THE ELEPHANT IN THE ROOM: THE WORK-INTEGRATED LEARNING OF STUDENT TEACHERS, AND THE INFLUENCE OF TEACHER EDUCATOR SCHOLARSHIP ON THEIR PROFESSIONAL DEVELOPMENT

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ABSTRACT—In this paper I reflect on the dialectic of scholarship and practice, by shedding light on personal practices, experiences and research as a science teacher educator for the past 25 years. The guiding question in this inquest is whether a teacher educator’s inquiries and research might lead to a better understanding of the complexities of teaching and learning—both for the teacher educator and his student teachers. Many teacher educators voice their concerns about student teachers’ school experience (work-integrated learning), and my argument in this paper is that a teacher educator could, through scholarship, create ‘low-risk settings’ for novice learning, to address the so-called theory-practice divide in teacher education. The literature shows that there are two opposing views on the feasibility and value of such teacher educator research. Some authors refer to the reciprocal, recursive and symbiotic relationship between scholarship and practice in teacher education. On the other hand, there is a sharp critique and even dismissal of this kind of research in several policy and research contexts. In this paper I reflect on my own research in pre-service science teacher education, and what my students and I have learned from the joint interventions we engaged in. Using a mixed-methods research design, I explore three realistic examples of learning from practice for practice, that I have implemented and researched. The findings of the three research studies are examined, and its affordances to enhance the professional development of science student teachers are discussed.

Keywords: Pre-service teacher education; classroom action research; scholarship; case-based teaching; prolepsis; zone of proximal teacher development; indigenous knowledge; nature of science.

1. INTRODUCTION: THE DIALECTIC OF SCHOLARSHIP AND PRACTICE

Lederman and Lederman (2015:670) describe the student teaching practicum or work-integrated learning (WIL), which is an essential component of pre-service teacher education, as the ‘elephant in the room’. These authors note that “…the capstone experience in any science teacher education programme is the student teaching practicum... (a)fter all, this is where the rubber hits the road”. However, many teacher educators will agree that this WIL component is sometimes very insufficient in assisting the science student teacher to develop an own footing and voice as a teacher. Very often the student teacher receives mixed messages from respectively the teacher educator at university, and the mentor teacher at the WIL school, and this lack of alignment could result in the so-called ‘theory-practice divide’. Scholars such as Grossman and McDonald (2008) indicate that teacher educators often leave the development of pedagogical skill and the interactive aspects of teaching almost entirely to this fieldwork or WIL. Unfortunately 21st century skills such as problem-based learning (PBL) are rarely used in many science classrooms (Rotherham and Willingham, 2010:17), despite the emphasis on this in teacher education programmes. These authors state that PBL is often “…a matter of chance rather than a deliberate design of our school system...we cannot afford a system in which receiving a high-quality education is akin to a game of bingo”. This metaphor of a game of bingo can also be used to describe many essential skills that are left for the teaching practicum. I claim that the teacher educator has a responsibility to facilitate the development of these knowledges and skills as part of the learning programme. This, I further claim, asks for teacher educator scholarship.

John Slaughter, as quoted in Chmielewski and Stapleton (2009, p. 53) stated that “research is to teaching what sin is to confession; if you don’t participate in the former you have very little to say in the latter”. Cochran-Smith (2005) is one of many scholars who refers to the reciprocal and symbiotic relationship between teaching and research on the one hand, and scholarship and practice on the other. However,
from the literature it also emerges that there is critique and even dismissal among some, regarding the value of the research done by teacher educators. The reasons for this skepticism about the value of such research, are that bias might step in, that often different criteria are used for making knowledge claims than those used in traditional formal research (Fenstermacher, 1994), and that the cumulative meaning of such small-scale studies is difficult to assess (Sleeter, 2001).

Cochran-Smith (2003:12) highlights the personal discomfort which often characterizes scholarship of teaching and learning, as follows “…I also exposed the limits of my competence, the extent of my uncertainty, and the arrogance of some of my assumptions”. This might be the reason why some teacher educators are not engaged in researching their own practice. By researching your own practice, you become vulnerable.

