Five years on: learning programme design for primary after-school maths clubs in South Africa

Debbie Stott[1]
[1] *South African Numeracy Chair Project, Rhodes University, South Africa*
[1] d.stott@ru.ac.za

Both globally and in South Africa, out of school time (OST) programmes are increasingly seen as ways to extend learning and bridge the gap between home and school contexts. Literature reveals that OST programmes with an academic focus that have sequenced, active, focused and explicit design features show positive findings. The purpose of this conceptual paper is twofold: 1) to describe the design of an academically focused primary after-school maths club learning programme that has been tested in a South African context over a five-year period in a development and research project and 2) to situate this design in the broader literature and context of other such programmes. The sharing of this design may be useful in terms of it having been tested in many clubs over the 5 years, providing a prototype for after school programmes of this type. Additionally it is a way of communicating the framework for expanding the sphere of influence of the club programmes beyond the immediate project. Furthermore, due to a lack of published research and publication into these types of programmes in our local context, this article calls for more of this kind of work in order to provoke discussion about the design of local OST programmes and their effectiveness.

Keywords: out of school time programmes, Vygotsky, after-school maths clubs, zone theory, zone of proximal development, learning metaphors, primary school, South Africa

Introduction, context and focus of the paper

As a member of the South African Numeracy Chair (SANC) project, I co-ordinate and facilitate a number of primary after-school mathematics clubs. Two Grade 3 after-school maths clubs formed the empirical field for my doctoral research. As the maths club co-ordinator I am responsible for the club-learning programme design and related facilitator training for the SANC project. My work within the SANC project is thus focussed on both development and research in the field of numeracy.

The challenges with mathematics education in South Africa are well documented (see for example Fleisch, 2008; Schollar, 2008) and I will not repeat them here. With these challenges foregrounded, one key strand of the SANC project development work is direct learner intervention activities. After-school mathematics clubs are the projects' major regular learner intervention (Graven, 2011; 2012) and serve two purposes: firstly, they are a place where the SANC project team can directly influence what happens with learners and secondly, they provide the project research community with an empirical research field in which they can interact directly with the learners and thus be insiders to the learning process (Graven, Stott, Mofu & Ndongeni, 2014). Since 2012 the project has run 26 clubs for over 284 grade 2 to 5 learners and have supported another 16 clubs outside the immediate project. The after-school clubs are conceptualised as informal learning spaces focused on developing a supportive learning community where learners can develop their mathematical proficiency, make sense of their mathematics and where they can engage and actively participate in mathematical activities (Graven, 2011). Individual, pair and small group interactions with mentors are the dominant practices with few whole class interactions. The clubs are intentionally designed to contrast some of the more formal aspects observed in the classrooms of the SANC project participating schools (Graven & Stott, 2012; Graven, 2011). Research findings from after-school clubs have been published elsewhere, see for example Stott (2014 and in press).

In an earlier publication, Stott and Graven (2013) reflected on how a pilot club in 2011 influenced the proposed design of the learning programme for my subsequent doctoral research clubs. The

emergent design discussed in this previous work was used for the two research clubs, which formed the empirical field for my doctoral study in 2012 but was as yet untested beyond the pilot and research clubs. In this conceptual paper, I build on this earlier work and specifically focus on two aspects. Firstly, I position this design in the broader out of school time (OST) field. Secondly, I document and share the actual club-learning programme design that has been tested over a five-year period in a range of research and non-research clubs. This design framework forms the basis of the project's maths club model. In the last two years, the design framework has been communicated as detailed here to organisations beyond the SANC project that have started and run maths clubs using the project model.

The intention in sharing this design is to expand on both local and international research about such programmes and to stimulate discussion about OST programme design and effectiveness. In this conceptual paper, I discuss the theoretical framework underlying this design, review and connect the club design with relevant literature and then share the club-learning programme design.

Theoretical framework

Theoretically, a broad perspective of Vygotskian learning and development forms the basis of the club-learning programme design which additionally draws on Sfard's (1998) early work with learning metaphors. Vygotsky (1978) conceptualised development as the transformation of socially shared activities into internalised processes in his "general genetic law of cultural development" arguing that higher mental functioning appears first on the social level and then on the individual level.

> Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first, between people ... and then inside the child. This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher [mental] functions originate as actual relations between human individuals" (Vygotsky, 1978, p.57).

