

A STRATEGIC MODEL FOR PLANNING AND IMPLEMENTING
AN ON-LINE APPROACH FOR CONTINUOUS PROFESSIONAL
DEVELOPMENT

by

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I declare that **A STRATEGIC MODEL FOR PLANNING AND IMPLEMENTING AN ON-LINE APPROACH FOR CONTINUOUS PROFESSIONAL DEVELOPMENT** is my own work and that all the sources I have used or quoted have been indicated and acknowledged by means of complete references.

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(MR TM VAN DER MERWE)

.....

DATE

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Summary

The poor performance by South African pupils in The Third International Mathematics and Science Study highlighted the importance of and need for Continuing Professional Development (CPD) for South African mathematics teachers. For these teachers, the sudden, rapid and dramatic advent of the World Wide Web (WWW) and its communication conduit, the Internet, with its multimedia capabilities, interactive tools and telecommunication facilities, seems full of potential as a catalyst for significant and sustained online CPD activities. However, the Internet's usefulness for mathematics and spontaneous mathematical interaction is severely limited.

Against this background, the motivation for this study was born out of two beliefs – a belief that context needs to be considered in online endeavours, particularly given the disparities that exist between disadvantaged and advantaged teachers in the South African context; and the belief that a bottoms-up approach to community formation allows space for a self-organizing system whose continual health and functioning is dependent upon local ownership and member identification. Having developed a mathematics-friendly online forum environment (ODEM) that allows teachers to include mathematical expressions in their posts, this study investigated the personal and situational tensions impacting on the use and value of this appropriate forum environment as a reflective tool in pursuit of CPD.

Two groups of disadvantaged and advantaged mathematics teachers were separately provided with Personal Computers and home Internet access, thereby creating opportunities for reflection, communication with colleagues and the exchange of knowledge and ideas.

Little evidence of community growth was found, while disadvantaged teachers faced more tensions than advantaged teachers in using the ODEM. Despite these differences, both groups' tensions pointed to their real (and thus forum) needs not being addressed. These forum needs are related to issues arising from their practice and the need for a channel of communication to a Subject Advisor that should actively manage these needs. A vertical relationship with the Subject Advisor is preferred over collegial interaction, over the needs to include expressions in their posts, or to reflect on their practice. Until teachers' needs are resolved, the ODEM is thus perceived to have potential value.

The results furthermore informed a model that can be used by a Subject Advisor to determine teachers' tensions and needs in context, thereby ensuring appropriate online CPD strategies.

Key terms

Continuous professional development; online forum; mathematics teachers; disadvantaged; advantaged; online professional development model; personal tensions, situational tensions.

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1. Introduction

- 1.1 Introduction**
- 1.2 Problem identification**
 - 1.2.1 The usefulness of the Internet for spontaneous mathematical interaction
 - 1.2.2 Personal and situational tensions
 - 1.2.3 Research focus
- 1.3 Objectives of the current study**
- 1.4 Main purpose of the current study and research questions**
- 1.5 Scope, assumptions and limitations of the study**
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- 1.7 Research methods employed**
- 1.8 Definition of terms**
- 1.9 Research contributions and publications arising from the current research**
- 1.10 Outline of the study**

1.1 Introduction

Education in South Africa in the last decade has been both dynamic and volatile, as several important policy initiatives were launched by a newly elected democratic government. The initial *White Paper on Education and Training* released in 1995 (Department of Education, 1995), was the first important policy paper providing a framework for a new system of education. This paper highlighted the importance of mathematics and science as secondary school subjects.

Also in 1994/1995, South Africa became part of the largest and most ambitious international study of mathematics and science ever undertaken by the International Association for Educational Achievement. The Third International Mathematics and Science Study (TIMSS) involved 41 countries and half a million pupils. Since their release in 1997/1998, the results of TIMSS received much attention both in South Africa and around the world. A repeat study was performed in 1998, with grade 8 pupils a particular focus. South African pupils performed particularly poorly in mathematics when compared to other participating countries. The mean score of 275 (standard error, SE, 6.8) was well below the international mean of 487 (SE 0.7). The results were also significantly below the mean scores of all other participating countries (Achievement, 1995)

One of the issues where the data suggested action may be appropriate and where it seems feasible, was on mathematics teacher preparation, especially where it concerns teachers from previously disadvantaged communities. Half of the teachers surveyed reported

feeling ill prepared to teach the content of the mathematics curriculum. There appeared to be few teachers with significant experience, with a relatively small percentage having a university level qualification. Their lack of adequate preparation in terms of content knowledge, in particular, has left these teachers feeling poorly prepared to teach their pupils. It is generally recognized that Continuous Professional Development (CPD) is needed because initial teacher education cannot contain all the proportional knowledge that is needed when a syllabus is altered or when positioning oneself for promotion or new responsibilities (Knight, 2002).

While government has reaffirmed its commitment to promote the status of mathematics in high schools (BuaNews, 2007), initiatives to foster CPD are largely driven by Higher Education Institutions offering accredited distance education courses, with in-service education and training efforts largely limited to workshops offered by the various Departments of Education (DOE).

However, workshops or event-delivery models are held too infrequently to be of real value in a constantly changing environment, while their usefulness is also debatable (McLaughlin and Marsh, 1978; Guskey, 1986; Bradley, Conner and Southworth, 1994; Goleman, 1998; Clark, 2002; Knight, 2002). As Wiske, Sick & Wirsig (2001) lament, workshops are inclined to focus on general topics, are inattentive of teachers' individual interests, are disconnected from specific classroom practices and are isolated from ongoing support. Some of the other pertinent limitations identified by Becher (1999) are costs (rural teachers, in particular, are geographically dispersed) and variability in the quality and level of CPD provision. Given the diversity of South Africa's educational environments and the numerous echelons of educators, there is bound to be some level of disparity between provision and needs. These limitations are further enhanced in the absence of a clear CPD strategy for educators in South Africa (Mashile, 2002).

Cluster meetings, where teachers gather in language groups and geographical proximities, are a new initiative that aims to overcome these shortcomings. The purpose of these meetings is to enhance ongoing faculty and course/curriculum development. There is evidence, however, that cluster meetings are not popular, possibly as a result of the greater demands it places on them and subject advisors (Venter, 2003). More importantly, because of their geographical isolation, many teachers in rural areas will remain on the periphery of CPD opportunities like cluster meetings.

For these and other teachers, the sudden, rapid and dramatic advent of the World Wide Web (WWW) and its communication conduit, the Internet, with its multimedia capabilities, interactive tools and telecommunication facilities, seems full of potential as a catalyst for significant and sustained CPD activities. In fact, the WWW with its extensive and sophisticated capacity for interaction between learner and content, teacher-and-learner and learner-and-learner has encouraged some to predict a coming educational revolution.

Accordingly, in recent years there has been a significant and continual increase in research efforts aimed at exploring the role and contribution of the WWW to all levels of education. The majority of research has focused on issues related to both electronic teaching as an advanced tool for teachers, and to electronic learning as a means of enhancing the learning process.

One very popular research route focuses on the use of online discussion forums in an attempt to create virtual communities of practice. While pressing questions remains as to how online activities support quality and success in online endeavours (King, 2002), there is little doubt that Internet technologies are a dominating force, and as such, are bound to transform traditional CPD models.

1.2.1 Problem identification

Schagler and Fusco (2003) report that over the past decade education reform and teacher training projects have spent a great deal of effort to create and support sustainable and scalable online communities of education professionals. They note that for the most part, those communities were created in isolation from the existing local professional communities within which the teachers practice and that professional development should be treated as a socio-organizational system. They warn that there are socio-cultural preconditions that needs to be considered to prevent “us from putting the cart before the horse” when developing online communities. (Barab, 2003) supports their viewpoint by arguing that a “virtual community” must evolve with a group, around their particular needs, and for purposes that they value as meaningful.

South Africa with its history of apartheid is a country defined by diverse socio-cultural communities. In general terms, the white population group is recognized as (previously) advantaged, while the black population group is recognized as (previously) disadvantaged. Schagler and Fusco’s (2003) warning thus acquires added significance in this context, and

the first question that arises is what personal and situational tensions exist within these diverse communities that would impact on the use and value of an online discussion forum in support of the CPD of mathematics teachers?

Here “personal tensions” refers to factors that are specific to the individual and that prevents optimal participation and thus opportunities for CPD in a virtual community, while “situational tensions” refers to factors specific to the advantaged or disadvantaged environment the individual lives and practices in. The border between these tensions is somewhat vague since situational tensions may exaggerate personal tensions and personal tensions may expose individuals to situational tensions that they otherwise may not have been. Either tensions are therefore inclusive of the other, but are generally intended to refer to preventative factors that exist in an advantaged or disadvantaged environment.

A corresponding issue that precedes the possible impact of tensions but more specific to mathematics in an online context relates to the usefulness of the Internet for spontaneous mathematical interaction. Brief backgrounds on these two issues are presented in the next two sections.

1.2.1 The usefulness of the Internet for spontaneous mathematical interaction

The Internet’s usefulness for mathematics and therefore spontaneous mathematical interaction in an online forum environment is severely limited. The defining characteristic of an online forum environment lies in its support for spontaneous interaction.

Mathematics has symbol-rich expressions, and while the mark-up language HTML (the programming language utilized to display text and pictures on the Internet) consists of a large repertoire of tags (definitions of how to display text and images), it simply does not cater for mathematical symbols.

Authors thus resort to radical means to display mathematics on the Internet. Popular methods involve inserting images of equations into Web pages, and/or making electronic documents available for download in various formats, such as *portable document format* (pdf). Such methods share several shortcomings. Some of the more prominent limitations are:

- a relatively high degree of technical competence, advanced software and/or the support of technical staff is required before content can be published to the Web;
- the process is tedious and quick publishing is not possible; and

-
- none are supportive of interactive forum environments where mathematical content can be offered and responded to in real time.

Here the Web becomes a distribution channel of static content while a response requires the reversal of above roles, typically on a separate Web space which offsets the perceived benefits of interactivity as offered by a forum environment.

Opportunely, the World Wide Web Consortium (W3C), who develops interoperable technologies (specifications, guidelines, software, and tools) to lead the Web to its full potential, is working on MathML, an application of eXtended Markup Language (XML) that is a new low-level specification for describing mathematics as a basis for machine to machine communication. It provides a much needed foundation for the inclusion of mathematical expressions in Web pages.

In order to publish MathML content on the WWW, several types of authoring tools were developed. One approach was the development of translators that attempt to interpret and translate math-rich code into XML hyperdocuments viewable over the Internet using any of the popular browsers in existence today. Two examples are the open source translators LaTeX2HTML and TeX4ht. Both make use of the TeX typesetting system to prepare documents for the WWW. Unfortunately an extremely high level of computing skills and know-how is required to initiate and use these (and other) translating tools in a WWW environment. Moreover, the final product they offer is also limited to static web pages.

Given the high level of skills required, routes of least resistance are often preferred and commercial authoring tools have thus become popular alternatives. Design Science's WebEQ and MathType, IBM's Techexplorer and Mathsoft's MathCad are three examples of commercial products that attempt to ease and facilitate the transition to online mathematics. Some tools like webMathematica even allow the creation of interactive activities such as plotting graphs, calculations and visualizations.

While these and other products and translators are sophisticated and have much to offer, they are considered unsuitable for purposes of online CPD, for several reasons. Firstly, these tools are relatively expensive. Every teacher who takes part in the forum will require an installation, and this is simply not viable within a current educational environment where money is in short supply. Secondly, all these tools are higher level applications and require a steep learning curve. Thirdly, and most significantly, their main focus is the

transfer of knowledge and strategy as opposed to interactivity. In short, one is limited to what is offered by the creator of the content.

The basic premise advanced here is that some level of interactivity and productivity is lost if one cannot include mathematical expressions in your online interactions - if the need to do so exists. Therefore a need for a forum environment that explicitly supports the inclusion of mathematical symbols on demand exists.

1.2.2 Personal and situational tensions

The TIMMS study provides evidence of personal and situational tensions that may impact on the value of an online forum environment for teachers from disadvantaged communities. The quality and challenges of education received and offered to the different cultural communities in South Africa are well-known and documented in the popular press, the accuracy thereof supported by my own experiences as a teacher and lecturer in both advantaged and disadvantaged schools and universities in both apartheid and democratic South Africa. Given this challenging environment, research on situational and personal tensions is important if we are to successfully pursue online CPD activities for South African mathematics teachers. This notion is supported by Barab (2003) which argues that understanding a community may be relevant to understanding relationships among teachers in an ongoing open-ended professional development group. She thus views an online community as:

“a persistent, sustained (socio-technical) network of individuals who share and develop an overlapping knowledge base, set of beliefs, values, history and experiences focused on a common practice and/or mutual enterprise”. (p.55)

Knowledge of personal and situational tensions impacting on an on-line community will be helpful in identifying key issues related to CPD in a particular socio-economic group. For example, in order to participate in an online environment, teachers require some level of technological readiness, as well as access to the WWW. It is expected that a huge disparity will exist between previously disadvantaged and advantaged teachers in terms of their level of technological readiness and Internet access. At a practical level, which reflects these historical disparities, Nieftagodien (2005) reported figures of 8% and 36% Personal Computer (PC) ownership in the upper two affluent black economic categories (10,5% of the black population) compared to 36% and 67% ownership under two affluent white

economic categories (71% of the population). While most affluent blacks have a comparable ownership of 36% with the second most affluent white category, only 10% of the remainder of the black population owns a PC. Thus, whereas a PC is likely to be viewed a luxury item in township communities, it is a standard household item in many advantaged households. To complicate matters, South Africa is also a low-bandwidth region with Internet access expensive and not readily available to all.

On face value then, the advantaged teacher is thus more opportune, prepared and equipped to successfully engage in online CPD activities than disadvantaged teachers.

While previous research has uncovered many issues related to the types and value of online activities in the CPD of teachers, none focused specifically on the personal and situational tensions impacting on the use and value of an online environment as a tool for the CPD of disadvantaged and advantaged mathematics teachers in the South African context of disparities. The absence of such research supports the importance and need for the current research.

The two problem areas identified above provides not only the research focus of the current study, but motivate the research problems.

1.2.3 Research focus

The first problem is that no online forum software to support the inclusion of mathematical symbols in posts is currently available. What is required is a mathematics-friendly forum environment that will allow teachers to effortlessly include mathematical expressions - if the need exists to do so - in their interactions. To ensure all teachers have access to this forum environment, it must be freely available and therefore Open Source.

The research that this study focuses on relates to the use and value of such an innovative forum environment. A part of the title of a research paper by Brazelton and Gorry (2003) fittingly articulates the problem: “If you build it, will they come?” And if they don’t come (or come but don’t use it as anticipated), what personal and situational tensions exist in disadvantaged and advantaged communities that will impact on the use and value of such a forum environment? Do disadvantaged and advantaged communities face different tensions? Answering questions like these will allow us to determine the value of the forum environment as a (potential) tool for the online CPD of teachers.

However, given the novelty of this environment, some “means” must be provided in order to create opportunities for meaningful participation. To prevent “putting the cart before the horse” (Schagler et al., 2003) by applying existing models of CPD that may or may not fit a specific socio-cultural community, a bottoms-up approach makes sense. As Barab (2003) notes, a virtual community cannot be designed a-priori or by someone other than the community members. Following a minimalist and bottom-up approach allows space for a self-organizing system whose continual health and functioning is dependent upon local ownership and member identification (Barab, Barnett, Yamagata-Lynch, Squire and Keating, 1999). One bottom-up approach that is topical and relevant and where the literature is very clear on the advantages thereof is that of reflective communities of practice (COP) in the CPD of teachers.

Smiley and Conyers (1991), in reconceptualizing CPD for teachers, called for a paradigm shift from learning separately and learning through replication (static learning) to learning together and practicing reflection (interactive learning). As Barnett (1998) notes, teachers are often isolated from one another and there is a need for them to engage in inquiry and reflection, a viewpoint supported by Clandinin and Connelly (1995) and Stein, Smith and Silver (1999). Reflection, communication with colleagues and the exchange of knowledge and ideas is thus the conceptual backbone of this paradigm shift, and is particularly suited to an on-line discussion forum environment.

In supporting this viewpoint, the *Norms and Standards for Educators* (Republic of South Africa Government Gazette, 2000) state that reflective competence is one of three strands of competence required of all teachers. By providing a mathematics-friendly on-line forum environment for teachers where they can interactively reflect on their practice, suitable means for investigation is thus created. An important distinction is made here. Whereas “reflective practices” is generally described in the literature in idealistic terms, this study approaches it from a more realistic perspective. While teachers will be encouraged to adopt a reflective approach in their posts to the forum, they will equally be encouraged to use the forum as they see fit, thereby presenting opportunities for communication, learning, and the exchange of knowledge and ideas.

1.3 Objectives of the current study

The objectives of this study are three-fold.

The first objective is to develop an inexpensive and undemanding web-based Online Discussion Environment for Mathematics (ODEM) that will support and nurture spontaneous interaction between mathematics teachers, allowing them to include mathematical expressions if the need arises. Its contribution to the current study lies exclusively in the structures it provides within which one could study the main research problem, which is also the second objective. The development of this environment is exclusively presented in Annexure A, while the user manual is provided in Annexure B.

The second objective is to separately provide the ODEM to two groups of advantaged and disadvantaged teachers in order to discover the specific personal and situational tensions that impact on the use of the ODEM as a reflective tool in the CPD of teachers.

The third objective, closely tied to and a natural outflow from the second objective, is to determine the value of the ODEM as a reflective tool in support of the CPD of advantaged and disadvantaged mathematics teachers.

1.4 Main purpose of the current study and research questions

The main purpose of this study can be stated as follows:

To discover personal and situational tensions impacting on the use and value of an appropriate online discussion forum environment as a reflective tool for the CPD of advantaged and disadvantaged teachers in South Africa.

In this study, the focus is on mathematics teachers. The ODEM offers an appropriate online forum environment since it allows for the inclusion of mathematical expressions in discussions. Whilst the development of the ODEM is an important element of the current study, its primary purpose is to provide an appropriate and external source of information to the CPD (change) and community of practice environment. The primary focus remains on the personal and situational tensions preventing and/or supporting the use and value of an online forum as a reflective tool for the CPD of advantaged and disadvantaged teachers.

This study's research questions are then:

- 1. What are the personal and situational tensions that impact on the use of a mathematics-friendly online forum environment as a reflective tool for the CPD of disadvantaged mathematics teachers?*

2. *What are the personal and situational tensions that impact on the use of a mathematics-friendly forum discussion environment as a reflective tool for the CPD of advantaged mathematics teachers?*
3. *What differences exist between the advantaged and disadvantaged groups as it relates to the personal and situational tensions identified?*
4. *Is a mathematics-friendly online discussion environment valuable as a tool for the CPD of disadvantaged and advantaged mathematics teachers?*

1.5 Scope, assumptions and limitations of the study

A literature search established that the problem areas identified has not received any research attention in the South African context. Ample scope thus exists for the current research into this field.

