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THE ROLE OF METAPHOR IN A NEW SCIENCE TEACHER'S LEARNING FROM EXPERIENCE

1. INTRODUCTION

In this chapter, a teacher candidate and a teacher educator explore the role of analogy and metaphor in the development of a pre-service science teacher. The primary data source is an interactive electronic journal, spanning a 10-week teaching practicum, with the two authors exchanging comments at fortnightly intervals. Analysis continues through to the conclusion of the pre-service program, supplemented by further analysis of the practicum exchanges and the interaction of candidate and teacher educator during their work in chemistry and physics method courses. This chapter documents and interprets a teacher candidate's awareness of his early professional development and draws connections to recent literature about the role of perception in learning from experience.

2. THE CONTEXT FOR STUDYING METAPHORS IN LEARNING TO TEACH

Michael completed an eight-month Bachelor of Education program at Queen's University between September 2002 and April 2003; his teaching subjects were chemistry and physics. Initial data were collected in the period October to December 2002, when Michael completed a ten-week practicum placement in an eastern Ontario secondary school. (In early November, halfway through the practicum, he returned to Queen's for additional classes.) Metaphors appeared early and spontaneously in Michael's writing about his experiences. These metaphors quickly became the major focus of our conversations and a significant feature of Michael's professional development.

During the October-to-December period, Michael sent a practicum report file every two weeks to Tom, who inserted comments and returned the file to Michael. As we passed the file back and forth over the course of 12 weeks, we built a document that ran to more than 12,000 words. Why Michael uses metaphors often in

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writing about his professional learning is not something we can explain here. Our goal is to illustrate and interpret the metaphors and to explore their significance in Michael's professional learning as a science teacher.

3. METAPHORS IN THINKING AND WRITING ABOUT PRACTICE

We know little about *why* we use metaphors in our thinking, speaking and writing. The experience of seeing one thing as or like another seems far more spontaneous than deliberate. Thus it seems quite different from many of our teaching and learning experiences in schools, where deliberate, step-by-step learning seems the norm. In the literature on learning to teach, metaphor is mentioned frequently and is often seen as an element of reflective practice. Hoban (2000) asked preservice teachers to identify a metaphor to "conceptualise an optimal relationship between teaching and learning" (p.168), while Martinez, Sauleda, and Huber (2001) worked to "clarify the crucial role of metaphors in educational thinking" (p.966), concluding that "by disclosing the metaphorical bases of thinking about teaching and learning we hope to assist teachers in bridging the gap between their implicit and explicit knowledge" (p.973). Hunt (2001) used metaphor in a discussion of the facilitation of reflective practice in a programme for experienced educators, and Perry and Cooper (2001) used metaphor "as an educative tool for reflection" on "personal images of change" held by teacher educators (p.41). Cook-Sather (2001) proposed "that teacher educators use the metaphor of translation to illuminate the process of preparing to teach" (p.177) and came to the following conclusion:

> Learning to teach must be an ongoing, informed, deliberate, embodied process of discerning and rendering meanings that continually shift. The metaphor of translation illuminates the efforts, struggles, resistances, and epiphanies preservice teachers experience as they prepare to re-enter high school classrooms. It throws into relief the process of becoming a teacher—a process that is at once duplication, revision, and recreation, with meaning lost, preserved, and created anew. (p.189)

Michael's accounts of his practicum experiences and our conversations about them illuminate the role of metaphor in his process of learning to teach through his early efforts at reflective practice. The following selections from our original file illustrate the range of metaphors that Michael used.

Table 1. Excerpts from Michael's Practicum Notes, with Tom's Comments

Michael's comments on his practicum experiences	*Tom's comments in reply*
Weeks 1 – 2 Prepared and delivered a lesson on projectile motion for the Grade 12 physics class. I was pretty excited about it: it had a good hook (monkey/ banana toss on overhead when they came in); review from the basics up with some good thought-examples; a little mini-lab; and a handout with a couple of problems which spelled it all out so explicitly. I knew it was something they were shaky in but had been exposed to, as I'd seen them stumble on rectangular components but finally achieve projectile motion problems. It was brilliant!	This 'episode' you describe could be a textbook classic—or should be! You make it so very clear how excited you were by the planning you had done, and then you quickly found yourself reminded that it's you+subject+students, not just

