# Chapter 1.2.2
# School Experience During Pre-Service Teacher Education from the Students' Perspective

**Merrilyn Goos**, *University of Queensland, Australia*, and B. Arvold, N. Bednarz, L. DeBlois, J. Maheux, F. Morselli, J. Proulx

A challenge for teacher education is to understand how pre-service teachers learn from experience in multiple contexts—especially when their own schooling, the university methods course, and their practicum experiences can produce conflicting images of teaching. This chapter examines how pre-service teachers interpret their school experiences in the light of their university pre-service courses, their personal histories, knowledge, beliefs, and attitudes, and the specific constraints of the school environment.

## 1. Pre-Service Teachers' School Experience: (Dis)Connections with University Coursework

Ensor (2001) notes that the apparent disconnection between the teaching practices privileged by the university methods course and the practices adopted by pre-service and beginning teachers in their classrooms have been:

> variously attributed to educational biography (e.g., Lortie's [1975] "apprenticeship of observation"), school setting (e.g., Zeichner & Tabachnik, 1981), differential engagement by students with their teacher education courses (e.g., Lacey, 1977), or a failure to change teachers' belief systems (Cooney, 1985; Thompson, 1992) (p. 316).

Ensor acknowledges these influences in her longitudinal study of the transition from pre-service to beginning teaching of secondary-school mathematics, but she argues that the theory-practice disjuncture is better understood in terms of novice teachers' recontextualisation of pedagogical practices from the pre-service course to their school experience. This recontextualisation is shaped by access to recognition rules, which allow beginning teachers to identify and discuss "best practice", and realisation rules, which enable them additionally to implement best practice in their classrooms. Ensor suggests that university methods courses may provide pre-service teachers with access to recognition rather than realisation rules, leaving them unable to develop the repertoire of practices promoted by teacher educators.

Contributions to the 15th ICMI Study drew on a variety of theoretical positions to investigate ways in which pre-service teachers make the transition from university to classroom. Canadian research carried out by DeBlois and Maheux (2005) adopted

the theoretical framework surrounding situated cognition (Brown, Collins, & Duguid, 1989) to account for the influence of teacher education students' experiences in different contexts—as school pupils, university students, and pre-service teachers in a school setting. This research investigated gaps between primary pre-service teachers' planning and enactment of classroom activities, their explanations for these gaps, and the nature of the learning that resulted. Discussion teams were formed to promote joint reflection, each consisting of the pre-service teacher, his or her partner teacher, the school's special education teacher and a researcher. Meetings of the teams were held before and after the pre-service teachers tried out planned activities in the classroom.

Analysis of transcripts of the team discussions resulted in the identification of four types of adaptations to describe gaps between plans and classroom enactments: projective adaptations, withdrawal adaptations, normative adaptations and avoidance adaptations. Projective adaptations occurred either at or near the beginning of activities, whenever pre-service teachers exploited pupil attitudes or interest "to question them further" or whenever they used "a pupil's difficulty or explanations to foster or pursue a discussion". Withdrawal adaptations occurred when pre-service teachers deemed "the pupils capable of resolving certain difficulties" and decided not to intervene. This sometimes led them to turn the discussion over to the pupils or allowed them to observe consistent error patterns amongst several pupils. Normative adaptations occurred whenever pre-service teachers observed "a gap between a pupil's comments and the teacher's expectations", and prompted the pupil to adjust or adapt by pointing out the error. Avoidance adaptations arose whenever pre-service teachers simplified the task at hand or lowered their expectations, for example, in response to pupils' lack of motivation or understanding.

The number and type of adaptations deployed appeared to depend on three factors. The first relates to the specificity of the teaching intention, possibly stemming from the pre-service teacher's previous experience as a university student. Well-defined intentions seemed to prompt the pre-service teachers to adjust to pupil reactions projectively, while ill-defined intentions prompted them to adhere more closely to their plan even when this was not appropriate. The second factor is concerned with the level of comfort with pupil reactions, teaching materials and mathematical concepts, and preferred teaching approaches, which may stem from growing experience as a pre-service teacher. Comfort is associated with projective adaptations and discomfort with a need for control, evidenced by normative or avoidance adaptations. The third factor is based on pre-service teachers' previous experience as a school pupil, in which a given event is posited as resulting from a "best" intervention. As a result of these team discussions, the pre-service teachers were better able to understand and justify their choices with respect to interpretations of pupil reactions. They—and the teacher educators—were then able to recognise the evolution of the teaching situation (Brousseau, 1983), the "taking charge" of classroom activities, and the pre-service teachers' projection into their professional practice.

