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DISPOSITIONS AND CHANGING TEACHER PRACTICE IN MATHEMATICS

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and Paola Valero [Aalborg University]

Abstract:

In this paper, interpretations of learning from different socio-cultural-political perspectives are integrated to form a theoretical framework for exploring professional development in mathematics teaching. Although it is possible to identify the separate, contributing factors that operate in mathematics classrooms, little is known about how teachers perceive factors interacting together to affect student learning and the impact of these perceptions on their uptake of professional development opportunities. From their point of view, immersed in the complexity of everyday practice, teachers may perceive a different set of factors interacting in other ways than those imagined by the professional development designers and by the researchers. Therefore, the learning that teachers gain from participating in professional development may make only a limited contribution to them changing their practices and consequently improving student outcomes. We combine the work done in mathematics education by Skovsmose and Valero with Kemmis and Grootenboer's work on practice architectures to provide a theoretical framework for unpacking why some teachers may gain more from professional development than others.

Introduction:

Learning is a complex activity which has been theorised in many ways over the last one hundred years, but rarely has teacher professional development been considered in relationship to these theories. This may be because learning about being a teacher is equated with being a teacher (1999). Changing teacher practices due to a better understanding of what is occurring in their classrooms is seen as something that is 'done' rather than as something to be 'learnt'. Consequently, there is a perception that there is a difference between on-the-job learning and formal courses. Nevertheless, Linda Evans (2002) suggested that if teacher development is to be taken seriously as a research field, then it is imperative that there be greater conceptual clarity about what it actually is. In the conclusion of her article she listed a series of questions that she believed should be responded to by researchers in teacher development. These were:

- What constitutes teacher development?
- What factors influence teacher development?
- What does the teacher development process involve?
- What are the effects on the education system of teacher development?
- How might the teacher development process be effected? (p. 135)

In this paper, teacher development is considered to be a particular kind of learning and as such is a process embedded within a wider socio-political framework. The questions posed by Linda Evans frame our discussion of why such a broad interpretation of teacher professional development/teacher development/teacher learning is a beneficial. Within this discussion, the issue of social justice is highlighted. A concern for social justice is important because of the continuing, limited access that students from marginalised groups in society have to effective participation and achievement at higher levels in relationship to the expectations of the educational system. Limited participation and achievement in school practices are both the result of structural inequalities, as well as the vehicle for reproducing and strengthening these inequalities. It is a task of education to devise real possibilities to address this situation.

Over the last few years, testing regimes around the world including Australia have identified schools whose students are under-achieving in mathematics/numeracy. Professional development has been considered as one way to "fix" teachers to improve student outcomes (Duncombe & Kathleen, 2004; Borke, 2004) but this has not always resulted in success. For example, although a large scale numeracy professional development carried out in New Zealand led to increases in achievement for all students, the amount of increase differed according to ethnicity, socio-economic status and gender (Young-Loveridge, 2000; Young-Loveridge, 2003). Thus, the gap between the achievement of outcomes for different groups of students actually increased as a result of the professional development program. The Count Me In Too (CMIT) numeracy professional development project implemented in New South Wales often resulted in improvements in students' numeracy results on standardised tests. However, as Mitchelmore and White (Mitchelmore & White, 2002) stated "CMIT is no automatic

guarantee of such improvement. The school must also provide the appropriate environment to support its effective implementation” (p. 22). They clearly see the problem with the poor implementation of CMIT as lying with the schools rather than with the program itself. Unless the complexity of teacher development is explored more fully, then toss-away lines based on the work of researchers that blame one or other components of the program are all too easy for politicians to make. In relationship to jobs such as teaching, Stephen Billet (2003) expressed an understanding of the complexity of professional practice in relation to the diversity of conditions for its enactment:

So, despite its historical legacy and expression of cultural need, sociocultural practice in the form of a vocation is not uniformly enacted, as the circumstances of its enactment are likely to be diverse, and have distinct goals and requirements. (p. 136)

Therefore, using the ideas of Sfard and Prusak (2005), the questions that we should be asking when investigating human action and its underlying mechanisms are to do with the reasons why different individuals act differently in the same or similar situations, and why, despite differences, there seems to be a ‘family resemblance’ among the actions? If teacher development is about improving students’ life opportunities—and opening thereby the door to social justice— as a consequence of teachers changing their mathematics teaching practices, then there is a need to consider why it is effective in only some circumstances. Consequently, it is essential to not just understand what teacher development is but to consider what supports or hinders teachers to change because of the different contexts in which they enact their professional practice.

What constitutes teacher development?

One of Evans’ (2002) complaints about the *teacher development* field is the lack of clear definitions. However, when reviewing literature there also seems to be a proliferation of related terms, few of whom are compared with each other. For example, Kelly (2006) stressed that ‘teacher development’ should be considered ‘teacher learning’ because he felt that the teacher development could be equated with professional development opportunities and this did not match his concern about teachers moving towards expertise. However, he expressed his need to use an alternative term as “unlike Evans I will not use the term teacher development because, in my view, it does not provide for a distinction between teacher knowing and teacher identity” (p. 505). Consequently the definition rather than clarifying his terms actually makes them more opaque.