Vygotsky saw this social and individual learning and development as dialectically linked and described the dialectical nature of learning and development thus:

> learning awakens a variety of internal-development processes that are able to operate only when the child is interacting with people in his environment and in cooperation with his peers. … learning is not development; however, properly organised learning results in mental development and sets in motion a variety of developmental processes that would be impossible apart from learning. Thus learning is a necessary and universal aspect of the process of developing culturally organised, specifically human, psychological functions (Vygotsky, 1978, p. 90).

The relationship between social and individual learning and development in the Vygotskian perspective forms an important foundation for the design of the project club-learning programme as the clubs aim to encourage more participatory mathematical practices whilst at the same time promoting the development of individual learner mathematical proficiency. For the club design, Sfard's[8] 1998 work on the metaphors of learning extends Vygotsky's theoretical ideas. She identified and described the differences between two metaphors for learning. She described the metaphor 'learning as acquisition' as implying that learning is the *acquisition* of something that is then stored in an individual. Learning as acquisition theories can be regarded broadly as mentalist in their orientation, with the emphasis on the individual building up cognitive structures. In contrast, she identified the 'learning as participation' metaphor as considering learning as a process of *becoming* a member of a certain community, which entails the "ability to communicate in the language of this

[8] It should be noted that more recently, Sfard has developed a theory of learning with an emphasis on discourse where learning and development are seen as changes in discourse. See for example her work entitled "Introduction to thinking as communication" (2008).

community and act according to its particular norms" (p. 6). Sfard noted, that often these two metaphors can be seen as being in opposition to each other. However, working within the broad Vygotskian perspective described above, the tensions between the two notions of acquisition and participation are nothing unusual as the genetic law already links them. Thus, I argue that the two notions complement rather than conflict with each other (Stott, 2014).

Drawing on Vygotsky's work and on Sfard's 'metaphorical mappings' (1998, p.7), the club design purposely incorporated both the Vygotskian ideas of individual and social learning and development and these metaphors of acquisition and participation. Figure 1 below gives a tabular comparison of the two metaphors described in Sfard's article. Later I discuss how these have been specifically accommodated by the club-learning programme design thus using these theoretical ideas as the foundation for the design.

Acquisition metaphor		Participation metaphor
Individual enrichment	Goal of learning	Community building
Acquisition of something	Learning	Becoming a participant
Recipient (consumer), (re-)constructor	Student	Peripheral participant, apprentice
Provider, facilitator, mediator	Teacher	Expert participant, preserver of practice/discourse
Property, possession, commodity (individual, public)	Knowledge, concept	Aspect of practice/discourse/activity
Having, possessing	Knowing	Belonging, participating, communicating

Figure 13: Sfard's (1998 p.7) Metaphorical mappings

Kilpatrick, Swafford and Findell's (2001) strands of mathematical proficiency have been widely used in South African mathematics education circles (see for example Adler, Ball, Krainer, Lin, & Novotna, 2005). The power of this work is that it provides a rich and elaborated notion of mathematical proficiency that extends beyond a focus on procedural mathematics. Within the broader SANC project and specifically within the clubs, the project promotes the development of mathematical proficiency in all learners, drawing on Kilpatrick et al.'s definition, which comprises five intertwined and interrelated strands. Conceptual understanding - comprehension of mathematical concepts, operations and relations; procedural fluency - skill in carrying out procedures flexibly, accurately, efficiently and appropriately; strategic competence - ability to formulate, represent, and solve mathematical problems; adaptive reasoning - capacity for logical thought, reflection, explanation and justification and productive disposition - habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy (p. 5).

Literature review

In order to situate these project clubs in the literature, I approached this literature review as a narrative review to provide sufficient background for understanding the broader OST field, out of school time programmes as well as the features and effectiveness of such. I also provide an overview of zone theory as background for the final section of the paper, in which I share the tested design.

Out of school time programmes

OST refers to the hours in which school-age children are not in school where children are doing something other than activities required by school attendance. A wider definition includes summer schools, before school and weekend programmes, therefore after-school programmes can be seen as a specific sub category of OST programmes (Lauer, Akiba, Wilkerson et al., 2006). Much of literature pertaining to after-school programmes originates from the United States (US), where after-school programmes have been in existence for many decades. I draw on the US literature as the basis for this review as there is little academic literature on OST programmes to be found in the broader African and more specific South African context.