Michael's comments on his practicum experiences	*Tom's comments in reply*
Then I *delivered*. The monkey overhead sparked some interest, but *getting them to talk about different possibilities was like pulling teeth.* They all wound up agreeing on one answer, mostly because they were afraid to be wrong. I reassured them that it's just ideas, but *they played the part of torture victims*. So I left them hanging, promising that by the end of the class they'd know the answer, and why.	you and the subject (or you and the students). What's magical in your writing is your imagery! It adds a lot of clarity as well as interest.
In the review of rectangular components, they explained their ways of remembering when to use cos & sin, and I wrote them on the board. We talked about the exclusivity of perpendicular elements, and did a demo. I guess I should have had them do some simple, simple problems early on, because when I finally had them do what I thought was a simple problem, *they froze up and seemed to have never seen the stuff before!*	
I don't know. *I was so expecting some lights to go off.* Out of the six, two of them got it, but probably already had it. …	
I think: 1) I overestimated where they're at, 2) I overestimated the brilliance of the logic of my presentation, and 3) I presented things in a way sufficiently different from what they're used to that they froze up and forgot what they did know.	
Weeks 3–4–5 Time. It's the great enemy. At night, lesson planning. During the day, teaching. Throughout the year, trying to teach a curriculum. I love being with the kids, I love running a well-planned class. I have troubles getting excited about all the time it takes to do it. I'm tired.	Here's the image/analogy of the week (in italics). Your sense of persistence ('I'll get 'em yet') contrasts a bit with 'all the time it takes to do it.' As weeks go by, you are learning how to set priorities. Can you sense that some things are already getting a bit easier?
The Grade 12s are interesting to teach. There are only six of them, so it's a very casual atmosphere; management is simply not an issue. They all (save for one) have great work ethics and are keen to learn. But get excited? I haven't seen it yet. *They're like whipped horses*, obliging but *somehow lacking some life in them*. I struggle to find the spark for them. Humour goes a little ways, but isn't the catalyst it can be. Challenges are taken, but with a sense of WORK, as opposed to adventure. I'll get 'em yet, somehow.	
On-campus for two weeks between weeks 5 and 6 When I got to [my school] and met my associate, my impression was 'I'm sure I have lots to learn from him.' And I feel I have. I think I've integrated well into his class, format, and routine. I made most of my lessons from scratch, preparing the daily overhead notes, making up worksheets, tests, labs, etc.	Learning to be the teacher you don't want to be sounds pretty serious — perhaps you can focus some of your thoughts of the next five weeks on this issue. 'Arbitrary harness and blinders' — wonderful imagery again. I don't think we'll scare it away by noticing it!
But looking back, I can't help but feel that I'm learning to be the teacher I don't want to be! It seems there's so much of my own vision that has been *obscured by some arbitrary harness and blinders I've willingly stepped in to.* While the routine is good for class management, and perhaps even the consistency some kids	

