

USING A VALUES-BASED APPROACH TO PROMOTE SELF-EFFICACY IN MATHEMATICS EDUCATION

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Abstract

This study examines the effects of a values-based approach to teaching mathematics on promoting self-efficacy amongst university mathematics education students (n=130) registered for a BEd degree course at the Nelson Mandela Metropolitan University. Data were generated using students' written reflections (disposition statements), interviews, student journals, and observation of classroom practice video-clips. These data were analysed and triangulated to provide insights into aspects of the 'social reality' in terms of the moral values that participants brought to their mathematics education classes, how they perceived their experience of making explicit moral values in mathematics education classes, and whether these experiences influenced their mathematics self-efficacy. The data suggest that the strategy raised self-efficacy levels and that the participating students recognized the importance of their lecturer practicing core values in her classes, and that they also recognized the importance for themselves as future teachers.

Introduction

This study on a values-based approach to mathematics teaching and learning emanated from an interest in values and morals in education and broader concerns around low self-efficacy amongst many pre- and in-service teachers (Nieuwenhuis, 2007). The 'new scholarship' approach of Whitehead (1989) and McNiff and Whitehead (2006), which is premised on the view that teaching is about participatory learning and the living nature of educational enquiry, provided a framework for the intervention used and the analysis of the data generated.

The intervention used firstly introduced the 130 participating pre-service mathematics education students to a 'values wheel' (honesty, fairness, respect, accountability and compassion bounded within a ring (rim) of integrity, and turning on an axle of trust), after which whole-class discussions were held to provide opportunities to clarify their thinking about these values, as well as the possible influence that a values-based approach might have on their learning. The lecturer (first author) then informed them that she would attempt to live out the values of respect, fairness, accountability, honesty and compassion, and encouraged them to hold her accountable. She explained that she believed that by doing so a respectful and trustful relationship could be developed, which would provide opportunities for them to experience feelings of success and wellbeing, which are essential for the development of self-efficacy (Woolfolk, 2004). As such, the ultimate aim of the intervention was to assist students to adopt a self-efficacious and life-affirming view of themselves as individuals and as mathematics teachers (McNiff, 2002). Data on the effect of this approach was generated via interviews, written student reflections (affective-disposition statements), journal entries and video-recording of an aspect of the intervention.

Values and self-efficacy

Kidder (2006) refers to core values as the moral values which constitute humanity's common moral framework. Based on research conducted by the Institute for Global Ethics these core values are acknowledged as "the core moral and ethical values held in highest regard in diverse communities around the world, given the global diversity of culture, ethnicity, race, religion, gender, political persuasion, economic disparity and educational attainment" (p. 42-43). The core values are the five moral ideas of honesty, fairness, respect, responsibility and compassion (Kidder, 2006, p 64). Nieuwenhuis (2007) asserts that values are consciously and unconsciously at work in all our interpersonal interactions and are an integral part of all human actions, thus making education by its very nature a value-based and value-laden phenomenon. He further notes that there is general agreement that values are important concerns that education institutions will have to deal with if they are serious about issues of quality and effectiveness. He argues that we choose our behaviour based on our personal and socially constructed values, assumptions and beliefs, which in turn inform our understanding of what is morally right and morally wrong and of the type of conduct that would be just and ethical (Nieuwenhuis, 2007). Furthermore, values need to be clarified, discussed, refined and reinvented through a process of active deliberation, debate and the provision of concept clarifying within the socio-cultural milieu of the classroom and community.

Woolfolk (2004) points out that without students' trust, respect and cooperation even the best teaching materials and methods can fail, and she believes that enabling students to feel valued and respected plays a strong role in developing their sense of self-efficacy. The intervention used in this study attempted, via examining moral values in the classroom, to make these relationships explicit and tangible for students. It also attempted to provide opportunities for them to experience success and feelings of well-being and, as such, to create learning environments that foster positive self-efficacy.

The critical outcomes of the South African curriculum suggest that the government has accepted that inculcating values associated with being a 'good citizen' is a key objective in order to develop responsible citizens for the 21st century (Department of Education, 2002; 2007). It is this apparent acceptance that motivates and provides context for this study.

Research design and methodology

Seventy nine first-year and 51 second-year (n=130) mathematics education students, who came from diverse social, cultural, economic and political backgrounds, and who were registered for a B Ed degree at the NMMU in Port Elizabeth, South Africa, participated in the study. The participants were informed as to the aims of the project, that the data generated would be used for research purposes, and that they could withdraw from the project if they wished to do so.