> Afterschool programs are a critical first step in the process of changing not just how we educate our children, but how we come together, in partnership - school and community - to ensure their success (White, 2005, p. 8).

This quote suggests the importance of providing after care programmes for children. White suggests that when a neighbourhood or home context are "less than desirable" (p.3), after-school programmes can bridge the gap between these and the school. This is particularly pertinent to the South African context where many children (over 60%) live in poverty and where many home contexts can be seem as problematic (Fleisch, 2008). Durlak and Weisberg (2007) note that there is increasing evidence that the ways in which young people spend their out of school time hours can have important implications for their academic, personal and social development (ibid).

Many US OST programmes target at-risk children and the types of programmes range from basic school after-care, through academic development to specific social, sport and artistic programmes. One of the aims of the SANC project's after-school maths clubs programme is to promote and potentially improve mathematical proficiency in local primary school learners; this can be seen as a focus on academic development as opposed to sports development for example. Hence the remainder of this review will look at OST programmes that emphasise *academic* development. In this regard, Beckett, Borman, Capizzano et al. (2009) highlight that "OST is an opportunity to supplement learning from the school day and provide targeted assistance to students whose needs extend beyond what they can receive in the classroom" (p.1). The SANC project club learning programme provides an example of how South African learners could supplement and extend school learning on mathematics and points to a possible way to address some of the cognitive backlog in our education system that Schollar (2008) refers to.

Research in the US centres on the impact and effectiveness of after-school programmes and Durlak and Weissberg (2007) summarise the positive effects of OST programmes as follows:

> young people benefit when they spend time engaged in structured pursuits that offer opportunities for positive interactions with adults and peers, encourage them to contribute and take initiative, and contain challenging and engaging tasks that help them develop and apply new skills and personal talents (p. 5).

There are a number of ideas here that resonate with conceptualisation of the SANC project maths clubs which have a deliberate focus on increasing learner engagement, learner confidence and participation in mathematical sense making (Graven, 2011).

Lauer et al. (2006) concluded that OST programmes can have positive effects on achievement in reading and maths. However, they highlighted that future research and evaluation studies should document the characteristics of the OST programme and how the programme is implemented, as more evidence is needed of what characterises *effective* programmes. This final point is relevant to my work with clubs in the South African context, where effective OST programmes could be one way of addressing learner backlog. Additionally, for future sustainability of the project clubs and expansion of their sphere of influence, the characteristics of the project's club-learning programme should likewise be documented and shared in the broader academic space.

The benefits of and critical success factors in after-school programmes

Papanastasiou and Bottiger (2004) described the advantages and benefits they found in voluntary middle school (grades 5 to 8) maths clubs held before school time as providing opportunities for students to develop personal self-esteem, inquiring minds, relatively close human relationships and a sense of belonging and purpose or usefulness and, as low stress environments, clubs enable students to learn about teamwork and of the importance of cooperation and mutual support. Similarly, Little, Wimer and Weiss (2007) listed the academic outcomes associated with participation in after-school

programmes as better attitudes toward school; better performance in school (as measured by achievement test scores and grades); improved homework completion and better engagement in learning. Amongst the social and emotional benefits, they included improved self-confidence, self-esteem; improved social and communication skills and/or relationships with others (peers, parents, teachers); improved feeling and attitude towards self and school and development of initiative.

There is some commonality in these findings particularly with regards to the development of self-confidence, attitudes towards school and learning, improved social and communication skills as well as improvement in academic performance. These findings cohere with Graven's (2011) motivation for starting clubs as a fundamental SANC project intervention and with subsequent findings from the five-year SANC project. Graven (2015) reports that learners are shifting ways of participating and showing increased enjoyment of mathematics, willingness to discuss the methods they used to arrive at an answer, willingness to try maths problems without fear of being wrong and increased confidence. Stott (to appear) notes from her research clubs that they are "enabling spaces for both recovery and extension of mathematical proficiency in learners as these spaces are free from several contextual constraints that teachers face in their classrooms" (no page).

However, Little et al. (2007) raise concerns that not all research and evaluation studies of OST programmes have shown benefits. For them, a critical component of achieving high quality in after-school programmes is to intentionally develop programmes that "focus on promoting targeted outcomes through well-organized and engaging activities" (2007, pp. 12–13).