need, I just know there's so much more I can do!So many different

Michael's comments on his practicum experiences	*Tom's comments in reply*
ways to be!	
On-campus for two weeks between weeks 5 and 6 I was so busy trying to figure out where the next good wave was coming in, and *paddling like mad to get there and heaving myself up onto the board and trying to balance and steer and not get scrubbed in the sand* below and . . . Wait a minute, breathe! What's the weather doing? Am I integrating with the waves or fighting them? Am I still in safe distance from the shore? Am I remembering the reason I'm out here? Couldn't see the ocean for the waves. Coming back to McArthur [for two weeks] was like a swim in to the beach, and checking in with a wizened old surfer cat blinking slowly and saying, 'Sure looks like you're working hard out there.'	You DO like the imagery and run well with it. What you say here seems very rich. You take the time to spin it out—something I often don't manage to do. I admit that I wondered if I qualify as a 'wizened old surfer cat'—I expect I do, even if I can't surf!
End of two weeks on campus I fear I've become a bit self-conscious of metaphor now. I have this fear of being contrived. Are there any ways in which you'd like us to steer this conversation? I appreciate your questions, and know there is a deeper well to reflect from than what I can necessarily see from my perspective.	I'm no longer worried that I've made you self-conscious—I think it comes to you fairly naturally!
Weeks 6 – 7 I'm amazed at how slowly some of the 11s hold on to even the simplest things, especially compared to the 9s! Most of the Grade 9s are *sponges who soak up information*, while the 11s are *suitcases, already full with sports, relationships, fitting in, etc., into which they sometimes find room to store coursework.*	Here we are—yet another image!! Sponges vs. suitcases. I wonder if the same contrast applies to teacher candidates? Some are real sponges? Some are suitcases with very fixed views on everything from subject area to how kids should behave? You strike me as a *sponge who's willing to consider throwing some of his stuff out of his suitcase?*
Weeks 8 – 10 They didn't always *take the bait* with demonstrations; I couldn't believe how underimpressed they were by making sound disappear by actually removing the air molecules [the bell is] vibrating! They were content to believe me in what's happening without needing to see (or hear) it for themselves. And the 'do we get marks for this?' question; I'm sure there must be more I can do to promote intrinsic motivation, but there seems to be *a culture that rebels against that*, almost feels threatened by it, and works to dismantle the small outposts of it that do exist. It's like I have to *'trick' them into being curious about something!* I need some more of those tricks.	I expect that evacuating a bell jar didn't get their attention because they've seen it several times before. Your comments here could lead to a book! As long as a teacher is 'tricking' students into curiosity, then the more fundamental intrinsic motivation issue is being ignored, and the tricks won't work. Yes, it's a culture, a culture of extrinsic motivation driven by well-meaning parents and teachers who hope that kids can be tricked into better marks and staying in school. Surely one of your own personal characteristics is that

Michael's comments on his practicum experiences	*Tom's comments in reply*
Final comments about 10 weeks When you first asked (Weeks 6-7) whether I thought more on-campus time between practicums would be beneficial, I was unsure. I had a sense that more time could be beneficial, but not a clear idea of how, or why. I felt there was adequate time to digest the previous five weeks. Now, though, I can see it. They were an active two weeks on campus, especially on the subconscious level. *Digesting, backing the chair away from the table. Looking up from the enchanting plate before us and surveying the massive feast laid out on the table. Some exchanges with fellow diners, and the subtle influence of the chefs, ensuring we're enjoying the meal. Then, soon enough, the next course is served.*	you are intrinsically motivated. Interesting that you says it's on the subconscious level—how could we make it otherwise?
Not a bad approach. *But between those courses—full of the aroma, tastes, intoxication of the food—could be a very inspired time to head to the kitchen and prepare some variations on the dishes.* Now could be the best time to prepare some of the dishes we can imagine in this unique place and time we're experiencing! *Get up from the table, not only to share what's happened, but also to go to the kitchen and whip up a few inspired dishes!* Soon enough we'll be engaged in the next course, a little more experienced, but nonetheless fully engaged in all that's before us. All of which is a roundabout way of saying that more time could be effectively used to prepare some exemplary lesson plans.	Notice the brilliant metaphor you use here—diners at a feast. And then you pursue it by suggesting that the diners themselves need to experience preparation of these new dishes, all with a view to preparing to actually using the intoxicating ideas being served up. So you suggest using the restaurant venue as a setting for that preparation—and indeed I've always felt that much of the purpose and potential power of the practicum, for secondary candidates, involves their returning to students and setting that have become quite familiar.

Ultimately, during our seven-month conversation, metaphors were in one sense the catalyst and in another sense only the tip of the iceberg. The metaphors in Michael's writing prompted us to continue these conversations in person and in further electronic entries. At the end of the eight-month program, Michael stayed in Kingston for several weeks and agreed to review all that he had written with a view to interpreting the metaphors he had used in his writing and to assessing their significance in his professional learning. His efforts were very productive, helping him to understand the many transitions he experienced during the learning-to-teach process.