Several limitations and assumptions were forced upon the current research by its innovative design. These assumptions and limitations also defined the scope:

1. Whereas an appropriate discussion forum environment for mathematics would offer online interaction in all disciplines related to school mathematics (algebra, geometry, analytical geometry and trigonometry) and its various sub-disciplines, the current ODEM design was limited to the use of mathematical expressions. Subdisciplines like graphs are only attainable via Java-rich applications, which would have placed too great a demand on already-limited bandwidth availability. Such applications are only feasible via faster Internet speeds offered by ADSL-connections, which was neither practical nor feasible, for reasons discussed in more detail in Chapter 4.
2. Only teachers that actively participated in cluster meetings were invited as subjects, the assumption being that these teachers are intrinsically motivated towards CPD efforts, allowing the focus to remain on the tensions that impact on the use and value of the ODEM.
3. Teachers were provided with Personal Computers to access the ODEM from home, the reason therefore two-fold. Firstly, a discussion with the Subject Advisor for Gauteng-North confirmed a lack of computer laboratories and Internet-connections at disadvantaged schools. Secondly, by providing teachers with access from home,

they would have full access to the computer, providing motivation for participation. There is an inherent danger in such an approach which may well prove a limitation. Teachers' participation may simply be the returning a favour in order to "earn" their computers, thereby hiding tensions and/or superficially increasing participation rates.

4. Given the financial costs associated with providing teachers with Personal Computers and Internet access, the total number of subjects that could be accommodated was limited. Only ten teachers from the disadvantaged community could be accommodated, while only nine volunteered. Seven teachers from the advantaged community volunteered as subjects. The final subject pools were thus small and unequal in size, effectively forcing the research to adopt a case study approach (see Chapter 3).
5. As guided by the SIMSS study, only teachers from Grades 7-9 were included in the current research.
6. The high costs of Internet access limited the cycles of implementation of the ODEM to a total of four months for disadvantaged teachers, and five months for advantaged teachers (which included a traditional holiday month during which limited participation was expected). The assumption was that four months would provide ample opportunity for personal and situational tensions to reveal themselves.

1.6 Significance of the study

The current research's significance lies primarily in its practical value. In a rapidly expanding technological age with bandwidth becoming cheaper and more readily available, the Internet is expected to play an ever increasing role in CPD activities. The significant and continual increase in research efforts aimed at exploring the role and contribution of the WWW to all levels of education (Chapter 2) bears testimony to this certainty. While not all teachers and schools have access to the Internet, tangible efforts are underway to correct imbalances. This study therefore provides a much needed foundation, benchmarks and pointers for future implementations of online environments aimed at the online CPD of South African mathematics teachers.

A secondary contribution lies in the potential value that information mined from the results provides to Departments of Education and Subject Advisors. The tensions that impact on the use and value of the ODEM provides higher management with insight into the challenges teachers from different communities experience at grass-roots level. Should this information be embraced, concrete steps can be taken to support mathematics teachers in their important task as educators.

1.7 Research method

For development of the ODEM, software engineering practices for system analysis and design were used. I subsequently searched for Open Source and freeware technologies that, when adapted and integrated, would provide such a facility. My experiences as teacher, programmer, application developer and researcher guided the development of the ODEM. The ODEM development phase is detailed via a concise design report in Appendix A.

The implementation phase of the ODEM in both the advantaged and disadvantaged communities provided the primary research setting for this study. Case study approaches provided opportunities for in-depth contextualized understandings of the personal and situational tensions within each community. Data was obtained from server records, teacher research diaries, semi-structured interviews, content analysis of forum posts, focus questionnaires as well as from my own research diary, which I kept throughout the study. Qualitative methods, as proposed by Miles and Huberman (1994) offered a source for well-grounded, rich and thick descriptions and explanations of the processes occurring in local contexts.

The underlying philosophical approach was interpretive, and was particularly suited to fundamentals of Grounded Theory (GT) and Activity Theory (AT) analysis.

This research approach is described in more detail in Chapter 3.

1.8 Definition of terms

The following acronyms are used through this study:

COP: Community of Practice. A term advanced by Lave and Wenger (1991), it captures the importance of activity in fusing individuals to communities. It implies participation in an activity system about which the participants share understandings concerning what they are doing and what that means in their lives and for their communities.

ODEM: On-line Discussion Environment for Mathematics, it refers to the novel mathematics-friendly on-line forum environment used by advantaged and disadvantaged teachers to reflect on their practice.

CPD: Continuing Professional Development. It refers to continual efforts to develop professionally whilst in service.

CHAT or AT: Cultural Historical Activity Theory or Activity Theory. One of the main theoretical frameworks adopted by this study, it is particularly suited when context is acknowledged.

GT: Grounded Theory. The theoretical framework partly adopted by this study, it is particularly suited when there is no theory to prove, disprove or extend. With its focus on discovery, it has a strong commitment to the world of practice

AS: Activity System. An activity is the engagement of a subject toward a certain goal or objective. An activity is undertaken by a human agent (subject) who is motivated toward the solution of a problem or purpose (object), and mediated by tools (artifacts) in collaboration with others (community). The structure of the activity is constrained by cultural factors including conventions (rules) and social strata (division of labor) within the context (Ryder, 1999).

DAS(*n*): Disadvantaged Activity System, with *n* denoting sequential Activity Systems. DAS1 would thus refer to the first Activity System identified for the disadvantaged group.

AAS(*n*): Advantaged Activity System, with *n* denoting sequential Activity Systems. AAS1 would thus refer to the first Activity System identified for the advantaged group.

The following terms require clarification:

Personal tension refers to a preventative factor that is specific to an individual, and that has the potential to destabilize an Activity System.

Situational tension refers to a preventative factor brought about by the environment the individual lives and practices in, and that has the potential to destabilize an Activity System.

1.9 Research contributions and publications arising from the current research

1. Van der Merwe, TM; Grayson, D. and Venter, L.M.. (2003). An Interactive On-line Forum Environment in Support of the Continuing Professional Development of Mathematics Teachers. *South African Mathematical Society Bi-annual Congress*. Johannesburg.
2. Van der Merwe, TM; Venter, L.M. and Grayson, D. (2004). The development of an interactive online forum environment for mathematics. *6th Annual Conference on World Wide Web Applications*. Johannesburg.
3. Van der Merwe , T.M., van der Merwe, A.J. and Venter, L.M. (2008). Online Continuing Professional Development: Tensions Impacting on the Reflective Use of a Mathematics-friendly Forum Environment. *SACJ*. Accepted for publication.

1.10 Outline of the study

This study consists of 9 chapters. Chapter 1 provides an introduction and background to the study inclusive of the research problems, research questions, scope, assumptions and limitations. In Chapter 2 an overview of relevant theory as it relates to the research questions are provided, culminating in the rationale for the study. In Chapter 3 the research approach, philosophical perspective and method this study followed is described. Chapter 4 reports the results from the first case study (disadvantaged group), followed in Chapter 5 by the advantaged group results. Chapter 6 compares the findings of the previous two chapters from another perspective. In Chapter 7, and based on the result from the three previous chapters, the value of the ODEM is discussed. Chapter 8 presents the contributions of the current study. Chapter 9 provides the conclusion.

2. Literature Review

- 2.1 Introduction**
- 2.2 Continuing Professional Development**
- 2.3 Collaborative approaches in pursuit of CPD**
- 2.4 Reflection as a strategy in the CPD of teachers**
- 2.5 Online collaboration in pursuit of CPD**
- 2.6 The South African context**
 - 2.6.1 Historical locational differences
 - 2.6.2 Research on reflective practises in the South African context
- 2.7 Summary**

2.1 Introduction

The goal of Chapter 2 is to provide a background on the relevant literature as it relates to the research problems identified in Chapter 1. In this chapter, the literature base reviewed shifts from a general focus to an online focus. The literature foundation on CPD is dealt with in section 2.2. Research on collaborative approaches to CPD is presented in section 2.3. Reflective practices are a dominating strategy in current CPD approaches, and are reported on in section 2.4. In section 2.5 the concept of collaboration in pursuit of CPD is dealt with. Here the focus shifts from research on general collaboration to online or virtual communities. Section 2.6 provides research background on the South African context by firstly providing a review of historical locational differences, and then on research on local reflective practises.

2.2 Continuing Professional Development

Continuing Professional Development (CPD) is also known as further professional development, professional growth, in-service training, staff development and on-the-job training (Montello & Norton, 1994). For purposes of this study, the term CPD is used since it implies an enduring process of professional development, occurring throughout a qualified teacher's career. The ultimate goal of CPD is to improve student learning outcomes (Guskey, 2003).

Knight (2002) says that CPD is required since initial teacher education cannot contain all of the proportional knowledge that is needed if one is to become a successful teacher. How CPD should be approached has changed over the last two decades. For many years, professional development paradigms focussed on a deficit-training-mastery model that implied a deficit in teacher skills and knowledge, and where change was a once-off event

(such as a workshop) with teachers being passive participants. Dennis Sparks, in an ERIC review (Review, 95) eloquently (and somewhat humorously) sums up the status of CPD efforts pre-1995:

“...But whatever it was called, it too often was essentially the same thing - educators (usually teachers) sitting relatively passively while an "expert" "exposed" them to new ideas or "trained" them in new practices. The success of this endeavour was typically judged by a "happiness quotient" that measured participants' satisfaction with the experience and their assessment regarding its usefulness in their work.” (p.4)

Smith and Gillespie (2007) label this model of workshops, conference sessions, seminars, lectures, and other short-term training events as the Traditional Professional Development model because it is the standard, most commonly offered type of professional development. There against, the Job-embedded Professional Development model, which became popular during the 1990s, locates training within the school or local context and makes use of activities such as study circles or inquiry groups, thereby allowing teachers greater participation in shaping the content of instruction closely tied to their own contexts. This model developed in a response to research identifying the ineffective features of traditional professional development. It represents a key shift in agency when teachers became active learners, shaping their professional growth through reflective participation in professional development programs and in practise (Clark, 2002).

Villegas-Reimers (2003) conducted an extensive review of the literature on this new approach to professional development which concisely sums up the main characteristics and viewpoints of this new approach. She identifies seven characteristics of this new perspective from the literature:

1. It is based on constructivism rather than on a ‘transmission-oriented model’.
 - Teachers are treated as active learners who are engaged in the concrete tasks of teaching, assessment, observation and reflection
2. It is perceived as a long-term process as it acknowledges the fact that teachers learn over time.
 - Rather than one-off presentations, a series of related experiences are most effective as it allows teachers to relate prior knowledge to new experiences.

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3. It is perceived as a process that takes place within a particular context.
 - Whereas traditional staff development opportunities did not relate ‘training’ to actual classroom experiences, the most effective form of professional development is that which is based in schools and is related to the daily activities of teachers and learners.
 - Because teachers are engaged in professional development activities, schools become communities of learners, communities of inquiry and professional communities.
 - Teacher development opportunities that are most successful are ‘on-the-job learning’ activities such as study groups, action research and portfolios.
 4. Many identify this process as one that is intimately linked to school reform, as professional development is a process of culture building and not of mere skill training.
 - Teachers are empowered as professionals and therefore should receive the same treatment that they themselves are expected to give their students.
 - A teacher professional development programme that is not supported by the school or curricular reform is not effective.
 5. A teacher is conceived of as a reflective practitioner, someone who enters the profession with a certain knowledge base, and who will acquire new knowledge and experiences based on that prior knowledge.
 - The role of professional development is to aid teachers in building new pedagogical theories and practices and to help them develop their expertise in the field.
 6. Professional development is conceived of as a collaborative process.
 - While isolated work and reflection is encouraged, the most effective professional development occurs when there are meaningful interactions between teachers and between teachers, administrators, parents and other community members.
 7. Professional development may look and be very different in diverse settings, and even within a single setting, it can have a variety of dimensions.
 - There is not one form or model of professional development.
 - The needs, cultural beliefs and practices of a school and teachers determine which professional development model is most beneficial to their particular

situation. Different factors within a workplace such as school structure and school culture can influence the teachers' sense of efficacy and professional motivation.

- Where there are contradictory results reported in the literature, these can be explained by examining the contexts in which the different studies were completed.
- The importance of paying attention to context so that the “optimal mix” of professional development processes can be identified and planned is strongly argued. Professional development must be considered within a framework of social, economic and political trends and events.
- A critical factor in education is the uniqueness of the individual settings. What works in one situation may not work in another because of the enormous variability in educational contexts. Each context will thus have its own collection of answers.
- The researcher's focus should be on finding the optimal mix of professional development processes and technologies that work best in a particular setting.

Of particular relevance here are the key terms *constructivism*, *context*, *communities of learners*, *reflective practitioner*, *collaborative process* and *diverse settings*. Combined, they speak of professional development programs taking into account and being developed around the context wherein the program is offered, and affording teachers the opportunity to actively take charge of their own professional development, shared in a community of colleagues through collaborative reflective practises.

At this point, consider this study's first three research questions:

1. *What are the personal and situational tensions that impact on the use and value of a mathematics-friendly online forum environment as a reflective tool for the CPD of disadvantaged mathematics teachers?*
2. *What are the personal and situational tensions that impact on the use and value of a mathematics-friendly forum discussion environment as a reflective tool for the CPD of advantaged mathematics teachers?*
3. *What differences exist between the advantaged and disadvantaged groups as it relates to the personal and situational tensions identified?*

Table 2.1 presents a comparative view of the key terms extracted from these research questions, listed against the key terms identified in the previous paragraph.

Table 2.1 Research key terms versus CPD terms

Research question key terms	CPD key terms
Personal and situational tensions	Context
Reflective tool	Constructivism, reflection
Disadvantaged/advantaged groups	Context, diverse settings, community of learners
Mathematics-friendly online forum environment	Collaborative, community of learners
Differences between groups	Context, related experiences

From Table 2.1 it is deduced that the first three research questions cover most of the key terms associated with the modern CPD approach. The current research is thus relevant to best CPD practices and enlarges the base literature on CPD, particularly as it relates to the role of context.

Elements of the last three points of characteristic 7 fit the design of the current study perfectly:

- Professional development must be considered within a framework of social, economic and political trends and events.
- What works in one situation may not work in another because of the enormous variability in educational contexts. Each context will thus have its own collection of answers.
- The researcher's focus should be on finding the optimal mix of professional development processes and technologies that work best in a particular setting.

The research quoted so far referred to CPD in general. With specific reference to the CPD of mathematics teachers, and after her own extensive review of the literature, Loucks-Horsley (1998) identified five categories of strategies that are commonly researched and used. These categories are immersion, curriculum, examining practise, collaborative work en vehicles and mechanisms.

- Immersion strategies involve teachers in "doing" mathematics themselves, such as working on and solving mathematical problems.
- Curriculum strategies involve teachers with the actual learning experiences and materials they will use with their students (e.g. new curriculums, new materials, new topics, new ways of teaching etc.)

- Professional development strategies that focus on teachers' own practice afford direct "job-embedded" learning.
- Collaborative strategies include professional networks inside and across school boundaries, thereby presenting opportunities to share wisdom and build a professional culture.
- Vehicles and mechanisms strategies involve the structures through which learning occur, e.g. workshops and the use of technology or combinations thereof.

The three strategies relevant to the current study are collaborative approaches, examining practise (through reflective techniques), and vehicles and mechanisms (here an online approach to CPD).

The next three sections present a blended review of the literature as it relates to these strategies.

2.3 Collaborative approaches in pursuit of CPD

Collaborative approaches in CPD imply teachers coming together and working in partnership to stay current in, and advance their field.

Communities

Stein, Smith and Silver (1999) assert that teachers can connect with one another through building “communities” in which they can communicate, reflect and collaborate.

Yamagata-Lynch (2001) states that in the past decade “community” have become a popular term in educational settings and that many of its implications are in alignment with situated learning theories, sociocultural learning theories, and organizational learning.

Educators and policymakers are increasingly advocating for “community-based” collaborative models that is learner-centered (Barab, 2003).

As with CPD, there is much debate in the literature over what “community” is and what it is not. Grossman, Wineburg and Woolworth (2000) warn that terms such as "communities of practice", "discourse communities", "learning communities", "school community", "teacher community" and “communities of learners," has seemingly become an obligatory appendage to every educational innovation. Barab (2003) concurs, saying that too little of the education literature provides clear criteria on what a community is and is not, and that it has become a slogan. Rather than getting involved in this debate about what a

community is or is not, this research assigns itself to Barab and Duffy's (2000) description: a community has a significant history, a shared cosmology, social interdependence, a common cultural and historical heritage, and a reproduction cycle.

Accordingly, Lave and Wenger (1991) speak of a community of practice where participants share an understanding of what they are doing and what that means in their lives and for their communities. Darling-Hammond and Ball (1999) thus suggest that teachers need to form communities with colleagues and experts outside their own schools and even districts. It is here where the current research is situated: providing teachers with a means (the ODEM) to establish a CPD community outside their schools.

With regard to *online* communities, a review of the literature on discussion groups, computer-mediated discussion and online discussion forums is presented.

Discussion groups

Research on face-to-face discussion groups indicate teachers to have a need to engage in enquiry and reflection with colleagues (Barnett, 1998). In fact, discussions for analysis and reflection is considered central to the development of teachers (Darling-Hammond et al., 1999). Le-May Sheffield (2002) provides several reasons why discussion groups can be productive:

- it provides a consistency (in terms of recurrent participants and immediate importance to classroom experience);
- it provides a safe environment to consider ways to improve teaching;
- ideas for discussion comes from within the group rather than from outside (or top-down), allowing for learner-directed agendas; and
- they promote different teaching methods between faculty members of varying experience, to name a few.

However, there are barriers to such programs, such as the expense of bringing groups of teachers together, scheduling constraints and the difficulty of sustaining reflection about practise beyond the conclusion of such collaboration (Schlagal, Trathen and Blanton, 1996).

Computer-mediated discussion

Whereas teaching has been described as a culture of isolation (Schlagal et al., 1996), the WWW instantly brings teachers closer together, affording immediate opportunities to fulfil these desires through collegial collaboration. Computer-mediated discussion, regardless the tool employed (email, bulletin boards, listservs, discussion forums, blogs, etc.), provides for flexibility and convenience of participation (Lowry, Koneman, Osman-Jouchoux and Wilson, 1994), with participants not being tied to a specific place or time to converse with others (Levin, Waugh, Brown and Clift, 1994). Additionally, there is time to consider and revise responses (Ahern, Peck and Laycock, 1992), possibly leading to reflective practises. McMahon (1997) sees the appeal of network-based professional development in its potential to support group discussions, accommodate teachers' busy schedules, integrating professional development with classroom practise, reducing isolation, and supporting reflective dialogue. In these processes, teachers' familiarity with new technologies is increased. If there was any doubt about the accuracy of these assertions, or the portability of communities to online versions, the current proliferation of immensely popular online social networking sites such as Facebook provides adequate prove.