Durlak and Weissberg (2007) applied a number of criteria to a range of OST programmes to establish whether positive results emerged. They concluded that programmes that devote sufficient time to skill enhancement, being explicit about what they wish to achieve, use activities that are coordinated and sequenced to achieve their purpose, and require active involvement on the part of participants ('SAFE': sequenced, active, focused, explicit) show significant positive findings with regards to many of the outcomes discussed above such as improved feelings of self-confidence, positive social behaviours and improved school grades. In their 2010 work they note that these SAFE features can be applied to a wide variety of intervention approaches, which is the case in learning programme design described here as it has been intentionally designed by working from a strong theoretical base to echo a number of these features.

I noted that research literature on academically oriented primary school clubs is relatively limited, particularly so in Africa. Peer reviewed literature on school maths clubs in South Africa is largely non-existent except for Graven's (2011) article referred to earlier. In the absence of formal academic research on OST programmes in South Africa, an Internet search for after-school programmes in South Africa reveals many programmes (some with a mathematical focus), many privately funded and run by NGOs. What is noticeably lacking from the public space is research on how these programmes are structured and whether they are effective in addressing some of the issues with mathematics education. Thus, additional motivation for writing this article is to encourage research and publication into these programmes in our local context, in order to provoke discussion about their design and what characterises their effectiveness.

Zone theory overview

The broader SANC project work is framed as a community of practice, particularly with regard to the teacher development programme (Pausigere & Graven, 2014). In searching for a framework around which to structure the maths club-learning programme, several considerations had to be taken into account. Designs and frameworks needed to cohere with the SANC project's broader theoretical framework, be related to mathematics education, were recent in research terms, take the 'SAFE' features into account and be flexible enough to cope with changes as both my research and the SANC after-school club project moved forward over the 5-year period.

In connection with Vygotsky's work on the zone of proximal development, Valsiner (1997) proposed zone theory as an "explanatory structure within the field of human development" (Galbraith & Goos, 2003 p.365). Galbraith and Goos (ibid) adapted Valsiner's work for teacher-student relationships and have extended it further into teacher development. Their work on zone theory particularly resonated with these broader project considerations.

Valsiner suggested two additional zones in namely the *zone of free movement* (ZFM) and the *zone of promoted action* (ZPA) to further describe the structure of a child's development in terms of the environment and relationships between the child and other people in the environment (Goos, Dole and Makar, 2007). The two additional zones are intended to give a better understanding of how the ZPD operates in a specific learning context and create a picture of the physical and cultural space in which the ZPD is situated. From this work, the ZFM, ZPA and ZPD can be seen as structures through which an adult or more knowledgeable other constrains or promotes the learner's thinking and actions and as such the ZFM/ZPA combination interactively generates the environment in which that learner develops (Blanton, Westbrook, & Carter, 2005).

Although much of this is detailed in earlier work, for completeness I provide a brief overview of zone theory (ZT) as used in educational research. The ZFM describes what is allowed for the learner by the adult in a particular learning context. In other words, the way an adult organises the ZFM anticipates the nature of the child's thinking about the concept being taught at the moment and in the future. In this sense, the ZFM ultimately channels the direction of learning development for the child, providing a framework for cognitive activity, learning and potential development (see Blanton et al., 2005; Galbraith & Goos, 2003) and for possible emergence of the child's ZPD.

The set of activities available and promoted in the learning environment are the means by which an adult or more knowledgeable other attempts to persuade a learner to act in a certain way (Blanton et al., 2005). This is called the ZPA. The activities promoted in the ZPA should ideally be in a learner's ZPD. In other words, the ZPA should promote activities that stimulate the emergence of the ZPD by being just beyond what the learners are currently able to do on their own (Blanton et al., 2005; Galbraith & Goos, 2003).

In educational literature, the ZPD is conceptualised in many different ways (see Stott, submitted). In ZT, the ZPD is described as the "set of possibilities for development that are in the process of becoming actualised as individuals negotiate their relationship with the learning environment and the people in it" (Goos, Dole and Makar, 2007 p.25). Elsewhere, I have identified and discussed how the zone of proximal development came to be the critical design concept for the clubs (Stott & Graven, 2013). For the purposes of this paper and this discussion of ZT, the ZPD is conceptualised as something that does not exist prior to the learning activity and is created (or not) through the social interactions with others during club activities. It depends on the active contributions of the learners as well as the mentor. The ZPD is as a symbolic space that encompasses the whole person. The emergence of a ZPD is encouraged by presenting activities that are meaningful to the learner, activities that can be accomplished with assistance, ones that allow the learner agency to benefit and take advantage of the assistance from others (Stott, 2014).