4. NEW PERSPECTIVES ON THE DEVELOPMENT OF PROFESSIONAL KNOWLEDGE

4.1 Metacognition and Conceptual Change in Learning to Teach

Before reporting our further conversations about the metaphors in Michael's writing about his teaching experiences, we call attention to three recent contributions to the

literature on teachers' development of professional knowledge. We begin with a case study of a student teacher named 'Barbara.' Bryan and Abell (1999) introduce the case by declaring their perspectives on the role of experience in learning to teach:

> The heart of knowing how to teach cannot be learned from coursework alone. The construction of professional knowledge requires experience…. Experience influences the frames that teachers employ in identifying problems of practice, in approaching those problems and implementing solutions, and in making sense of the outcomes of their actions. (pp.121-122)

The case begins with an account of what Barbara believed about science teaching and learning and moves on to describe her vision for teaching elementary science as well as the tensions within her thinking about her professional responsibilities. Of particular interest was Barbara's initial premise that a teacher should continue to teach a scientific concept until all children show that they understand it. As the process of reflection became apparent to her, "Barbara began to shift her perspective and reframe the tension between her vision and practice. Her professional experience provided feedback that forced her to confront the idea that in teaching science, teachers need to consider more than students getting it" (p.131). While this is only one case study, the implications for further study of learning from experience seem clear:

> Barbara's case implicitly underscores the fallacy of certain assumptions underlying traditional teacher education programs: (a) that propositional knowledge from course readings and lectures can be translated directly into practice, and (b) that prospective teachers develop professional knowledge before experience rather than in conjunction with experience.... Teacher educators are challenged to coach prospective teachers to purposefully and systematically inquire into their own practices, encouraging them to make such inquiry a habit... (p.136)

Bryan and Abell conclude that "the genesis of the process of developing professional knowledge should be seen as inherent in experience" (p.136). "A preeminent goal of science teacher education should be to help prospective teachers challenge and refine their ideas about teaching and learning science and learn how to learn from experience" (p.137). Our conversations about Michael's practicum experiences forced us both to re-think our assumptions about how people learn to teach.

4.2 Phronesis and Episteme

Kessels and Korthagen (1996) offered a novel perspective for reducing the "theory-practice problem" by drawing on the Greek distinction between *episteme* and *phronesis*, a distinction that can also be seen as the difference between scientific understanding and practical wisdom. While episteme is at the core of our experiences of schooling and thus quite familiar, phronesis calls attention to our perceptions and how they are influenced by experience.

> The ultimate appeal of phronesis is not to principles, rules, theorems, or any conceptual knowledge. *Ultimately the appeal is to perception.* For to be able to choose a form of behavior appropriate for the situation, *one must above all be able to perceive and*

> *discriminate the relevant details.* These cannot be transmitted in some general, abstract form…. This faculty of judgment and discrimination is concerned with *the perception or apprehension of concrete particulars,* rather than of principles or universals. (p.19, emphasis added)

Kessels and Korthagen extend their comments about the significance of phronesis for those learning to teach in words that extend those of Bryan and Abell and challenge the fundamental premises of many preservice teacher education programs:

> The point of phronesis is that the knowledge a student needs is perceptual rather than conceptual. Therefore it is necessarily internal to the student, it is in the student's experience instead of outside it in some external, conceptual form. It is thoroughly subjective…. And so there is nothing or little to transmit, only a great deal to explore. And the task of the teacher educator is to help the student teacher explore and refine his or her perceptions. This asks for well-organized arrangements in which student teachers get the opportunity to reflect systematically on the details of their practical experiences, under the guidance of the teacher educator—both in group seminars and in individual supervision. (p.21, emphasis added)

Acknowledging that we live in an educational world that relies extensively on episteme, we do not claim to have understood fully the meaning of phronesis. Yet phronesis seems intimately linked to metaphor within the experience of perception. Our focus here has not been on Michael's formal understanding of teaching but on his evolving perceptions, not only of the students he taught but also of his own learning to teach.

