The mathematics allergy: Is Drama in Education the much-needed antidote?
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Abstract: “DIE changes the attitudes of being allergic to mathematics.” The power of drama in education is the explicit link it creates between mathematics and the everyday world of the participants. This is explored through a description of how drama in education was utilised with a group of in-service teachers from Lesotho to provide a context for the participants to engage with an alternative learning and teaching methodology. In this paper we explain how Drama in Education developed participants’ confidence, encouraged active participation and challenged previously held attitudes towards mathematics.

In the light of negative attitudes encountered towards mathematics and difficulties incurred within the learning and teaching of mathematics, new learning approaches seem essential. These should focus on making mathematics alive and more realistic so that learners view mathematical skills and concepts as an integral part of their everyday lives. A potential strategy, explored in this paper, is the use and relevance of Drama in Education (DIE) to facilitate the development of mathematical concepts. The workshop described in this paper served as a pilot to explore the potential of DIE for learning and teaching mathematics.

Context
In 2001, the Lesotho College of Education, with agreement from the Ministry of Education, requested our support in conducting a series of mathematics workshops for twenty-five participants including in-service teachers within the foundation phase (grades 0 to 3) and college lecturers. The purpose of the workshops was to share and develop alternative strategies for supporting learning and teaching of mathematics in the foundation phase. The Lesotho College of Education was particularly interested in developing a partnership with a higher education institution situated in the Eastern Cape in South Africa as many of the challenges facing our province are consistent with those in Lesotho. This paper is based on the third workshop, which focused on development of young learners’ spatial sense.

Lesotho is a small, landlocked and mountainous country with a population of just over 2 million. 81% of the total population live in rural areas. This presents a number of challenges, particularly with regards to education. Some of these include the low, deteriorating quality of education, teacher learner ratio, low levels of staff qualification, a paucity of facilities and resources, a high dropout and repetition rate, multi-standard teaching and poor management of the education system (Lefoka & Sebatane, 2002)

The workshop was initially developed from three intended outcomes, which were: To develop an understanding of the importance and use of contexts in promoting young children’s mathematical learning; to explore a variety of ways of encouraging their children’s mathematical understanding; and to explore the use of DIE within the context of mathematics learning and teaching.

During the course of the workshop it became apparent that the participants own understanding of spatial concepts was limited in the sense that a number of misconceptions were articulated. For this reason a further aim was identified, that being to develop the participants’ conceptual understanding of shape and space.

The potential of Drama in Education as a methodology for learning mathematics
Norman (1999) defined DIE as an active and collaborative learning process involving “our unique ability to imagine, empathise, and project … in an attempt to make sense of the world in which we live. The distinctive features of this process are the creation of an ‘as if’ context and situation, the taking of roles, the motive power of feeling engagement” (p.17).

Our choice of DIE as a learning and teaching methodology that emphasises communal activity and a sharing of culture (Bruner, 1986), and as a vehicle for developing the participants’ mathematical understanding is rooted in the view that knowledge is constructed socially and is culturally and historically situated. DIE takes place in the ‘real world’ of the classroom and within the fictitious world created by the context. The interrelationship between these two worlds is central to the unique learning and teaching experience that DIE provides.
The strengths of DIE lie in its potential value as a means for exploring, constructing and making meaning. As stated by Wagner, DIE, or process drama “…enables participants to look at reality through fantasy to look below the surface of actions to their meaning” (Wagner, 1998, p.8). It is used to “…help children become active in understanding themselves and the world, and in creating the future.” (Williams, 2002, p.6)

DIE, as is also the case with approaches that have moved away from traditional, transmission-based learning such as ‘situated learning’ (Lave and Wenger, 1991), ‘problem-based learning’ (Stepien and Gallagher, 1993), ‘collective learning’ (Aronovitz and Giroux, 1993) and ‘other contextualised approaches to learning’ (Anderson, 2002) changes the relationship between the teacher and the learner, and presents a ‘different way of knowing’. The notion of a ‘different way of knowing’ and the broadening and challenging of “the parameters of what can be seen as legitimate knowledge … to experience and explore the issues of human concern and intellectual enquiry” (Carroll, 1988, p.21) are essential aspects of DIE which place it firmly within particular approaches to learning and teaching which resonate with our assumptions about learning and teaching.

The change in relationship, between educator and learner, impacts on the nature of power and the type of knowledge envisaged for the classroom. Teachers and learners as partners, bring to the learning environment, their own unique experiences. The teacher is a partner who brings to the process subject knowledge and prior experiences, the responsibility for structuring and initiating the learning process and strategies for facilitating the learning process and enabling learning. As Crumpler (1996) pointed out “Rather than insist on one right interpretation, multiple possibilities are encouraged; … rather than the transmitter of information, the teacher becomes a facilitator and co-constructor of meaning.” (p.39) The students are partners who bring to the process new perspectives, opinions and fresh ideas, the ability to construct their own understanding, the responsibility for their own learning, different learning styles for participating in and processing learning, and a multiplicity of prior experiences.