For the maths club-learning programme design, following Goos et al. (2007), zone theory is used in conjunction with a professional development framework which extends ZT to ensure that broader project concerns and processes are included in the design of related learning programmes. This extension is described in the next section.

Overview of SANC project club-learning programme design

What follows is the description of learning programme design framework used for the two case study research clubs in 2012 and for the on-going implementation of broader SANC project maths clubs over the last 5 years. Figure 2 below shows the final tested design framework. As will become clear

as we progress through this section, there are a number of reasons why the framework as shown is useful. As a process it is easily explainable to others and contributes to ensuring that the maths club model is sustainable beyond the time frame of the project. The framework provides a process for setting goals, planning and evaluating the on-going learning programme in the clubs. As the process is iterative and cyclical it allows evaluation of what works and does not work on a regular basis and this can be used to plan and implement subsequent actions and activities in the clubs. This kind of evaluation process was undertaken after the pilot club in 2011 (see Stott & Graven, 2013).

Key areas on the diagram are numbered one to three. One highlights the shared vision of the broader SANC project across all its developmental activities in terms of the factors that enable learners to become mathematically proficient. The broader aims of the project are noted in the framework (see 2). For the specific club-learning environment, the inter-related components of zone theory define the structure of the learning environment in the club, the activities promoted and the relationships between the all participants in the club as well as foregrounding the possibilities for learning in the ZPD.

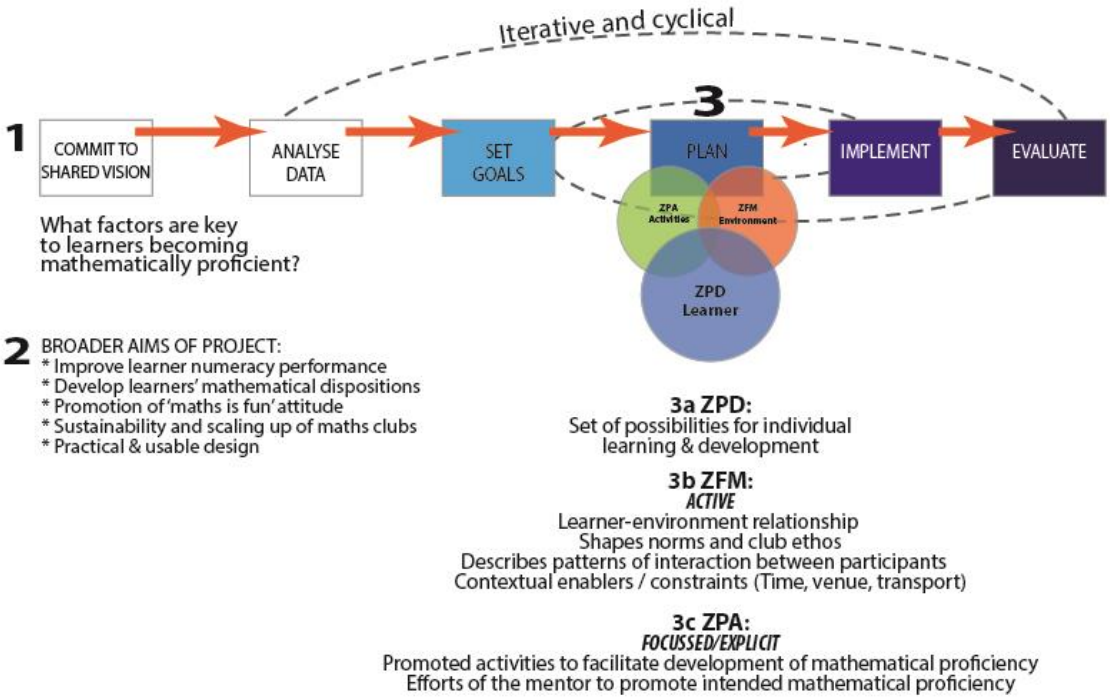

Figure 14: Club-learning program design framework (adapted from Stott & Graven, 2013: 33)

Based on the conceptualisation of the ZPD given earlier, the ZPD (see 3a) is highlighted as the critical design concept for the clubs and is shown as a larger circle. The ZPD is not portrayed as a fixed entity or as a fixed set of possibilities that are the same for each learner in the clubs. Using diagnostic assessment activities at the beginning of a club helps to establish what the set of possibilities may be but these possibilities can only be developed in subsequent club sessions. The ZPD is created (or not) by the social and dialogical interactions of each club session and as such is different for every child, in every session (Stott, 2014).