In this paper I would like to share insights from three research studies that I have conducted the last decade, which I claim might address the perennial problems that I list in the next section (Cronje, De Beer and Ankiewicz, 2015; Gravett, De Beer, Odendaal-Kroon and Merseth, 2016; Van Wyk and De Beer, 2014). The research findings that emerged, prompted me to rethink my own teaching, and to make changes to both curricula and pedagogies alike. However, based on the above-mentioned critique, I do not claim that these insights are applicable over a diversity of contexts. Nevertheless, I do argue that a teacher educator must be a researcher as well, as this scholarship may result in approaches that will better prepare student teachers for practice. Feiman-Nemser and Floden (1986) drew particular attention to the issue of “self” when they outlined the shift in research focus from studying teaching at a distance to trying to understand how teachers actually viewed their own work. This shift in focus is important, because the knowledge of teachers is a crucial source of insight for the improvement of teaching. Kosnik et al (2005, p. ix) are of the opinion that the same applies to teacher educators: “Thus, it can be argued that through focusing on personal practice and experience, teacher educators’ inquiries might lead to a better understanding of the complexities of teaching and learning - for themselves and their students”. This paper reflects on the findings of three such research studies that I conducted, in collaboration with my student teachers.

2. THE PERENNIAL ISSUES THAT PLAGUE SCIENCE TEACHER EDUCATION

South Africa languish at the bottom of the list when it comes to the performance of school learners in science (De Beer, 2016). The Centre for Development and Enterprise (2011) makes it clear that teachers are at the centre of South Africa’s struggling school system and poor performance of learners. For this reason both pre-service and in-service teacher development are of prime importance. Teacher education institutions should be introspective on whether their programmes optimally prepare student teachers for the complexity of the teaching profession. A recurrent theme in the literature is claims of a ‘theory-practice divide’ (Kinsella and Pitman, 2012; Darling-Hammond, 2006; Intrator & Kunzman, 2009). Kessels and Korthagen (1996, p. 2) refer to the ‘gap between our words and the students’ experiences that we cannot bridge’. A good example is the emphasis that is placed on inquiry learning in pre-service science teacher education programmes, yet student teachers see very little of such heuristic practices when they go out to schools during work-integrated learning (De Beer & Ramnarain, 2012). This often result in student teachers falling back on “chalk-and-talk” approaches, despite teacher educators’ attempts to convince them of the affordances of inquiry approaches in the science classroom.

There are several reasons that are listed for this ‘gap’ or lack of ‘practical wisdom’ to integrate theory and practice. One of the reasons often cited is what Lortie (1975) refers to as the ‘apprenticeship of observation’. Student teachers enter their pre-service teacher education with baggage collected over a 12 year period as school learners. Of particular concern in science education, is the widely practiced transmission-mode approaches (“chalk and talk”) that student teachers were exposed to, at the expense of inquiry learning approaches.
Shulman (2004, p. 504) described classroom teaching as “perhaps the most complex, most challenging, and most demanding and frightening activity our species has ever invented”. Student teachers however often have naïve understandings of the complexity of teaching. Due to their supposed familiarity with a teacher’s work, they frequently tend to oversimplify the nature of teaching (Gravett et al, 2016). This results in the unfortunate situation that student teachers sometimes view conceptual knowledge in teacher education programmes as irrelevant in preparing them for the teaching profession (Korthagen, 2011).

A third reason for the ‘theory–practice divide’ is the problem of enactment. Darling-Hammond (2006, p. 305) states that learning to teach requires student teachers not only to “think like a teacher”, but also to “act as a teacher”. In South Africa student teachers engage for extensive periods of time in work-integrated learning (WIL), and teacher educators trust that student teachers will learn “to act as teachers” during the WIL experience. The problem however is that student teachers often do not have good mentors during their WIL, and often this ideal of “acting as a teacher” does not materialize sufficiently.

3. THE THREE RESEARCH STUDIES AND RESEARCH METHODOLOGY

In this paper I (briefly) reflect on three research studies in which my student teachers and I engaged in over the years. It can probably be best described as classroom action research (CAR). Gravett and De Beer (2015:344) describe CAR as “…a midway between teacher reflection on the one end, and traditional educational research at the other”.

3.1. Research design and methodology

In Table 1 I provide context on the methodology that characterized each of the research studies.

<table>
<thead>
<tr>
<th>Table 1: Methodology followed in the three research studies</th>
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<tr>
<td>Research study</td>
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<td>Contextualising science education through the infusion</td>
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<td>The affordances of case-based teaching and learning in</td>
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3.2. The theoretical framework underpinning all three these interventions: scaffolding student teacher learning across the zone of proximal teacher development

All three the interventions described below is underpinned by Vygotsky’s (1978) theory of the ‘zone of proximal development’. Warford (2011) has refined this Vygotskyan concept in relation to teacher development, and he talks of the zone of proximal teacher development (ZPTD). Warford (2011:253) states that the ZPTD represents the distance between what student teachers can do on their own without assistance, and the proximal level they might attain through structured mediated assistance (scaffolding) from more capable others. What is important of Warford’s construct, is the four stages in which learning and professional development takes place:

Stage 1: Student teachers are required to reflect on prior experiences and assumptions. All three the interventions described in this paper, placed emphasis on scaffolding the student teacher’s development as a critical-reflective practitioner, who has the ability to identify own pre-conceived ideas that might affect their teaching.