One of the reasons that Evans (2002) felt the need for definitions to be made explicit was to understand the relationship between a conceptual framework for teacher development and the research methodologies used. A fundamental issues seems to be whether teacher development is the process by which teachers come to implement changes in their practices—that is, a focus on the actual practice of teachers—or the professional development package provided to teachers that is the focus of the research program—that is, a focus on an intervention designed to alter teachers’ actual practice. Of course, there is a relationship between the two but it is essential that researchers make explicit how they conceive the relationship when clarifying the definitions. In this paper, we generally use the term teacher development but draw on discussions of teacher professional development and teacher learning. Our focus is on the process of teachers deciding to change their actual practices, and how this is affected not just by what is offered through a professional development package but also, and more importantly, by the many other influences that impact on teachers’ lives as human beings and as professionals. In particular, we want to know why some teachers find it difficult to adopt new practices even when they may acknowledge that these practices could support their students’ learning.

Research methodologies are based on theoretical frameworks and are chosen to match specific research questions (Borko, 2004). Consequently, a socio-cultural perspective rather than a cognitive perspective is more likely to be valid in our situation because we wish to focus on the context in the learning process. Borko’s (2004) definition, therefore, has much to offer a definition of what teacher development is. She stated that “[s]ituative theorists conceptualize learning as changes in participation in socially organized activities, and [changes in] individuals’ use of knowledge as an aspect of their participation in social practices” (p. 4). Reeves and Forde (2004) in a paper on “The social dynamics of changing practices” had similar attributes for the ‘activity sets’ used in their analysis of a head teachers’ program in Scotland. Others in different ways have used definitions that allow for contexts to include more than just what happens within a classroom. For us, teacher development involves teachers changing their actual teaching practices because of a change in the possibilities to make sense of and articulate the different resources of practice—including a variety of forms of knowledge, artifacts, values, norms, etc.— that are available to them. These resources for practice could be something that they already have a sense of and incorporate in their practice but which gains a new level of meaning, or new resources that they may start to be aware of and appropriate. In the next section we explore some of the factors

that we see as being important in teacher development.

What factors influence teacher development?

Borko (2004) saw professional development as consisting of:

- The professional development program;
- The teachers, who are the learners in the system;
- The facilitator, who guides teachers as they construct new knowledge and practices; and
- The context in which the professional development occurs. (p. 4)

These components identify the formal elements of professional development, but at the same time they ignore the informal dynamics of practice. The daily engagement in curricular development activities, the over-heard corridor conversations among colleagues, as much as working with a child in difficulties after school can be important moments of awareness that also contribute to teachers' possibilities for changing their actual practices (Valero, 2007). This is because aspects of these experiences match features of "effective professional learning", such as: opportunities for *collaboration*; *autonomy* and *choice* in teachers' work; *reflection*; *time* within the workday for professional development; and a *culture of inquiry* (Bonner, 2006 Summer). Features of a professional development program should be considered in very broad terms and not be restricted to prepackaged programs presented away from the schools in which teachers work (Duncombe & Kathleen, 2004).

In a similar manner, the people and the contexts considered as having an impact on teacher learning also need to be more than just the teachers themselves and the facilitators. Alrø, Skovsmose and Valero (Alrø, Skovsmose, & Valero, 2009) described the complexity of factors that constitute and affect mathematics learning in terms of a learning landscape. Although this model was developed from identifying the components that constitute students' learning in multicultural settings, it is not so far fetched to see the similarities with teachers' learning, especially if their classrooms are made up of diverse learners. Figure 1 is adapted from Alrø, Skovsmose and Valero's original diagram and suggests some components that constitute teachers' learning.

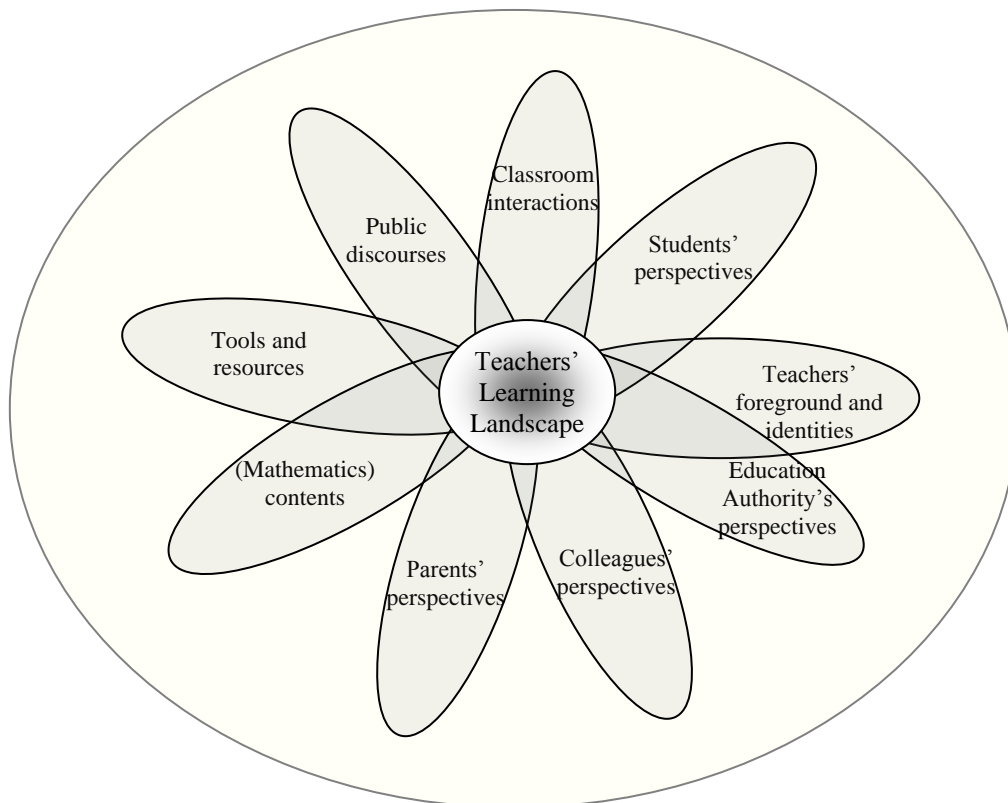


Figure 1: Learning landscape for teacher development

In contemplating why some professional development programs result in increases in students' performance whilst others do not, it is essential to keep this complexity in mind. Teacher development is not just about an