The *zone of free movement* (ZFM) (see 3b) explains the learner-environment relationship and how that environment supports the intended learning, thus playing a supporting role in the emergence of the ZPD. Specifically, for the club-learning programme, a number of connectionist teaching characteristics from the Effective Teachers of Numeracy study (Askew, Brown, Rhodes et al.,1997) are foundational to understanding the specific ethos promoted in the clubs. Of note are those that suggest that learners become numerate through "purposeful interpersonal activity based on

interactions with others" (p. 35) and that numeracy teaching is based on "dialogue between teacher and pupils to explore understandings" (p. 36). Specifically club mentors are active participants and co-learners and facilitate rather than teach, they encourage participation and engagement, promote the club ethos, provide flexible mediation to challenge and build learner confidence and encourage learners to feel comfortable both with mistakes and with hard work and struggle (Boaler, 2014). Thus the key features of the ZFM for the clubs are that all participants are active, including the mentor and pair and group work are encouraged, dialogue is foregrounded (for example talking about mathematical thinking and understanding) and as such the *active* characteristic of effective OST learning programmes is incorporated (Durlak and Weissberg, 2007).

The *zone of promoted action* (ZPA) (see 3c) describes the activities that are promoted in the club to facilitate development of mathematical proficiency in each club learner and describes the efforts of the mentor to promote this learning. It defines the diagnostic activities that enable a mentor to establish where learners are in their mathematical proficiency trajectories and activities that promote the development of the five strands of proficiency discussed earlier. The kind of activities that are promoted in each club are directly influenced by each learners "set of possibilities" for their ZPD. Consequently only the diagnostic assessment activities, which can be formal assessment tasks or simple card and dice games, are planned in advance. The data and reflections from these initial activities drive the subsequent activities for the club that are aimed at learning and development of mathematical proficiency for each learner with the hope of encouraging the emergence of ZPDs. The overarching intention for any activity promoted in the clubs is the fostering of sense making and flexible thinking using an interwoven approach to the development, where possible, of the five strands of mathematical proficiency (Kilpatrick et al., 2001). In terms of procedural fluency, focus is on developing efficiency, accuracy and flexibility in order to take the attention away from using traditional algorithms. In this way, the ZPA incorporates the *sequenced, focused* and *explicit* characteristics of effective learning programmes highlighted by Durlak and Weissberg (2007).

Earlier I spoke about the acquisition and participation metaphors (Sfard, 1998). From this examination of the ZFM and ZPA zones for the club-learning programme, it is clear that the clubs have a dual focus in that learner mathematical proficiency is promoted as well as mathematical forms of participation. This design framework addresses and accommodates the relationship between the acquisition and participation metaphors and Figure 3 shows how this dual focus is intentionally interwoven in the club design.

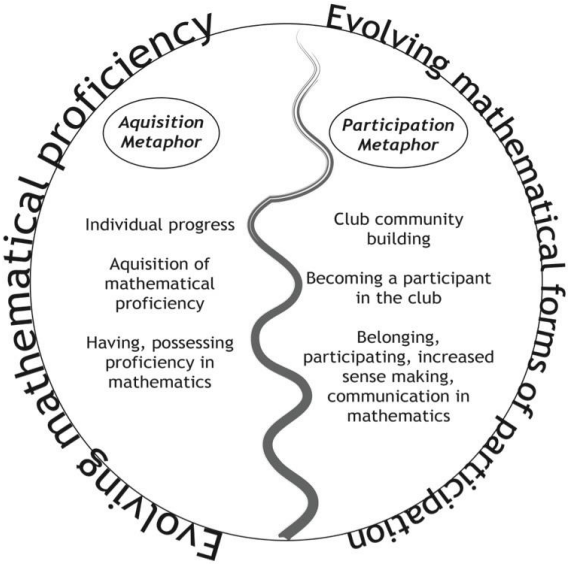

Figure 15: Club-learning program design: metaphorical mappings (Stott & Graven, 2013:31)

Individual learner progress and the acquisition of mathematical proficiency is shown on the left of the diagram and represents the acquisition aspect of the design. As mentioned, the ZPD is the foregrounded design construct that focuses on each individual club learner. The diagnostic assessment activities promoted in the ZPA establish and track where each individual learner is on their own individual mathematical proficiency trajectory, with the overarching aim of improving learner mathematical proficiency over time.

