BUILDING ON A SOLID FOUNDATION: PRE-SCIENCE TEACHER EDUCATION IN THE FIRST YEAR OF UNIVERSITY STUDY

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ABSTRACT
The Centre for Development and Enterprise Report (2011) highlights the need for well-trained science and technology teachers. Over the past few years the Faculty of Education at the University of Johannesburg (UJ) saw a big growth in the number of science education students. The first year of the BEd programme poses two potential risks, that this paper reflects on. The first is the risk of high student attrition - most of our students are first-generation university students. The second risk factor is the naïve understanding of the students about the teaching profession, and the fact that students with a skewed image of the profession often do not finish their studies. Often first-year students come to university with baggage collected during their twelve years of schooling, where they, unfortunately, also encountered negative role models-Lortie’s (1975) notion of the apprenticeship of observation. In this paper we reflect on some of the interventions incorporated in a first-year module, Teaching Studies, at the Faculty of Education, University of Johannesburg. The authors provide a profile of first year UJ students, as well as an overview of First Year Experiences interventions, such as the use of case studies, as well as focusing on the use of a pedagogy of play during an annual first year student excursion. These activities are conceptualized to provide first year students with a more nuanced understanding of the teaching profession. Cultural Historical Activity Theory (CHAT) is used as a research lens to interpret the data. Data collected over seven years show that the excursion provides first-year students with a sense of belonging, which might be beneficial to their academic progress within the faculty.

Keywords: science education, teacher education, first year experience, new pedagogies, excursions.

1. INTRODUCTION

In a country that has been successful in its bid for the square kilometer array (SKA) telescopes, a country that needs to look at innovative ways to sustain food security and to combat disease, a country that has to expand and maintain its infrastructure, the preparation of science teachers is almost negligible in terms of what is required to enhance science in the country (De Beer, 2008). This is the case throughout the different phases of school education. In order to be a global player in the world economy, South Africa needs innovative, creative scientists, and one key to
solving this problem is the drastic improvement of science education in schools. South Africa needs young, creative science teachers— an aspect that is also echoed in the well-known Bernstein report (The Centre for Development and Enterprise Report, 2011). Bursary opportunities (e.g. the Funza Lushaka bursaries) do seem to attract teacher education students in the field of science education. Over the past few years the Faculty of Education at UJ saw a big growth in the number of science education students. The first year of the B.Ed programme poses two potentials risks that this paper reflects on. The first is the risk of high student attrition— most of UJ’s students are first-generation university students. The second risk factor is the naïve understanding of the students about the teaching profession, and the fact that students with a skewed image of the profession often do not finish their studies. Often first-year students come to the university with baggage collected during their twelve years of schooling, where they, unfortunately, also encountered negative role models— Lortie’s (1975) notion of the apprenticeship of observation. In this paper the authors reflect on some of the interventions incorporated in a first-year module, Teaching Studies, at the Faculty of Education, University of Johannesburg. Firstly the focus will be on a few generic principles that were implemented, such as a team-teaching approach, tutor support and continuous assessment, and then the article zooms in on an educational excursion.

During the annual excursion students are exposed to a radical intervention in which their pedagogical and social boundaries are stretched or “expanded” in the way that Engeström (1987, 2001) has used the term to describe transformation. The programme aims to challenge notions of what becoming a teacher means in a diverse and socially struggling society. Students face one another in small group activities that range from stereotyping, leadership, and pedagogies for teaching in schools with optimal diversity. They are grouped away from their spontaneous ethnic, gender, and cultural peers to form working groups that are optimally diverse. They spend four days together, learning about the pillars on which the Faculty of Education’s conceptual framework for learning is built namely care, accountability, critical reflective practice, and agency. The authors argue that an excursion as a different activity system from a formal university classroom offers a unique opportunity for our students to identify, interrogate and work towards changing their unarticulated practices and prejudices. As most theories of learning ascribe to the notion of a state of discomfort or disequilibrium the researchers believe that an excursion as a learning experience is an ideal milieu in which to bring about sufficient discomfort that can facilitate learning. We have seen evidence of how students learn as they navigate this unusual socio-cultural and epistemic space, and deal with the unexpected tensions which arise as they move from one activity system to the other. It is the researchers’ view that the excursion takes students from a zone of comfort to a zone of development and so begins their journey of professional development towards a professional voice and footing (De Beer & Henning, 2011; De Beer, Petersen & Dunbar-Krige, 2012).
2. RESEARCH METHODOLOGY

The aims with this research are to determine what the risk profile of the UJ Faculty of Education student is, and further to determine whether planned interventions in the first year could lead to a more nuanced understanding of the teaching profession amongst first year students, and whether it could contribute towards a sense of belonging.

