

SOCIAL COGNITIVE THEORY AS AN INTEGRATED THEORY OF MATHEMATICS TEACHERS' PROFESSIONAL LEARNING

Gosia Marschall, Steven Watson

Stockholm University & University of Cambridge, University of Cambridge

Mathematics teachers' professional learning has frequently been treated as either predominantly participationist or acquisitionist – as social learning in becoming part of a community of practice or cognitive learning in the acquisition of knowledge and beliefs. Our experience within mathematics education suggests that professional learning is neither purely acquisitionist nor participatory and that a theoretically integrated treatment of both, together with affective processes of learning, helps shed more light on the complexities of professional learning. In this theoretical paper we firstly show how Social Cognitive Theory and its component theory of self-efficacy attend to this integration; and, secondly, illustrate this integration with an example from our research into preservice mathematics teachers' training.

INTRODUCTION

In the past, professional learning theory has often been characterised as either *acquisitionist* or *participationist* (Borko, 2004; Sfard, 1998). That is, theory tended to foreground the individual, cognitive, *acquisitionist* or the social, community, *participatory* aspects of professional learning. What we do in this paper is consider a particular learning theory, *Social Cognitive Theory* (SCT) (Bandura, 1986) and its component self-efficacy theory (Bandura, 1997), which helped us address the issue of theory dichotomy. This was prompted by our work and research in mathematics teachers professional learning (TPL) (e.g. Watson, 2013; Watson & Marschall, in press). Our interest in SCT resulted from our observations of and empirical work with professional learning rather than from a review of theory. Indeed, in this paper, we neither aim to critique other theories which, in the last two decades, have tried to attend to a comparison and an integration of the two dichotomised aspects of learning, nor do we suggest a grand theory of TPL. Our theoretical perspective comes from practice and is informed by social psychological theory.

Our interest in professional learning began from the perspective of practice and through our work in mathematics teacher education. In our work we noticed the importance of teachers' affective experiences and teachers' agency in their professional learning. We came to recognise the level of emotional demand on trainee teachers during their training (Watson & Marschall, In press) and we observed the extent to which practising

teachers would implement and sustain ambitious teaching approaches based on their level of confidence and emotion (Watson, 2014). For this reason, we considered professional learning in terms of the development of teacher self-efficacy (Bandura, 1997), with its overarching theory, SCT (Bandura, 1977, 1986, 1997). As we interpreted SCT in the context of mathematics TPL, we found that it provided a useful theoretical integration of *acquisition* and *participatory* metaphors of learning. It is an account of this theoretical investigation that we present here.

In this paper, we explain how SCT (Bandura, 1986) and its component self-efficacy theory (Bandura, 1997) integrate the dichotomised cognitive or *acquisitionist* and social or *participationist* treatment of theory of mathematics TPL (see, for example, Borko, 2004; Sfard, 1998) within one theoretical approach. While we have limited space to offer a full account of SCT and self-efficacy theory, our contribution here is in explaining, at a theoretical level, how this integration works and illustrating this with an example from preservice secondary mathematics teacher training. Overall, we suggest that this theoretical integration, that not only accounts for *acquisition* and *participation*, but also attends to affective aspects and teacher agency, could improve understanding of TPL.

We begin with a brief description of the *acquisition* and *participation* learning metaphors (discussed by Sfard (1998)). We then introduce a triadic causality framework, which we use to explain the dichotomised nature of the two approaches. Using the triadic framework, we then describe SCT and self-efficacy theory and explain how they integrate the two learning metaphors. Finally, we illustrate this integration with an example from our research into mathematics initial teacher education (ITE).

THE ACQUISITION AND PARTICIPATION METAPHORS FOR LEARNING

The *acquisition* metaphor represents the accumulation of knowledge; where concepts, ideas, meaning, facts and representations are internalised, appropriated or transmitted through cognitive and psychological processes (Sfard, 1998). Here, knowledge acquisition is seen as transfer, “from a social to an individual plane and internalised by the student” (Sfard, 1998, p. 6), but is considered primarily as an individual activity (Sfard, 2006). The *acquisition* metaphor implies learning programmes that develop or change beliefs, or that develop teachers’ knowledge.

The *participation* metaphor suggests social bonds and the development of identity in becoming part of a community of practice (Sfard, 1998). “*Participationists* conceptualise developmental transformations as changes in what and how people are

doing and claim that patterned collective activities are developmentally prior to those of the individual” (Sfard, 2007, p. 568). Research within this perspective focuses on membership in communities of practice or discourse, which are governed by their particular rules and norms (e.g. Sfard, 2007). In professional learning this suggests a focus on professional community, where learning involves changing the discourse an individual participates in (Sfard, 2007).

In reality, however, learning theories are neither purely one or the other but rather “acquisition-oriented or participation-oriented” (Sfard, 1998, p. 7), and any approach to understanding professional learning should attend to both metaphors (Sfard, 1998). In line with this view, there have been many attempts at utilising both metaphors, although executed mainly by employing pluralistic methodological research approaches (e.g. Borko, 2004; Kaiser, Blömeke, König, Busse et al., 2017). For example, in the context of teacher professional development, Borko (2004) proposed a *situative* approach, which makes use of “multiple conceptual frameworks and multiple units of analysis” (p. 4); using psychological frameworks when focusing on individuals and their knowledge evolution and development of understanding, and sociological frameworks when focusing on group of students and learning through participatory activities. What makes SCT different is that, instead of employing integration of the two metaphors on a methodological level, it presents a theoretically integrated approach.