4.3 Spontaneous and Non-Deliberate Processing of Experience

Schön (1983) gave considerable impetus to the "teacher as reflective practitioner" movement with his distinction between problem-solving and problem-setting (pp.39-42). Reframing problems to develop and enact new approaches became an attractive image for teachers thinking professionally about their work. Working from a conceptual analysis based on the work of Iran-Nejad (1990), Oosterheert and Vermunt (2003) suggest that teacher educators have been trying to encourage reflection-in-action without acknowledging the differences between problem-solving, on the one hand, and reframing of problems, on the other. Suggesting that there are three sources of regulation in knowledge construction, Oosterheert and Vermunt (2003) distinguish between "external" and "internal" sources of regulation in constructing knowledge. External sources (including practicum teaching experiences) provide information from outside the learner (whether child or adult). Internal sources of regulation refer to the capacities of the brain "to process information and to reconstruct existing knowledge" (p. 159). Adding to the familiar idea of "active" internal sources of reflection, the authors offer the new category of "dynamic" internal sources of regulation and argue that these are essential in learning to teach. In doing so, they build on Iran-Nehad's (1990) challenge of the assumption that learning involves incremental internalisation in response to external sources. They contrast active and dynamic self-regulation in the following terms:

- Active processing is "slow," "deliberate," and "sequential," while dynamic processing is "rapid," "non-deliberate," and "simultaneous."
- Active self-regulation processes information that is "conceptual" and "important", while dynamic self-regulation processes information that is "sensorial" and "interesting."
- The learning experience of active self-regulation involves "internalisation," "knowing," and "effort," while the learning experience of dynamic self-regulation involves "reconceptualisation," "understanding," and "ease." (Oosterheert & Vermunt, 2003, p. 160)

Teacher educators who have employed reflective practice perspectives may quickly recognize these contrasts between "active" and "dynamic" as similar to Schön's contrast between *solving* problems and *reframing* problems. We are particularly interested in the implications of seeing internal sources of regulation as

- "Active" self-regulation appears to capture the familiar tasks of schooling, including note-taking, homework, reviewing, quizzes and tests. In contrast, "dynamic" self-regulation appears to lead to the conceptual changes that science teachers often take as goals and genuine indicators of their success in teaching. It also appears relevant to the conceptual changes that teacher educators seek to develop in helping new teachers understand and learn from practicum experiences.
- "Active" self-regulation appears to capture the familiar tasks of learning to teach, including class participation, preparing and presenting practicum lessons, and completing assigned work. In contrast, "dynamic" self-regulation appears to lead to the shifts of understanding and perspective that teacher educators often take as genuine indicators of their success in helping individuals learn to teach.

Key features of "dynamic" self-regulation, as presented by Oosterheert and Vermunt, include "rapid, spontaneous, non-deliberate, simultaneous" processing of "sensorial" information leading, with "ease" to "reconceptualisation" and "understanding" (p.160). These all seem to be characteristics of Michael's spontaneous use of metaphors in writing about his practicum experiences. He was not deliberately attempting to include metaphors; his metaphors were part of dynamic rather than active self-regulation.

Oosterheert and Vermunt provide a key conclusion that seems particularly relevant to Michael's writing:

> Dynamic sources only become effectively involved when existing knowledge is not taken for granted in the interpretation of classroom experiences. Teaching experiences fail to be educative when the desire to see something new is absent…. One cannot (start to) see things that one is not looking for. Without interest…. there is mere perception, based on existing prior knowledge. The perception of classroom life then tends towards self-confirmation. (Oosterheert & Vermunt, 2003, pp.165-166)

Thus the authors contend that learning to teach involves taking learning beyond activities in which students proceed "deliberately and intentionally" (p.170). In their view, professional learning also involves "non-deliberate processing strategies" (p.170).

5. THE SIGNIFICANCE OF METAPHORS IN MICHAEL'S PROFESSIONAL LEARNING

We return now to our account of Michael's learning. Table 2 reports an exchange between Michael and Tom over a seven-day period shortly after Michael completed the formal requirements of his B.Ed. program. Here Michael writes explicitly about opening up to his own learning, as he and Tom write back and forth with a view to exploring the significance of metaphors in Michael's professional learning. Metaphors, metacognition, and conceptual change are all apparent in this summary of what Michael feels he learned from this extended conversation about his learning from experience.

