the elementary classroom reflects a principled approach to teaching in a specific domain requiring knowledgeable teachers responsive to the needs of all students (Greer & Meyen, 2009; Jordan, Schwartz, & McGhie-Richmond, 2009). Responding to the needs of individuals on the basis of teachers' knowledge of children's thinking is challenging and complex and is connected to the type of professional development that teachers undertake (Jacobs, Lamb, & Philipp, 2010). Knowledge of children's mathematical understanding is a powerful instructional pointer (Fennema, Franke, Carpenter, & Carey, 1993) which facilitates an educational response to the learning needs of all pupils (Behrend, 2003; Empson, 2003). Cognitively Guided Instruction (CGI) provides a research-based framework, developed at the University of Wisconsin-Madison (Carpenter, Fennema, Franke, Levi, & Empson, 1999), for teachers to learn about children's mathematical thinking. This article reports on the introduction of the principles of CGI to mainstream classrooms in the UK. It focuses on the learning of twenty-one teachers in Scottish primary (elementary) schools. It considers what they gained from this professional development and specifically the extent to which they felt better equipped to support the learning of all children.

1.1. Inclusive pedagogy

A traditional response to support children who struggle in their learning follows a medical model in which the problem is viewed as a deficit within the child to be remediated. Such reductionist approaches are fundamentally rooted in behaviourist, lock-step approaches to teaching and assessment that historically have been a feature of special education (Dyson, 2001; Goddard, 1997; Thomas & Loxley, 2007). Rather than permitting the purpose of identification to be separatist (Tomlinson, 1982) and responding to this identification and assessment on the basis of individualistic interventions (Dyson, 2001), teachers and managers within schools might consider how they conceptualise learning difficulties not solely in terms of the needs of the individual but also from a pedagogical perspective. Ainscow (1994) has argued that the individualisation which traditionally lies at the heart of many interventions designed to respond to children's needs is problematic because it encourages a focus on the individual rather than on the curriculum, thus failing to recognise issues of instruction as potentially problematic. McIntyre's paper (2009), published posthumously, contains an editor's note that merits reproduction, in which an inclusive pedagogy is defined as:

a collaborative approach to teaching based on the idea that all children can learn together, and that participation in learning requires responses to individual differences among learners that do not depend on ability labelling or grouping, or the withdrawal of the learner for additional classroom support (p. 603).

This position questions the usefulness of distinguishing between groups in order to classify, instead drawing attention to the need to consider classroom conditions and contexts that facilitate effective learning for all pupils (Ainscow, 1999). Within this

perspective instructional decisions are not made on the basis of categorical differences but rather are based on detailed knowledge of the conceptualisations of individual children and the degrees of support required (Empson, 2003; Stough & Palmer, 2003). How this detailed knowledge then informs teaching and how teaching is structured to support all learners become important pedagogical decisions. Recognising the development of inclusion as linked to the development of pedagogy is key. In the US a case has been made for focussing on the improvement of teaching through focussing on children's learning (Stigler & Hiebert, 2009). This argument connects with Japanese models of teacher development that focus on interpreting pupils' learning rather than on techniques of teaching (Watanabe, 2002). This practice has been developed in Europe and in the UK (Dudley, 2012; Norwich & Jones, 2014) and specifically around children with learning difficulties as a way of developing more inclusive practice (Ylonen & Norwich, 2012).

A pedagogy in which the 'transformability' of every learner is recognised supports the learning capacity of every individual and the development of an inclusive culture (Hart et al., 2004). Florian and Black-Hawkins (2011, p. 2) describe this as requiring a 'shift in pedagogical thinking' away from what works for most learners along with something 'additional or different' for some learners towards creating opportunities in which all learners are able to participate. Inclusive pedagogy rests in a complex interplay involving teachers' knowledge and beliefs about: individual learners, teaching, self-efficacy and the pedagogical decisions and action which ensue (Jordan et al., 2009; Lalvani, 2013). Such practice also requires domain specific knowledge without which teachers may be ill-equipped to support all learners (Ball, Thames, & Phelps, 2008; Hiebert, Gallimore, & Stigler, 2002; Ma, 1999).

1.2. Pedagogical knowledge and beliefs

Pedagogy goes beyond the act of teaching and includes 'the ideas, values and beliefs by which that act is informed, sustained and justified' (Alexander, 2008, p. 4). Recognising pedagogy as teaching acts influenced by values and beliefs helps to distinguish an inclusive pedagogy from inclusive practices, the latter potentially being seen to address issues of equity through responses to legislation and procedural imperatives (Dyson, 2001). Implicitly an inclusive pedagogy recognises teachers' attitudes and beliefs as key elements of an inclusive approach.

The success of mathematics education initiatives is dependent on encouraging teachers to make changes in their beliefs (Lloyd, 2002, p. 150). Initiatives that seek to develop mathematical teaching which can be viewed as part of a reform movement in mathematics instruction (Fuson et al., 2000) are, to a considerable extent, dependent on the identification of effective strategies for professional development at every level within a school (Carpenter et al., 2004). Such initiatives prospectively facilitate significant shifts in teachers' beliefs (Lloyd, 2002). When teachers engage with innovative, or at least unfamiliar, practices there is potential for personal as well as professional development; opportunities arise in which existing pedagogical beliefs are challenged and questioned (Janssen, Westbroek, & van Driel, 2014; Makinen, 2013; Waitoller & Kozleski, 2103).

Although it has been acknowledged that no teacher alone has the expertise to meet the needs of every learner (Gardner, Scheuermann, Jackson, & Hampton, 2009) the notion that there is a unique body of pedagogical knowledge required by teachers to support particular learners has been challenged (Fletcher-Campbell, 2005; Jordan et al., 2009; Lewis & Norwich, 2001). This argument maintains that the interpretation of children's understanding is a crucial element in developing inclusive practices and recognises the application of knowledge of children's

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