Two research questions guided this research:

(a) What are the factors that should be considered that will make first year students’ transition into tertiary studies easier?

(b) How can creative pedagogies be used to facilitate a smoother transition in the BEd programme?

This research reflects on the data obtained from the Academic Development and Support (ADS) division of the University of Johannesburg, which collects data on the profile of first year students, as well as data collected over a period of seven years on the role of an excursion intervention on students’ understanding of the complexity of the teaching profession. The researchers used a generic qualitative research design (Merriam, 1998) and collected data related to student experiences and learning over a seven year period (2007 – 2013) from about 3500 students and 20 members of staff who participated in the programme. Data were collected via questionnaires, educational artifacts and afterwards through reflective learning portfolios of students. Although these methods are valuable, the researchers required additional data collection methods that could capture evidence of student learning-in-action. We then turned to video recording of student interactions in 2009, and has done it ever since. Data, in the form of a reflective narrative were collected from staff who participated in the excursion. In addition focus group interviews were also conducted with students, to gauge student responses to the excursion after a period of two or three years had elapsed. Triangulation of data- reflections from portfolios, student questionnaires, artefacts (e.g. the newspapers that students compiled), observations (activities were captured on DVD, and transcribed using Transana software), and staff reflections—result in the descriptions provided in this article. An interpretative, inductive qualitative data analysis strategy was used to try and understand the data as best as possible. The quantitative data were analysed by the Academic Development and Support Division at UJ, using the statistical package for the social sciences (SPSS). Qualitative data were analysed by coding data, and identifying emerging themes. Simultaneous coding (Saldana, 2009, 70) was done, since we made use of in-vivo coding (the code was taken from the exact words spoken by a participant), descriptive coding (or topic coding) (where we summarized what was said in a passage by a short phrase), and value coding (reflecting a participant’s values, attitudes and beliefs).
3. First year Education students’ naïve understanding of the teaching profession and pedagogies to address it

3.1. Students at risk
Data provided by the Academic Development and Support Division of UJ, indicate that our first year students are at risk of not completing their qualifications. In Figure 1 below, it is clear that we see a larger number of first-generation university students every year. Whereas the Faculty of Education had 63.3% first-generation university students in 2006 (these students did not have immediate family members like parents or siblings who graduated from university), the number grew to 78.3% in 2012. Also, whereas only 42.6% of parents of first-year students had matric or less (no post-school qualifications) in 2007, this figure grew to 72.1% in 2012. It is therefore clear that our students cannot expect too much academic support from their parents. English is a second or third language to the majority of our students (Figure 3 shows how the percentages fluctuates annually between 64.2 and 79.7%). Of particular concern, is the number of hours that our students studied in Grade 12. In the surveys over the last few years, the number of students who indicated that they studied less than 10 hours per week, grew from 47.5% in 2007, to a shocking 60.1% in 2012.

Figure 1: Percentage of first-generation university students in the Faculty of Education (Acknowledgement: Data provided by Dr. Andre van Zyl, ADS)

Figure 2: Parental qualifications of first-year students in the Faculty of Education (Acknowledgement: Data provided by Dr. Andre van Zyl, ADS)
Figure 3: The percentage of students to whom English is a second or third language (Acknowledgement: Data provided by Dr. Andre van Zyl, ADS)
3.2. First-year students’ naïve understanding of the teaching profession

Many first-year education students (including the science education students) enter the B.Ed programme with a very naïve understanding of what it means to be a teacher. Often these students come with baggage collected during their twelve years of schooling, where they, unfortunately, also encountered negative role models—Lortie’s (1975) notion of the apprenticeship of observation. In the following few paragraphs, the authors reflect on some of the interventions incorporated in a first-year module, Teaching Studies, at the Faculty of Education, University of Johannesburg. The researchers firstly reflect in paragraph 3.3 on a few generic principles that were implemented, such as a team-teaching approach, tutor support, the use of cases, and continuous assessment, and then the focus shifts to an educational excursion in paragraph 3.4. These interventions, the researchers claim, may improve students’ sense of belonging, and assist them in developing a more nuanced understanding of the teaching profession. Ultimately this may even improve student throughput, and help the country in obtaining more science educators who graduate from the university.