Stage 2: During the expert-other stage, scaffolding or mediation will assist the student teacher in her professional development.

Stage 3: Internalisation: Through critical reflection and journaling, the student teachers start to develop their own ‘footing and voice’.

Stage 4: The recursion or de-automatization phase: This is the ‘theory to practice’ stage, as student teachers confront the dichotomy of theory and practice in all its intensity (Warford, 2011, p. 255).

In all three interventions described in this paper, these stages described above were followed.

4. CONTEXTUALISING SCIENCE EDUCATION: THE ROLE OF INDIGENOUS KNOWLEDGE

According to literature science teacher educators should take cognizance of two pertinent problems. The first is the naïve views that science student teachers hold about the tenets of the nature of Science. Abd-El-Khalick, Bell and Lederman (1998) point out the relationship that exists between teachers’ views of the nature of science, and how they teach science. If a teacher does not have a nuanced view of the
nature of science, it would be expected that the teachers’ teaching would also not reflect tenets of science such as that it is empirical, tentative, inferential, etcetera, and such a teacher will in all likelihood also not promote inquiry learning. A second problem is that learners often view the science curriculum as irrelevant to their daily lives - amongst others due to the marginalization of the affective domain (Jackson, De Beer & White, 2016). The ostracism of the affective domain can be seen as the ‘missing link’ in science education, and this negatively impact on learners’ appreciation of the role of science in our daily lives. By making science more interesting and relevant for learners, we might see improved learner performance. Indigenous knowledge could play a role in better contextualizing the ‘western’ science curriculum for African learners. I introduced a strong focus on contextualized Life Sciences in my preservice education module. Student teachers need a nuanced understanding of the nature of respectively natural sciences and indigenous knowledge, and the epistemological and ontological similarities and differences shared by these two knowledge systems. In order to address these tenets, student teachers in my class engaged in ethnobotanical surveys, and they engaged, by way of example, in an adapted Kirby-Bauer technique in the laboratory to test the anti-microbial activity of medicinal plants. Such epistemological border-crossing is needed to provide student teachers with a nuanced understanding of the shared tenets of indigenous knowledge and the natural sciences.

At the beginning of the academic year, student teachers were asked to complete the views-on-the-nature-of-indigenous-knowledge (VNOIK) questionnaire (Cronje, De Beer & Ankiwicz, 2015), and again towards the end of the year. This VNOIK questionnaire, developed by Cronje et al, is based on the views-on-the-nature-of-science (VNOS) questionnaire (Abd-El-Khalick et al, 1998). The responses of the student teachers were analysed using the procedure described by Cronje et al (1998). A rubric was used to guide the coding, and every response was coded as an informed view, a partially informed view, or an uninformed view. To obtain the predominant category for each student teacher, the average was calculated and rounded off. The results for one cohort of student teachers (n = 85) are shown in Table 2.

<table>
<thead>
<tr>
<th></th>
<th>VNOIK Pre</th>
<th>VNOIK Post</th>
<th>Percentage change</th>
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<tbody>
<tr>
<td>UI</td>
<td>8%</td>
<td>1%</td>
<td>7% &lt;</td>
</tr>
<tr>
<td>PI</td>
<td>78%</td>
<td>32%</td>
<td>46% &lt;</td>
</tr>
<tr>
<td>I</td>
<td>14%</td>
<td>67%</td>
<td>53% &gt;</td>
</tr>
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UI = uninformed view; PI = partially informed view; I = informed view.

This intervention assisted student teachers to develop a much more informed view of the nature of indigenous knowledge, as can be seen in Table 2. Whereas only 14 per cent of the student teachers had an informed view of indigenous knowledge at the beginning of the academic year, 67 per cent had an informed view towards the end of the year. One of the student teachers commented that, “This microbiology activity has shown me that I should not just be mentioning examples of indigenous knowledge in my classroom one day. I should actually design activities for my learners to do”.