The right side highlights an intended focus on evolving forms of mathematical participation whereby the learners, mentors and other people in the club become participants in the club with increased sense making and communication in mathematics. Addressed through the ZFM, these participationist aspects. Additionally, the collaborative activities promoted in the ZPA extend the participationist aspect further by promoting activities that allow possible increased sense making and mathematical communication in a collaborative way.

Concluding remarks

Over the past five years, following on from the pilot study in 2011 and earlier publication, this design has been tested as the framework for all the clubs run both within and beyond the SANC project. The framework has been shared in varying forms of complexity with educators who are interested in starting and running their own clubs. On reviewing this model for my doctorate, one person commented that the model described in this paper contributes to an area of extra-curricula programming as it relates to contexts throughout the world where opportunities to enhance mathematics education of children is an on-going challenge.

I argue that the club-learning programme design communicated here enables the promotion of targeted academic outcomes (in this case, the development of mathematical proficiency) through well-organised and engaging activities and the 'SAFE' (sequenced, active, focused, explicit) design features. This learning programme has been purposely designed with a solid theoretical background based on Vygotsky and Sfard's work, incorporating those theoretical concepts, zone theory and these SAFE design features and goes some way to contributing to research on how after-school spaces can benefit young learners.

Without such well-designed approaches to academic OST learning programmes, the maths clubs could merely be "more of the same" and may well simply be an extension of the maths classroom. The opportunity to promote specific practices (as described here) that intentionally contrast to those found in many of our South African classrooms would then be lost. Furthermore, in order to improve OST programmes both in South Africa and abroad, it is important that research is carried out on how they are designed and on what makes them effective. They may be an important aspect in addressing some of the educational challenges we face here on the African continent, particularly in bridging the gap between home and school contexts as research emanating from our project suggests that after-school maths clubs could be valuable spaces for changing foundation phase learner attitude and learning habits.

Acknowledgement

The work of the SA Numeracy Chair, Rhodes University is supported by the FirstRand Foundation (with the RMB), Anglo American Chairman's fund, the Department of Science and Technology and the National Research Foundation. I thank the Chair, Mellony Graven, who was also my supervisor, for her guidance with regard to my research and input into this paper.

References

Adler, J., Ball, D., Krainer, K., Lin, F.-L., & Novotna, J. (2005). Reflections on an Emerging Field: Researching Mathematics Teacher Education. *Educational Studies in Mathematics*, 60(3), 359-381.

Askew, M., Brown, M., Rhodes, V., Johnson, D., & William, D. (1997). *Effective teachers of numeracy*. London: London: King's College/TTA.

Beckett, M., Borman, G., Capizzano, J., Parsley, D., Ross, S., Schirm, A., & Taylor, J. (2009). *Structuring Out-of-School time to improve academic achievement: A practice guide*. Washington DC: National Centre for Educational Evaluation and Regional Assistance, U.S. Department of Education.

Blanton, M. L., Westbrook, S., & Carter, G. (2005). Using Valsiner's zone theory to interpret teaching practices in mathematics and science Classrooms. *Journal of Mathematics Teacher Education*, 8(1), 5–33.

Boaler, J. (2014). The mathematics of hope: Moving from performance to learning in mathematics classrooms. *youcubed*. Retrieved from http://youcubed.org

Durlak, J. A., & Weissberg, R. P. (2007). *The impact of after-school programs that promote personal and social skills: Executive summary*. Chicago, Illinois.

Fleisch, B. (2008). *Primary education in crisis: Why South African schoolchildren underachieve in reading and mathematics*. Johannesburg: Juta.