Virtual communities

The creation of online or "virtual" communities has attracted equal debate. Decades ago Hillery (1955) uncovered ninety-four different definitions of community, and even today there is an equal lack of consensus regarding a appropriate definition of the term "virtual community" (Komito, 1998). Kling and Courtright (2003) concur, believing the casual use of the term "community" to characterize groups that are engaged in electronic collaboration to be seriously misguided, and even losing its meaning. Achieving virtual community is, according to Barab (2003), a major accomplishment.

One reason for all these authors' protests is offered by Tu and Corry (2001), who note that nearly 85% of studies they reviewed only examined messages (the end-product of community communications) and was not concerned with the "why" and "how" the online community formed. They argue that simple discourse analysis is not adequate to capture the individual "self" that ultimately determines one's understanding of the virtual community, i.e. why it works or not. Kling et al. (2003) agrees, warning that one cannot ignore the fragility of the social processes in developing virtual communities.

McMahon (1997) advances another possible, somewhat frank, reason: that the difficulty in creating virtual communities is because most research reflects more about the proponent's

hopes than about the user's actual experiences. She further warns that while the overarching goal of many online initiatives is to encourage professional relationships between teachers in a manner that supports reflective conversations, not enough is known about what enhances or gets in the way of these relationships. More research has been done since her warning and more is known, but her warning remains valid today. Derry, Lee, Kim and Seymour (2001) are more specific, recommending that any attempt to design an online community should respect the context and consider a careful analysis of local conditions.

The general line of reasoning offered by all these authors is that the success of a virtual community in the pursuit of CPD is dependent on its context. In reviewing several authors' contribution to a special issue on designing virtual communities, Barab (2003) states that the overriding assumption of all those authors is that one cannot simply design community for another, but that community is something that evolves with a group, around their particular needs and for purposes that they value as meaningful. She therefore speaks of designing *for* virtual communities, as opposed to designing virtual communities.

Her viewpoint concurs well with the primary focus of this research. Here, no attempt was made to create a virtual community per se. Rather, the purpose was to offer a novel, mathematics-friendly environment to teachers, thereby providing them with an opportunity for "online collaboration" to build a virtual community as they see fit, and then to discover the contextual personal and situational tensions that may prevent the creation of a successful virtual community.

Note that the intention was not to simply "throw" an online environment at teachers and leaving it to them to conjure up a virtual community. All teachers attended a workshop where they were introduced to and practised posting to the ODEM. Time was also set aside to train and sensitize teachers to reflective techniques. Moreover, with all teachers involved in same area cluster meetings, they knew one another and were already a "community" of some sort. The intention was thus to convert a job-embedded community to a virtual community, by changing the communication channel and meeting place, and identifying the tensions that would prevent such a relocation from being successful.

The majority of the research available on online collaboration was done in the 1990's, the same decade the WWW became accessible to the masses. For reasons explained in more

detail in section 8.4 (implications for existing theory), sociological aspects of collaboration in pursuit of CPD, whether in person or online, offers a more pertinent lineage for review.

Hence Clandinin and Connelly (1995) described three human desires central to professional life: a desire to tell stories, a desire for relationship and a desire to reflect or think again.

This approach hold true today and have contributed to the seemingly effortless shift in agency from workshops and similar once-off approaches to collaborative efforts, typically contained in networks such as discussion groups and electronic communities.

Lieberman and Wood (2001) says that networks provide powerful contexts for teacher learning, community, and enhancement of teachers' confidence and self-esteem. Electronic community networks of teachers are thought to provide socio-emotional support to a cohort group (Schlagal et al., 1996; Thomas, Clift and Sugimoto, 1996). Caggiano, Audet and Abegg (1995) and Harasim, Hiltz, Teles and Turoff (1995) see the value of electronic communities in its offering of an environment wherein people can interact on a personal, social and professional level by sharing thoughts, seeking advice, and sharing problems and success. Barab, MaKinster and Scheckler (2003) points out that the maintenance of sociability is one of the biggest tasks of a successful online community since communities are overwhelmingly social spaces.

Online discussion forums

One popular form of electronic community networks is online discussion forums, the communication tool offered to the subjects of this study. Online forums support reflection and other forms of higher order thinking (Hannafin, Land and Oliver, 1999). Li (2004) concurs, albeit from a different perspective and several years later, stating that online discussion forums provoke sustained knowledge generation because they not only provide a space to develop ideas and questions, but also provide a store for these ideas and questions so that they are always available for further discussion and revision.

Smith (2001) sees the value of online forums in the immediate application of new information to learner's professional lives, and that they are flexible and provide time to reflect and think. Carboni (1999) points out that the success of an online forum is dependent on upon the type of environment that is created by the facilitator and the participants, and that this can be achieved in a supportive, non-evaluative culture of collaboration wherein the participants can feel secure, comfortable and that they really

know the participants. Lesolo and Stakiw (2000) minimizes the role of the facilitator by noting that ideas for discussion should come from the group rather than from outside or top-down, thereby allowing for learner-directed agendas. Le-May Sheffield (2002) points out that discussion groups provide a safe environment wherein teachers can consider ways to improve their teaching and in the process improve their professional practise.

Reflecting on the literature available, it appears as if there are as many advantages to online discussion forums as there are researchers. However, there is also research available that points to drawbacks of computer-mediated communication. Li (2004), for example, points out that a few individuals may dominate a forum, squashing other students' dialogue. Stephens and Hartman (2004) used an online forum to afford mathematics teachers an opportunity to strengthen professional culture through open discussions. When that proved insufficient, they took purposive actions to provide teachers with focus and guidance – to no avail. They postulated that teachers had simply not yet become comfortable with the combination of discussion and medium, and preferred face-to-face networking. It must be added here that they recruited multiple teachers from the same school, which seemingly reduced the need for online participation. They suggest that for discussion forums, a balance between project goals and teacher needs and interest is required. Carboni (1999) identified four main criticisms against computer-mediated communication: (1) interpersonal concerns such as not posting for fear of sounding unintelligent, (2) confusion in following discussions, (3) technological problems such as lack of user training and support, and (4) time constraints.

Pertinent to the use of a mathematics-friendly forum environment as used in this study, it is noted that there is no research available on a discussion forum that supports the inclusion of mathematical symbols, simply because such software has never been available. The absence of such research magnifies the scope of the current study.

In concluding this section, Anderson and Kanuka (1997) offers that fundamentally it does not matter what research indicates as the best method for using online forums in CPD. She quotes Rogers (1995) who says that all that matters is whether or not the participants perceive the forum as a valued process, and if they do, they will adopt it. Barab et al.(2003) argues along the same lines when they state that researchers need to be careful not to get caught up in the whirlwind of theoretical aspirations, but rather remain visionary when examining empirical data.

A definition of an online (virtual) community that considers all these issues is offered by Barab et al. (2003):

“A persistent, sustained (socio-technical) network of individuals who share and develop an overlapping knowledge base, sets of beliefs, values, history and experiences focused on a common practice and/or mutual enterprise” (p.23).

This definition highlights the importance of context. Before considering research on the context within which the current study was done, the general body of research on reflection as a strategy in the CPD is dealt with first.

2.4 Reflection as a strategy in the CPD of teachers

As stated in Chapter 1, given the novelty of the ODEM, some “means” must be provided in order to create opportunities for meaningful participation in order to study the tensions that would prevent participation in the ODEM. Rather than applying existing (and westernized) models of CPD that may or may not fit the South African context, a bottom-up approach where a virtual community is created and sustained by participants themselves made best sense. Here reflective practises were actively promoted as the “bricks” with which to build the virtual community, although teachers were not limited to reflective posts. Consider Figure 2.1 which illustrates the basic design and thought pattern of the current research.

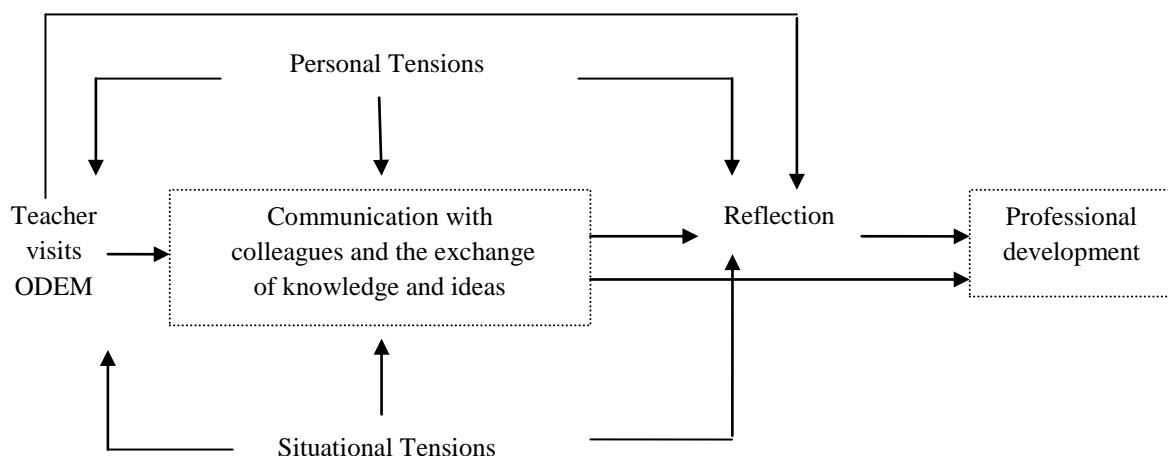


Figure 2.1 Communication, exchanges, reflective practises and tensions

Figure 2.1 illustrates that when a teacher visits the ODEM, opportunities for collaborative communication with colleagues and the exchange knowledge and ideas are created. A “breeding ground” for reflective practises is created, e.g. a teacher may start or contribute to an existing discussion by saying: “I thought about this or that and decided to do it this

way, and maybe you should also try to do it this way”. But teachers may also communicate and exchange knowledge and ideas without reflecting on their practise and still develop professionally, as Figure 2.1 shows. What is important is that teacher needs are catered for, thereby collapsing any tensions forced by the reform agendas of educational researchers.

What this study is mainly interested in, are the barriers that preclude these opportunities for communication, exchange of ideas and reflection. As Figure 2.1 shows, personal and situational tensions conceivably impact at various levels in this simplified model. It may impact on how regularly a teacher visits the ODEM, on the quality of communication that takes place, and on their reflective practises. What these tensions are (if there are any) and their impact on the use and value of the ODEM is the focal point of this study.

But what are reflective practises, and why was it so actively promoted in the current study? Research suggests that self-examination of beliefs about mathematics have an impact on teaching practices (2001). King (2002) postulates that transformational learning is dominated by critical reflection, providing the framework from which one can critically evaluate ones’ belief, values and assumptions. Reflection is thus considered a key to conceptual change (Hiebert, 1992).

Dewey (1916) is generally acknowledged as the key originator of the concept of reflection, viewing it as a special form of problem solving, thinking to resolve an issue through active chaining where a careful ordering of ideas links each with its predecessors.

Reflective thinking generally addresses practical problems (Adler, 1991). Hence Ghaye and Ghaye (1998) defines reflection as

“Looking back and making sense of practice, learning from this and using this learning to affect your future action. It is about making sense of your professional life”. (p.27)

It speaks of renewal, of constructing meaning about practice and acting upon the knowledge gained – a seemingly natural process that most of us perform on a daily basis, and not just in our professional lives.

Whereas individually mediated reflection is primarily achieved through learning journals (Costa and Kallick, 2000), socially-mediated reflection is enhanced considerably, and becomes apparent by collaborative work (von Wright, 1992). Literature emphasizes the

basic adult learning tenets as building on prior experience, developing a climate of respect, encouraging active participation, employing collaborative inquiry, learning for action and empowering participants (Lawler and King, 2000). It is therefore important that teachers are provided with opportunities to share their reflections with communal support, and to learn from one another - even if it is in learning “how to reflect”.

However, and once again, there is some disagreement in the literature on what reflection is, how reflection should be practised and if reflection is beneficial at all. For example, whereas Martinez and Mackay (2002) assert that in their experience many teachers in all stages of their careers have a very narrow view of critical reflection, often materializing as “How did that go” or “What did I like about that”, Fendler (2003) counters by charging that when education research provides elaborate programs for teaching teachers to be reflective practitioners, there is an implicit assumption that teachers who do not practice the specific techniques promoted are incapable of reflection. Zeichner (1996) sums it up when he suggests four reasons why some reflective practices do not obtain its intended purposes:

- the privilege of university research over teacher research;
- an emphasis on teaching techniques and classroom management;
- disregard of the social and instructional context of teaching, and
- individual reflection rather than collaborative sharing.

He contends that that there is no such thing as an “unreflective teacher”. Russel and McPherson (2001) agree by submitting that the development of teachers who seek to improve practice, question assumptions, and challenge themselves has the potential for an unending and ever-evolving pursuit.

It appears that these debates can be divided into two factions. Some researchers seek to build, argue and defend elaborate models of reflection, while others are more pragmatic in their approach to what reflective practises are and how it should be practised. For purposes of this research, reflective practises is viewed as the ability to analyse one’s own teaching practise (Adler, 1991) and deliberate thinking about action with a view to its improvement (Hatton and Smith, 1995).

There is another important consideration applicable to the current study. Ebbutt and Elliot (1998) question the appropriateness of reflective approaches, based on western

assumptions and preconditions, in developing countries. O'Sullivan (2002) notes that these assumptions and preconditions include:

- A quality general education and teacher training upon which teachers can reflect
- Teachers possessing the tools of reflection
- An innovative structure
- A situational view of knowledge, and
- An assumption about professional autonomy.

She charges that all the above assumptions are absent in developing countries. If that is true, then how should reflective practises and evidence thereof, be approached in the context of the current study? Before answering this question, research in the South African context should be considered.

2.5 The South African context

The context of the current study is closely linked to its purposes. As Johnson and Monk (2000) note, teachers in economically developing countries face different sets of circumstances, have different perspectives on the work they do, and thus needs different in-service programmes to those in developed countries – where much of the discourse literature on CPD originates. Policy approaches are drawn from developments in countries like Australia, England, New Zealand and the USA which has features very different to South Africa (Harley, Barasa, Bertram, Mattson and Pillay, 2000).

Johnson et al. (2000) further charge that “overseas” research spends too much time asking “How can I make them behave otherwise” as opposed to asking “Why do teachers behave as they do?” These beliefs motivated the purposes of the current study which aim to discover the tensions that prevent the use and value of the ODEM. The focus is on “what impacts” rather than “how can” or “how does”.

An in-depth review of available research databases revealed a dearth of research on CPD for mathematics teachers in the South African context, particularly as it relates to online endeavours. In the next sections, I review the available South African literature to highlight historical locational differences between disadvantaged and advantaged schools, teachers and reflective practises.

2.5.1 Historical locational differences

Given the dearth of research available, I draw on the work of Harley et al. (2000), Adler (1991) and Johnson et al. (2000) to highlight historical locational differences between disadvantaged and advantaged schools and teachers. What makes their research relevant to the current study is that they highlight some of the more pertinent challenges that disadvantaged teachers face. From their work, the following summary is provided:

- From 4 educational systems (White, Black, Indian and Coloured) that exemplified the apartheid regime, there is now one system in place. Despite ongoing efforts to redress imbalances and equal opportunities, several disparities remain in place for previously disadvantaged schools:
 - Legacies of neglect and conflict remains
 - Higher student-teacher ratios, in most cases over 50
 - Deprived classrooms (books and equipment) and facilities
 - Low administrative expertise, parental support and school ethos
 - Disenchanted and poorly behaving student body in many instances
 - In the classroom, teachers rely on recitation, rote learning and memorisation
 - Only 17% of South African Schools have libraries and only 41% electricity
 - Teacher-centered classrooms with pupil-activity restricted to individual practise on exercises from the prescribed textbook
- Disadvantaged teachers remains largely disadvantaged:
 - Caught in a process from deskilling and proletarianisation to reskilling and professionalisation
 - Poor qualifications and thus lower salaries
 - Overcrowded and uncomfortable homes for teachers, few own cars
 - Mastery of subject content is weak to moderate
 - Although interested in professional development, they are easily discouraged due to, for example, low financial remuneration
 - Training of teachers occur in academically isolated, small and poorly equipped colleges of education, although this is changing

As Johnson et al. (2000) notes, the above sets a rather bleak background to the possibilities for professionalism under disadvantaged teachers. The above research attempts to point out the shortcomings of disadvantaged teachers and schools in relation to advantaged settings,

thus advantaged schools and teachers are generally opposites of the above points. This is not to say that there are not poorer “advantaged” schools, or no well-functioning “disadvantaged” schools. But in general terms, disadvantaged teachers and schools are certainly more disadvantaged in the current South African context, and this holds true for the setting of the current study.

2.5.2 Research on reflective practises in the South African context

In Chapter 1 it was noted that in South Africa, reflective competence is one of three strands of competence required of all teachers. It was also noted that a reflective community of practice permits for a bottoms-up approach that allow teachers space for a self-organizing system whose continual health and functioning is dependent upon local ownership and member identification – a point stressed in previous sections. There is another compelling reason for using reflective practises as the means for participation in the ODEM. As Harley et al. (2000) note, current policy describes the ideal teacher with clarity and precision, but does not see the real teacher within their cultural and material constraints as imposed by classroom reality, although the President’s Education Initiative (launched in 1998) seek to address this through empirical research into teaching and learning in South African Schools. It is envisaged that a more “hands-on” approach to the co-ordination of appropriate forms of flexible and context-sensitive teacher development will result. Reflective practises fit in this view by its “realness” as opposed to being “idealistic”.

Little research is available of the value and use of reflective practises in developing countries such as South Africa. Where research has been done, Action Research was mainly employed as the reflective tool of choice (Stuart, 1987; Walker, 1994; O’Sullivan, 2002). The countries studied included South Africa, Namibia and Lesotho. Mixed success was achieved, but in all studies the approach was facilitative and person-to-person.

Adler (1997) confirms the importance of context when she says that what the South African experience brings to the theory and practice of ‘mathematics teachers as researcher’ is a large number of teachers whose situational constraints are different from those who defines and informs the movement. Although referring to Action Research specifically, there is a resonance with reflective practices. She argues that these teachers also need a place in the movement, and that there should be recognition of the limits opposed by their conditions, as well as the nature and creativity of their contributions. Referring to a collection of reflective writings of primary teachers, she points at the

astonishing enthusiasm evident in these teachers' thinking about and working on their practice in over-crowded and under-resourced classrooms in black Townships in Cape Town. Although not meeting existing research criteria, she warns that we should not place these teachers outside the movement, and that we should have realistic expectations.

Walker (1993) investigated 'teachers as researchers' in South African Schools, and concludes that the majority of teachers are more prone to following the prescriptions of education authorities than they are to working reflexively. Reed, Nyabanyaba and Davis (2002) researched the take-up of reflective practise by teachers involved in an in-service development programme. Teachers from primary and secondary schools, in urban, peri-urban and rural areas were included in their study. Despite mixed and somewhat disappointing results, they found that support from colleagues was an important factor in promoting reflective practice.