3.3. Generic interventions in Teaching Studies

All first year B.Ed students are required to register for the Teaching Studies module. To get students off to a good start, the researchers felt that it was important to make this a unique learning experience, but in ways that would meet the needs of the first year students in the
Faculty of Education. For a start we make sure that the module (with 800 students registered) is well-organised and seeks to respond to the needs of the many first-generation students. For instance, the Faculty appointed twelve tutors in the module, and apart from individual consultations, students are also required to attend a compulsory tutorial session with their assigned tutor every week. Since the module has tutors who speak different mother tongues, the tutorial classes are offered in English, Afrikaans, Sesotho, isiZulu and Xhosa. This particular module can even cater for Portuguese-speaking students, since one of the tutors grew up in Mozambique and speaks fluent Portuguese. Continuous assessment is also used, and students complete an on-line EduLink test every week; this allows the tutors to assist in identifying any at-risk students.

A team-teaching approach is followed: we involve seven members of our department in teaching the module. This serves two goals. In the first place, students come to know all the academic staff, as well as the fields of expertise of the different academics. Secondly, it provides an opportunity for the more novice colleagues to learn from the experience of more seasoned lecturers – constant staff professional development is built into the module. Lecturers involved constantly engage with new pedagogies. In 2011 we started to experiment with the use of cases. At the Harvard Graduate School of Education (one of the Faculty’s partner institutions) the use of cases is a tested pedagogy, but at South African universities this approach is only rarely followed. Many of our students have unfortunately had bad teacher role models (not inspiring learners through creative pedagogies) during their twelve years of schooling, and we have to ensure that they do not simply continue to follow these. By using authentic cases in the module lecturers are able to challenge this “apprenticeship of observation”. Through the use of cases, students start to understand why the educator Lee Schulman described teaching as the “most frightening activity that human kind has ever invented”!

The “theory-practice divide” in the education of teachers is widely discussed in the teacher education literature (Holland, Evans & Hawksley, 2011; Laverty, 2006; Kessels & Korthagen, 1996). Teacher education institutions are often criticized as being distant from practice and therefore ineffective in preparing student-teachers for the demands of the teaching profession. Learning in practice, through school experience is the predominant way in which teacher-students encounter the practice of teaching. In addition, practice could be brought into coursework through employing learning from practice. Learning from practice includes the study of practice, using discursive resources to analyze different practices across a variety of contexts, video records, lesson observations and drawing from case studies (Department of Higher Education and Training of South Africa, 2011). Proponents of case-based teaching claim that cases are ideal for communicating the complexity of teaching to student-teachers (Shulman, 1992; Merseth, 1996). Furthermore, case-based teaching could contribute significantly to narrowing the theory-to-practice gap because teaching through cases allow for the interweaving of theoretical material with the dilemmas of teaching as represented in the cases. Cases also
allow for reflecting and deliberating on the “messiness” of teaching through invoking of various theoretical perspectives. The main findings of UJ lecturers’ engagement with cases as a pedagogy are that students report on developing a better understanding of the complexity of teaching as a career. Students also highlight the realization of affective outcomes through such a pedagogy: they are more engaged, and find the discussion of cases intellectually demanding and stimulating. Staff members report on the advantage of getting a good understanding of the preconceived ideas that first year students often have when they start their B.Ed degree- Lortie’s (1975) apprenticeship of observation.

This holistic approach followed in the Teaching Studies module has been extremely successful. For the past three years we have consistently had a pass rate of between 80% and 90% in the module. Students also develop a “sense of belonging” by participating in the excursion, which is discussed in the next paragraph.