increase in awareness on teachers' interactions mediating content and pedagogy, but includes an understanding of how a wide range of dimensions interact to shape their enactment of new practices (Kelly, 2006). For example, Swaney (2007) advocates the use of staff reviews to force teachers to determine their learning needs. This could be seen as extremely threatening by teachers in schools which achieve poor results on national testing and thus endure the backlash of the public discourse which blames teachers for such poor performances (see interview with Julia Gillard, Australian minister for education, 10 September 2009 on http://www.deewr.gov.au/Ministers/Gillard/Media/Transcripts/Pages/Article_081009_185213.aspx).

Consequently, it is unlikely that such an approach would be successful with these teachers, not just because it does not meet the requirements for quality professional development, but because it infringes on their identities as teachers by positioning them as incompetent. This example shows that any kind of strategy for professional development has a systemic impact, and that we need to consider how it touches upon the complexity of inter-related dimensions where teachers' possibilities for changing their actual practices are constituted.

What does the teacher development process involve?

If we conceive of teacher development as changes in teaching practices based on a change in teachers' possibilities to make sense of and articulate the different resources of practice that are available to them, there is a need to know more about this process in terms of learning. Cognitive theories of learning, even when they acknowledge the role of social interaction, still focus on how individuals construct their knowledge (Billett, 2003; Kelly, 2006; Radford, 2008). Yet, nobody, including professionals, learn something new in isolation from other aspects of their whole lives. Teacher development is not just about adding new skills, knowledge etc. as advocated by many teacher educators (e.g., Bonner, 2006). Rather it is about helping teachers gain awareness, through their participation in collective practices, about what they already know and do. Alternative practices need to be seen not just in relationship to what teachers know about the general teaching profession, its historical and social construction, and the contents of schooling, but also about what they know about their immediate context. Hence, we subscribe to a "relational ontology that seeks to explore connections between all elements of a system, in contrast to an atomistic ontology in which 'objects' are defined discreetly, and in non-relational ways" (Wheelaan, 2007, p. 189). Following Radford (Radford, 2008), the "relational ontology" can be formulated as the social process through which participants become progressively conversant with the collectively and culturally constituted forms of reflection. The appropriation of those forms of reflection always happens in the entangled relationship between the individual, the collectivity and the forms of practice — including its resources. Therefore, learning is "not just about knowing something but also about becoming someone" (Radford, 2008, p. 215) within the set of given relationships. Teachers have knowledge about themselves and their teaching practices that are so ingrained in what they do that it remains unrecognised and unvalued, yet could contribute to learning if brought in relation with the awareness of other teachers (Duncombe & Kathleen, 2004). By construing teacher development as a process of teachers making sense of how they come to enact practices then it involves them continually becoming within that system of relationships.

In looking at the teacher development process in more detail, we have chosen to combine three sources of theories: socio-cultural and socio-political theories developed to address children's mathematics learning, general cultural theories of learning, and theories of practice architectures in teachers' development. The focus of these theories on learning as a process of meaning making seems particularly pertinent when considering why some teachers do not seem to transform their teaching practices as a consequence of involvement in professional development. If the meanings that teachers gain from being involved in teacher professional development do not result in changes to their practices, then they will have developed other meanings and these need to be understood.

Skovsmose (2005b) described learning as ascribing meaning to different activities that learners are engaged in, whilst Radford (2008) stated that learning "is a matter of actively and imaginatively endowing the conceptual objects that the student finds in his/her culture with meaning" (p. 223). Both Radford and Skovsmose acknowledge the impact of more than the learner themselves on this process. In developing his cultural theory of learning, Radford (2008) considers that learning is a culturally mediated experience, in which a learner or subject comes to understand an object in relation to "the dynamic and ever changing cultural-normative sphere of knowledge" (p. 225). In this way the object not only becomes 'visible' in the awareness of the learner but the learner him/herself becomes part of what is to be understood in the learning process. Subsequently, learning is seen not just as a process of knowing but as a practice of becoming. Therefore, these ideas are closely aligned to relational ontology and the tacit knowledge that teachers possess become part of the learning trajectory. For Radford, the dialectic process of objectification/subjectification does not occur in a vacuum but is embedded in the social-historical context in which the learner finds him/herself. Although in describing his theory, he gave some particulars about this 'context', it is not described in detail.