Table 2. Michael's Analysis of his Professional Learning

Michael on May 13	Tom on May 18	Michael on May 19
Looking back on my year of teacher training with an eye on the metaphors I used to describe my experiences has offered me a **fresh perspective on my own development process.**	Michael, I put the bold in yesterday, and the italics after reading today. Anything you can add in reply to my comments and questions would move us even further.	The fact that we're engaged in this right now is excellent continued learning. It would be easy for me not to unpack some of this stuff.
I came into the program *looking for tools to help make my job easier*. I hadn't particularly thought about *how I would acquire the tools,* beyond the obvious mix of theory and practice that lay ahead. **If pressed, I would likely have said that I would learn some skills and practices from my professors, then apply them in the classroom. Simple!** Like so many students, **I was hoping to be told how to teach**. Of course, this is hardly surprising – it's how I remember most of my own schooling.	I find 'looking for tools' fascinating—learning to teach is acquiring tools (perhaps skills?)—certainly not fresh perspectives!	Or so I saw it coming into the program. But *so much of what we need to learn is in fact about perspective:* understanding what it means to be a professional, for example, or what it means to have ADHD.
My approach to my own learning naturally shows up in my teaching, and my reflections about it. I am now both surprised and informed to see **how much of the imagery I invoked in my writing about my practicum experiences revealed a transmissive approach** – where I thought I was 'delivering the perfect lesson' and 'expecting	This is a very honest as well as impressive insight.	I think I was aware of this at the time of teaching, and this is a reason for my discontent and for the *shift* I felt I needed. *It's the realization that I have something I want to or need to learn that makes all the difference.*

lights to go off' for the kids.

Michael on May 13	Tom on May 18	Michael on May 19
Although **lacking a clear alternative** to this style of teaching, I became acutely aware that this was not the type of teaching to which I aspired. I stated that I saw senior students 'behaving like whipped horses,' and was fearful that I, too, was **stepping willingly** into the **'harness and blinders'** provided to me by my practicum situation. I did not feel that I was finding the type of modelling that I was hoping for in the classroom, and did not particularly expect that my professors could fill that role in the university classrooms. *Something had to shift for me*, and it did.	WHY did something have to shift? To deal with the frustration you were feeling?	Yes, I was frustrated and disappointed. I wasn't finding what I was hoping to find. So I had to change either what I was looking for, or how I was looking for it. I guess both eventually happened, but the rigidity of the program made the former more accessible than the latter.

We conclude this analysis of Michael's professional learning by stepping out of the table format and presenting Michael's concluding analysis, revealing active self-regulation, on May 13 and 19. On May 13, he wrote as follows:

> In fact, my shift as a student in a B.Ed. program became visible to me only in hindsight, and through an examination of the metaphors I used to describe my teaching and learning experiences. Although there were many contributing and reinforcing factors along the way, there was a point where I changed from expecting delivery from associate teachers and professors to recognising my own responsibility in learning what I felt I needed to learn. Perhaps characteristically, the deep learning came as an offshoot of another topic. Through discussions about rubrics, I realised the number of preconceptions, biases and assumptions I had about them, even though I had never actually used one! I was also amazed to realise 'how malleable' I was, and these revelations triggered for me an understanding of the importance of that term I had heard but not felt: metacognition. I described it as 'the distorting haze of my prior beliefs burn[ing] away,' and it was the point at which I 'bought in' to the teacher education program. I realised that I had much to learn about my own learning and teaching, and that the responsibility for both lay with myself. From this point on, there are some changes in the metaphors I used towards a more egalitarian conception of teaching and learning: references to being 'on the same team,' or on a wagon together.

On May 19, his final thoughts were these:

> 'Transmission' shows me how steeped I was in it and the tension I was feeling to get out of it. Two main things come to mind:
>
> 1. The surprising amount of 'transmissive teaching' imagery in my descriptions explains much of the dissatisfaction I felt during the practicum and reveals the fundamental tension that drives my own learning: the difference between the teacher I am by default, and the teacher I would like to be. I was looking for ways to learn how to be a different type of teacher—one more student-centred—and it was rarely obvious