In another Canadian contribution to the 15th ICMI Study, Bednarz and Proulx (2005) investigated the extent to which secondary pre-service teachers appropriated aspects of their university mathematics education program. They invoked

the concepts of "action knowledge" (Schön, 1983) and "structuring resources" (Lave, 1988) as principles guiding the design of a four-year secondary mathematics teacher education program that focuses specifically on the learning of mathematics teaching-in-action rather than learning-about-action. From the pre-service teachers' perspective, emphasis is placed on actual teaching situations in a cycle of planning based on a conceptual analysis of a mathematical notion, a prior analysis of curricula and usual teaching approaches, the construction of a repertoire of chosen problems, a classroom teaching experiment consisting of a sequence of lessons, presentation of a reflective analysis of these lessons to fellow students and an experienced practising teacher, and subsequent re-adjustment of plans for the lessons taught.

Bednarz and Proulx summarised case studies of five pre-service teachers' practices that reveal interesting differences in how they appropriated elements of this teacher education program. Analysis of interviews showed that each had a different view of the program (**Table 1.2.2.1**); these views were also reflected in their video-recorded teaching practices.

Enrico, Donna, and Carl appropriated principles on a general level: for them teaching is a way of being rather than doing. Albert worked mostly on a pragmatic level, using ideas from the course only in a technical way and at specific moments, while Bertrand reproduced what he was taught in the program without really knowing why. Each of these pre-service teachers used their particular "lens" to interpret many other aspects encountered in their school practicum, for example, when they interpreted textbooks, interacted with practicum supervisors and associate teachers, analysed final exams, and so forth. These results prompted Bednarz and Proulx to question their own practice as teacher educators modelling "good practice" and acknowledge the problematic nature of the relationship between pre-service teachers' university and school experiences.

**Table 1.2.2.1**  Pre-service teacher views of the teacher education program (Bednarz & Proulx)

| | |
|---|---|
| Albert | The program is seen as a source of potential teaching resources. It offered him, in his terms, some interesting and possible 'tools' (activities, problems, questions to ask, etc.) to use in his teaching. |
| Bertrand | The principles/content brought forth in the program are considered optimal and ultimate: he does not question them and takes them for granted. The teacher educators have an authoritative status for him, and he 'blindly' follows what was suggested. |
| Carl | He recognized himself, as a teacher, in the principles brought forth in the program—involved implicitly in his practice. This program confirmed his practice and helped him to explicate (give a name to) the very practices he was enacting. |
| Donna | The enunciated principles were seen as a philosophy of teaching, in which general ideas on education and mathematics teaching were the centre. She does not focus on specifics for particular subjects, she aims at themes like encouraging students to argue, working on diverse solutions, contextualising mathematics, and so on. |
| Enrico | The program gave him a model-in-action of teaching—not by the concepts brought forth in the program, but from the way the teacher educator was teaching. The teacher educators were seen as teaching-in-action models. |

Reflecting on the enormous variation in the pre-service teachers' perceptions of the university program led Proulx (2005) to further question the structure, development, and possible objectives of mathematics teacher education programs:

> Drawing on Pimm's (1993) concept of "change merchant", Breen (1999) explains that for some educators it has become a central task to convince others of the quality of their own particular merchandise and have people use their "magical" infallible method—that is, to have the intention of controlling and of striving towards creating or generating "perfect teachers".

However, Proulx suggests that the outcomes of a teacher education program cannot be controlled, as they are more diverse and unpredictable than we might expect. This is not to say that it is unproductive to educate teachers or that there cannot be specific goals in a mathematics teacher education program. The issue, rather, is how to treat the notion of objectives.

Oriented by the research results outlined above, Proulx offers a redefinition of "objective" as a starting point for development instead of an end point to attain. From this proposal he theorises that objectives could be framed in terms of expanding the space of the possible (Davis, 2004). The focus would then shift from ideas of conformity and convergence on a specific way to teach towards ideas of emergence and expansion, thus striving for legitimisation of a generative model of teaching that views teachers as responsible and autonomous beings. The significance of such a model is that teachers should "come to possess rationales and reasons to support the actions and claims they make in the classroom". Proulx argues that this is where the identity of the teacher stands: in the acquisition and construal of a personal, defensible, sustained rationale (stance and position).