5. THE AFFORDANCES OF CASE-BASED TEACHING TO ADDRESS THE SO-CALLED THEORY-PRACTICE DIVIDE

The research question that guided this qualitative inquiry was: What are the affordances of case-based teaching in addressing the so-called theory-practice divide? In this case-based research, I structured several of our classroom meetings around the discussion of a case\(^1\), and in this paper I can only provide findings in a very condensed form.
Shulman (2004, p. 474) defines a case as “an account of an experience in which our intentions have been unexpectedly obstructed, and the surprising event has triggered the need to examine alternative courses of action”. His wife again views a case as “a way to bridge the abstract nature of principles and teaching standards to classroom practice... they tell vivid, often moving stories, and give life to abstract principles, and are more likely to be remembered ...” (Shulman, 2002, p. 2). I was guided by literature when I conceptualized this classroom action research, which indicate that case-based teaching fosters critical thinking, increase practical knowledge through reflection, and provide a link between educational theories and practice (Gravett et al, 2016). Student teachers were asked to read the case prior to coming to class. The class started with providing the student teachers the opportunity to discuss the case in small groups. Next, feedback was elicited from some of the groups, which I then summarized. The student teachers’ feedback was then used as a springboard to introduce literature and theory. Student teachers then discussed the case again, but this time they had to use theoretical lenses to interrogate practice. After the class, student teachers had to write personal reflections, on what this case meant for their own professional development.

Five major findings emerged from this research.

5.1. Case-based teaching prompts engaged learning

Student-teachers indicated that they found the case-based teaching gratifying and fun, and this led to them being more focused than they would normally be in class.

5.2. Case-based teaching enables student-teachers to experience the reality of school teaching vicariously

Case-based teaching could be a (second-best, admittedly) substitute for experiencing the complexity of the classroom. The student teachers involved in this study experienced case-based teaching as a valuable pedagogy, which made them to experience the reality of school teaching vicariously.

5.3. Case-based teaching helps to develop an appreciation of the complex nature of teaching

The data clearly shows that case-based teaching provided student teachers with a more nuanced understanding of what it means to be a teacher.

5.4. Case-based teaching enables student teachers to relate course literature and theory to dilemmas of practice

As teacher educators we are often asked, “But why should we learn these theories?” Cases provide student teachers the opportunity to interrogate scenarios that play themselves out in practice, by using theory.

5.5. Case-based teaching powerfully elicits student teachers’ existing conceptions of teaching

Engaging with case-based teaching made it clear that such a pedagogy is an effective window into the conceptions that student teachers bring into the university classroom, and their (sometimes naïve) perceptions of what it means to be a teacher.
6. PROLEPSIS AND ENGAGING STUDENT TEACHERS IN COMMUNITIES OF PRACTICE (USING JAPANESE LESSON STUDY AS PLATFORM), IN TEACHING LIFE SCIENCES UNDER ‘IDEAL’ CONDITIONS FOR AN ENTIRE YEAR

My growing discontent about my student teachers’ WIL experiences prompted me to conceptualize an intervention that required them to teach Life Sciences to the learners of a neighboring school over an entire academic year. The school in question was a top-performing school that did not offer Life Sciences as a subject, and the principal of the school agreed that my student teachers, under my supervision, could offer the subject and teach the grade ten to twelve learners (the subject was introduced over a three year period). The student teachers had to take full responsibility for all aspects of teaching: adhering to the timeframes (“pace setters”) of the Department of Education, developing inquiry learning opportunities that would emphasize the tenets of the natural sciences, taking responsibility to ensure that an inclusive approach is followed, and meeting all the requirements of the national curriculum in terms of assessment. Learners who signed up for Life Sciences came to the university on Saturdays, and classes took place for five hours every week. The advantage was that the student teachers had access to most of the facilities at the university. This enabled us to expose the learners, for example, to the work done at the African Centre for DNA Barcoding. This intervention was characterized by (a) the use of a technique known as prolepsis, which “assumes that students know more than they actually do” (Van Lier, 2004:153), and (b) using Japanese lesson study as a platform for students to work as members of small communities of practice. Especially for the Post-graduate Certificate in Education (PGCE) student teachers this was a difficult task, as they had to teach as from the beginning of the academic year, before they had the benefit of their teacher education.

The difference between this intervention and the typical work-integrated learning, is that the student teachers took responsibility for the school learners for an entire year. They were the teachers who had to follow the guidelines in the national curriculum, ensure that pedagogies lead to true inquiry learning and inclusive education, and plan and execute assessment tasks. It also provided the opportunity of an “ideal island situation”, as we were not influenced by the usual (sometimes disruptive!) factors and dynamics in a school. For instance, student teachers had access to any materials and equipment they needed for inquiry learning classes, as they could use university resources.