Galbraith, P., & Goos, M. (2003). From description to analysis in technology aided teaching and learning: A contribution from Zone Theory. In L. Bragg, C. Campbell, G. Herbert, & J. Mousley (Eds.), *Proceedings of the 26th Annual Conference of the Mathematics Education Research Group of Australasia* (Vol. 1, pp. 364–371). Melbourne: Deakin University.

Goos, M., Dole, S., & Makar, K. (2007). Designing professional development to support teachers' learning in complex environments. *Mathematics Teacher Education and Development*, 8, 23–47.

Graven, M. (2011). Creating new mathematical stories: exploring opportunities within maths clubs. In H. Venkat & A. A. Essien (Eds.), *Proceedings of 17th National Congress of the Association for Mathematical Education of South Africa* (AMESA) (pp. 161–170). Johannesburg: University of the Witwatersrand.

Graven, M. (2012). Accessing and assessing young learner's mathematical dispositions. *South African Journal of Childhood Education*, 2 (1), 49-62.

Graven, M. (2015). Strengthening math learning dispositions. In K. Beswick, T. Muir, & J. Wells (Eds.), *Proceedings of 39th Psychology of Mathematics Education conference*. Hobart, Australia: PME.

Graven, M., & Stott, D. (2012). Design issues for mathematics clubs for early grade learners. In D. Nampota & M. Kazima (Eds.), *Proceedings of the 20th Annual Meeting of the Southern African Association for Research in Mathematics, Science and Technology Education* (pp. 94–105). Lilongwe: University of Malawi.

Graven, M., Stott, D., Mofu, Z. A., & Ndongeni, S. (2015). Identifying stages of numeracy proficiency to enable remediation of foundational knowledge using the Learning Framework in Number. In D. Huillet (Ed.), *23rd Annual Meeting of the Southern African Association for Research in Mathematics, Science and Technology Education (SAARMSTE): Mathematics, Science and Technology Education for Empowerment and Equity* (pp. 69–83). Maputo, Mozambique: SAARMSTE.

Kilpatrick, J., Swafford, J., & Findell, B. (2001). *Adding It Up: Helping Children Learn Mathematics*. Washington DC: National Academy Press.

Lauer, P. A., Akiba, M., Wilkerson, S. B., Apthorp, H. S., Snow, D., & Martin-Glenn, M. L. (2006). Out-of-school-time programs: A meta-analysis of effects for at-risk students. *Review of Educational Research*, 76(2), 275–313.

Little, P. M. D., Wimer, C., & Weiss, H. B. (2007). *After school programs in the 21st Century: Their potential and what it takes to achieve it.* Cambridge, MA: Harvard Graduate School of Education.

Papanastasiou, E. C., & Bottiger, L. (2004). Math clubs and their potentials: making mathematics fun and exciting. A case study of a math club. *International Journal of Mathematical Education in Science and Technology*, 35(2), 159–171.

Pausigere, P., & Graven, M. (2014). Learning metaphors and learning stories (stelos) of teachers participating in an in-service numeracy community of practice. *Education as Change*, 18(1), 33–46.

Schollar, E. (2008). *Final Report: Short version The Primary Mathematics Research Project 2004-2007 - Towards evidence-based educational development in South Africa*. Johannesburg.

Sfard, A. (1998). On two metaphors for learning and the dangers of choosing just one. *Educational Researcher*, 27(2), 4–13.

Stott, D. (2014). Learners' numeracy progression and the role of mediation in the context of two after school mathematics clubs. Doctoral thesis. Rhodes University, South Africa.

Stott, D. (in press). Researching the nature of early numeracy progression in after school clubs. In M. Graven & H. Venkat (Eds.), *Improving primary mathematics education, teaching and learning: Research for development in resource constrained contexts.* Basingstoke: Palgrave Macmillan Publishers.

Stott, D. (submitted) Exploring the zone through a categorisation framework. *African Journal of Research in Mathematics, Science and Technology Education*.

Stott, D., & Graven, M. (2013). The dialectical relationship between theory and practice in the design of an after-school mathematics club. *Pythagoras*, 34(1), 29–38.

Valsiner, J. (1997). *Culture and the development of children's action: A theory of human development* (2nd edition.). New York: John Wiley & Sons.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.) (pp. 1–159). Cambridge, Mass.: Harvard University Press.

White, W. S. (2005). *Afterschool programs: Giving hope and help to all our children*. Chicago: Charles Stewart Mott Foundation.