DIE can make a direct contribution to mathematics education as it promotes: The understanding of mathematics as a human activity; opportunities for exploring mathematics in a variety of historical, social or cultural contexts; a multiple perspectives approach to problem solving by bringing different worlds and people in different times and places into the classroom; and authentic contexts for learning and motivation for the tasks required within the drama.

**Linking the features of DIE to the Lesotho Workshop**

The ‘as if’ context or context of meaning refers to the situation selected and used as the framework within which the learning process takes place and which provides the motivation for the learning process. It is the “...vehicle or context for teaching and learning through the fiction that is established” (Holden, 2003, p.36). In this workshop, the context of meaning was to develop a heritage site for the Masimanyeni Foundation (Masimanyeni is an isiXhosa term that means ‘Let’s Build Together’). Within this context the participants were introduced to numerous mathematical concepts through DIE and participatory story-telling. The reasons for this choice of context were the ease of relating spatial sense to construction; the provision of an opportunity for teachers to draw on their local knowledge and expertise; and the metaphor of building knowledge together. The participants were willing to engage with the context because of its relevance. The workshop was situated at the Mohale Dam which is to become a tourist site in Lesotho.

In setting the context, we took on the role of representatives of the Masimanyeni Foundation who had access to a team of building contractors, architects, designers, financiers and engineers. The teachers were the community experts because they had knowledge of the area, the needs of the community, and the requirements of a Lesotho heritage site. Our experience was that there was a high level of participation when the participants were in role. Through the process of assuming a ‘real’ role the motivation to become involved in the process and to participate was increased. In addition to this, the participants realised that they needed to develop an understanding of certain mathematical concepts to function effectively within the role. The learning of concepts became more important to the participants because they identified their conceptual limitations, rather than the facilitators.

Within the context of the Masimanyeni Foundation, we were required to change roles for a number of reasons: We wanted to give the participants an experience of working with different people attached to the Masimanyeni Foundation who would require different tasks. For example working with planners and architects initially to presenting to financiers and engineers; to encourage
consolidation and ascertain levels of understanding through the introduction of a ‘new arrival’ who was not part of the initial process; and to adopt various statuses within the drama depending on whether the focus was on facilitating the process and giving input (‘authority’ – high status), working collectively with the teachers (‘one of the gang’ – medium status), or playing ‘the helpless one’ (low status) to ascertain understanding.

Throughout the process, it was necessary for us to signal the changes in role clearly. Sustaining interest and maintaining the context required the use of a number of aids. We used ‘hard hats’ to signal the changes in role. When wearing the hats we changed from designers and financiers to building constructors and engineers. The use of the ‘hard hats’ and other aids assisted us to maintain the drama context and to build belief.

Although it was important for us to identify enough with our roles in order to be convincing, we needed to remain sufficiently detached to identify the needs of the teachers in terms of their understanding of spatial sense. For the facilitators, the context required us to be constantly negotiating the curriculum between two frameworks; what the fictitious context required and the outcomes of the workshop. This resulted in discussion outside of the drama to determine what needed to be built into the process relating to direct teaching.

During our workshop it emerged that there were a number of misunderstandings related to mathematical concepts, which were required to continue the drama. We therefore created a space to facilitate the conceptual development of those concepts. Initially this space occurred outside the context of the drama. However, it became apparent that the teachers were less likely to question us while focusing on developing conceptual understandings of the mathematics outside of the drama as opposed to within the drama. Creating spaces within the context of the drama to challenge mathematical misconceptions required us to be able to ‘think on our feet’ and constantly reflect on how to use the drama context most effectively to facilitate learning. For example, finding realistic reasons within the context to explore the properties of 3-dimensional objects to determine which fit the criteria of polyhedra.

Furthermore, we had to be flexible and continuously evaluate our planned curriculum in terms of the workshop ‘reality’. For example, we assumed that the participants would understand the relationships between 2-dimensional and 3-dimensional figures and objects. However this was not the case and we had to do some direct teaching of this within the framework of being very clear for our own site and needing to get the shapes ‘right for the building contractor’.

The advantage of having two facilitators is that we could assume different roles within each sub-context. For example, when we realised that the participants were not aware of the relationship between a square and a rectangle or a cube and cuboid, we set up a convention (we used the convention of one facilitator adopting the role of the ‘helpless one’ i.e. one who does not understand the required mathematical concepts) whereby one facilitator, as designer, had the relevant understanding and the other facilitator, as financier, had limited understanding and shared the misconceptions that the participants expressed (‘the helpless one’). This took the attention off the participants and, it enabled them to assume a high status role as they had to educate ‘the helpless one’. Having further input and support supplied by the ‘authority’ while the participants were articulating their understanding through assisting the ‘helpless one’ was extremely beneficial in analysing the participants’ understanding and providing immediate input.