Nevertheless, if we are to understand why some teachers seem to be able to articulate their understandings of their practices and others are not, it is useful to have theoretical tools that help us making sense of how individuals are shaped by the cultural, extra-individual conditions, that is, their ‘context’. Duncombe and Armour (2004) felt that professional development provided through collaboration would be beneficial for teachers, but they were unsure whether it would be possible to implement a relational approach given the individualising structures within their school. To better understand the impact of these structures, we have drawn of the ideas of Kemmis. We see that his understanding of how practices transform an individual has resonances with Radford’s description of learning:

The process of gaining experience is a process of self-formation, especially when a person becomes ‘experienced’ in a deep and reflective sense. The identity of the practitioner who lives in and through familiar passages of practice is similarly shaped and formed by practice – the ‘skin’ of the practice is not external to the practitioner’s identity but part of it. The practitioner is an *agent* and *subject* of the practice; her or his *subjectivity* is reflexively formed and transformed by living through both familiar passages and new and surprising ones that call for new ways of working or living within the practice. (Kemmis, 2009, p. 11)

Kemmis and Grootenboer (2008) described three extra-individual structures and processes: culturally-discursive, material-economic, and social-political. These structures “shape dispositions and actions, both in the educator’s general response to a particular situation or setting, and in relation to their particular responses at particular moments” (p. 50). These processes were described as ‘practice architectures’ that both “enable and constrain each new interaction, giving familiar practices like education or farming or medicine their characteristic shapes” (Kemmis, 2009, p. 6). The saying, doings and relatings that mediate the shaping of individuals and structures that contribute to practice architectures often are bundled together. Figure 2 illustrates the connections between the structures and processes.

	Individual and collective <i>praxis</i> constitutes, and is constituted in, action via	Dimension/medium	Practice architectures constitute, and are constituted in, action via	
	Characteristic ‘sayings’ (and thinking)	The <i>cultural-discursive dimension</i> (semantic space) realised in the medium of language	Characteristic <i>cultural-discursive</i> orders and arrangements	
The individual: Education and the good for each person Education for living well	Characteristic ‘doings’ (and ‘set-ups’ of objects)	The <i>material-economic dimension</i> (physical space) realised in the medium of activity and work	Characteristic <i>material-economic</i> orders and arrangements	The world we share: Education and the good for humankind Education for a world worth living in
	Characteristic ‘relatings’	The <i>social-political dimension</i> (social space) realised in the medium of power	Characteristic <i>social-political</i> orders and arrangements	
	which are bundled together in characteristic ways in <i>teleoaffective structures</i> (human projects).		which are bundled together in characteristic ways in <i>practice traditions</i> .	

Figure 2: The individual and collective purposes of education constituted in praxis and practice architectures (from Kemmis, 2009)

Culturally-discursive mediating preconditions for engaging in teacher development would be the ways that teacher development is considered and discussed both by the teachers as participants and by facilitators as practitioners. For example, Kemmis and Grootenboer (2008) stated that “In the case of the education of the educator, the disposition of *epistēmē* – aimed at attaining truth – is formed and developed through engaging

with, and coming to one's own conclusions about, the different knowledge and traditions that have shaped and formed education in the past, and the perspectives of different educational theorists that inform different approaches to education today" (p. 41). In this paper, it can be seen that different approaches to teacher development may not share a similar set of terms for a discussion and this would affect what was deemed as appropriate teacher development strategies. Lange and Meaney (2010 forthcoming) described how as professional developers, they were mindful of providing support in ways that the teachers would recognise as being appropriate. On the other hand, material-economic preconditions are to do with the impact of the provision of resources. For example, in the teacher development literature there is much discussion about the need for teachers to have time in their busy days to undertake professional development (Bonner, 2006; Duncombe & Kathleen, 2004). If teachers are expected to do their learning in their own time, they may easily find it more valuable to concentrate on doing the myriad of activities that are already part of their jobs. On a different aspect, Radford (2008) describes the impact of artefacts on the meanings that learners make and so what is available to teachers will have an impact on how they develop their own teaching practices. The social-political dimension is concerned with how teachers are positioned in relationship to others. All of these relationships, such as ones with their principals, are historically-constructed sets of power relations. If, as Radford (2008) suggests, learning is about the process of becoming, then teachers' perceptions of the control that they have over the direction of their learning will affect the relationship that they have with other participants such as facilitators. If teachers, like students, have no say in what they learn and how they learn it because power relations have enabled others to determine this for them, then they are less likely to engage in the learning activities provided to them.

So far in our exploration, we assert that learning is a socially constructed activity. Individuals do not learn by themselves but through and with others (Radford, 2008). However, it is the learners' interpretation and sense making of the 'objective' reality that becomes the viaduct for locating and adopting alternative teaching practices. Skovsmose (Skovsmose, 2005b) wrote that "[m]eaning in learning comes to refer to a relationship between the dispositions of the learner, the intentions of the learner, the intended and unintended effects of learning activities, and the socio-political situation". More concretely, he says:

By the *foreground* of a person I understand the opportunities, which the social, political and cultural situation provides for this person. However, not the opportunities as they might exist in any socially well-defined or 'objective' form, but the opportunities as perceived by the person. Nor does the background of a person exist in any 'objective' way. Although the background refers to what a person has done and experienced (such as situations the person has been involved in, the cultural context, the socio-political context and the family traditions), then background is still interpreted by the person. Taken together, I refer to the foreground and the background of a person as the person's *dispositions*. (Skovsmose, 2005a, pp. 6-7)

The dispositions of a person "embody propensities that become manifest in actions, choices, priorities, perspectives, and practices" (Skovsmose, 2005a, p. 7). These propensities may be contradictory because the person may conceptualise different foregrounds and backgrounds at different times and situations.