## 2. Pre-Service Teachers' School Experience: Personal Histories and Embedded Traditions

Research has suggested that pre-service mathematics teachers' beliefs, orientations toward knowing, goals and aspirations, and early educational experiences are critical to teaching practices. Morselli (2005) claims that the situation for prospective primary school teachers is of special concern as their previous experience of learning mathematics at school has not always been positive. Her contribution to the 15th ICMI Study adopted Charlot's (1997) concept of relation to knowledge (*rapport au savoir*), of which the relation to mathematics (*rapport aux mathématiques*) is a special case. The relation to mathematics is defined as "the set of relationships that the subject has with some objects (theorems, activities, but also people, situations, events) that are related to mathematics". Charlot suggests an analysis of the difficulties of students in terms of their interpretation of school experiences. As a consequence, Morselli takes into account the personal histories of pre-service primary school teachers in asking, "How can the concept of relation

to mathematics help to better understand the needs and difficulties of pre-service teachers?"

Although Morselli's study does not examine participants' school experience during the teacher education program, it does consider possible relationships between their past and present relation to mathematics and their future work as teachers of mathematics. A questionnaire seeking this information was completed by 122 pre-service primary teachers. Responses to open questions gave personal opinions about mathematics referring to school life, teachers, and difficulties in learning mathematics, thus confirming the centrality of school experiences. Responses to the question, "How do you feel, if you think of your future job as a teacher, referring in particular to the teaching of maths?" were varied: 12 percent felt optimistic and prepared, and 31 percent affirmed their hope that they would help their pupils like mathematics. On the other hand, 14 percent felt worried, 3 percent feared they would make their pupils hate mathematics, and 15 percent doubted that they would be able to make their pupils understand. These answers suggest that their relation to mathematics may influence the quality and efficacy of their teaching.

In a related contribution to the 15th ICMI Study, Arvold (2005) uses the concept of embedded tradition to explain inconsistencies between teacher education programs and the classroom practices of pre-service and beginning teachers. She proposes that embedded tradition, an amalgamation of beliefs, goals, orientations towards knowing (and thus reminiscent of Morselli's "relation to mathematics"), and other constructs that are closely aligned with each other and central to a person's identity, can provide a springboard for personal and professional growth.

Nine cohorts of pre-service secondary mathematics teachers participated in Arvold's research, and many volunteered to continue their involvement after graduation. Through an early study of three novice teachers, Arvold came to realise that they attended to different aspects of the pre-service program and made sense of the program quite differently as well (cf. Bednarz & Proulx, 2005). Their orientations towards knowing and their beliefs about mathematics, teaching, and learning were different, but most striking after analysis of data from their year in the program and their first year of teaching was the influence of their differing goals and aspirations. Follow-up visits to these teachers' classrooms near the end of their eighth year of teaching confirmed that their goals and teaching methods remained much the same. The question emerging from working with these initial participants was, "Could we better prepare teachers if we focused on helping them springboard from their embedded traditions?" Arvold's subsequent research has been in response to this question. She challenges us to reconsider our goals as teacher educators and to ask whether we are preparing students well if we only prepare them to model what we demonstrate. Her work strongly suggests that:

> teacher educators need not direct all teachers to what they consider successful methods, i.e., 'best practice', but instead teacher educators might at least consider helping teachers use their embedded traditions to springboard themselves into a profession in which diversity of teaching methods will provide students with even greater chances for mathematical success.

## 3.  Learning From Experience: School Contexts, Personal Histories, and University Coursework

Rather than examining separately the disconnections between pre-service teachers' school experiences and their university coursework, personal histories, beliefs, goals, and orientations to knowing, Goos's (2005) contribution to the 15th ICMI Study outlined a theoretical framework for simultaneously analysing these relationships and how they shape novice teachers' professional identities. The framework draws on sociocultural theories that interpret learning as increasing participation in social practices. It extends Vygotsky's (1978) concept of the Zone of Proximal Development (ZPD) to enable analysis of teachers' interactions with their environment and other people, over time and across different contexts, by introducing two additional zone concepts originally proposed by Valsiner (1997). The Zone of Free Movement (ZFM) represents environmental constraints within the school context, such as student characteristics, curriculum and assessment requirements, and availability of teaching resources, while the Zone of Promoted Action (ZPA) symbolises the efforts of a teacher educator or more experienced colleague to promote particular teaching skills or approaches. Pre-service teachers develop under the influence of two ZPAs—one provided by their university program, the other by supervising teacher(s) during their school experience—which do not necessarily coincide.