The researchers referenced here all focused on disadvantaged teachers. As Adler (1997) carefully points out, the purpose is not to pathologise nor patronise disadvantaged communities, but to pose and consider a question – “if mathematics teacher as researcher is a route to professional development, how will it include (disadvantaged teachers)?” More importantly, on the basis of other research results, she argues for a continuum from reflection to research in order to include the range of mathematics teacher inquiry that exists. It is here that value of including advantaged teachers' in the current study reaches fruition – it allows me to place teachers on this continuum, highlighting not only differences but also similarities.

Finally, as Reed et al. (2002) note, in addition to considering the possible difficulties for teacher to reflect, researchers working in South Africa need to consider teachers' histories. The value of the current study is once again highlighted.

In conclusion, from the little research that is available it is evident that, given the history and context of disadvantaged teachers, one should not underestimate the reflection practises that do take place.

Having considered the available literature the questions that remains are: given the context of the current study, what constitutes reflective practises, and how should evidence thereof be measured?

After their review of available literature Hatton et al. (1995) provide a basic set of criteria that is based on different types of reflection and how to recognise evidence of such reflection. Their criteria are presented in Table 2.2. For clarity, examples were added.

Table 2.2 Types of reflections

Type of reflection	Description	Example
Descriptive reflection	Some attempt to provide reason justification for events or actions, but in a reportive or descriptive way	“I chose to do this because I believe that...”
Dialogic reflection	A “stepping back” from the events/actions, leading to a different level of mulling about, discourse with self and exploring the experience, events, and actions using qualities of judgements and possible alternatives for explaining and hypothesising.	“I quickly became aware that it did not work. Thinking about it, I came to the conclusion that.... Alternatively, a number of students did not...”
Critical reflection	Demonstrates awareness that actions and events are not only located in, and explicable by, reference to multiple perspectives, but are locate in, and influenced by multiple historical and socio-political context.	“What must be recognised, however, is that this issue can only be understood within the wider setting of....”.

Adapted from Hatton and Smith (1995)

Hatton et al. (1995) provide one more criterium – that of descriptive writing, which does not fit the current research design.

The current study will make use of these criteria to evaluate if teachers made use of reflective techniques in their posts to the ODEM or not. To ensure that teachers understood the principles of reflection, a simplified handout and discussion of practical reflective techniques were provided to the teachers when they attended training in ODEM use (Annexure E).

2.7 Summary

In this chapter the available literature base on general and online focuses as it relates to CPD efforts were reviewed. The research questions of this study were shown to correlate

well with key terms of modern CPD approaches. Three strategies relevant to the current study were reviewed, namely collaborative approaches, examining practise (through reflective techniques), and vehicles and mechanisms. In terms of collaborative approaches and the vehicles and mechanisms, the general line of reasoning offered by research alludes to the thought that the success of a virtual community in pursuit of CPD is dependent on its context. While reflective practices are generally acknowledged as an important skill to pursue in CPD, research in the South African context indicates that such skills are not easily achieved and needs to be nurtured.

3. Research Design and Methodology

3.1 Introduction

3.2 Research approach

- 3.2.1 Philosophical perspective
- 3.2.2 Research method
 - 3.2.2.1 Grounded Theory
 - 3.2.2.2 Activity Theory
 - 3.2.2.3 Case Study method

3.3 Research design

- 3.3.1 Revelatory, interpretive and descriptive approach
- 3.3.2 The selection of cases
 - 3.3.2.1 Subject and environment profiles
 - 3.3.2.2 Workshops
- 3.3.3 Data collection protocol
 - 3.3.3.1 Introduction
 - 3.3.3.2 Interviews
 - 3.3.3.3 Direct observation
 - 3.3.3.4 Research diary
 - 3.3.3.5 Focus questionnaires

3.4 Data analysis

- 3.4.1 Open coding of interview and journal data
- 3.4.2 Axial coding of interview and journal data
- 3.4.3 Activity Systems and classes from interview and journal data
- 3.4.4 Analysis of ODEM posts

3.5 Narrative inquiry, validity, reliability, transferability, trustworthiness and thick description

3.6 Summary

3.1 Introduction

The purpose of Chapter 3 is to define, outline and justify the research design and methodological approaches this study followed in answering the following research questions:

1. *What are the personal and situational tensions that impact on the use and value of a mathematics-friendly online forum environment as a reflective tool for the CPD of disadvantaged mathematics teachers?*
2. *What are the personal and situational tensions that impact on the use and value of a mathematics-friendly forum discussion environment as a reflective tool for the CPD of advantaged mathematics teachers?*
3. *What differences exist between the advantaged and disadvantaged groups as it relates to the personal and situational tensions identified?*
4. *Is a mathematics-friendly online discussion environment useful as a reflective tool for the CPD of disadvantaged and advantaged mathematics teachers?*

In order to find meaningful answers to these questions, a fitting research design and associated methodology is required. The research approach, inclusive of the philosophical approach adopted and research methods employed, dictated the research design and are presented in the next section, followed in section 3.3 by the research design where a framework is presented which guided the remainder of the research design. Section 3.4 deals with the procedural analysis of data. In section 3.5 issues related to the quality of the study are discussed. This chapter is concluded with a summary in section 3.6.

3.2 Research Approach

The purpose of this study was to discover the personal and situational tensions that impact on the use and value of a mathematics-friendly forum environment (ODEM) as a reflective tool in the CPD of disadvantaged and advantaged teachers in the South African context of disparities.

While the ODEM can be classified as an Information System (IS), the primary focus of the study was on discovering the personal and situation tensions that affected the use and value of an IS technology (the ODEM) in an educational process, which is Continuing Professional Development (CPD). This study therefore positioned itself primarily in the field of Technology Education. The development of the ODEM is exclusively reported in Annexure A.

Two main approaches are available to the researcher in Technology Education. Each approach represents a fundamentally different inquiry paradigm, and the researcher's actions are dependent on the underlying assumptions of each paradigm.

Phenomenological inquiry, or qualitative research, uses a naturalistic and non-positivistic approach that seeks to understand phenomena in context-specific settings, whereas logical positivism, or quantitative research, uses experimental methods and quantitative measures to test hypothetical generalizations (Lincoln and Guba, 1985; Merriam, 1988).

From the purpose of the study and the research questions listed above, it was clear from the outset that context is very important. The focus of the research questions are on human actions that takes place in the context-specific settings of advantaged and disadvantaged communities, and how their actions are influenced by their setting. Human activity should be studied in their real-life situation (Marshall and Rossman, 2006), and this study therefore adopted the qualitative research paradigm.

Consider the following two descriptive definitions of qualitative research:

Qualitative research is an inquiry process of understanding based on distinct methodological traditions of inquiry that explore a social or human problem. The researcher builds a complex, holistic picture, analyzes words, reports detailed views of informants, and conducts the study in a natural setting. (Creswell, 1998:p.34)

Qualitative research is multi-method in focus, involving an interpretive, naturalistic approach to its subject matter. This means that qualitative researchers study things in their natural settings, attempting to make sense of or interpret phenomena in terms of the meanings people bring to them. Qualitative research involves the studied use and collection of a variety of empirical materials case study, personal experience, introspective, life story interview, observational, historical, interactional, and visual texts-that describe routine and problematic moments and meaning in individuals' lives.(Marshall et al., 2006:p.67)

Definition keywords that resonate in the current research questions are “holistic picture”, “natural setting”, “interpretive” (as in unraveling), “life story interview”, “views of informants” and “historical”, confirming the current research as mainly qualitative.

In order to construe and give a credible account of the social context of the participants, it was necessary to discover the research orientation. Since all research has some assumptions about what constitutes valid research and which research methods are appropriate, it was necessary to select a *philosophical* stance or perspective.

3.2.1 Philosophical perspective

Orlikowski and Baroudi (1991) suggest three categories of philosophical perspectives that underlie assumptions about whether this research was valid and what research methods were appropriate. These perspectives are defined as positivist, interpretive and critical.

A summary of these perspectives, as tabled by Myers (2007), is provided in Table 3.1.

A positivist approach includes hypothesis testing and quantifiable measures of variables, which was not true for the current study.

Superficially, the current research could have adopted a critical perspective. Consider the following precise definition of critical research as offered by Tripp (1992).

Socially-critical research in education is informed by principles of social justice, both in terms of its own ways of working and in terms of its outcomes in and

orientation to the community. It involves strategic pedagogic action on the part of classroom teachers, aimed at emancipation from overt and covert forms of domination. In practical terms, it is not simply a matter of challenging the existing practices of the system, but of seeking to understand what makes the system be the way it is, and challenging that, whilst remaining conscious that one's own sense of justice and equality are themselves open to question. (p.13)

Table 3.1 Available philosophical perspectives

Approach	Summary
Positivist	<p>Positivists generally assume that reality is objectively given and can be described by measurable properties which are independent of the observer (researcher) and his or her instruments.</p> <p>Positivist studies generally attempt to test theory, in an attempt to increase the predictive understanding of phenomena.</p> <p>Hypothesis testing, quantifiable measures of variables, formal propositions and the drawing of inferences about a phenomenon from the sample to a stated population</p>
Critical	<p>Critical researchers assume that social reality is historically constituted and that it is produced and reproduced by people. Although people can consciously act to change their social and economic circumstances, critical researchers recognize that their ability to do so is constrained by various forms of social, cultural and political domination.</p> <p>The main task of critical research is seen as being one of social critique, whereby the restrictive and alienating conditions of the status quo are brought to light.</p> <p>Critical research focuses on the oppositions, conflicts and contradictions in contemporary society, and seeks to be emancipatory i.e. it should help to eliminate the causes of alienation and domination.</p>
Interpretive	<p>Interpretive researchers start out with the assumption that access to reality (given or socially constructed) is only through social constructions such as language, consciousness and shared meanings.</p> <p>Interpretive studies generally attempt to understand phenomena through the meanings that people assign to them and producing an understanding of the context, and the process whereby the information system influences and is influenced by the context".</p> <p style="text-align: right;">(Myers, 2007)</p>

The key part of the definition offered here above is *emancipation*, referring to a process whereby oppressed and exploited people become empowered to transform their circumstances for themselves by themselves. That the ODEM could potentially play a significant role in the emancipation of especially disadvantaged teachers is evident. The main purpose of the study, however, was to discover tensions that would prevent the usefulness and value of the ODEM - a *potential* emancipatory tool in an emancipatory process (CPD). With the focus on an emancipatory tool (the ODEM) and the tensions that impacted on this tool, a critical approach was therefore not appropriate.

Since the current study was aimed at producing an understanding of the context of implementation of an information system (ODEM) and the process whereby the use and value thereof was influenced by the context, I adopted an *interpretive perspective* as my philosophical base.

The philosophical base of interpretive research is hermeneutics and phenomenology (Boland, 1985), which neatly tied the philosophical approach selected to the qualitative approach that this study followed.

In summary then, this study followed a qualitative approach and the underlying philosophical approach was interpretive. Since a research method is a strategy of inquiry which moves from the underlying philosophical assumptions to research design and data collection (Myers, 2007), the next chronological decision was what research method(s) to employ.

3.2.2 Research method

Several qualitative research methods were available given the interpretive stance taken. The appropriate research method was determined following an approach proposed by van der Merwe, Kotze and Cronje (2005). Here, a brief summary of the key elements of the available paradigms were matched against the research questions and this approach is presented in Table 3.2. To support comprehension of the table, the research questions are listed again.

1. *What are the personal and situational tensions that impact on the use and value of a mathematics-friendly online forum environment as a reflective tool for the CPD of disadvantaged mathematics teachers?*
2. *What are the personal and situational tensions that impact on the use and value of a mathematics-friendly forum discussion environment as a reflective tool for the CPD of advantaged mathematics teachers?*
3. *What differences exist between the advantaged and disadvantaged groups as it relates to the personal and situational tensions identified?*
4. *Is a mathematics-friendly online discussion environment useful as a reflective tool for the CPD of disadvantaged and advantaged mathematics teachers?*

A review of the table shows all of the research questions to fall within a Grounded Theory (GT) or Activity Theory (AT) analysis in a Case Study (CS) context:

- *CS - Investigator has little control:* There was no intervention once the teachers' started using the ODEM.

- *CS - Contemporary phenomenon with real life context:* Embodied in the relevant and pertinent contextual research focus on personal and situational factors that affect the use of the ODEM.

Table 3.2 Available Research Approaches

Research Paradigm	Characteristics	RQ 1	RQ 2	RQ 3	RQ 4
Critical Social Theory	Social roles				
	Social reality	x	x	x	
Action Research	Focus on what practitioners do	x	x	x	
	Explicit criteria				
	Practitioners and researchers with mutual goals				
	Apply theory with goal to enhance				
Case Study	Investigator has little control	x	x	x	x
	Contemporary phenomenon with real life context	x	x	x	x
	Study life cycles	x	x	x	x
Ethnographic Research	Active participation				
	Observational data				
	Social context with participants	x	x	x	x
	Extended in-depth study				
Grounded Theory	Limited to one field study	x	x	x	x
	Starts with phenomenon	x	x	x	x
	No preconceived theory	x	x	x	x
	Open approach and inductively derived	x	x	x	x
Activity Theory	What is relevant emerges	x	x	x	x
	Context-specific	x	x	x	x
	Participation in social organizations	x	x	x	
	Affected by social environment	x	x	x	x

- *CS - Study life cycles:* The ODEM was implemented and studied in two separate cases or cycles.
- *GT - Starts with phenomenon:* The ODEM as a reflective tool presents a novel experience which needs to be studied.
- *GT - No preconceived theory:* Since tensions are to be discovered, the results are emergent.
- *GT - Open approach and inductively derived:* The tensions are discovered from and thus grounded in the available data.
- *AT - Context-specific:* The two groups present context-specific cases.
- *AT - Participation in social organizations:* Interaction in the ODEM provides opportunities to build upon and extend social groupings.
- *AT - Affected by social environment:* What this study is about.

Miles and Huberman (1994), in their definitive book on qualitative data analysis, state that the strongest message of their book is that none of the methods they cover should be applied scrupulously. Rather, they contend, the creation, testing and revision of simple,

practical and effective analysis methods remain the highest priority for qualitative researchers. In concurring with this viewpoint, this study made use of both GT and AT in a Case Study context, but structured and adapted to needs and requirements in order to effect a credible account of the tensions found.

There is added value in following such an approach. The interplay derived from using GT and AT leads to a process known as *theoretical triangulation*. In its simplest terms, it means analyzing the same set of data from multiple perspectives. Theoretical triangulation is not a new concept. Anells (2006) notes that different research approaches can be creatively and successfully used in one study if there has been adequate consideration of vital factors that determine if there is a good 'fit' of the approaches, not only with the research problems and questions, but also with each other, while maintaining the integrity of each approach.

The next three sections summarize the available literature on GT, AT and the Case Study approaches.

3.2.2.1 Grounded Theory

Martin and Turner (1986) define GT as an “inductive theory discovery methodology that allows the researcher to develop a theoretical account of the general features of the topic while simultaneously grounding the account in empirical observations of the data”. There are two key beliefs in GT: at the start there exist no theory to prove, disprove or extend, and grounded theory is discovered through constant comparison between incidents and properties of a category (Glaser and Strauss, 1967). It is considered appropriate when “little is known about the topic and where there are few existing theories to explain a phenomenon” (Hutchinson, 1988).

GT derives its name from the practice of generating theory from research which is “grounded” in data. It was formally proposed by Barney Glaser and Anselm Strauss in their book *The Discovery of Grounded Theory* (Glaser et al., 1967). Over the next three decades the theory was refined (Glaser et al., 1967; Glaser, 1978; Strauss, 1987; Strauss and Corbin, 1990; Glaser, 1992; Glaser, 2004).

Major differences between Glaser and Strauss’s views on GT emerged over the years to the extent that today, a Glaserian or Straussian approach to GT exists. These differences lie in their respective views of the procedures and processes that should be followed (Stern,

1994). It is beyond the scope of this chapter to enter the debate on which approach should be followed. While even a cursory examination of the literature revealed the Glaserian approach to be more favored, some studies involving an IS and employing GT made use of elements from both approaches, depending on circumstances (Fitzgerald, 1997; Hughes and Jones, 2003; Hansen and Kautz, 2005). The current study followed this approach since the GT method, by nature, is open-ended. In the current study, the research results are explicitly emergent. That is, no preconceived theory exists about the tensions impacting on the use and value of the ODEM as a reflective tool for the CDP of mathematics teachers. In such cases, an open strategy must be followed (Creswell, 1998).

GT is ideally suited for adult education, a discipline which is characterized by its lack of a well-developed theoretical foundation and a strong commitment to the world of practice (Babchuk, 1996). Some of the more prominent studies advocating a GT methodology in IS include Orlikowski (1993), Walsham (1995), Fitzgerald (1997), Hughes et al.(2003) and Hansen et al. (2005). Research employing GT in an educational environment included studies on teacher burn-out and stress (Blase, 1982), reference group socialization of secondary school teachers (Gehrke, 1982), middle school students perceptions of factors facilitating the learning of science, (Spector and Gibson, 1991), academic change (Conrad, 1978), training needs of science teachers (Kozma, 1985), adaptive strategies of expert teachers (Campbell, 1987), life in an adult basic education classroom (Courtney, Jha and Babchuk, 1994), instructional innovation in higher education (Kozma, 1985) and web-based learning environments (Zimmerman, 2002).

The three basic elements of GT are concepts, categories and propositions (Pandit, 1996). Incidents or activities are analysed as potential indicators of phenomena and are given conceptual labels in order to accumulate the basic units for theory generation. Categories are higher level abstractions of these concepts and provide the means whereby theory can be integrated. Propositions indicate generalized relationships between a category and its concepts, and between discrete categories. Pandit (1996) also lists 5, not necessarily sequential, analytical phases of GT theory building, namely research design, data collection, data ordering, data analysis and literature comparison.

3.2.2.1.1 Grounded Theory in the current study

Table 3.3 shows an adapted and expanded version of Pandit's view of the process of building GT. Phases are presented in relation to the activities inherent to the phase and the

rationale behind it. A comments column lists relevant excerpts from literature to authenticate the phases, while the Current Study column indicates which activities were utilized in the current study.

From the table it is seen that the majority of the activities used in a GT approach were followed, with exceptions forced upon by the use of a case study approach which limits concurrent cycles of data collection, and therefore the generalizability of results. This is true of a case study approach (section 3.2.2.3) in general. As Miles et al. (1994) point out, a case study is not necessarily singularly monolithic. A case may have many sub-cases embedded within them, which may offer an even deeper understanding of processes and outcomes of cases and a good picture of locally grounded causality. The current study also did not attempt to generate theory.

In conclusion, Barab, Schatz and Scheckler (2004) note that whereas it is common for researchers of educational technologies to publish case studies that report the character of systems that they develop in terms of a unitary, coherent, and refined entity, they fail to portray and acknowledge the complex dynamics that are characteristic of its making and use. It is here where Cultural Historical Activity Theory (or simply Activity Theory) justified its selection as the second research approach within the current case studies.