In the centre of Figure 2, dispositions are interconnected with intentions, learning environments and reflections on the effects of learning activities, to contribute to teachers' development of meaning. Alrø and Skovsmose (2002) were interested in learning as action. They took intentionality as a defining element of action, thereby separating action from mere activity. If the learning situation allowed the active involvement of teachers, the resulting learning process could be one of action. Teachers identify with the intentions of the development activity, and thus joint ownership and shared perspectives between teachers, facilitators and others could develop. Intentional learning acts constitute forms of learning that are described as action. The meaning ascriptions resulting from learning-as-action would be different to those where teachers do not engage willingly.

Alrø and Skovsmose (2002) did not believe that all learning came from the active involvement of the learner. Much learning, including what occurs in pre-packaged professional development, happens by enculturation or assimilation, where teachers adopt knowledge or skills without much awareness that they have done so. Teachers need good reasons to engage in development activities, in order for their intentions to be connected to the learning process. The school principal, for example, cannot force teachers to accept the invitation to learn within a professional development activity, nor control the reasons why they accept. However, facilitators or principals can influence teachers' choices and reasons by making use of the teachers' experiences and previously acquired understandings when designing scenarios for teacher's development. However, the 'working conditions' provided by the school setting as perceived by the teacher need to encourage, sustain and valorise such creativity in design.

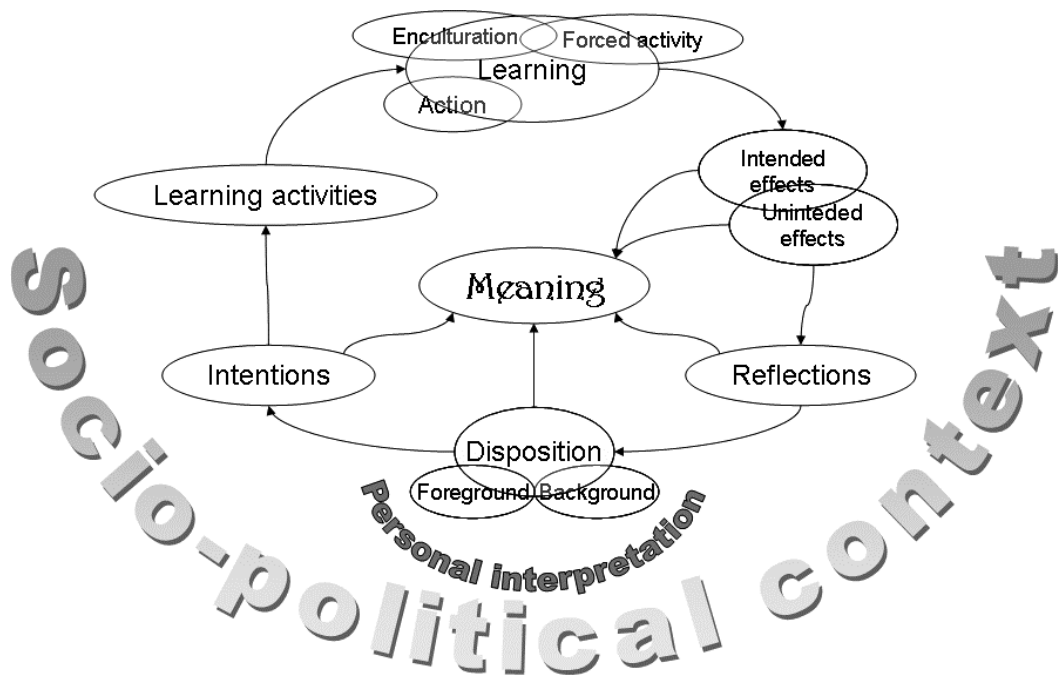


Figure 3: An illustration of the complexity of meaning in learning (from Lange & Meaney, 2010 forthcoming)

If teachers are not invited to engage in meaningful learning acts, the field is left open to all sorts of other meaning productions, such as *underground intentions* (Alrø & Skovsmose, 2002), which “refer to the students’ zooming-out of the official classroom activity[...] partly setting an alternative scene for what is going on in the classroom.” (p. 158). If adapted to teacher development, these intentions could result in teachers learning how to manoeuvre themselves out of the development opportunities, so that they avoid getting involved by sitting next to the right person, or by completing other work surreptitiously.

The teacher development process is complex and dynamic. It is perhaps no wonder given that teachers in a variety of different contexts bring with them a range of understandings of their current teacher practices and thus have different responses to teacher professional development activities. Sometimes these responses result in changes that support students’ own learning and at other times no change occurs. What does seem clear is that teachers are more likely to change their actual practices when they have more autonomy in the choice of professional learning activities in which they engage and when these activities make connections to their current awareness of classroom practices. Although many have listed similar attributes for teacher development as described in the previous section, this section has identified why these attributes are important by theoretically examining this process.

What are the effects on the education system of teacher development?

All too often teacher development and the education system is constructed as a one way street, with the education system designing and dictating the sort of teacher development that is offered. However, Kemmis (2009) argued that this should not be the case:

This to me is part of *the collective responsibility of a profession* like education or medicine: to contribute to the evolution of the professional practice for which its practitioners are not just accredited operatives but also stewards – custodians of the practice for their times and generation. As stewards, they have the responsibility to protect, nurture, support and strengthen the practice for changing times and circumstances, not as something fixed and fully sufficient but as something that must always evolve to meet new historical demands in the interests of changing communities, societies and the good for humankind (p. 12).