The following five main themes emerged from this case study:

6.1. The intervention assisted student teachers in their pedagogical knowledge development

When the project started at the beginning of the academic year, the student teachers’ lessons were generally characterized by transmission-mode pedagogies. Working through numerous PowerPoint slides, with hardly any learner engagement, was the trademark of the first cycle of lessons presented by the student teachers. What was alarming to me as a teacher educator, was that, after such “chalk and talk” lessons, the student teachers generally expressed their satisfaction with the (‘good’) lessons. Gradually, as the academic year progressed, the “chalk and talk” lessons were replaced by lessons characterized by open-ended inquiries (De Beer, 2017).

6.2. The intervention provided student teachers with a more nuanced understanding of the nature of science

The WIL experience often do not provide the student teachers an opportunity to engage in more heuristic strategies in the school laboratory, to accentuate the tenets of the nature of science. This intervention took such epistemological and ontological considerations as the point of departure. One of the student teachers reflected: “What I’ve realized with school experience, is that teachers don’t do practical work at all, and if they do it is always sort of ‘cookbook’ activities that serve to confirm. In this
project we were taught something that we don’t learn during school experience—how to facilitate good inquiry labs” (De Beer, 2017).

6.3. The student teachers valued the mentoring from both peers (in the Lesson Study groups) and teacher educator

Another theme that emerged from the data is that student teachers valued the mentoring that they experienced in the project, which they felt was far more substantive than the mentoring provided by mentor teachers in schools. Slowly, through the course of the academic year, the views of the student teachers about the role of the teacher educator changed. Initially some of the student teachers saw the teacher educator’s role as judgmental and finding fault, but later on in the year the student teachers realized that this ‘critical friend’ provided very good mentoring and support. The following comment from a student teacher serves as illustration: “I was terrified by the presence of the professor in class on the first day. Now I feel most comfortable, because I know he is going to provide supportive feedback that will help me to grow”.

6.4. The project enhanced affective development, and a pedagogy of care among the student teachers

Unlike the situation with school experience, where student teachers engage with learners for a few weeks, the student teachers in this project engaged with school learners for an entire year, and developed a sense of responsibility for the learners.

6.5. Student teachers experienced team-teaching within a community of practice, and the complexity of the socio-political relations that characterize such communities

A fifth theme that emerged strongly from the data, was that the student teachers came to know what the advantages and challenges associated with communities of practice are. Whitelaw, De Beer and Henning (2009) observed that new teachers are very vulnerable to attrition factors. These authors showed that some neophyte teachers leave the profession because they struggle to ‘fit in’, and they have negative experiences of being accepted within the professional community of the school. As teacher educators we need to ask ourselves whether we adequately prepare our student teachers for the socio-political relations that are often found in schools. During this intervention, several of the student teachers requested to rather work on their own, and they undertook to then prepare and present an entire series of lessons as individuals. Common reasons cited for this request were that “I do not like the conflict in our group. We can never agree on a particular approach”. I declined such requests, and insisted that the students work within their groups. This necessitated that student teachers had to engage in communication to resolve conflicts—an important skill that the neophyte teacher should have. One of the student teachers remarked towards the end of the academic year that “…not always agreeing with my fellow students taught me how important it is to be able to also consider other points of view… and not to have an ‘I-know-it-all’ attitude”.

8. CONCLUSION

In pre-service teacher education it is of essence to create what Schön (1987) calls ‘a low-risk setting for novice learning’. Teacher educators should not assume that work-integrated learning will necessarily provide student teachers with an opportunity to grasp how theory could be used to interrogate practice. The teacher educator should explore opportunities for student teachers to learn in practice and from practice. In the three interventions described in this paper, student teachers were challenged— their social and pedagogical boundaries were stretched, or “expanded”, in the way that Engeström (1987) uses the term.
Research and teaching go hand in hand, and provided that there are good relationships between student teachers and teacher educators, they could jointly engage in research projects that would lead to a better understanding of the complexities of teaching and learning. I used the metaphorical idiom of ‘the elephant in the room’ in my title, and have already referred to this ‘elephant’ being teacher educators’ frustrations over student teachers’ WIL experience, yet many of us continue to rely on this immersion in practice, without creating low-risk alternative learning platforms. However, there is another ‘elephant in the room’, and that involves ethics. Some readers might, after reading this paper, claim that very often such classroom action research is suppressed by research ethics committees (REC’s). Very often researchers accuse REC’s of “not getting” what educational researchers are doing, and that these committees are “...too stringent and unjustified by the limited risks posed by social/ behavioral research” (Wolf, 2010:77). It is essential that we as teacher educators constantly engage in dialogue with REC’s, so that these committees- who have the very important task of protecting the interests of all groups- understand the goals and approaches used by teacher educator researchers.

Acknowledgement

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9. REFERENCES AND CITATIONS