Table 3.3 The process of Grounded Theory (adapted from Pandit, 1996)

PHASE	ACTIVITY	RATIONALE	COMMENTS	CURRENT STUDY
RESEARCH DESIGN PHASE				
1. Review of literature	Definition of research question and priori constructs	Focuses efforts and constrains irrelevant variation and sharpens external validity	While it is considered critical in GT methodology to avoid unduly influencing the pre-conceptualization of the research through extensive reading in the substantive area and the forcing of extant theoretical overlays on the collection and analysis of data (Glaser, 2004), (Strauss et al., 1990) treats the technical literature as a good source for research questions.	A concise literature review is undertaken, thereby aligning the current study between Glaser and Strauss and Corbin's view.
2. Selecting cases	Theoretical, not random sampling	Focuses efforts on theoretically useful cases that tests and/or extends the theory	The process of data collection for generating theory whereby the analyst jointly collects, codes and analyses data and decides what data to collect next and where to collect the data in order to develop the theory as it emerges (Glaser et al., 1967)	The teachers that participated in the study were all actively involved in cluster meetings and identified by their Subject Advisor as useful candidates for the study. They formed the two cases studied.
DATA COLLECTION PHASE				
3. Develop rigorous	Create case study	Increases reliability and	(1989) states that every case	All the data collected is

data collection protocol	database	construct validity	study should strive to develop a formal, retrievable database so that other investigators can review the evidence directly and not be limited to written reports.	made available on CD-ROM.
	Employ multiple data collection methods	Strengthens grounding of theory by triangulation of evidence and enhances internal validity and reliability	The GT approach advocates the use of multiple data sources (Glaser et al., 1967). These sources converge on the same phenomenon, and have been termed ‘slices of data’. A multifaceted approach, there are no limits to the techniques of data collection, the way they are used, nor the type of data collected (Pandit, 1996). Triangulation across various techniques of data collection is considered particularly beneficial in theory generation, since it provides multiple perspectives, supplies more information on emerging concepts, allows for cross-checking, and yields stronger substantiation of constructs (Orlikowski, 1993).	Data were collected from semi-structured interviews, teacher journals, server logs, my own journal kept throughout the study and a focus questionnaire, providing multiple perspectives and ensuring triangulation.
	Qualitative and quantitative data	Synergistic view of evidence		The nature and pattern of teacher posts to the ODEM were quantitatively explored.
4. Entering the field	Overlap data collection and analysis	Speeds analysis and reveals helpful adjustments to data collection	Overlapping data analysis with data collection gives the researcher a head start in analysis whilst allowing for flexible data collection, i.e. it provides the freedom to make adjustments during the data collection process (Eisenhardt, 1988)	Given the purpose of the study, i.e. to discover tensions that impact on the use of the ODEM, analysis could only be done on completion of the implementation phases.
	Flexible and opportunistic data collection methods	Allows investigator to take advantage of emergent themes an unique case features		My own research diary kept throughout provided flexible and opportunistic data.
DATA ORDERING PHASE				
5. Ordering data	Arraying events chronologically	Facilitates easier data analysis and allows examination of processes		Not applicable here as teachers within each case participated in the same time frame.
DATA ANALYSIS PHASE				
6. Analysing data relating to case	Use open coding	Develop concepts and categories and their properties	The purpose is to open the data material by looking for different words in the statements and classifying part-statements with labels to explain the meanings of the different parts (Hansen et al., 2005). It is concerned with identifying, naming, categorizing and describing phenomena in the text (Glaser et al., 1967).	Followed by using the Atlas-ti software package’s coding functionality.
	Use axial coding	Develop connections	The purpose is to find the	Followed by using the

		between a category and its sub-categories	categories into which the concepts can be classified. The meanings behind concepts are compared and categorized in order to explain the data material and relationships between concepts (Hansen et al., 2005)	Atlas-ti software package's network editor.
	Use selective coding	Integrate categories to build a theoretical framework	The purpose is to explain relationships between categories. The theory is delimited to one (or two) core variable(s) which acts as a guide for further data collection and analysis (Glaser, 1978). It is the process of choosing one category to be the core category, and relating all other categories to that category (Strauss et al., 1990)	Adopted but adapted. Here the intention was to find the core tension as opposed to the core category.
7. Theoretical sampling	Literal and theoretical replication across cases (go to step 2 until theoretical saturation)	Confirms, extends, and sharpens theoretical framework		Limited to the two cases under study. Given the cost associated with running the project, it was not possible to replicate cases within communities and therefore a case study approach with inherent limited generalizability was followed.
8. Reaching closure	Theoretical saturation	Ends process when marginal improvement becomes small		As per what a case study allowed.
LITERATURE COMPARISON PHASE				
9. Compare emergent theory with extant literature	Comparisons with conflicting frameworks	Improves construct definitions and therefore internal validity	GT methodology treats the literature as another source of data to be integrated into a constant comparative analysis process (Glaser, 1978)	Followed in Chapter 8, but not to prove theory as no theory is developed.
	Comparisons with similar frameworks	Improves external validity by establishing the domain to which the study's findings can be generalized.		Followed.

3.2.2.2 Activity Theory

AT is particularly suited as a theoretical framework to follow when context is acknowledged. This study was underpinned by the philosophy that participation in social organizations (e.g. families, communities, institutions or other informal collectives) provides for a complex set of interactions from which we cannot extricate ourselves, were we are simultaneously affected by our social environments while, at the same time, we participate in their creation (Little, McAllistair and Priebe, 1997).

For example, very early in the study it became apparent that the focus of some teachers was not always on contributing to the ODEM. For most disadvantaged teachers, getting online in order to visit the ODEM provided a major shift in focus from the purposes of this study for a prolonged period of time. This struggle can therefore be viewed as sub-case, and AT is ideally suited for recognizing and defining such sub-cases.

A review of the literature promoting AT as a research approach follows next. According to Vygotsky (1978), a human individual never reacts merely directly (or merely with inborn reflects) to the environment. The relation between the human agent and the object is mediated by cultural means or artifacts. The basic types of these means are signs and tools. During socialization, an individual internalize, by participating in common activities with other humans the means of culture: language, theories, technical artifacts as well as norms and modes of acting. Thus consciousness doesn't exist situated inside the head of the individual but in the interaction - realized through material activity - between the individual and the objective forms of culture created by the labour of mankind. These viewpoints form the basis of what was later to become Activity Theory (AT).

A.N. Leontjev, a disciple of Vygotsky stressed that activity is socially mediated: consciousness and meaning are always formed in joint, collective activity (Leontjev, 1978). As a result, the unit of analysis in studying human mediated activity is an activity system, a community of actors who have a common object of activity (Engeström, 1987; Cole & Engeström, 1994). In this model social mediatedness is characterized by division of labour and rules mediating the interaction between the individuals in the activity system. The collective activity system as unit of analysis connects the psychological, cultural and institutional perspective to analysis. The study of activity ceases to be psychology of an individual but instead focuses on the interaction between an individual, systems of artifacts and other individuals in historically developing institutional settings.

Leontiev (1981) further states that attempts to correlate context and participants as interactants in communicative events (such as that which the ODEM offers) suggests the possibility of interpreting their interrelationship by applying the tri-stratal analysis of social activity.

Figure 3.1 presents this tri-stratal framework.

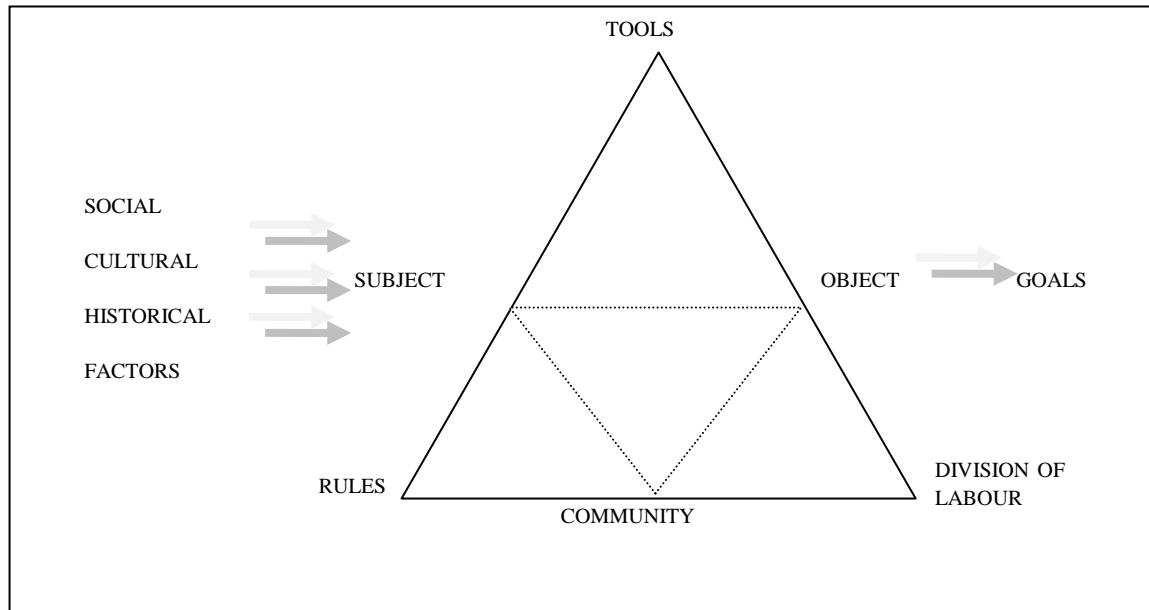


Figure 3.1 The tri-stratal framework of Activity Theory

In Activity Theory, the basic unit of analysis is human (work) activity. In its simplest terms, an activity is defined as the engagement of a subject toward a certain goal or objective. An activity is undertaken by a human agent (subject) who is motivated toward the solution of a problem or purpose (object), and mediated by tools (artifacts) in collaboration with others (community). The structure of the activity is constrained by cultural factors including conventions (rules) and social strata (division of labor) within the context (Ryder, 1999)

Bannon (1991) uses the following metaphor to describe AT:

The carpenter uses a saw and a hammer to produce a house out of wood and the like, the teacher uses language, books, pictures, maps etc. to teach her pupils geography. However the carpenter building a house is not alone in the world. He works together with other carpenters, as well as with other building workers. The ensemble of carpenters divides their work between them. The ways of doing work, grounded in tradition and shared by a group of carpenters, nurses or the like, we call practice or praxis. When getting trained as a carpenter or nurse, one gets to share this praxis. At the same time each individual who holds a praxis continues the praxis, and he or she changes it as well, by coming up with new ways of doing things. It is this praxis that allows us to talk about more than just individual skills, knowledge and judgement, and not just about a "generic" human being. In other words, we can talk about the appropriateness of a certain tool for certain praxis. (p.106)

Applied to the current study, the following summary is made from this metaphor:

The teachers who participate in this study are bound by praxes that are likely to influence their interactions with other teachers in, and with the ODEM. An understanding of their praxes and the Activity Systems that exist within and outside the ODEM is required if the research purposes are to be met.

3.2.2.2.1 Activity Theory in the current study

Consider the act of a teacher wanting to participate in the ODEM. Participation in the ODEM can be considered an Activity System. However, before he can participate in the ODEM, a connection to the Internet is required. The act of connecting can be considered another Activity System, which goal (i.e. making a successful connection) must be met before the teacher can participate in the ODEM. At certain times then the focus of activity may shift from the goal of participating in the ODEM to making or even maintaining a successful connection, which presents a second Activity System with its own goal.

The three primary components of an Activity System are the *subject*, the *object* of the activity and the *community* in which they occur. The subject is a mathematics teacher, the activity is connecting to the Internet, and the community is disadvantaged. Each activity the teacher performs, for example connecting to the Internet, is analyzed as part of the collective and with a social-cultural context of the individual and the collective. A shared understanding of the character and history of the subject, the object which the individual is trying to reach, the characteristics of the community and the tools available to the subject is required if sense is to be made.

Supporting components on the apexes of the triangle are the *rules*, the *division of labour* (roles) and the *tools* used. Continuing with the second Activity System example, the tool would be an Internet-ready Personal Computer, the rule would be that the teachers must make a connection, while the roles may be Telkom, who must supply a clear and working telephone line to prevent disconnections, an Internet Service Provider to provide access to the Internet, and the teacher who must pay the Internet connection fees and who must perform the activity. If the object is a successful connection, but the Internet connection fees were not paid the previous month, no connection is possible and the object of the Activity System then becomes paying the fees. In the process of the object changing, all the other components adopt new perspectives, and a new Activity System is born.

Note that the components of Activity Systems are not static components existing in isolation from each other. They are reciprocally interacting with and reciprocally constituted through interactions with the other components that make up the Activity System. *An examination of any phenomenon must therefore consider the dynamics between all these components.* Data analysis thus needs to take place within Activity Systems. This will ensure context and understanding of the activities, actions and operations performed by the subjects, and reveal their motives, goals and instrumental conditions, respectively.

It is important to note here that AT is a broad conceptual framework and not a "theory" in the strict interpretation of the term. It consists of a set of basic principles which constitute a general conceptual system, which can be used as a foundation for the application of more specific theories, such as GT.

3.2.2.2.2 Activity Theory and tensions

One of Engeström's (1987) original motivations for developing this model was to allow researchers to identify the inner contradictions that impose tensions on participants' settings and help them change the nature of an activity to overcome those tensions. He proposed four levels of inner contradictions to exist with an Activity System. Table 3.4 presents the four levels of inner contradictions and a definition of each contradiction. An accompanying example is provided to clarify the contradiction that exists.

Table 3.4 Engeström's (1987) Four Levels of Inner Contradictions in Activity Systems.

Contradiction Level	Engeström's Definition	Examples
Level 1 Primary Contradiction	When activity participants encounter more than one value systems attached to an element within an activity that brings about conflict.	Teachers may not perceive outside CPD efforts as valuable, thereby choosing not to participate in such efforts, creating a tension in the Activity System.
Level 2 Secondary Contradiction	When activity participants encounter a new element of an activity, and the process for assimilating the new element into the activity brings about conflict.	Should teachers choose to participate in outside or directed CPD efforts, more demand is placed on their daily work activities, thereby creating a tension that impacts on the new rules and division of labour brought into their daily routine by their participation in CPD activities.
Level 3 Tertiary Contradiction	When activity participants face conflicting situations by adopting what is believed to be a newly advanced method for achieving the object.	Teachers may resent having to adopt a new teaching method which they feel is far removed from their everyday practises.
Level 4 Quaternary Contradiction	When activity participants encounter changes to an activity that result in creating conflicts with adjacent activities.	Teachers have to spend more time preparing to use a new teaching method in class, which leaves them less preparation time for other teaching subjects.

Regardless the level of contradiction, a tension brings instability to an Activity System.

The identification of tensions therefore provides an indication of the stability of the Activity System. If there are no tensions, there are no contradictions and the nature of an activity does not have to change in order to overcome the contradictions, or to solve the tension for that matter.

For purposes of the current study, the use of the AT approach was limited to the identification and provision of contextual units of analysis (or Activity Systems), and to identify tensions that exist within each Activity System.

3.2.2.3 Case Study method

In section 3.2.2 a case study approach was recognized as an appropriate method given the nature of the research questions. This section provides more background to case study approaches.

Case study refers to the selection and presentation of detailed information about a particular participant or small group, frequently including the accounts of the subject themselves (Becker, Dawson, Devine, Hannum, Hill, Leydens, Matuskevich, Traver and Palmquist, 2005). Its methodology is frequently criticized for its dependence on a single case, thereby rendering it incapable of providing a generalizing conclusion. Responding to criticism about the generalizability of case study results and its resultant contribution to scientific development, Flyvbjerg (2004) argues case studies are a necessary and sufficient approach that holds up well when compared to other methods. He charges that a discipline without a large number of thoroughly executed case studies is a discipline without systematic production of exemplars, and that a discipline without exemplars is an ineffective one, and that the choice of method should clearly depend on the problem under study and its circumstances.

Yin (1998, 2002) further argues that the goal of the study should establish the parameters, and then should be applied to the case under study. In this way, even a single case could be considered acceptable, provided it met the established objective. In this manner, the researcher is called upon to work with the situation that presents itself in each case (Tellis, 1997).

Merriam (1988) defines a case study as an examination of a specific phenomenon, such as a program, an event, a process, an institution, or a social group, while Yin (1984) equates a case study with an investigation into a contemporary phenomenon within its real-life

context where the boundaries between phenomenon and context are not clearly evident. Eisenhardt and Graebner (2007) state that single-case studies can richly describe the existence of a phenomenon while multiple-case studies typically provide a stronger base for theory building. The main purpose of the current research was to gain an in-depth understanding of the tensions that impact on the use of the ODEM in two distinct communities, or cases. Context played a significant role in each case and the research was a process of discovery, rather than confirmation of pre-defined hypotheses. While it is tempting to define the current research as a multiple-case study, this was not the case. Here the disadvantaged group presented one distinct case, and the advantaged group another distinct case. A single case approach was thus appropriate in analyzing both groups.

Single case studies that do not attempt to confirm or challenge a theory (known as a critical case) are unique, extreme or revelatory cases. Unique and extreme single case studies are typically followed in settings such as clinical psychology, where a disorder may be so rare that it is worth documenting and analyzing. Revelatory cases, there against, are ideal where an observer may have access to a phenomenon that was previously inaccessible. Since ample scope existed for the current research (section 1.6), it fell within a revelatory case. The *descriptive* information associated with a revelatory case makes the study worth conducting (Yin, 2002).

In summary, the current study followed a revelatory single case approach, but repeated in two distinct communities defined by discrete parameters.

The case study approach dictated the research design that was followed and is dealt with next.

3.3 Research Design

Figure 3.2 presents a case description of the current study, which served as the framework used to investigate the research questions. It also presents a road map for the following sections and the following chapters.