CONCEPTUAL FRAMEWORK – THE BPE MODEL

In order to illustrate the *acquisitionist-participationist* dichotomy we use a triadic causality BPE model, as developed by Bandura (1977, 1997). In the model, behaviour and actions are denoted as ‘B’; a person’s individual thinking, affective states and cognition as ‘P’ and the environment, social context or culture as ‘E’. Although we acknowledge that *acquisition* or *participation* are not pure phenomena (there is a degree of overlap between them), for the purpose of our argument we present the most idealised forms of each metaphor i.e. almost purely *acquisitionist* or *participatory*.

In the *acquisition* metaphor (illustrated in Figure 1a) learning process involves the acquisition of knowledge and beliefs (P) about teaching. These are developed in response to the social and cultural context (E): $E \rightarrow P$. Actions and behaviours, practice and pedagogy (B) are a consequence of the teachers’ knowledge and beliefs: $P \rightarrow B$. In the *participation* metaphor (illustrated in Figure 1b) the main influence is of the social context (E) on behaviour (B): $E \rightarrow B$.

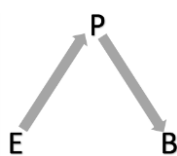


Figure 1a: Acquisition metaphor

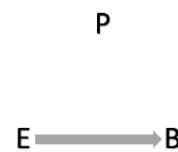


Figure 1b: Participation metaphor

This simplified visualisation illustrates the underlying dichotomy in the two metaphors of learning. We will use this model to show how SCT and self-efficacy not only integrate the two metaphors but also pay attention to affect and offer a sophisticated account of individual agency.

SOCIAL COGNITIVE THEORY

SCT integrates both cognitive and social aspects of learning presenting a reciprocal triadic relationship between behaviour (B), the individual (P) and the environment (E) (illustrated Figure 2), which Bandura (1977) explains as follows:

Personal and environmental factors do not function as independent determinants, rather they determine each other. Nor can “persons” be considered causes independent of their behavior. It is largely through their actions that people produce the environmental conditions that affect their behavior in a reciprocal fashion. The experiences generated by behavior also partly determine what a person becomes and can do which in turn, affects subsequent behavior (p. 9).

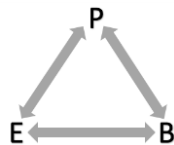


Figure 2: Reciprocal causation (Bandura, 1977, p. 10).

This presents a “transactional view of self and society, [where] internal personal factors in the form of cognitive, affective and biological events; behaviour; and environmental events all operate as interacting determinants that influence one another bidirectionally” (Bandura, 1977, p. 6). As well as integrating the social and cognitive aspects of learning, SCT incorporates affective aspects and provides a sophisticated conceptualisation of individual agency within a collective social context. Although *agency* is often treated as a property, capability or characteristic of the individual (Biesta, Priestley, & Robinson, 2015), SCT treats it as an emergent and evolving state, “achieved by individuals through the interplay of personal capacities and the resources, affordances and constraints of the environment by means of which individuals act” (Priestley, Biesta, & Robinson, 2015, p. 19). In other words, reciprocal causation provides opportunities for and simultaneously sets limits on individual self-direction for action (Bandura, 1997). This action, however, is guided by the individual’s agency and governed by their self-efficacy.

Self-efficacy is the belief an individual has in their capability to be successful in a domain (Bandura, 1997). It was originally presented as a component of SCT, though

its popularity as an operationalisation of SCT, it has latterly become a *guise* of SCT. It carries within it the triadic reciprocal causation of SCT, the transactional nature of agency, and reflects the affective aspects of confidence and motivation. It acts on behaviour,

by impacting goals, outcome expectations, affective states, and perceptions of socio-structural impediments and opportunities (Bandura, 1997). It is a belief about one's capabilities, developed through a self-assessment and assessment of the context, based on which the individual mentally models a course of action. Individuals who feel that they will be successful on a given task are more likely to be so because they adopt challenging goals, try harder to achieve them, persist despite setbacks, and develop coping mechanisms for managing their emotional states (Bruce & Ross, 2008, p. 347).

In learning to teach mathematics, the trainee teacher has a degree of agency as they construct and implement mental models of elements of practice and pedagogy that they have learnt through observing experienced teachers. They become self-efficacious in implementing culturally embedded practices, i.e. traditional teacher-centred approaches. The more self-efficacious the teachers become, the more likely they are to deviate from culturally accepted norms or use innovative approaches.

How self-efficacy is acquired has important implications for understanding and theorising teachers' professional learning and development. Bandura proposes four sources of self-efficacy: direct experience, vicarious experience, verbal persuasion, and physiological and affective states (Bandura, 1997).