3.4. **The annual first-year excursion**

The four-day excursion is an integral part of the Teaching Studies module that focuses on the personal and professional development of teachers. The researchers’ major findings are that the excursion provides a different learning environment for personal and professional development and these assist students in planning their professional trajectory. Outcomes related to social justice, and working towards social cohesion amongst diverse students from various cultural, language and religious groups are also achieved. These, the authors claim, hold much promise for teacher education.

South Africa is a young democracy, in which there are still schools that are under-resourced, and where many of the teachers are under-qualified (De Beer, 2008). How do we bring about a cohesive, democratic and prosperous society? Many of the students coming from such ‘disadvantaged’ backgrounds, have had very poor role models, where teaching was most commonly characterized by rote learning and chalk-and-talk (De Beer, 2008). Cognisance has to be taken of the challenges of poverty, unemployment, inequality, homelessness, landlessness and divisions of race, class and gender in South Africa.

The researchers find that the formal nature of university classroom interactions limits and constrain students’ academic learning and their personal and professional development. The authors posit that the inclusion of the excursion as part of the curriculum package for first year students, especially when it has been deliberately designed to address the problematic aspects described above, offers a way of ameliorating these factors. We believe that the excursion presents a complimentary (augmenting) pedagogy and ‘learning space’ to that of the formal classroom of the university. In addition the authors argue that the uniqueness of the excursion as
learning space offers opportunities for pre-service teacher education students to confront their learned biases and prejudices as part of their professional development.

**The excursion within the module: “Teaching Studies”**

Over the past seven years that this excursion is offered as a component of Teaching Studies, the emphasis has changed to focus on the professional development of the student teachers which includes preparing them to deal with diversity in the school population. This expresses a commitment to the education and training of caring, accountable, critically-reflective teachers who are able to nurture and support learning in diverse educational contexts (Petersen, Dunbar-Krige & Fritz, 2008). The excursion curriculum includes activities where a pedagogy of play is used to interrogate issues of social justice and inclusion. For instance, students are issued passports of different countries, and they are then issued money based on the GDP and Human Development Index of that country, with which they can purchase food at the “food banquet”. This is followed by a discussion on social justice in the classroom, and how a teacher deals with the “haves” and “have nots” in the classroom.

When one considers Shulman’s (2004) view that teaching is ‘…*perhaps the most complex, most challenging, and most demanding and frightening activity our species has ever invented*’, as teacher educators, it is incumbent upon us to structure suitable learning opportunities for students to learn how to conduct themselves as professionals and interact more fully in multicultural and multilingual contexts. We argue that placing students in the excursion environment, characterized by uncertainty, discomfort, and situations in which students have to ‘think on their feet’ constitutes a ‘real’ (authentic) learning environment to prepare them for coping with complexity. In this environment students are asked to learn by engaging in activities that require lateral and critical thinking, innovation and problem solving, without the stringent monitoring and evaluation characteristic of activities associated with a formal learning environment. This to us is akin to what Tyack and Cuban (1995) cited in Nespor 2000 (pg 29) call ‘disruption in the standard grammar of school practice’.

It is precisely ideas such as these that we have considered in structuring the curriculum of the introductory module in which the excursion is embedded. Three specific aspects of the excursion warrant mentioning for the purpose of this paper as the ‘dramatical collisions’ (Veresov, 2007) are largely attributable to these. Firstly, students are deliberately divided into small mixed (multi-racial and multi-lingual) groups with whom they are required to work for the duration of the excursion of four days and all interaction has to be in a language common to the whole group. We learned through hard experience with the 2007 group that when students were allowed to choose their own working groups they chose along the lines of race and home language and in subsequent years we thus insisted on assigning students to working groups ourselves to prevent this recurrence. Secondly, the structure of the curriculum and the sequential arrangement of activities within it are meant to support student learning through experience (De Beer, Petersen...
& Dunbar-Krige, 2012). The excursion includes a variety of educationally-based activities that incrementally (over the course of the excursion) aids students in being able to formulate and articulate a personal teaching philosophy (vision statement). Students engage with issues of inequality and social justice through activities such as the food banquet game (focusing on socio-economic conditions), and bush dialogues (as from 2013) where they discuss issues of transformation. Finally, students are required to complete a number of reflective activities, either in group format after each discussion by responding to critical questions facilitated by one of the lecturers or in written format using a double-entry journal. These reflections are meant to stimulate critical discussion and thought and bring into focus and help address the routinised nature of student thinking about controversial issues.