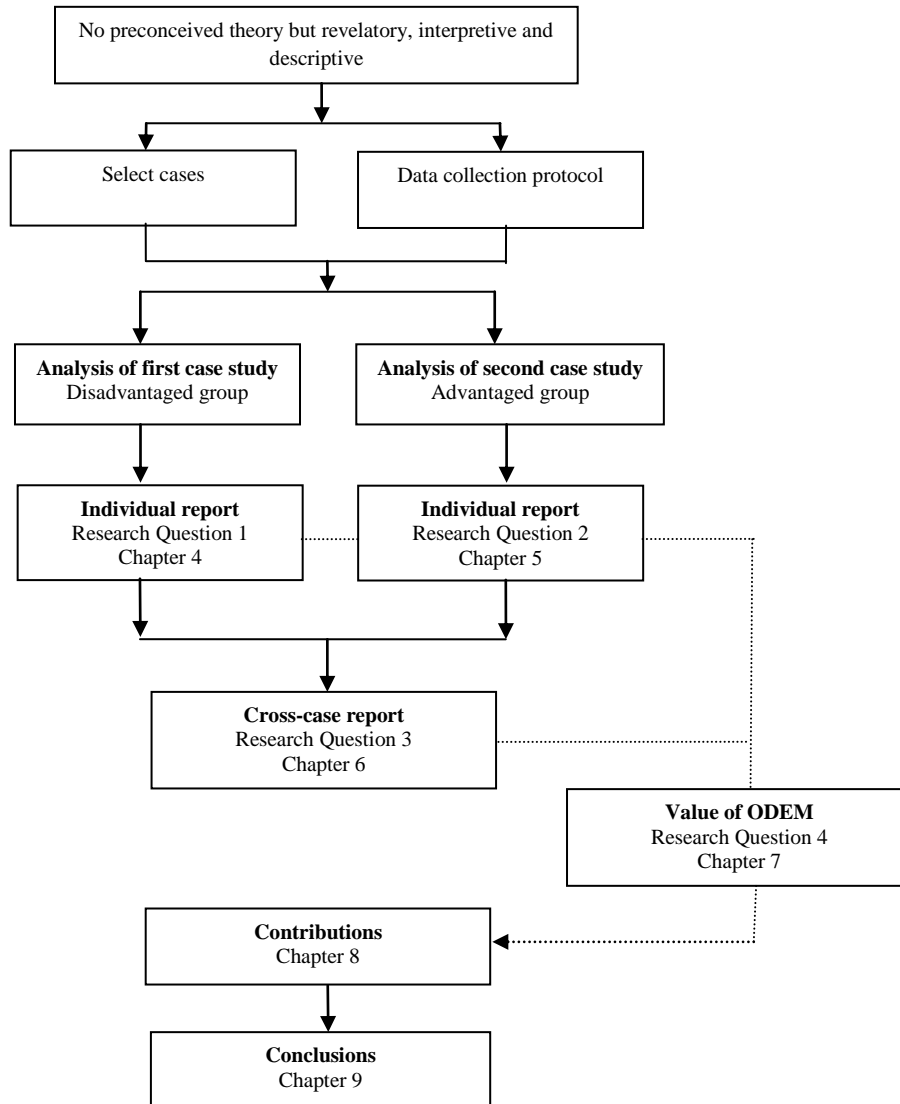


Figure 3.2 Case description and research design roadmap

3.3.1 Revelatory, interpretive and descriptive approach

In the previous sections the current study was positioned as a revelatory case study, and GT was selected as one of the research paradigms. GT is primarily geared towards generating theory through a theoretical account of the general features of the topic under investigation. The current study, however, centered on properties of units (a disadvantaged and an advantaged group), and as Glaser (Glaser, 1978) directs, properties of a unit are more relevant to *descriptive* qualitative studies, while properties of a process are more relevant to studies aiming at theoretical conceptualization. Following the selection of a repeated single case approach, I focused on identifying, interpreting and describing the tensions within identified Activity Systems in each case, thereby offering new variables that impact on the use and value of the ODEM as a reflective tool in the CPD of

mathematics teachers. As described in section 3.2.2.1 there was no attempt at theory building and selected techniques of GT were used. Chow (1998) adopted a similar approach in a qualitative descriptive study which had GT overtones by its employment of GT techniques without any theoretical rendering.

As described in section 3.2.1, the philosophical base of the current study was interpretive. Thorne, Reimer Kirkham and O’Flynn-Magee (2004) describe *interpretive description* as a coherent conceptual description that taps thematic patterns and commonalities believed to characterize the phenomenon that is being studied and also accounts for the inevitable individual variations within them. This description accurately fits the current research.

The current study thus adopted a *revelatory, interpretive and descriptive* approach to the cases under investigations.

3.3.2 Selection of cases

Miles et al. (1994) describes a case as a phenomenon of some sort occurring in a bounded context. A unit of analysis, there is a focus of the study and some boundary which defines the edge of the case, i.e., what will not be studied. The boundary defined by the current cases was dictated by the sampling parameters, which was partially set by the research questions, issues related to the availability of research funds and issues of practicality.

As Miles et al. (1994) furthermore points out, there is a finite amount of time, with variable access to different actors and events, and an abundance of logistical problems. The implication is that the start-up sampling frame is constantly shifted and reframed, which further defines the boundaries as the study continues.

The dominant sampling strategy in quantitative inquiry is probability sampling. Such strategies depend on the selection of a random and representative sample from the larger population with a purpose to generalize the research findings to the population.

Qualitative research, by contrast, employs purposeful sampling as the dominant strategy. Purposeful sampling seeks information-rich cases which can be studied in depth (Patton, 1990). Patton furthermore describes 16 types of purposeful sampling. Some of the more prominent types are extreme or deviant case sampling; typical case sampling; maximum variation sampling; snowball or chain sampling; confirming or disconfirming case sampling; politically important case sampling and convenience sampling.

Lincoln et al. (1985) propose that the most useful strategy for the naturalistic approach is maximum variation sampling. This strategy aims at capturing and describing the central themes or principal outcomes that cut across a great deal of participant or program variation. According to them, small samples have a great deal of heterogeneity which can be a problem because individual cases are so different from each other. The maximum variation sampling strategy turns that apparent weakness into a strength by applying the following logic: Any common patterns that emerge from great variation are of particular interest and value in capturing the core experiences and central, shared aspects or impacts of a program. The variations between the two cases (disadvantaged and advantaged) included race, level of advantageousness, ethnicity differences, school conditions, level of education and levels of PC- and Internet-literacy (see Table 7.1), thus allowing for large variation in describing the cross-case themes that emerge.

There against, the sampling of each case followed a snowball approach which was largely dictated by circumstances. In snowball sampling, one begins by identifying someone who meets the criteria for inclusion in the study. This person is then asked to recommend others who they may know who also meet the criteria. Snowball sampling is especially useful when you are trying to reach populations that are inaccessible or hard to find (Trochim, 2001).

Shank and Brown (2007) furthermore note that the process and strategy of participant selection should be based on what the research is trying to accomplish. The research questions of this study were very specific to disadvantaged and advantaged mathematics teachers and therefore set the first sampling parameter – a case each from a disadvantaged and an advantaged community. However, securing subjects for these cases proved a difficult process. An initial attempt where invitations for participation were sent directly to teachers via the headmasters of several disadvantaged Township schools in the Pretoria region. This effort proved unsuccessful when no teachers volunteered, for reasons that remain unknown.

A meeting with the Subject Advisor for Gauteng North then opened up access to more teachers who regularly participated in her Subject Advisor-driven cluster meetings, and whom she considered to be intrinsically motivated towards CPD given their regular participation in these meetings. Although the Subject Advisor was earmarked to but did not participate in the ODEM, her recommendation of the subjects was based upon her

familiarity with the teachers who formed the subject groups and her understanding of what the study wanted to achieve. The result was that the boundaries of the two cases were narrowed to include only teachers who actively participated in cluster meetings.

Issues related to the availability of research funds and practicality issues further defined the boundaries of the cases. In order to purchase Personal Computers and Surfmore packages for teachers, I had to secure research funds. This process proved challenging. Funding for the disadvantaged group was eventually secured in early 2005 through The Shuttleworth Foundation (TSF), a non-profit organization that actively supports further research into Open Source software and social innovation in the field of education, especially in science and mathematics. A generous grant of R30 000,00 in early 2005 allowed for a maximum of ten disadvantaged teachers being supplied with refurbished Personal Computers and a period of 4 months Internet access. Principle specifications of the hard- and software are provided in section 4.3.1.1. A requirement of the grant was that teachers had to teach Grades 7 to 9, which further defined the sampling boundaries.

A further grant secured through the National Research Foundation's (NRF) Thuthuka initiative for 2006 allowed me to continue with the advantaged case cycle. To ensure integrity of comparison between the two cases, it made sense to limit the advantaged group to 10 teachers as well. Special permission was obtained from the NRF to purchase hardware with the grant, which was approved. The advantaged group was thus also provided with refurbished computers similar in specifications to the disadvantaged group and Surfmore packages for 4 months. An extra month was added since their participation started in November, and December is a traditional school holiday month when lower participation rates was expected. The decision to provide teachers with Internet access to the ODEM from home was argued in Chapter 1. This further delineated the boundary of the cases, in that only teachers with existing telephone lines could participate. Since a basic requirement to participation in the ODEM is PC-literacy, an additional requirement was that teachers had to be computer-literate.

The purposeful sampling technique of this study was therefore dictated by the research questions, the availability of research funds and practical issues.

Finally, as indicated earlier, the ultimate goal of purposeful sampling is to obtain cases deemed information-rich for the purposes of the study (Sandelowski, 2000). Marshall et al. (2006) propose that a realistic site is where (a) entry is possible; (b) there is a high

probability of that a rich mixture of the processes, people, programs, interactions, and structures of interest is present; (c) the researcher is able to build trusting relationships with the participants; (d) the reporting of data can be done ethically; and (e) the quality of data and credibility of the study are reasonably assured.

Having a subject pool of teachers who actively participated in cluster meetings and were petitioned by a familiar person (the Subject Advisor) provided an entry point and a level of trust. Workshops held with teachers before their participation in the ODEM furthered opportunities for trust building between myself and teachers. The advantaged and disadvantaged environments, by their very nature, provided a high probability for richness. The final two propositions, ethical reporting and quality of and credibility of the study are less bounded by site but are mostly determined by the methodological decisions followed, and the research results.

In summary, the selection of cases was based on pragmatic decisions. In the next section, precise information on the subject profiles is presented;

3.3.2.1 Subject and environment profiles

Section 2.6.1 provided an elaborate description on the historical locational differences between disadvantaged and advantaged teachers in terms of school environments. Here some of the more important descriptions are highlighted, and a concise summary is provided of the subject profiles as it relates to the procurement of the subject pool.

Despite an invitation to 10 disadvantaged teachers who were active cluster meetings participants of the Gauteng North branch, only 9 teachers volunteered, of which 8 were active participants in the ODEM. Seven of these teachers were black, living and teaching in Mamelodi, a Township situated towards the Northeast of Pretoria (Tshwane). Like other Townships, Mamelodi was established in the apartheid area on the periphery of white towns and cities – close enough to work for the “madams and bosses” but distant enough to ensure separate development. Although many Townships have more affluent areas, they are generally under-developed in terms of housing, services and infrastructure. Despite several years of democratic rule and sincere efforts to upgrade living conditions, the status quo remains for Mamelodi with those residents fortunate enough to earn higher salaries relocating to the former white suburbs. The same holds true for Township schools. While parents who can afford send their children to former white schools located in advantaged

areas, the Township schools are generally populated by children from the surrounding neighbourhoods. The disadvantaged teachers were thus teaching in disadvantaged Township Schools, and the pupil profile is largely disadvantaged in terms of the level of education they receive (section 3.6.1) and the environment. Another black female teacher taught in Pretoria Central, which is classified as less affluent suburb. The student body of this school is with a few exceptions black. The final disadvantaged teacher was an Indian female who lives and teaches in Ladium, and Indian community situated on the border of the inner city of Pretoria, which is more affluent than Pretoria Central.

Four of the disadvantaged teachers were female and three were male. Eight disadvantaged teachers held teaching diplomas, with just one male teacher having a degree. All teachers teach at least one grade in Grades 7-9, with most teaching higher levels as well.

Only 7 advantaged cluster teachers volunteered for the study, of which 6 were female and one male. They teach at different schools around Pretoria to the North, the East and the Southwest, and with the exception of one teacher, lived in the general area they teach in. All these areas are considered affluent areas. With one exception (a female teacher) all teachers held degrees. All teachers teach at least one grade in Grades 7-9, with most teaching higher levels as well. One teacher, however, taught only Grade 7. All teachers were classified advantaged because of their race (they had far more opportunities than disadvantaged teachers had in the past), the schools they teach at, and the areas they live in.

In the disadvantaged group, one female teacher did not visit the ODEM at all and was also not available for an interview. For the advantaged group, two female teachers did not visit the ODEM, but both were interviewed.

All teachers, with the exception of two, were older than 30 and younger than 52. The significance of their ages lies in the fact that disadvantaged teachers were privy to Apartheid schooling, which favoured the advantaged teachers and which is evident in their higher level of tertiary education. Length of service ranges from 2 years to 23 years with a mean of 12 years.

In general terms then, the disadvantaged and advantaged labels of the groups were accurate.

3.3.2.2 Workshops

Before implementation of the ODEM, two workshops were held with disadvantaged teachers and one with advantaged teachers. These workshops had several purposes:

1. To meet teachers and to establish a basic level of trust between myself and teachers.
2. To introduce teachers to the ODEM, and to provide training in posting mathematical expressions.
3. To sensitize teachers to reflective techniques. I made a purposeful decision to provide teachers with simplified and practical examples of reflective practices, anticipating teachers to grow in reflective stature as they participate. The documentation provided to support this discussion is provided in Annexure E.
4. To let teachers sign a Memorandum of Understanding (MOU), which served as a “binding contract” to ensure that their intention to participate were genuine. This MOU is provided in Annexure F. Note that I used this MOU purely to ensure “intention”. To have *enforced* participation would have defeated the purpose of the research.
5. The final purpose of the workshops was to assign teachers their computers, to show them how to connect the different hardware peripherals, and to explain the support route to them. The first level of support was with Telkom, and I offered to refund any such support calls. The second level of support was myself. Given several difficulties experienced (see Chapter 4), a second workshop was held with the disadvantaged group where they received their computers

During the workshops the exact nature and focus of the research was not disclosed, thereby ensuring that tensions surfaced naturally.

3.3.3 Data collection protocol

3.3.3.1 Introduction

Each of the research methods employed in the current study provided one or more techniques for collecting data.

Activity Theory techniques lied exclusively in the discovery of Activity Systems that aims to compartmentalize data collection, forming the units for analysis. These techniques also allowed for various data views.

Grounded Theory techniques employed included analysis of semi-structured interviews, server logs, my own and teacher research diaries kept throughout the study and a focus questionnaire thereby providing multiple perspectives and ensuring triangulation of data (Glaser et al., 1967; Orlikowski, 1993; Pandit, 1996).

Several sources of evidence in case studies are available. These are documents, archival records, interviews, direct observation, indirect observation, participant-observation and physical artifacts (Stake, 1995). Of these data collection methods, only interviews and direct observation (via server logs) were practically realizable. These techniques overlap with Grounded Theory techniques. Besides server logs direct observation was also done by reviewing the nature and patterns of teachers' participation directly from their posts to the ODEM.

Each of these techniques is discussed in the following sections.

3.3.3.2 Interviews

Interviews can be structured, semi-structured or unstructured (Fowler and Mangione, 1990; Blomberg, Giacomi, Mosher and Swenton-Hall, 1993). A structured interview has formal and limited set questions, while an unstructured interview has relatively few preset structures. A semi-structured interview has set questions, but is flexible allowing new questions to be brought up during the interview based on interviewee responses.

Fowler et al. (1990) lists several benefits and limitations of interviews. The benefits are:

- Useful for identifying possible areas for more detailed analysis
- The data gathered provides information on general principles and is faster than observational methods
- Interviews are useful for investigating events which occur infrequently and are popular, well known and widely accepted
- Interviews have the extremely positive feature that they give the interviewee the feeling that their input to the process has been taken account of
- Issues can be addressed from different perspectives

- Respondents can provide reasons to answers
- Is less intrusive than formal interviews

The limitations of interviews are:

- There is room for considerable bias in what questions are asked and how the answers are interpreted
- The interviewer may need to acquire domain knowledge in order to know what questions to ask
- What people say often differs from what they really do
- The interviewer may influence respondents
- Generates a lot of information that is difficult and time consuming to analyse
- Insufficient rapport, trust or understanding may result in low quality data

Since the current study is revelatory (or elicatory), a semi-structured interview method was appropriate.

Fowler et al.'s (1990) guidelines on how to conduct a structured interview were followed:

1. A "nurturing" phase which served as the initial warm-up to the interview with pleasantries exchanged, and the purpose of the interview relayed. Apologies for not conducting the interview in the disadvantaged teachers' mother tongue were also made.
2. An "energising" phase, where the area of discourse was relayed.
3. The interview itself, where the interviewer is continually probing, generally asking open-ended questions about issues to understand the range of responses the users produce. It is important at this stage for the interviewer to remain analytical and neutral.
4. The "closing" phase, where summaries are given as to what has taken place. This closing phase was not necessarily the final act of the interview, but was rather employed throughout the interviews to ensure my understanding of what was said and meant was accurate.

The focus of the semi-structured interview is decided upon by the interviewer who generally makes use of a framework of themes to be explored. By allowing the respondent

the time and scope to talk about their opinions, the interviewer gains an understanding of the respondent's point of view, rather than making generalisations. The interview thus mimics a conversation by employing open-ended questions. The wording of questions will not necessarily be the same for all respondents.

Riel and Levin's (1990) schematic framework for describing network communities was used to conceive the opening questions used in the semi-structured interviews. Their framework is used to isolate the features that correlate with successful patterns of network (ODEM) interaction. They proposed five network participant structures to guide analysis of group interaction on computer networks, namely:

- Organization of the network group
- Task organization
- Response opportunities
- Response obligations
- Coordination and evaluation

Organization of the network group refers to features associated with the network group that describes the participants' background outside the network. Task organization refers to the activity pursued, which may be highly specified or broadly defined. Response opportunities covers features surrounding ease of access of access to the network, while response obligations refers to features that support a shared commitment to make productive contributions to the network. Coordination and evaluation refers to the level of control and evaluation of the success of the network, either centralized (group members) or decentralized (outside leader). They suggest that successful networks deviate from the pattern proposed by one single feature, while unsuccessful networks deviate by two or more features. Stephens and Hartman's (2004) study of an online professional development project is an example of a prominent study that employed this framework to evaluate its success. Using the framework to set the opening questions of the interviews was useful since it provided opportunities to generate and encourage a comprehensive array of data from which tensions can be discovered.

The question-set as used during the interviews is provided in Annexure D. Not all questions were open-ended. Some questions, such as teachers' highest qualification, were asked to obtain exact information.

3.3.2.3 Direct observation

Direct observation included data collected from server logs and searching for (counting) patterns from the actual posts teachers made to the forum.

Server logs provided data on the number of times teachers practiced before they posted, their success rates, lurker statistics and the time of day they posted. XML-files of all their efforts, whether posted or not, provided an exact history of the content of posts which was useful for data analysis purposes (note that teachers were required to preview a post before submission, this step allowing for the generation of XML-files).

Looking for patterns in the posts was primarily a means of data analysis, yet it is a data collection method in itself. To avoid replication, these techniques are dealt with in section 4.4 where the framework employed is outlined in more detail.

3.3.2.4 Research diaries

As recommended by Lincoln et al. (1985) and Erlandson, Harris, Skipper and Allen (1993), a reflexive research diary was kept throughout the project in order to contribute to the reliability and objectivity of the current study.