Vignettes from a case study of transition from pre-service to beginning secondary teaching illustrate how the framework can guide analysis of teachers' professional experiences (**Fig. 1.2.2.1**).

The ZPA offered by supervising teachers in Sandra's practicum school was not a good match for the ZPD that defined her knowledge, beliefs, and goals about using technology in mathematics education, nor did it provide a pedagogical model consistent with the technology emphasis of the pre-service course. While some elements of Sandra's ZFM (e.g., easy access to calculators that no one else wanted to use) presented favourable opportunities to use technology, others (e.g., students' attitudes and lack of motivation) may have acted as constraints, discouraging her from using technology again. Sandra's response to this configuration of experiences suggests that there was sufficient overlap between the university course's ZPA and her personal ZPD for her to continue enacting her pedagogical beliefs about using technology.

Compared with her practicum experience, Sandra's first year of teaching offered a more expansive ZFM. Yet there was no ZPA within her school environment, and lack of professional development opportunities in this isolated community made it difficult for her to access an external ZPA. While she was still able to draw on the knowledge gained during her university program (the pre-service ZPA), Sandra recognised her need to gain new ideas via collaboration with other more experienced teachers beyond the school in order to further develop her identity as a teacher for whom technology was an important pedagogical resource.

Goos proposes that the zone framework could support pre-service teachers' learning by helping them to analyse their school experiences (ZFM), the pedagogical models these offer (school ZPA), and how these experiences reinforce or

**Vignette #1: School experience**

Sandra's university methods course emphasised integration of technology (computer software, Internet, graphics calculators) into mathematics teaching and learning. Her responses to questionnaires concerning mathematical and pedagogical beliefs demonstrated strong commitment to use of technology as part of a student-centred teaching approach. Her practicum placement was in a large school with many computer laboratories that had recently purchased its first class set of graphics calculators. None of the teachers had found time to learn how to use the calculators. Sandra was familiar with computer software used in mathematics teaching and regularly searched the Internet for teaching ideas. She used the computer laboratories in her mathematics teaching during the practicum, but she had not observed other teachers in the school use any kind of technology with their classes. When Sandra was teaching linear programming, she decided to show her mathematics class how to use the graphics calculators because this would help them understand how to plot the objective function, observe the feasible region, and find the optimal solution. She found and adapted an optimisation activity from the Internet for this purpose. Because the students had never used graphics calculators before, she also devised a worksheet with keystroke instructions and encouraged students to work and help each other in groups. Yet she encountered strong resistance from the students, which seemed to stem from their previous experiences of mathematics lessons. Other teachers focused on covering the content in preparation for pen and paper tests and did not allow the students to work in groups. The students were not interested in helping each other or in learning how to use technology if this would be disallowed in assessment situations.

**Vignette #2: First year teaching**

After graduation Sandra moved to a small school in a rural town far from the city. The school had several class sets of graphics calculators as well as a hire scheme for senior students, but no other mathematics teachers knew how to use them effectively. Sandra had used all of the technology-based resources provided in the university methods course and continued searching for more. But she found this difficult because of a slow Internet connection and lack of access to professional development. Nevertheless she remained enthusiastic about using technology and could describe the benefits for students' learning in terms of developing deeper understanding of mathematical concepts. She used email to maintain contact with colleagues in other schools as a source of teaching ideas.

**Fig. 1.2.2.1** Vignettes from a case study of transition from pre-service to beginning teaching (Goos, 2005)

contradict the knowledge gained in the university program (university ZPA). This analysis could also support the transition to the early years of teaching by promoting in beginning teachers a sense of individual agency within the boundaries and constraints of the school environment (ZPD within ZFM).

## 4.  Concluding Remarks

Each of these studies speaks to the need for teacher educators to help pre-service teachers develop their own professional identities and acknowledges that identities are shaped by complex and often unpredictable interactions between pre-service teachers' past histories, their school experience during the teacher education program, and the objectives and practices promoted by the university methods course.