Within the context of creating a heritage site, various role tasks were introduced to the participants. “Learners-in-role benefit not only from engaging with realistic problems, but also by working and thinking within realistic roles.” (Anderson, 2002, p.1) The role tasks that focused on locating, developing and constructing the heritage site required the participants to assume the roles of cartographer, architect and building constructor. In order to prepare the participants for these roles and tasks, and to equip them with the required mathematical knowledge to perform the tasks it was necessary to divide the role tasks into two complimentary and reciprocal aspects namely project preparation (which focused more explicitly on developing mathematical understanding) and actual tasks for the site (which focused on applying their mathematical understanding). Both these aspects occurred within the drama context. For example, in order to develop the participants mapping skills participants were required to first draw a route map within the workshop venue. The reason given to the participants for the project preparation task occurred within the context. They needed to develop their mapping skills so that their maps of the site would be clear to the building contractor responsible for overseeing the construction of the site. Our reason for this task was firstly to assess their mapping
skills and secondly to create opportunities to develop skills that were needed. The participant realised their own limitations and the skills they needed to complete the actual task for the site. These skills included viewing perspective, scale and the use of symbols.

Using the drama context enabled the participants to play a more active role in determining the direction of the process. In our experience, the participants articulated that they wanted to extend their responsibilities as developers of the heritage site to include an exploration of the types of activities that would occur at the heritage site. This led to a discussion that focused on activities for young children that would enable them to explore their heritage. Indigenous games and stories formed the basis of this discussion. The participants expressed that within Lesotho, mathematics was an area of concern and they would explore their heritage through mathematical games and stories. This culminated in participants sharing different games and facilitators developing participatory storytelling methodologies with the participants within the context of the heritage site. Through the role tasks opportunities were created for the participants to reflect on both their mathematical learning and DIE as a methodology for exploring and developing mathematical skills and competencies.

Building belief (making the drama feel more ‘real’ through a range of techniques), leads to the teachers being able to ‘think from within a dilemma instead of talking about a dilemma’. (Heathcote, 1984) Although the drama context is obviously imaginary, to build belief, it was important that everything else within the drama was, and felt, as ‘real’ as possible. We began the process with a presentation of work that we, as building contractors, had done previously for other heritage sites. To set the scene and assess prior knowledge of shapes and objects we analysed photographs and models of a variety of ‘heritage sites’ During the drama process a number of opportunities for integrating other learning areas arose. This presented us with the dilemma of focusing specifically on the required outcome (developing young learner’s spatial sense) or using the participants’ responses to move the drama in a different direction (which would focus on other learning areas e.g. language, geography). We were concerned that our decision to disregard the participants’ ideas, due to limited time, would impact on the process of building belief and consequently we had to employ other techniques for building belief. These techniques included: processes which enabled us to develop mathematical concepts further (for example, making and wearing hats to visit a site which involved the art of origami); the use of props such as cell phones (for example, phoning the engineers to meet us at a site so that we could change roles); exploring and evaluating various manipulatives (for example card, straws, lego and geostructures) to be used in the construction process; creating a sub context (for example, setting up a space representing an aeroplane for a trip to the participants identified heritage sites); reminding the participants continuously of their roles by addressing them as cartographers, architects and building constructors; and creating a sense of urgency and commitment to achieving the goals of the foundation (for example, the financier urging participants to complete the tasks quickly as ‘time is money”).

Challenges

While the context encouraged participation and the development of spatial concepts, contextualisation was not fully understood. All the participants, except for one were able to recognize the importance of using a context to develop their learners’ understanding of shape and space but found it difficult to think of their own contexts for promoting learning. This was a new learning and teaching strategy for the participants and it is therefore understandable that more time was needed to develop the participants’ confidence in using this approach to learning and teaching, for reflecting on the drama process and for linking their experiences as learners to future experiences as teachers.

The participants acknowledged how much mathematics they had learned from each other and the drama context and expressed that their attitude towards mathematics had changed because learning was contextualised. However, some of the participants questioned the appropriateness of the level of understanding of mathematical concepts required during the drama context for foundation phase learners. Our experiences working with both pre-service and in-service teachers is that foundation phase teachers rarely see the point of developing their own mathematical understanding beyond grade 3 level.

As facilitators we realised that in order to maintain the participants’ commitment we needed to be completely committed to our roles throughout. We felt that the participants’ initial response to the drama context, because it was new to them, was guarded and less serious which meant that we had to work hard at building and sustaining their belief. As the process unfolded the participants became
increasingly more committed. They realised they had a role to play in driving the process as their contributions were considered seriously.

**Conclusion**

This workshop served as a pilot to explore the significance and relevance of DIE in mathematics learning and teaching. The workshop proved to be useful in developing the participants’ own understanding of shape and space as it challenged the participants’ own spatial conceptual understandings and provided a forum, albeit in a limited manner, for them to explore a variety of ways of promoting young learners’ spatial sense. We believe that DIE has the potential to be an exciting ‘anitdote’ for learning and teaching mathematics. It provided an authentic context for active learning; encouraged a multiplicity of views and perspectives; and gave the participants a sense of power and ownership over their learning as they had the historical, social and cultural background necessary for the development of the drama context that the facilitators lacked. As one participant articulated, “DIE changes the attitudes of being allergic to mathematics”

**References**

Norman, J. (1999). Drama - but don’t mention the ‘P’ word. SEAL journal, 17-20