The authors agree with Veresov (2004, 2007, 2008) that learning is a mediated process in which not only subject content is learned, but in which the relationships of mediation are crucial. Learning is thus optimally facilitated through interaction with peers in the learning environment as a social process that involves a variety of role-players and pedagogies. It is our contention that an educational excursion (in contrast with the formal university classroom) offers a learning environment that reflects these ideas. In addition, the ‘expanded’ nature of the excursion curriculum and the informal, often playful social tone of its activities create a number of unique opportunities for student learning. These opportunities become fertile ground for engendering the ‘dramatical collisions’ we believe are necessary to spark the critical thinking and discussion required in a pre-service teacher education course. We argue that these specific characteristics of excursions are largely what render it so promising for promoting student learning outside of routinised patterns.

4. DISCUSSION OF FINDINGS

We identified six major themes from our analysis of the data (De Beer, Petersen & Dunbar-Krige, 2012):

- The excursion provides a different learning environment for personal and professional development.
- The changing nature of student-lecturer relationships;
- Students learn how to negotiate rules of interaction in a culturally diverse grouping;
- Students develop sensitivity for cultural diversity;
- Exposure to different semiotic tools for teaching and learning;
- Envisaging a professional trajectory.
In the next section we discuss three of these themes in greater detail and used a number of excerpts and examples from the various data sets in support of the discussion points we raise.

4.1. The excursion provides a different learning environment for personal and professional development

In most lecture rooms, the lecturer is seen by students as the professor, the expert, the assessor, and the classroom manager. This is especially true of first-year students who come to university fresh from a regulated school environment with hierarchical structures of authority. The researchers’ experience of first year students during the introductory curriculum is that of bewilderment by the demands of a tertiary environment with the expectation that the hierarchical school system that they are accustomed to, will be replicated. (As mentioned earlier, most of the UJ students are first-generation university students). For example in the environment of the university campus, the Executive Dean is seen as a powerful person, and if called to her office it means that a student is in real trouble. During the excursion, however, with its more informal relationships, this intimidating office-bearer, who willingly accompanies students on their hikes within the park becomes co-learner about the fauna and flora of the park. As a co-facilitator in the programme, she also becomes a fellow teacher (engaging in more of a collegial relationship with the students), and a guide, or a facilitator. For many students who may not have had good teacher role models in schools, staff members also become positive role models of the teaching profession.

The formal classroom is characterized by the use of mostly academic discourse with the lecturer following an assessment-driven curriculum. This academic language and the vocabulary of the national curriculum becomes the semiotic tool or mediating artifact. (In analyzing our data, we use third-generation Cultural-Historical Activity Theory as a lens). During this excursion, more informal language and different semiotic tools such as games, simulations and social-educational activities dominate the interactions. A pedagogy of play, in a context of discomfort (e.g. the HIV/AIDS game\(^2\) or the food banquet game), seems to be very powerful in stimulating both students’ personal and professional development.

In the first year students’ academic focus can be best described as “surviving in the academic jungle” – passing tests, submitting assignments on time, and obtaining admission to the examination. During the excursion, students are faced with a different challenge - they have to find their own educational voice/s; each student is expected to express his/her educational philosophy and formulate it in a vision statement. Here it is not about passing tests or assignments, but constructing a map of their own individual journey and professional growth as teachers. The students, through their interaction with the subject content of the excursion, are encouraged to develop a ‘professional voice’. As a result students put on a different hat during the excursion- instead of remaining simply students, they become neophyte teachers, charting a professional trajectory.

4.2. Students learn how to negotiate rules of interaction in a culturally diverse grouping

Another area in which the value of the excursion can be seen is in the negotiation of the rules of interaction and how this contributes to a better understanding of cultural diversity amongst students. At the commencement of the excursion, a different set of rules (as compared to those on the university campus) are negotiated with the students, as these rules will govern their interactions with each other and the lecturers in more than just the learning environment. For example, during the excursion students live in large communal dormitories (accommodating about 20 students) with peers from different cultural groups and these negotiated rules are meant to facilitate collegiality within a community of practice. Despite these rules, the communal living space for students who have rarely had to share with others from different racial and cultural backgrounds give rise to a number of tensions. These tensions are evident in the differing notions of what constitutes ‘privacy’ and ‘private space’. Often students who come from more crowded households adapt more easily to the close confines of the dormitories and to the needs of others within this space including a schedule for ablution facilities than those accustomed to more personal space as a result of affluence.