Direct experience is the strongest source of self-efficacy, which develops self-efficacy through relating outcomes to the approach employed by the individual (Bandura, 1997). This implies the need for both cognitive processing and individual reflection during the learning process. As the individual develops mastery, the adopted approaches become less conscious and increasingly automated, routinised and based on sophisticated heuristics (Bandura, 1997). This goes some way in explaining why traditional teacher-centred practices are so common in mathematics classrooms and why they can be difficult to change (Watson, 2014) as well as why, once established, self-efficacy tends to remain stable over time (Bandura, 1997).

A second major source of self-efficacy is through vicarious observational processes. Individuals save considerable time and energy observing self-efficacious teachers and accumulating models of practice that they can use, adapt and absorb into their own developing practice. Lortie (2002) characterises teaching as an apprenticeship of observation, in which cultural patterns within practice and pedagogy are transmitted through generations. A third source of self-efficacy are social support and verbal persuasion. As teachers develop, encouragement from others helps them overcome dips in confidence and become more expansive in their teaching. In ITE these are offered by experienced mentors and colleagues, both in school and educational

institutions. The fourth factor, physiological and affective states, affect the individual's level of self-efficacy in two ways. On the one hand, stress and tiredness undermine a belief in one's capabilities. On the other hand, excitement and arousal can increase self-efficacy (Bandura, 1997).

The four sources of self-efficacy allow us to see the role of *acquisition*, *participation*, *agency* and *affect* in TPL. In England, university-based ITE involves the development of practice within the school context by collaborating and learning from experienced colleagues. These are complemented by faculty-based sessions, where trainee teachers are given theoretical tools to help them process, plan and reflect on their experiences. All of those create opportunities for preservice teachers to acquire knowledge, learn from others, participate in professional activities as well as reflect on practice and guide their own courses of action. The following example from our own research provides an account of this interplay.

ILLUSTRATION OF SCT IN INITIAL TEACHER EDUCATION

Alison is a trainee secondary mathematics teacher, whose development of self-efficacy is investigated over the course of a year-long ITE programme (see Watson & Marschall, In press). Alison's professional learning involves direct and vicarious experiences. As she begins to teach, Alison attends to planning, initially parts of and finally full, lessons. In terms of SCT, during this process, she cognitively constructs a *mental model* of actions in the lesson; a script that is to guide her action. The source of the models comes from observation of practice, even though, as SCT suggests, Alison's actions are not mere imitations of what she has observed. During the process, Alison expresses a degree of agency; she constantly assesses her capabilities and devises plans of action she believes she can execute effectively.

Affective aspects also have a role in Alison's mental modelling as well as in her performance. She herself often describes how big a part they play in her lesson planning and teaching, particularly in the early stages of her training. This is reflected in her account of her overall experience, which she summarises by saying: "...there were times when I felt like I wasn't really progressing, to go from being terrified to do a 10-minute starter, to actually enjoying teaching them for two hours is quite a big improvement!" (Watson & Marschall, In press, p. 17). Throughout the year, emotion and affect play important part in Alison's training. In our experience, this level of emotional demand is not uncommon for the majority of trainees.

While Alison *acquires* knowledge through *participation* in a community of practice, there is, as SCT suggests, a reciprocity, or transaction, between the *cognitive*

acquisition and the *social* participation. The development of Alison's abstract knowledge does not represent a mere *acquisition* of concepts but it is also practical and it relates to Alison's sense of self: affective and agentic. Alison's pedagogic knowledge and her actions in the classroom are deeply connected to her affective experiences, as illustrated by the following example:

[The lesson was] about using rectangles and trapezia to estimate the areas under curves, and I think it was the first ever thing I've taught where the students were more (rather than less) happy with it than I thought they'd be ... and it really boosted my confidence.

In short, Alison's self-efficacy reflects knowledge in action, affective aspects and agency, acquired within a community of practice.

IMPLICATIONS AND CONCLUDING REMARKS

SCT and self-efficacy integrate the *acquisitionist* and *participationist* metaphors of professional learning. The nature of the integration in SCT is transactional, the teacher negotiates their institutional and social context, with consideration of their personal resources: their knowledge, capabilities and dispositions. SCT takes into account affective states of an individual, where environmental and contextual effects together with physiological and emotional conditions can undermine teachers' level of self-efficacy. This is especially important for trainee teachers, who do not yet have enough experience to fall back on; in such situations mentoring and social support become critical in supporting them (Bandura, 1997). The transactional nature of self-efficacy allows for individual teacher agency: existing culturally embedded practices are sustained, but teachers can adapt the approach to reflect their own personality.

SCT provides a *theoretical* integration of dichotomised learning metaphors (as opposed to a methodological integration employed by other approaches). The key theoretical link involves affect and agency. SCT does not consider a teacher learning as acquiring knowledge and beliefs that are largely abstract or that *just* reflecting the behaviours developed through participation. It simultaneously considers the role of affect and agency in guiding and governing this learning.

Our current account has gone so far as to show *how* the theoretical integration takes place within SCT. We tentatively suggest, however, that, due to this integration, the application of SCT and self-efficacy to mathematics teachers' professional learning could contribute to improving the effectiveness of teacher training programmes.

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