> from my professors how to proceed. I didn't actually realise how steeped I was in a teacher-centred approach, but it explains a lot of the dissatisfaction with my own teaching that I felt, and what I was looking for. Of course, having a teacher-centred approach, I was looking to my professors for the answers, and was not always finding them.
>
> 2. The point at which I've referred to as having a shift is what I now see as the moment at which I came to understand what I needed to learn. I realised that I had significant unchecked assumptions that would influence the way I teach, perhaps more profoundly than any other single thing. When I realised this, I realised that I needed to take responsibility for my own learning. I began to get frustrated by classmates who stalled classes or complained about the program, because I now saw the role of my professors as giving me a forum for my learning, as opposed to giving me my learning. I had indeed 'bought in' to self-directed learning.
>
> Again, this shift in approach to my own education did not feel like a singular event at the time. While I was energized and aware of a changing perspective, it was only while looking back at the metaphors that I was able to single out this point and put it all together. I still maintain that I am highly malleable. That may be different from other students, but I bet that just as many feel they are blank slates and are not, they may also feel that they're not going to be influenced – but are. Whether or not they're influenced in a lasting way with measurable differences in a classroom is a different matter.
>
> I think I know what you mean about tangential and opportunistic learning. Nothing's better than a 'teachable moment', but I have a feeling that both are necessary, meaning the direct and deliberate also have a role to play in it. Once I saw the relevance of my own metacognition, I wanted to share it with my students; it's such an incredibly valuable tool for all students. And who in this world is living and not a student of something?

Our initial analysis focused on key features of *dynamic* self-regulation as we considered metaphors in his non-deliberate and spontaneous reflections. Michael's later analysis exhibited key features of *active* self-regulation. His later analysis was deliberate in that there was conscious reflection on how he came to learn to teach. It was sequential in that the data were presented and reviewed chronologically in the first instance; it was conceptual and important to Michael in that, for example, it contributed to his understanding of metacognition. Finally, there was internalisation in that Michael realised how identification and use of metaphor contributed to his learning.

6. CONCLUSIONS

Viewing Michael's learning in the context of the previously cited literature in which others have explored metaphors in professional learning extends our interest in the spontaneous and non-deliberate features of metaphors and in the value of documenting and analysing their significance. Tom did not teach Michael to use metaphors, nor did Michael attempt to create them. Realising that metaphors were appearing in his writing and then attending carefully to that insight encouraged and enriched Michael's awareness of his professional learning. Michael's willingness to pursue the conversation about metaphors after his practicum extended considerably

his awareness of the changes occurring in his professional knowledge and in his understanding of how such knowledge develops. This account of Michael's professional learning illustrates the potential value of assisting new teachers in identifying and interpreting changes in their perceptions of themselves and of those they teach. It also illustrates the power of bringing careful and deliberate attention to bear on spontaneous and non-deliberate features of learning from experience.

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8. REFERENCES

Bryan, L. A., & Abell, S. K. (1999). Development of professional knowledge in learning to teach elementary science. *Journal of Research in Science Teaching, 36,* 121-139.

Cook-Sather, A. (2001). Between student and teacher: Learning to teach as translation. *Teaching Education, 12*, 177-190.

Hoban, G. (2000). Using a reflective framework to study teaching-learning relationships. *Reflective Practice, 1*, 165-182.

Hunt, C. (2001). Shifting shadows: Metaphors and maps for facilitating reflective practice. *Reflective Practice, 2*, 275-287.

Iran-Nejad, A. (1990). Active and dynamic regulation of learning processes. *Review of Educational Research, 60*, 573-602.

Kessels, J. P. A. M., & Korthagen, F. A. J. (1996). The relationship between theory and practice: Back to the classics. *Educational Researcher, 25* (3), 17-22.

Martinez, M. A., Sauleda, N., & Huber, G. L. (2001). Metaphors as blueprints of thinking about teaching and learning. *Teaching and Teacher Education, 17,* 965-977.

Oosterheert, I. E., & Vermunt, J. D. (2003). Knowledge construction in learning to teach: The role of dynamic sources. *Teachers and Teaching: Theory and Practice, 9,* 157-173.

Perry, C., & Cooper, M. (2001). Metaphors are good mirrors: Reflecting on change for teacher educators. *Reflective Practice, 2*, 41-52.

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