Reflexivity is defined as *‘the capacity of any system of signification to turn back upon itself, to make itself its own object by referring to itself’* (Myerhoff and Ruby, 1982:p.2). A research diary kept throughout the life of a research project supported this process of reflexivity and encouraged meaningful internal dialogue about what seemed obvious and natural.

Teachers were also tasked to keep a research diary of their thoughts on and experiences with using the ODEM. In addition, and specifically in the data analysis phase, the memo writing capabilities of the Atlas-ti software package (see the next section) was employed to expand my research diary during coding. The advantage of such memos is that they are linked to specific sections of data, which makes reviews much easier.

3.3.2.5 Focus questionnaires

On completion of the data analysis, focus questionnaires were used to confirm certain themes that emerged and to recapture information that was incomplete. Not to be confused with focus groups which have very specific purposes, the focus questionnaire was a self-

devised tool I used “to tie loose ends” and confirm some findings upon completion of the data analysis. The focus questionnaire questions are provided in Annexure G.

The above sources contributed the data.

The raw data and hermeneutic units used in coding the data are available at <http://osprey.unisa.ac.za/mac/data.zip>.

The next step was to analyse the data.

3.4 Data analysis

With the exception of server logs, all the data collected through above methods were transcribed and fed into the commercially-available Atlas-ti software package for data analysis. The Atlas-ti software package is a powerful workbench for the qualitative analysis of large bodies of textual, graphical, audio and video data. It offers a variety of tools for accomplishing the tasks associated with any systematic approach to "soft" data, that is, material which cannot be sufficiently analyzed using formalized, statistical approaches.

An Atlas-ti *hermeneutic* unit was created with the following textual data sources:

- The disadvantaged teacher interviews
- The advantaged teacher interviews
- The teacher research diaries
- My own research diary
- The disadvantaged teacher ODEM posts
- The advantaged teacher ODEM posts

Hermeneutics is primarily concerned with the meaning of a text. The basic question in hermeneutics is: what is the meaning of this text? (Radnitzky, 1970).

Taylor (1976) describes hermeneutics as follows:

"Interpretation, in the sense relevant to hermeneutics, is an attempt to make clear, to make sense of an object of study. This object must, therefore, be a text, or a text-analogue, which in some way is confused, incomplete, cloudy, seemingly

contradictory - in one way or another, unclear. The interpretation aims to bring to light an underlying coherence or sense". (p.153)

As indicated earlier in this chapter, various techniques for analysing the data were combined. The first step was to use the Grounded Theory technique of open coding with the interview and journal data.

3.4.1 Open coding of interview and research diary data

Using open coding, the *interview* and *research diary* text were analysed by looking for different words in the statements and classifying part-statements with labels to explain the meanings of the different parts (Hansen et al., 2005). This process is concerned with identifying, naming, categorizing and describing phenomena in the text (Glaser et al., 1967). From the 13 teachers that participated, only 7 research diaries were returned.

During the first attempt, initial codes or labels were assigned to sections of text. Re-reading the text several times more resulted in some codes being changed, and others being renamed. This process brings themes to the surface from deep inside the data (Neuman, 2003). Rather than using nouns and verbs of a conceptual world as proposed by Guba and Lincoln (1981) and Strauss et al. (1990), I labeled the codes more descriptively. For example, rather than using the verb "value" on its own, I labeled a concept "value gained from participation". As a novice to the process of coding and surrounded by a lot of data, I considered this approach less confusing. An added value of this approach was that it prevented me from re-using existing labels across the two cases, thereby forcing case-distinct concepts into "best-fit" containers. As additional surety, I labeled the advantaged group in their and my mother tongue of Afrikaans, and the disadvantaged group in English.

The next step in the data analysis process was to use the Grounded Theory technique of axial coding.

3.4.2 Axial coding of interview and journal data

The purpose of axial coding is to find the categories into which the concepts can be classified. The meanings behind concepts are compared and categorized in order to explain the data material and relationships between concepts (Hansen et al., 2005).

I used the Network View Manager in Atlas-ti, to develop the categories by sorting concepts with similar meanings together. The Network View Manager makes it

particularly easy to revisit the exact text from which concepts arose, thereby ensuring that the meaning is as intended and that the concepts belong together. As an example, the category “Ease of use” developed out of the following codes: Easy to use (5); Equation editor difficult (1); Equation editor easy but troublesome (1); Expert finds it easy (2); Expressions time consuming (1); Usage problem (4) and Use became easier (1). The figure in brackets refers to number of quotations to which the code applied, giving an indication of its “groundedness”.

Having identified concepts and grouping them into categories, I adapted the next chronological step in Grounded Theory techniques to fit the Activity Theory purposes.

3.4.3 Activity Systems and classes from interview and research diary data

Activity Theory is useful to identify various activity systems which serve as units of analysis. The Grounded Theory technique following axial coding is selective coding, a process of choosing one category to be the core category and relating all other categories to that category. The essential idea is to develop a single storyline around which all everything else is draped. There is a belief that such a core concept always exists (Strauss et al., 1990).

The GT technique was adapted as follows: Categories identified in the previous steps were placed into classes, which served as a “category container”. For example, I placed the categories Preventative factors, Negative participation effects and Positive participation effects in a class which I named “Using the ODEM” (see Chapter 4). These categories fit here since they all contain concepts which related to the “use” of the ODEM by teachers. The difference in this approach compared to the authentic selective coding process is that rather than choosing one category from a group of categories to be the core category, a new “super” category was formed to act as a container (class) for related categories. The main purpose of these classes was to aid the identification of Activity Systems (see Chapter 4).

Once Activity Systems were identified, concepts were analysed and reported within the categories that led to the identification of the Activity Systems. Thereafter, and within an “Activity System”, connections between categories and its concepts were integrated as part of the interpretation phase, thereby bringing meaning and coherence to the categories, developing linkages between tensions identified and making sense of the collected

interview and research diary data. This analysis process and the procedures followed are reported in Chapters 4 to 7 as part of the interpretation phase.

Having analysed the interview and journal and research diary data, an analysis of the ODEM posts was done.

3.4.4 Analysis of ODEM posts

The main purpose of analysing the nature and patterns participation and posts was to discover possible tensions. The analysis process followed was a process of discovery as no existing framework is available. While a literature and Internet search on on-line forum use provided some clues as to a possible framework, some aspects of the framework provided here below grew out of the available data as it was analysed and concepts were formed. These concepts gave rise to further questions being asked about the data, and thus the framework expanded. No specific references are provided since it is a mixture of many unpublished resources and my own insight into general forum use, categorized according to the type of information I wanted to extract in order to gain a clear and comprehensive understanding of the nature and patterns of participation and posts.

Analysis was not confined to the text of the postings made to the ODEM. Evaluating teacher *attempts* at posting was useful in that it provided an indication of how easy it was for teachers to use the ODEM. Since all activity on the post form of the ODEM was also recorded in an XML file, I had a precise server record of the nature of posts not submitted (see section 3.3.2.3).

Note that while the primary use of the ODEM was for reflective purposes, teachers were not limited to just reflecting on their practice as teachers. They were encouraged to use the ODEM as they see fit or require, and the framework provides for these possibilities.

The framework employed was as follows:

- 1) Attempts
 - a) Practise, i.e. previews before post
 - b) Successful, i.e. successfully posted
 - c) Unsuccessful, i.e. not successfully posted

- 2) Postings
 - a) Number of active participants
 - b) Post and response patterns (interaction)
 - c) Lurker statistics (not posting but reading)

-
- d) Frequency of participation
 - e) Time of day
 - f) Nature of posts by classification
 - i) Questions
 - For clarification (to make clear, easier to understand, clear confusion/uncertainty, elucidate)
 - For support (require aid)
 - For solutions (require an answer to a problem)
 - Support in using the ODEM
 - ii) Responses
 - Agreeing (grant consent with what was said)
 - Affirming (maintain that what was said is true)
 - Offering a solution (providing an answer to a question)
 - Correcting (remove/indicate/remedy errors)
 - iii) Statements
 - Negative (opposition, resistance, refusal, denial, disagreeable, pessimistic, hostile)
 - Positive (certainty, acceptance, confident, no doubt, very sure, practical rather than theoretical)
 - iv) Reflective practices
 - Descriptive reflection
 - Dialogic reflection
 - Critical reflection

In Chapters 4-6, which deal with the first 3 research questions, this framework is more accurately described as part of the analysis process.

In summary, the previous sections listed the approaches followed in analysing the available data. These approaches were broadly defined. To espouse understanding of the data analysis process, it made more sense to expand on the approaches where it is employed in Chapters 4 – 7. The reader is thus directed those chapters for further information on the approaches followed.

The next section deals with issues related to canons of quality, providing the criteria of soundness of the current study.

3.5 Narrative inquiry, validity, reliability, transferability, trustworthiness and thick description

Sandelowski and Barroso (2002) note that whereas tables and figures provide much of the appeal in quantitative research, tableaux of experience and figures of speech provide much of the appeal in qualitative research:

Writers wanting to write appealing qualitative research reports tend to use devices, such as expressive language, quotes, and case descriptions, in order to communicate that they have recognized and managed well the tensions, paradoxes, and contradictions of qualitative inquiry. (p.8)

Sandelowski and Barroso (2002) also quote Van Maanen (1988) who says that qualitative writers desire to tell "tales of the field" that convey:

their methodological rigor, but also methodological flexibility; their intimacy with - while maintaining their distance from - their subjects and data; and, their fidelity to the tenets of objective inquiry, but also their feeling for the persons and events they observed. In this endeavour, qualitative writers want their reports to be as true as science is commonly held to be, and yet as evocative as art is supposed to be. (p.xviii)

Marshall et al. (2006) say that narrative inquiry seeks to understand sociological questions about groups, communities and context through individual's life experiences. Not without criticism, several authors such as Connely and Clandinin (1990), Riesman (1993) and Guba and Lincoln (1981) have provided criteria for good narrative inquiry. Kuzel and Like (1991) provide four characteristics of a qualitative study that increases the validity or trustworthiness of research findings:

1. *Member checking.* A technique utilized during the interview, member checking consists of the researcher restating, summarizing, or paraphrasing the information received from a respondent to ensure that what was heard or written down is in fact correct. Following data collection, member checking consists of reporting back preliminary findings to respondents or participants, asking for critical commentary on the findings, and potentially incorporating these critiques into the findings. These techniques raise the credibility of the study, with credibility being analogous to internal validity. The first requirement was adhered to largely as a result of

interviewer en vernacular effects (see Chapter 9). The second requirement was partially fulfilled by the use of focus questionnaires.

2. *Disconfirming Evidence.* This technique seeks accounts from other respondents that differ from the main or consensus accounts in critical ways. The validity of data is strengthened by the inclusion of complementary and conflicting data. The findings are stronger and more convincing if less disconfirming evidence is found. During the interviews, statements uncovered in earlier interviews were constantly tested with other teachers. In the concluding chapters, the results are also compared, where possible, with the extant literature in order to confirm and deny findings.
3. *Triangulation.* The primary goal of triangulation is to gather multiple perspectives so as to gain a more complete understanding of phenomena. Section 3.2.2 already covered the use of triangulation.
4. *Thick Description.* This refers to a detailed description of a phenomenon that includes the researcher's interpretation in addition to the observed context and processes. It may also include providing a thorough accounting of the methods and procedures followed during and after data collection. The current study made use of thick description wherever possible. For example, during analysis of the disadvantaged data I became increasingly aware that the results pointed towards the important role townships and school problems played in teachers' practice. While teachers did mention these problems in their interviews, the method followed highlighted the importance thereof.

Guba et al. (1981) add two other characteristics, namely transferability and dependability.

5. *Transferability.* Refers to the degree that findings can be transferred or generalized to other settings, contexts, or populations. To enhance transferability, a qualitative researcher needs to detail the research methods, the contexts, and assumptions underlying the study. Transferability is analogous to external validity, that is, the extent to which findings can be generalized. This chapter attempted to detail the research methods, while the assumptions and context were dealt with in Chapters 1 and 2 respectively.
6. *Dependability.* Relates to the importance of the researcher accounting for, or describing the changing contexts and circumstances that are fundamental to

qualitative research. Dependability is enhanced by altering the research design as new findings emerge during data collection. Dependability is analogous to reliability, that is, the consistency of observing the same finding under similar circumstances. The current study's research design changed numerous times until a "best fit" was achieved. Initially perceived as an Action Research design, it changed to a Grounded Theory design, then to an Activity Theory design before the current design was finalized when patterns were identified from the data.

3.6 Summary

Given the research questions of the current study, this Chapter argued for a qualitative research approach and a philosophical base that is revelatory, interpretive and descriptive. Within this approach and base, the appropriate research methods were identified to be Grounded Theory and Activity Theory within a Case Study context. The research design was discussed at length, while the Chapter concluded with canons of quality as it relates to narrative inquiry, validity, reliability, transferability, trustworthiness and thick description.

In concluding, the data analysis route used closely follow two statements by Cole and Knowles (2001):

“ While the analysis process does require systematic and disciplined attention to the information gathered, and is, in a sense, a reductionist activity; it does not require researchers to devise and strictly adhere to a rigid categorization system or analytic scheme. To do so would to risk the parts for the whole” (p.22)

“Understandings of participants' lives in context can never be truly whole or complete; however, we must strive to honor the richness and complexity of lives lived. We do so not by taking information and slicing it into discrete bits and storing the pieces in separate containers, but trying to understand, in a holistic way, the connectedness and interrelatedness of human experience within complex social systems” (p.11)

4. Case Study 1: The Disadvantaged Group

4.1 Introduction to Case Study 1

- 4.1.1 Approach followed
- 4.1.2 Conventions used

4.2 Identification of Case Study 1 Activity Systems

4.3 Description of DAS 1: Connecting to the ODEM

- 4.3.1 Decomposition of DAS1: Connecting to the ODEM
 - 4.3.1.1 Background – Pre-preparation phase
 - 4.3.1.2 Tensions in **DAS1**: Connecting to the ODEM
 - 4.3.1.2.1 T1|**DAS1**: Creating Internet Accounts
 - 4.3.1.2.2 T2|**DAS1**: Connecting to the ODEM and T3|**DAS1**: Lack of Suitable Support Structures

4.4 Description of DAS2: Using the ODEM

- 4.4.1 Decomposition of DAS2: Using the ODEM
- 4.4.2 Attempts
 - 4.4.2.1 Practice
 - 4.4.2.2 Correct
 - 4.4.2.3 Wrong
- 4.4.3 Postings
 - 4.4.3.1 Number of active participants
 - 4.4.3.2 Post and response patterns
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 - 4.4.3.5 Time of day
 - 4.4.3.6 Nature of posts by classification
- 4.4.4 Tensions in DAS1 and DAS 2 – Interview and Research Diary data

4.5 Interpretation of interview and Research Diary data

- 4.5.1 Connecting to the ODEM
 - 4.5.1.1 Connecting to the ODEM
- 4.5.2 Shared
 - 4.5.2.1 Financial factors
 - 4.5.2.2 Support required
- 4.5.3 Using the ODEM
 - 4.5.3.1 Preventative factors
 - 4.5.3.2 Negative participation effects
 - 4.5.3.3 Positive participation effects
 - 4.5.3.4 Suggestions
 - 4.5.3.5 Training
 - 4.5.3.6 Value of ODEM
 - 4.5.3.7 Personal characteristics
 - 4.5.3.8 Ease of use
 - 4.5.3.9 Other use of PC than for ODEM
 - 4.5.3.10 Motivation for participation
- 4.5.4 Asked
 - 4.5.4.1 Point of access
 - 4.5.4.2 ODEM versus cluster meetings
 - 4.5.4.3 Leader required
 - 4.5.4.4 Content versus reflection

- 4.5.4.5 PC-literacy
- 4.5.4.6 Cross-cultural

4.6 Synthesis

4.7 Summary

4.1 Introduction to Case Study 1

This chapter deals exclusively with the first research question, that is:

What are the personal and situational tensions that impact on the use of a mathematics-friendly online forum environment as a reflective tool for the CPD of disadvantaged mathematics teachers?

In order to discover these tensions, cognisance is taken of Miles and Huberman's (1994) statement that there are no fixed formats in the reporting of qualitative data. In this research the goal is firstly to select, condense and transform the data, then to display the data in an organized way, and then to draw and verify tensions from the displayed data. There is an advantage in such an approach. According to Erickson (1986), the reader becomes co-analyst, experiences the original setting vicariously, looks at the evidence, weights the interpretations and perspective by noting how it changes along the way.

4.1.1 Approach followed

In order to discover tensions, the analysis and reporting of data was pursued in the following order.

As a first step the interviews with the disadvantaged teachers, their and my own research diary entries were open-coded in order to indentify emerging concepts. These concepts were then grouped together in categories of best-fit. The relevant categories that emerged were then used to identify sub-cases, or Activity Systems.

Secondly, each Activity System was then "decomposed" within its framework of subjects, rules, community, division of labour and the objects and goals by way of a chronological report in narrative format. An attempt was made to interpret the collected data by identifying and describing the Activity System's components and possible tensions that existed in and between components. Decomposition was a revelatory process – with each additional category decomposed, more insight was gained into previously decomposed categories. These insights forced me to regularly revisit the raw data in order to confirm

and/or expand the growing “picture” that emerged. Thus, rather than following a step-wise process, a cyclic process of open-coding, decomposition and axial coding was adopted. That is, as more and more categories were decomposed, more tensions surfaced which either explained or exaggerated previous tensions.

Thirdly, connections between categories and its concepts were integrated as part of the interpretation phase – bring meaning and coherence to the categories, developing linkages between tensions identified and making sense of the interview and research diary data and the posts made to the ODEM. In a GT approach this process is known as axial coding. In this endeavour lied additional purposes of confirming existing or indentifying other tensions that may resolve of exaggerate the tensions already identified. Note that axial coding was not a third step as such, but attempted throughout this chapter as tensions emerged.

In this chapter, no attempt is made to connect findings to the literature. That is done in Chapter 9 where final conclusions are drawn. As indicated in section 3.4, the primary purpose of the interpretation phase, which this chapter forms part of, is to systematically reduce the data.

4.1.2 Conventions used

The following conventions are used in this and the following chapters:

- **Teacher’s identities:** Given the perceived sensitivity of the research design, no permission was sought to use teacher’s real names in reporting the data. Teachers registered on the ODEM with the online tags Unisa1, Unisa2, Unisa3 and so on in order to protect the subjects’ privacy and to prevent biasness in interpretation, and these same tags were used in reporting the data.
- **Quoted sections from the interview and research diary data:** Interview quotes or ODEM posts were not edited and are reproduced as was. A quote is followed by the teacher identification tag.
- **References to a Category:** the *Category* name appears in italics.
- **References to a Class:** the Class name is underlined.

- **Concepts:** These are my thoughts in words that made sense to me and that summarized a particular section of the interview, ODEM post and Research Diary data. Collectively they resulted in the emergence of *categories*, which in turn led to the discovery of classes.
- **Conventions for tensions: *T1/DASI*:** *Name of Tension* refers to the first tension (T1) identified from Disadvantaged Activity System1 (**DAS1**), followed by a descriptive label of the tension identified in italics.