Prior to the intervention, focus-group interviews were held with the students and they were required to provide written reflections (disposition statements) as to how they 'felt' about mathematics. The data generated by the post-intervention affective-disposition statements were used to probe the degree to which students had enjoyed participating in the values-based mathematics education strategy and whether their engagement had influenced their levels of mathematics self-efficacy. Pre-, mid- and post-intervention semi-structured interviews with focus groups of students generated similar data. The data generated by these interviews were classified into broad themes and analysed within the framework of the literature reviewed.

The students kept a personal journal in which they were asked (i) to respond to five formal prompts which were introduced sequentially throughout the semester, and (ii) to make *ad hoc* informal entries throughout the intervention. The prompts included questions as to whether they thought a values-based approach would benefit their teaching, what they enjoyed or did not enjoy about the approach, the influence of the strategy on their thinking and beliefs, their perceptions of what problem solving entailed, and their thoughts on the strategy for their own teaching using a values-based approach. The process of journaling allowed the students to record their perceptions, challenges and experiences, and their own 'transforming self-beliefs' (McNiff, 2002) in their ability to do mathematics. Video recordings of lessons also provided data as to the educational influence the strategy had with regard to students' self-efficacy and belief in their own ability to do and teach mathematics. Overall, the data generated, when triangulated, provided insights into aspects of the 'social reality' that participants brought to their mathematics education classes in terms of moral values, how they perceived these experiences, and whether they influenced their mathematics self-efficacy.

Results

Affective disposition statements

The results of the pre- and post- affective disposition statements suggest an improvement in self-efficacy over the course of the intervention. Twelve percent of the first year students and 20% of the second-year group indicated that they were more positive towards mathematics. Although no students from the second-year group initially expressed a desire to improve their mathematics skills, 15% responded in the post-intervention statement that they believed that they had in fact improved their mathematics skills during the course of the mathematics education lectures.

'Fear of failure' was expressed by 31% of second-year students and 7% of first-year students in the pre-intervention responses. However, in the post-intervention responses, only 17% of second-year students expressed reservations regarding their mathematics capabilities, i.e. that they were still fairly dependent on assistance in solving mathematics problems. No first-year student indicated that 'fear of failure' was a concern for them. These results suggest that both groups of students improved their self-efficacy levels during the intervention.

Interviews

Student responses from both groups indicated that they believed that their initial mathematics self-efficacy levels were directly linked to their success and achievement at mathematics, or lack thereof, during their school years. The results also indicate that a major motivating factor for enjoyment in mathematics was 'experiencing success' This finding concurs with Pajares' (2002) belief that students who perform well in mathematics are likely to develop a strong sense of confidence in their mathematical capabilities, whereas poor performance generally weakens students' confidence in their capability. Student responses clearly indicate that 'fear of failure' was a dominant cause of lack of enjoyment in mathematics. However, by the end of the semester, the data indicated that the intensity levels of students' 'fear of failure' had dissipated significantly, suggesting increased self-efficacy.

The majority of participating students (99%) regarded values as making a positive contribution to their engagement in mathematics education. Only two students felt that a

focus of values in mathematics teaching was not important, and stated that they believed that teaching values at university level was too late to make a difference.

Reflective journals

Student responses indicated that the use of journals in their mathematics education classes was a major motivating factor in terms of reflecting and internalising values, and highlighted the role they had played in contributing to social responsibility and social cohesion, especially when shared in class. They appreciated the time the lecturer had spent responding to each of their journal entries and believed that the written communication with her had enabled them to feel that she had a personal interest in them, despite the anonymity of the journal entries (students dropped off and collected their anonymous journals at agreed and predetermined times and places).

Observation

Observation of the video-clips suggest that the lecturer was able to make the core values explicit at appropriate times, that the values were evident in her attempts to guide the students towards experiencing success in the problem-solving activities, and that these activities elicited a positive response from most students who engaged in the process.

Discussion

Trustworthiness is defined by Kidder (2006) as the manner in which an individual acts in order to engender trust and merit the confidence of others. He describes the warm, solid ‘gut feeling’ you get from trust – from counting on yourself and in trusting and being trusted by others – as one of the great enablers of life. All student responses for both the mid- and post-intervention interviews suggested that they felt that they had developed a sense of trust in their lecturer. Journal entries and interview responses indicated that the development of a trust relationship was not only due to their perception of her personal commitment to both the students and her teaching, but predominantly to the fact that she had responded to every journal entry that they had submitted within a two-day period of time, as promised. Students’ verbal and written responses and discussions suggest that her behaviour in promoting and ‘living out’ the core values also encouraged the development of a lecturer-student trust relationship.