In 2013 we started to introduce “bush dialogues”, where students discuss issues of gender, cultural diversity, language, religion and sexual orientation at campfires, and these discussions continue after the excursion through social media (Facebook). One of the principles guiding these discussions, is that students should not dwell on guilt or blame when reflecting on the country’s apartheid history, and the challenges facing us in the journey to social integration. Strong themes that emerged from these discussions, are the conservative and patriarchal views of many of the students, and the literal interpretation of Bible verses, such as that God created Eve from Adam’s rib. Triangulation of data, notably the HIV/AIDS discussion and the social justice discussion highlights that these are topics that students are thinking about. It is hoped that, through continued discussion on social media, students would develop a more nuanced understanding of the complexity of these issues. Students clearly demonstrate a lack of knowledge about these sensitive topics.
4.3. Developing sensitivity for cultural diversity

An outcome of the excursion is to sensitize students towards cultural diversity. Although this is theoretically addressed in the formal classroom, the excursion provides the opportunity to experience this aspect of students’ personal and professional development practically. We are now going to highlight one example to illustrate this element.

As part of the excursion activities in the Golden Gate National Park in South Africa students leave the base camp and pay a visit to the Basotho Cultural Village – also within the Park. Here students experience first-hand the variety and richness of one particular cultural group. During this trip, students meet the ‘sangoma’ (traditional healer), and after the tour students are free to, at a nominal fee, visit him/her for a professional consultation. One of the white students commented as follows during the focus group interviews, capturing religious and cultural intolerance amongst some students (Focus group interviews, August 2009):

“I did not like the fact that students consulted the witchdoctor. It is not right; it is Satanism.”

This comment should be seen in the light of the history of South Africa. Traditional healing in virtually all its forms was illegal for more than a century in South Africa. Under provisions of the Suppression of Witchcraft Act of 1957, first introduced in 1895, all forms of divination were outlawed. Divination is at the heart of healing in Africa (Ashforth, 2005), and many black people are dependent on traditional healers for health care. However, this white student views it as Satanism, a practice which Odora Hoppers (2004) refers to as ‘knowledge apartheid’ - a complete disregard for indigenous knowledge systems. We argue that pre-service teachers in South Africa should become far more knowledgeable about these issues so that they can become more sensitive to them. We therefore have to make more effort to develop tolerance and respect for other cultures amongst our students.

Ironically, this incident happened at the cultural village which intended to teach students about respect for cultural diversity.

During the last seven years the researchers have also seen changes in the type of “dramatical collisions” that occur during the camp. The students who were camping in March 2013 are known as the “born frees” (They were born after the first democratic election in 1994), and therefore they probably have seldom first-hand experienced Apartheid or racial discrimination. The researchers find that the latter students are comfortable with students of different race groups, and we do not find the racial conflicts anymore, that occasionally occurred in Golden Gate. However, during discussions (e.g. the “bush dialogues”) we do realize that these students’ parents discuss the Apartheid regime with their children, and that there are students (the minority, though) that carry an anger in them. There is also not the sensitivity for language,

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3 The Basotho are an indigenous tribe of the Kingdom of Lesotho, an independent state landlocked by South Africa
4 This is an optional visit.
gender and cultural differences we would like to see in future teachers- an aspect that needs to be addressed in the curriculum.

4.4. Conclusion

In the South African context, with science education a national priority, we need to ensure that we support first-generation university students in their pre-service teacher education. This asks for new pedagogies, such as case studies, and radical interventions like excursions. With our racially divided history, as teacher educators we are very aware of the need to prepare teachers who are able to mediate learning in settings characterized by cultural and linguistic diversity. Our involvement with students in class (with pedagogies such as cases), and during the excursion has highlighted the value of such learning opportunities towards this goal. The research shows that students develop a better sense of belonging, helping with their transition into academia. They also develop a more nuanced understanding of the complexity of the teaching profession.

References