Teacher development should have an impact not only in practices inside classrooms and schools, but also on the education system. Depending upon the flexibility of the structures that surround the wider practice of education, the outcomes of teacher development will have more or less impact on the system in which it works. The cultural-discursive, material-economic and social-political dimensions will structure how the education system

receives feedback and implements it. Even in highly regimented systems, where teachers are required to attend state-run professional development sessions, the consequent loss of professionalism by teachers will have an impact on the education system. It may well be that in the long run the de-professionalisation of teachers results in the employment of teachers who are unable to flexibly initiate learning programs and processes for their diverse students, and this may have consequences for students' outcomes. In England, the National Numeracy Strategy was brought in for political reasons with the intention of improving students' achievement in mathematics. However, the professional development designed to support the implementation of the policy set in place a very strict teaching approach to numeracy, which teachers had to follow. Student results showed that high achieving students improved more than they had before the introduction of the National Numeracy Strategy, whereas low achieving student did not perform as well (Brown, Askew, & Millett, 2003). Although Brown et al. (2003) reported that teachers felt more confident with the teaching of mathematics and that professional development became more commonplace, teachers appeared to have adopted the simplest aspects of the Strategy such as planning and the structure of the lesson. Anghileri (2006) also found that boys performed better than girls after five years of the implementation of the strategy whereas before the implementation girls and boys had performed equally well. She ended her paper with "Where justification for the introduction of new strategies is not self evident, the impact of reform remains low in many schools" (p. 379). When the National Numeracy Strategy was renewed in 2006 and the structure became less rigid, teachers mentioned a loss of teacher knowledge as a consequence of the implementation of this strategy. Other critical analysis of the effects of the Strategy and its corresponding professional development initiatives show that the discursive strategies set in place contributed to the installment of a deficit view of mathematics teachers, which is difficult to overcome. De-professionalisation of teachers is an important tool of the Numeracy Strategy to justify itself and its permanence (Hardy, 2009).

How might the teacher development be effected?

At the core of teacher development there is a learning process. Teachers' learning about their practice, as argued above, is a dialectic process between the individual's possibilities of casting awareness over the complex set of elements that constitute teachers' practice —objectification, in Radford's terms— and the becoming conversant in the forms and resources of practice available in the collectivity and its context —subjectification, in Radford's terms. This process is social, cultural and political because it is embedded and constituted in a social, cultural, political, economic and historical context, that is, in an architecture of practice, a structural organization of practice. The relationship between the structural dimensions of teachers' practice —in Kemmis and Grootenboer's terms— is not deterministic. Individual teachers' practices and teachers' collective practices are shaped but not determined by those architectures. Teachers also shape and transform over time the form and meaning of those architectures. The relationship is dynamic. In Figure 4, we represent this relationship by having at the centre of the diagram the two interconnected arrows of subjectification and objectification, placed on the field formed by the confluence of the material economic dimension, the socio political dimension and the cultural discursive dimension of teachers' practice.

The dialectic process between learning at the level of the person and its structural constitution in context has mechanism of action. Those mechanisms, from many socio-cultural perspectives would be included in what is termed the *mediation* of thinking or of learning. We spell out what that mediation means in terms of a series of interconnected activities: As teachers engage in the action of changing their practice as a result of their new awareness on alternative possibilities, new intended and unintended effects are produced. These effects at the same time trigger a variety of interpretations of practice in relation to the complex, inter-related presence of a multiplicity of dimensions which affect teachers' practice. Those interpretations generate reflections and possibilities for an increase in awareness on the past, current and future possibilities of practice. At the same time, these enlarge the basis of dispositions from which new actions emerge. In the whole process, the relationship between the individual and all what embodies 'the social, the cultural and the political' —other people, the communities, the norms, values, regulations, structures, etc.— is the trigger of the mediational mechanisms. Without the recognition of "the otherness", no individual teacher has possibilities of becoming more conversant and, thereby, more aware of how to bring different resources of practice into play in the practice of teaching.

Designers and implementers of professional development packages for teachers need to understand that possibilities of actual teacher learning does not happen when setting in place programs that only tackle the content, or pedagogical, or pedagogical content knowledge of teachers. The issue at stake is not what kind of mental structures a professional program package is able to set in place in the teachers' heads. Teachers' development is a matter of opening the space for gaining awareness of how teacher learning happens within the intricacy of professional practice. Without linking in a strong way individual teachers with what entails the other

constitutive elements of their practice, no possibilities of change are possible. It could be then formulated that effective development strategies activate the “mediational” mechanisms of teachers’ learning.