Modelling of "best practice" during the pre-service course does not lead to the formation of "perfect teachers" cast entirely in the mould of the teacher educator. This is indicated by researchers' use of terms such as "recontextualisation" (Ensor, 2001), "appropriation" (Bednarz & Proulx, 2005), and "adaptation" (DeBlois & Maheux, 2005) to describe ways in which pre-service teachers draw on their university methods courses. Rather than viewing these disconnections—between theory and practice, university and school, plans and their enactment, teacher educators' objectives and pre-service teachers' aspirations—as a problem to be solved, it may be more helpful to treat the school experience component of the teacher education program as an alternative, and productive, site for engaging with pre-service teachers' identities within the profession.

# References

Arvold, B. (2005). *Goals embedded in tradition: Springboards for mathematics teacher education*. Paper presented at the conference of the 15th ICMI Study on the Professional Education and Development of Teachers of Mathematics, Águas de Lindóia, Brazil.

Bednarz N., & Proulx, J. (2005). *Practices in mathematics teacher education programs and classroom practices of future teachers: From the educator's perspectives and rationales to the interpretation of them by the future teachers*. Paper presented at the conference of the 15th ICMI Study on the Professional Education and Development of Teachers of Mathematics, Águas de Lindóia, Brazil.

Breen, C. (1999). Circling the square: Issues and dilemmas concerning teacher transformation. In B. Jaworski, T. Wood, & S. Dawson (Eds.), *Mathematics teacher education: Critical international perspectives* (pp. 113–122). London: Falmer Press.

Brousseau, G. (1983). Fondements et méthodes de la didactique des mathématiques. *Recherches en Didactique des Mathématiques, 7*(2), 33–115.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 28*(1), 32–42.

Charlot, B. (Ed.) (1997). *Du rapport au savoir. Eléments pour une théorie*. Paris: Anthropos Paris.

Cooney, T. (1985). A beginning teacher's view of problem solving. *Journal for Research in Mathematics Education, 16*, 324–226.

Davis, B. (2004). *Inventions of teaching: A genealogy*. Mahwah, NJ: Erlbaum.

DeBlois, L., & Maheux, J. (2005). *When things don't go exactly as planned: Leveraging from student teachers' insights to adapted interventions and professional practice*. Paper presented at the conference of the 15th ICMI Study on the Professional Education and Development of Teachers of Mathematics, Águas de Lindóia, Brazil.

Ensor, P. (2001). From preservice mathematics teacher education to beginning teaching: A study in recontextualising. *Journal for Research in Mathematics Education, 32*(3), 296–320.

Goos, M. (2005). *Theorising the role of experience in learning to teach secondary school mathematics*. Paper presented at the conference of the 15th ICMI Study on the Professional Education and Development of Teachers of Mathematics, Águas de Lindóia, Brazil.

Lacey, C. (1977). *The socialisation of teachers*. London: Methuen.

Lave, J. (1988) *Cognition in practice: Mind, mathematics, and culture in everyday life*. Cambridge: Cambridge University Press.

Lortie, D. C. (1975). *Schoolteacher: A sociological study*. Chicago: University of Chicago Press.

Morselli, F. (2005). *Reflections on pre-service primary teachers' needs and difficulties: Their "relation to mathematics"*. Paper presented at the conference of the 15th ICMI Study on the Professional Education and Development of Teachers of Mathematics, Águas de Lindóia, Brazil.

Pimm, D. (1993). From should to could: Reflections on possibilities of mathematics teacher education. *For the Learning of Mathematics, 13*(2), 27–32.

Proulx, J. (2005). *"Objectives to work on" vs "objectives to attain": A challenge for mathematics teacher education curriculum?* Paper presented at the conference of the 15th ICMI Study on the Professional Education and Development of Teachers of Mathematics, Águas de Lindóia, Brazil.

Schön, D. (1983). *The reflective practitioner: How professionals think in action*. New York: Basic Books.

Thompson, A. (1992). Teachers' beliefs and conceptions: A synthesis of the research. In D. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 127–148). New York: Macmillan.

Valsiner, J. (1997). *Culture and the development of children's action: A theory of human development* (2nd ed.). New York: John Wiley & Sons.

Vygotsky, L. (1978). *Mind in society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press.

Zeichner, K., & Tabachnik, B. (1981). Are the effects of university teacher education "washed out" by school experience? *Journal of Teacher Education, 32*(3), 7–11.