As noted above, the data suggest that the students believed that their lecturer lived out the core values adopted, and that not only did they recognise the importance of her practising core values in their classes, but that they also recognised the importance of making values explicit for themselves as future teachers. They appreciated the opportunity to practise values in their mathematics education classes and believed that values enrich and “make better people”. They also stated that they also believed that the implementation of a values-based approach to teaching and learning promotes more positive attitudes, improves performance and creates opportunities for the development of positive relationships. The importance of values for the wider community and society at large was also acknowledged.

It was the responses in which students suggested they trusted that their lecturer would not ridicule or ignore their contributions to the learning process that prompted her to believe that ‘valuing students’ opinions’ had played an important role in the development of their student-lecturer trust relationship. This supports Llewellyn’s theory (2005) of encouraging student inquiry as active participants in the learning process, as well as Brooks and Brooks’

(1993) model of building a classroom community by getting students to believe that their ideas count, promoting a trust relationship within a learning community, and thereby influencing their self-efficacy. We believe that without the continued purposeful recognition, acceptance and practice of the five core values which underpin this research study, the desired classroom climate of integrity (which depends on all of the core values being upheld) would have remained an unattainable goal. For this reason, we believe it was important to address issues which appeared to be in contradiction of the core values that the lecturer was trying so hard to uphold.

Although this research study is limited, and that more in-depth interrogation of students' conceptions of the role of values would be profitable in the search for greater understanding of the role of values in mathematics education, we believe it has a contribution to make in terms of informing teacher educators, teachers and policy-makers about perspectives and interventions which may contribute to pre-service teachers' mathematics self-efficacy levels, and provide pointers to strategies for developing teachers who will be able to contribute to the integrity and vitality of the teaching profession. These strategies include the role that a values-based approach to the teaching and learning of mathematics may have on influencing students' self-efficacy levels, both mathematically and within other subjects. We also believe that the findings of this study can contribute to the on-going debate about the process of quality teaching and learning in terms of the possible gains which could emerge from a values-based approach to teacher education.

The data suggest that, in spite of large classes of multi-cultural and diverse students with differing world views, the first author was able to encourage her students to commit themselves to devoting time and energy to the task of using values to develop an innovative educational approach, and to accept that such an approach has the potential to promote the development of their knowledge, competencies, and personal and professional values as they strive to reach their full potential and help shape a fairer, equitable and more just society in the 21st century (Department of Education, 2002; 2007). An underlying, but implicit intention of this study was to influence stakeholders at policy and other levels to consider and embrace the possibilities that a values-based approach to mathematics education may have on students' levels of mathematics self-efficacy, and to include these notions in the design of mathematics curricula for the 21st century. As such, we believe that the findings of this research study point to the potential to challenge teacher educators to re-assess, adapt and improve their teaching strategies, where necessary, and revise the assumptions about teaching and learning on which they are based.

Considering the current crisis in mathematics and science education in South Africa, as well as the crisis in responsible citizenship, it is imperative that we seriously consider the devastating consequences of teacher-education programmes which are not underpinned by sound value systems and effective approaches to teaching and learning. The challenge is to implement a curriculum which is relevant in content and context to South African educational demands for a strategic, but often controversial, reform processes. In attempting to promote such a paradigm shift, it is important that policy-makers, education departmental officials and teacher educators take cognisance of the reality that students consistently refer to the quality of their own teachers as the primary reason for their achievements and choice of careers.

Concluding remarks

Working in collaboration with students interrogating of her own practice was a new experience for the first author. She had always valued the opinions of others, but felt hesitant

about giving her students the responsibility for holding her accountable for living out the values identified in this research study. However, she realised the importance of giving them a voice in finding meaningful ways of improving her teaching practice, which in turn would motivate their own mathematics self-efficacy levels. She was aware that students (as they did in this study) often refer to the quality of their own teachers as the primary reason for their achievements, or the lack thereof, and for the choice of their career, and was gratified that the findings indicated that they felt that her “good teaching” contributed to their positive feelings about mathematics; and hence, their self-efficacy levels.

For her the significance of this research study was largely that she had learned to live her values more fully in her own practice. She developed greater insights into the issues she was investigating, and came to understand how her work has the potential to influence her students in new ways. In the case of this study, the new way was through using a values-based approach to teaching and learning, an approach which positively influenced her students’ levels of mathematics self-efficacy.

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