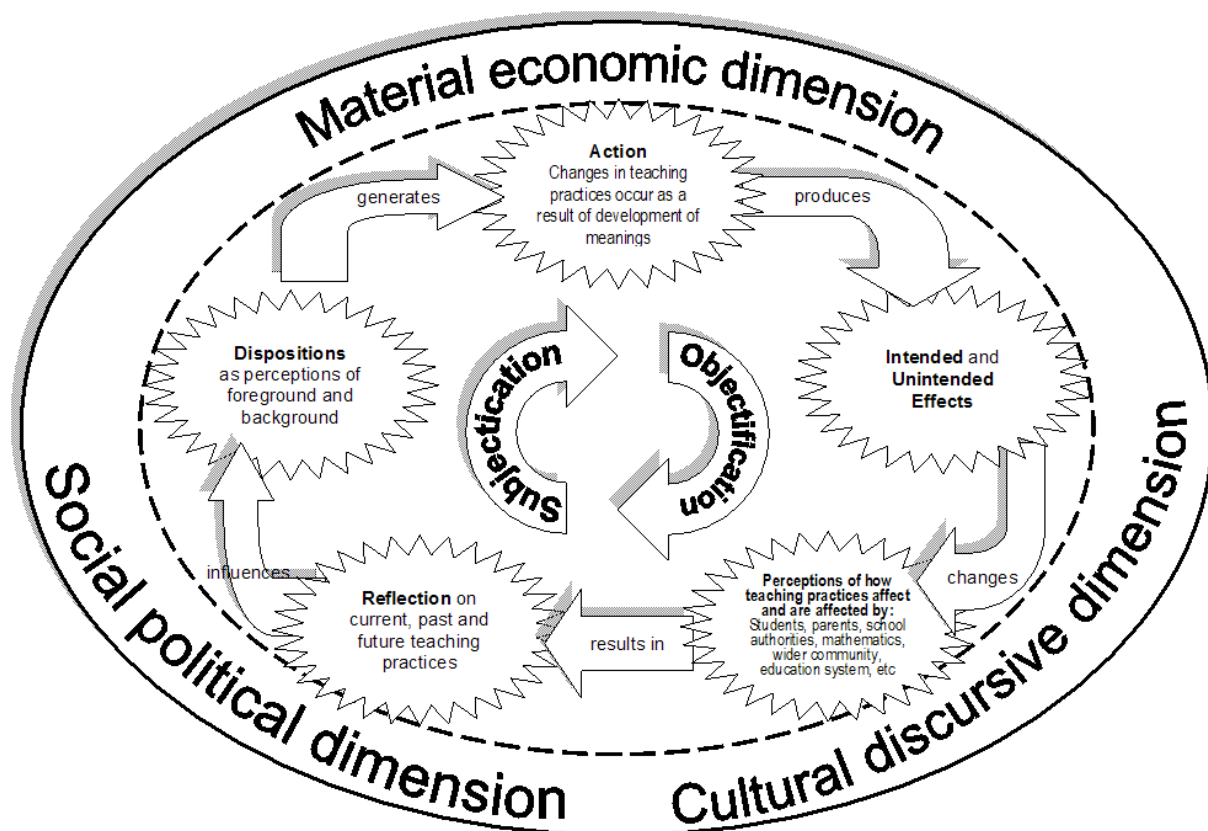


Figure 4: The mediation of teacher learning

Conclusion

Teacher development has been the focus of much research for some time. This work has tended to focus on identifying the features of professional development that were likely to contribute to improved student achievement. For example, Timperley, Wilson, Barrar, and Fung’s (2007) review of professional development research came up with a series of lists of features in professional development programs that were associated with increased student achievement. They also suggested a process by which teacher development occurs. However, there was no attempt to integrate the lists with the processes to provide a coherent picture of how teacher development occurs. Of the mathematics professional development projects that they reviewed, all were focussed on increasing teachers’ pedagogical content knowledge with more or less emphasis being placed on the content or the pedagogy depending upon the project. Although informative, we felt that research of this kind was not helpful in explaining why some teachers did not change their practices as a result of professional learning opportunities. Given that there were several instances of large professional development projects having the least impact on schools in low socio-economic areas where student achievement was already low, it seemed inappropriate to blame teachers. We anticipated that by theoretically describing the complexity of the teacher development process, we would better able to understand not just why some projects succeeded but also why some projects failed.

In this paper, we have used the questions of Linda Evans (2002) to frame our discussion of teacher development which we have considered could include activities from pre-packaged professional development opportunities to overheard corridor conversations of peers. Teacher development is the process that teachers undertake when deciding to change their classroom practices. This process needs to recognise that teachers have lives away from school that also contribute to their understandings about what occurs in their classrooms. Figure 4 illustrates how we have used the ideas of Radford (2008), (Skovsmose, 2005a; Skovsmose, 2005b) and colleagues (Alrø & Skovsmose, 2002; Alrø et al., 2009) and Kemmis and Grootenboer (2008) to illustrate how the teacher development process is affected by the teachers’ interpretations and awareness of the educational context, their individual teaching situations and the other people with whom they interact. Each of these sets of researchers has highlighted an aspect of how to consider the socio-political nature of teacher learning. From Radford, we

highlighted how teachers reconceptualise who they are as a consequence of the new meaning that they acquire. Skovsmose and colleagues provided details of how the circumstances are not add-ons but are intimately connected to the learning process. Kemmis' ideas of practice architectures showed how teachers may be constrained by the circumstances but they are not completely limited in what they are able to do. It is only through combining all of these ideas that the complexity of teacher development can be more fully realised.

If, as Kemmis (2009) suggested, education is to improve the lives not just of individuals but of the world community then models of professional learning need to acknowledge the importance of social justice. There is an old adage that "good teaching is good teaching anywhere" and this seems to pervade current research into effective professional development. Current research approaches seem to suggest that if only the features of effective professional development can be identified then teaching of all students will be improved. However, this is a far too simplistic understanding to be of any value and results in teachers in a range of challenging situations being blamed for limited improvement in student outcomes. By having a better insight into the complexity of the situation, it may be possible for facilitators of teacher development to be more flexible in what activities are offered and in the connections that are made to teachers' current understandings.

References

- Alrø, H. & Skovsmose, O. (2002). *Dialogue and learning in mathematics education: Intention, reflection, critique*. Boston: Kluwer Academic Publishers.
- Alrø, H., Skovsmose, O., & Valero, P. (2009). Inter-viewing foregrounds: Students' motives for learning in a multicultural setting. In M.César & K. Kumpulainen (Eds.), *Social interactions in multicultural settings*. Sense Publishers.
- Anghileri, J. (2006). A study of the impact of reform on students' written calculation methods after five years' implementation of the National Numeracy Strategy in England. *Oxford Review of Education*, 32(3), 363-380.
- Ball, D. L. & Cohen, D. K. (1999). Developing practice, developing practitioners: Toward a practice-based theory of professional education. In L.Darling-Hammond & G. Sykes (Eds.), *Teaching as the learning profession*. San Francisco: Jossey-Bass Publishers.
- Billett, S. (2003). Sociogeneses, activity and ontology. *Culture & Psychology*, 9(2), 133.
- Bonner, P. J. (2006 Summer). Transformation of teacher attitude and approach to math Instruction through collaborative action research. *Teacher Education Quarterly*, 33(3), 27-44.
- Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher*, 33(8), 3-15.
- Brown, M., Askew, M., & Millett, A. (2003). How has the National Numeracy Strategy affected attainment and teaching In Year 4? *Proceedings of the British Society for Research into Learning Mathematics*, 23(2), 13-18.
- Duncombe, R. & Kathleen, A. (2004). Collaborative Professional Learning: from theory to practice. *Journal of In-Service Education*, 30(1), 141-166.
- Evans, L. (2002). What is Teacher Development? *Oxford Review of Education*, 28(1), 123-137.
- Hardy, T. (2009). What does a discourse oriented examination have to offer teacher development? The problem with primary mathematics teachers. In L.Black, H. Mendick, & Y. Solomon (Eds.), *Mathematical relationships in education: Identities and participation* (pp. 185-197). New York: Routledge, Taylor and Frances.
- Kelly, P. (2006). What is teacher learning? A socio-cultural perspective. *Oxford Review of Education*, 32(4), 505-519.
- Kemmis, S. (2009). *What is to be done? The place of action research*. Keynote address to Collaborative Action Research Network Annual Conference, Athens, Greece, October 29-November 1, 2009
- Kemmis, S. & Grootenboer, P. (2008). Situating praxis in practice. In S.Kemmis & T. Smith (Eds.), *Enabling praxis: Challenges for education* (pp. 37-64). Rotterdam: Sense Publications.
- Lange, T. & Meaney, T. (2010 forthcoming). If a quarter crashes, so it dies : children's meaning making in mathematics lessons. In B.Sriraman, C. Bergsten, S. Goodchild, C. Michelsen, G. Palsdottir, O. Steinhorsdottir, & L. Haapasalo (Eds.), *The sourcebook on Nordic research in mathematics education*. Information Age Publishing.
- Meaney, T. & Lange, T. (2010 forthcoming). Structured or structuring: Setting up a professional development project. *Proceedings of the 6th Mathematics Education and Society International Conference*.
- Mitchelmore, M. & White, P. (2002). *The impact of Count Me In Too on Year 3 numeracy scores*. Sydney: NSW Department of Education.

- Radford, L. (2008). The ethics of being and knowing: Towards a cultural theory of learning. In L.Radford, G. Schubring, & F. Seeger (Eds.), *Semiotics in mathematics education: Epistemology, history, classroom and culture* (pp. 215-234). Rotterdam: Sense Publishers.
- Reeves, J. & Forde, C. (2004). The social dynamics of changing practice. *Cambridge Journal of Education*, 34(1), 85-102.
- Sfard, A. & Prusak, A. (2005). Telling identities: In search of an analytic tool for investigating learning as a culturally shaped activity. *Educational Researcher*, 34(4), 14-22.
- Skovsmose, O. (2005a). Foreground and politics of learning obstacles. *For the Learning of Mathematics*, 25(1), 4-10.
- Skovsmose, O. (2005b). Meaning in mathematics education. In J.Kilpatrick, C. Hoyles, & O. Skovsmose (Eds.), *Meaning in mathematics education* (pp. 83-100). New York: Springer Science.
- Swaney, A. (2007). Take the Leap: How Collegiality and Teamwork Leads to Real Professional Learning. *Teacher: The National Education Magazine*, (July 2007), 24-31.
- Timperley, H., Wilson, A., Barrar, H., & Fung, I. (2007). *Best evidence synthesis: Teacher professional development*. Wellington: New Zealand Ministry of Education.
- Valero, P. (2007). In between the global and the local: The politics of mathematics education reform in a globalized society. In B.Atweh, A. C. Barton, M. Borba, N. Gough, C. Keitel, & C. Vistro-Yu (Eds.), *Internationalisation and globalisation in mathematics and science education*. Springer Verlag.
- Wheelahan, L. (2007). Blending activity theory and critical realism to theorise the relationship between the individual and society and the implications for pedagogy. *Studies in the Education of Adults*, 39(2), 183-196.
- Young-Loveridge, J. (2000). How children's understanding of the number system varies as a function of ethnicity and socio-economic status. *23rd Conference of the Mathematics Education Research Group of Australasia (MERGA)*, (pp. 672-679). Freemantle: MERGA.
- Young-Loveridge, J. (2003). The impact of using strategy windows to select an appropriate form of assessment for students' numeracy learning. *NZARE/AARE Joint Conference Proceedings*. University of Auckland 30th November - 3rd December 2003: Available from <https://www.aare.edu.au/03pap/lov03402.pdf>