4.2 Identification of Case Study 1 Activity Systems

Table 4.1 provides a condensed class view of the category data on the disadvantaged group as it emerged after the open coding process. In the table, *Categories* are grouped in classes. The figure in brackets that appears after each category name is a reference to the number of concepts that emerged during the coding process, and which gave rise to the category. It is provided here to show the “groundedness” of the categories to be used in identifying Activity Systems. For example, the category *Connecting to the ODEM* in the Connecting to the ODEM class has 23 concepts associated with it.

Table 4.1 Class view of category data

Class	<u>Connecting to the ODEM</u>	<u>Shared</u>	<u>Using the ODEM</u>	<u>Asked</u>
Categories	<ul style="list-style-type: none"> • Connecting to ODEM (23) 	<ul style="list-style-type: none"> • Support required (19) • Financial factors (13) 	<ul style="list-style-type: none"> • Preventative factors (48) • Negative participation effects (25) • Positive participation effects (36) • Suggestions (13) • Training (17) • Value of ODEM (25) • Personal characteristics (15) • Ease of use (15) • Other use of PC than for ODEM (11) • Motivation for participation (5) 	<ul style="list-style-type: none"> • Point of access (7) • ODEM vs. Cluster (10) • Subject Advisor required (16) • Content vs reflection (11) • PC literacy (25) • Cross-cultural (7)

The class Connecting to the ODEM is linked to categories that has to do with providing and having access to an Internet-ready computer and successfully making an Internet connection to the ODEM in order to participate. The class Using the ODEM relates to categories that is self-descriptive, such as *preventative factors*, *negative participation effects* etc that impacted on the ODEM and its use. The Shared class is shared between the Connecting to the ODEM class and the Using the ODEM class, since some of the category

concepts exist in both these classes. The Asked class is referenced here but not considered for purposes of identifying Activity Systems since its categories were not discovered – their existence is the result of pre-defined questions that were asked during the interviews. For example, teachers were asked if they prefer access to the ODEM from home or from school. The category *Point of Access* was therefore not discovered – it exists because of a pre-constructed question that required a specific answer, such as ‘home’ or ‘school’. However, in answering a direct question like this, teachers may provide additional clues to tensions not necessarily related to ”home” or “school”.

Using the classes identified, the following two Activity Systems are readily identifiable from Table 4.1: (a) Disadvantaged Activity System 1 (**DAS1**): Connecting to the ODEM, and (b) Disadvantaged Activity System 2 (**DAS2**): Using the ODEM

Each Activity System is firstly described and then decomposed in the following sections without any reference to the categories. The categories themselves will be decomposed after the Activity Systems has been dealt with, specifically from section 4.5 onwards.

4.3 Description of DAS 1: Connecting to the ODEM

Consider Figure 4.1 which graphically depicts **DAS1**: Connecting to the ODEM.

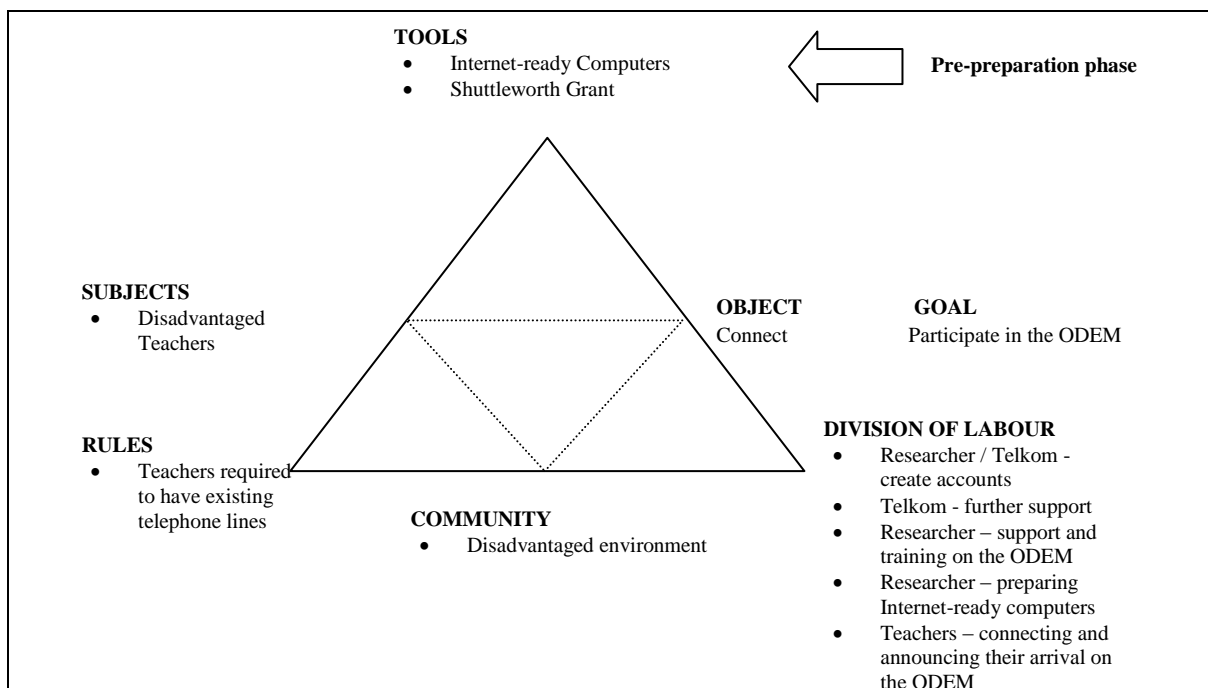


Figure 4.1 DAS1: Connecting to the ODEM

The central process of **DAS1**: Connecting to the ODEM is at the *Subjects -> Tools -> Object* level. In essence, it speaks of teachers from a disadvantaged community that must connect to the Internet in order to participate in the ODEM.

More specifically, the *object* was to connect to the Internet and the ODEM in order to realize the *goal* of participating in the ODEM. The *subjects* were the disadvantaged teachers. The *tools* were Internet-ready computers and the Shuttleworth Grant that allowed for the purchase of computers and the payment of Internet connection accounts on behalf of the teachers.

The key to understanding the relationship between a particular Activity System and the community wherein it occurs is in the degree of alignment in *tools, rules* and *division of labour*. Referred to as the socio-historical aspects of mediation, it provides the context of a disadvantaged community. Here the *rules* were somewhat emergent, but initially started off as that teachers must have existing telephone lines in order to connect to the ODEM. The *community* was the disadvantaged environment teachers worked and lived in. The *division of labour* included Telkom, to create accounts, be available for further support in case teachers are unable to make a connection, myself to provide additional support on unresolved problems and training teachers in the ODEM, and teachers who had to connect to the ODEM and announce their arrival by a post.

4.3.1 Decomposition of DAS1: Connecting to the ODEM

If all components of **DAS1**: Connecting to the ODEM is in balance, the goal of participating in the ODEM remains the focus of the Activity System. However, if tensions exist in any one or all of the components, the goal will change. For example, if a teacher does not have an existing telephone line, the Activity System becomes unbalanced for that teacher, and his or her new *object* is to obtain a telephone line. In this manner, a new Activity System is spawned. This new Activity System's *goals* must be met before the original Activity System can resume. In decomposing the identified Activity Systems, no attempt is made to decompose any secondary Activity Systems as this would detract from the focus of the study – to identify those tensions that imbalance the original *object* and *goal*.

4.3.1.1 Background – Pre-preparation phase

A pre-preparation phase, which largely negated the role of teachers, existed before **DAS1**: Connecting to the ODEM could be mediated. This phase is indicated in Figure 4.1 as impacting on the *tools* of **DAS1**. Its purpose was to prepare Internet-ready computers, which teachers can merely plug-in to their existing telephone line jack, and which would enable them to connect to and participate in the ODEM.

Refurbished computers were bought with the Shuttleworth grant. Principal specifications of the order were a P111 350 MHz processor, a 20Gigabyte Hard Disk Drive and 256K of memory. These specifications were largely dependent on the grant amount, and were considered appropriate given the primary and sole purpose of the computers – to connect to the ODEM. Although specifically requested to be Internet-ready computers, they arrived without modems and a CD-Rom to install an operating system and required software. Additional funds were made available by the Shuttleworth grant to purchase the missing hardware. In order to ensure maximum speed of computers together with ease of use, Windows ME was selected as the operating system of choice since software installations were minimal (Internet Explorer 6.0, the MathML-plugin and TextAide, to generate mathematical expressions). Newer operating systems such as WinXP would have placed too great a demand on the available processing power and memory. Windows ME was installed via a Microsoft Academic Alliance license which allowed use for research purposes.

Before delivery of the computers, a manual configuration of each PC's Internet settings was required (the configuration details of each computer's Internet account is generated and supplied by Telkom on creation of a user account). The account of choice was the Surfmore 10 package, which included line rental and 10 hours free Internet connection per month after 19h00. The cost of this account was R227 per month, and offered an advantageous connection rate.

While essentially part of the pre-preparation phase, the creation of accounts overlapped its boundaries by becoming a tension in **DAS1**: Connecting to the ODEM. Whereas I was fully responsible for preparing the computers up to this stage, teachers, as telephone line owners, were an integral part of the accounts creation process since they have to provide permission for these Internet accounts to be integrated into their existing telephone

accounts. This part of the pre-preparation phase is thus included and reported in the next sections which deal with tensions in the **DAS1: Connecting to the ODEM**.

4.3.1.2 Tensions in DAS1: Connecting to the ODEM

There are no prescribed procedures available to identify the tensions that existed in **DAS1: Connecting to the ODEM**. Rather, it was my deep engagement in the pre-preparation phase as well as interview and research diary data that allowed me to identify tensions pervasive to the stability of the Activity System. These tensions discovered were the result of contradictions that arose in the mediation processes of the Activity System, that is, when the accepted or expected way of doing things were in conflict with what was really happening. These tensions may result in the breakdown of the Activity System, and how these tensions are resolved (or exaggerated) require continuous transformations, or alternatively, the development of new practices. It is these transformations or new practices that ultimately lead to an understanding of the impact of tensions.

The tensions identified from **DAS1: Connecting to the ODEM** were (a) T1|**DAS1: Creating Internet Accounts**, (b) T2|**DAS1: Connecting to the ODEM** and (c) T3:**DAS1: Lack of Suitable Support Structures**. They are discussed in more details in the next sections.

4.3.1.2.1 T1|DAS1: Creating Internet Accounts

This tension impacted at the *rules-> community -> division of labour* level and therefore occurred in the cultural and historical context of the disadvantaged community.

In a community where computer ownership is likely to be low, teachers were expected not to have any experience in ordering Internet accounts from Telkom, and it made sense to apply, on their behalf, for their individual accounts. Such an approach had the added advantage that I was in possession of all the account settings required to configure their computers for Internet connections which eliminated unnecessary tensions. This process required faxing the personal details and day contact telephone numbers of teachers to a Telkom Call Centre agent, in order for the agent to get permission from every teacher to create an Internet account as the cost thereof is debited monthly against their existing telephone accounts. The money from the Shuttleworth grant would then be deposited into their bank accounts before the due date of their monthly accounts to minimize the

possibility of financial hardships. Internal Telkom rules prevented payment of the full amount in advance.

Obtaining accounts proved a difficult process, as my research diary entry on 2006-01-25 testifies:

The contact details of teachers as provided by the Subject Advisor are outdated and incomplete in many instances. In order to update their information so I can forward it to Telkom, is a tedious process. Trying to make contact with teachers via their school contact numbers proved extremely difficult. I have now resorted to faxes, which is marginally more successful since it requires having to redial for a fax line in many instances, only to find the line not fax-ready and having to redial – and then having the call going unanswered. It scares me to think that this process may have to be repeated in future for other purposes...

Research Diary - self

This assumption proved correct. The difficulty experienced in contacting the disadvantaged teachers remained a tedious process throughout the project and led to many delays. The relevant information was eventually obtained and faxed to the Telkom Call Centre agent. These preliminary difficulties, however, were soon transcended in enormity by a breakdown in **DAS1**.

Despite having access to teachers' correct cell phone numbers as supplied per fax, the Telkom Call Centre agent was also not able to make contact with all the teachers in a reasonable time frame. This was partly due to unavailability of teachers during her office hours (which mirrors teachers' school and teaching hours), and partly due to her position as Call Centre agent, which required her to attend to other customers inbetween her efforts to contact teachers. The structure of a Telkom Call Centre is also such that I could not contact her for progress updates as Call Centre calls are relayed to a generic number and automatically directed to the next available operator. A direct number to her was also not available, and I was dependent on her calling back. This inefficient support structure provided many frustrations and my research diary entry on 22-02-06, a few days before the planned workshop where teachers were supposed to receive their Internet-ready computers, introduces the Activity System breakdown:

Telkom informs me some of the teachers do not have telephone lines, but have ordered lines.

Having an existing telephone line was a specific requirement in the contract they've signed with me.

This will delay the project substantially...

Research Diary - self

It subsequently transpired, via the Telkom agent, that of the nine teachers participating, only four had existing telephone lines, of which two were prepaid accounts. The prepaid accounts were not valid for the Surfmore 10 packages ordered and their lines had to be upgraded to permanent lines, which held financial implications for these teachers on discontinuation of the project. The other teachers had, however, ordered lines to be installed, a process that could potentially take months to complete. A total of five lines had to be installed before accounts could be created and the project could continue.

Suffice to conclude that not only was a breakdown in **DAS1: Connecting to the ODEM** experienced, but T1|**DAS1: Creating Internet Accounts** was exaggerated and could only be resolved once telephone lines were installed.

In the interim, and given the difficulties experienced in contacting teachers, it was decided to continue with the intended workshop, thereby providing an opportunity to meet the teachers face-to-face for the first time, to discuss their telephone lines situation and to introduce them to the ODEM which was locally installed on a laboratory network. The workshop took place on Saturday 25 February 2006 at Unisa's computer laboratory on the Muckleneuck Campus in Pretoria.

My research diary entry after the workshop read:

The telephone line situation is not as bad as first led to believe by Telkom, who is to create their accounts and will oversee (and hopefully jump-start) the installation of telephone lines. Teachers with pre-paid phones are happy to convert to full-lines - I will pay their rent for the period of the project, since the rent of those that have applied for, and have full lines, are included in the Surfmore package.

Overall, a much more positive outcome than I anticipated. They are keen (and courteous) and understand that they also gain value (other than the PC's) out of this study. I realized how much need there is out there for CPD under these teachers.

Research Diary - self

It subsequently transpired that one teacher was black-listed due to non-payment, and could therefore not convert to a full-line. Pre-paid accounts, it later turned out, can in fact connect to the Internet, but not through the benefit of reduced rates associated with a Surfmore package. In the current context, some control was lost since there was no guarantee that the teacher would use the money paid into his bank account to purchase pre-paid Internet time.

The working relationship built up with the Telkom agent then came to an abrupt end when she did not report back on the status of the telephone line installations and when it became impossible to make further contact with her through the Telkom Call Center. A new relationship with another agent was secured when he provided me, against policy, with his personal cell phone number which made communication much easier and fast-tracked the process. Nonetheless, the physical process to install the outstanding telephone lines took another three months before T1|DAS1: *Creating Internet accounts* was resolved.

My research diary entry of 2006-05-24 concludes:

Finally!! It took 4 months to get lines installed and accounts sorted out! We can continue with the project!

Research Diary - self

Configuration of Internet accounts on the computers was completed, and each computer was tested by connecting to the Internet, visiting the ODEM and posting messages, inclusive of mathematical expressions.

On the 4th of June 2006, the second workshop was held, where teachers received their computers, training in connecting the computer peripherals at home and further training in using the ODEM. They were also introduced to reflective practices and received documented guidelines on reflective techniques. They were also informed that despite the requirement to reflect on their practice, they were welcome to use the ODEM for any purpose they see fit. Some time was spent explaining the support route. To ensure that such problems are not Telkom related, they were requested to phone the Telkom helpline if they experience connection problems. Mindful of the earlier difficulties experienced in contacting teachers, the second step was to contact me by sending a “Please Call Me” SMS message. I would then contact them after school hours. Everything seemed on track.

A focus on support routes was perhaps intuition, since connection problems quickly realized itself as the second tension: T2|DAS1: *Connecting to the ODEM*.

4.3.1.2.2 T2|DAS1: *Connecting to the ODEM* and T3|DAS1: *Lack of Suitable Support Structures*

In the week following the workshop I waited in immense anticipation for teachers to announce their arrival on the ODEM. This did not happen as a myriad of connection problems besieged 5 of the 7 teachers.

The category *Connecting to the ODEM* in Figure 4.1 shows a total of 23 concepts harvested from research diary entries and teacher interviews that gave rise to this tension.

As instructed, teachers phoned Telkom for support. With one exception, their problems were not resolved. The net result was that I received various calls for in-person support, thereby taking over Telkom's supporting role. The nature of their problems created problems not anticipated. With the exception of two teachers who had their own means of transport, it demanded from teachers to make use of public transport to visit me at home, after hours, in order to resolve their connection problems. However, such support could not be provided 24/24, and in some instances teachers did not answer their phones in the evenings. While the majority of teachers had cell phones over and above their telephone lines, it did not mean instant communication channels existed. The inevitable result was that T2|DAS1: *Connecting to the ODEM* was exaggerated.

In three cases the problem was related to the modem not emitting a handshake signal to Telkom's connecting server. Since the modems were brand-new and were successfully tested before delivery, the problem was traced to "card creep", a phenomenon which typically occurs when older computers are transported by road over bumpy surfaces, as is typically found in Townships.

One particularly interesting connection problem was resolved after numerous failed support calls to Telkom and a support visit to me. Although having received training on connecting the hardware peripherals, it transpired that one teacher had inserted her telephone cable into the network input jack on the modem, which is much larger than the telephone line jack. Despite the cable clearly not fitting, she precariously balanced it in the over-large jack, assuming that contact is made. In her case, T2|DAS1 was exaggerated. An isolated incidence, it nevertheless illustrates the challenges of providing support.

Once all teachers' connection problems were solved, two teachers did experience further connection problems, but these were related to the typical unavailability of connections or connectivity drops, which all Internet users experience from time to time. Teachers were notified to expect these non-connections, and to only report consistent problems.

One teacher decided to upgrade his operating system to WinXP in the misplaced support of a friend that it will resolve his intermittent connection problems. He visited me with his computer to have the original Windows ME software installed when the computer

experienced many other problems unrelated to his connection to the Internet. The tension T2|**DAS1** *Connecting to the ODEM* eventually resolved itself by the 24th of June 2006, nearly a month into the project.

From the previous sections, a 3rd tension, T3|**DAS1**: *Lack of Suitable Support Structures*, is readily evident. This tension existed in the lack of support in creating accounts, teachers not having ease of access to support and the difficulties experienced in providing secondary support to teachers.

Despite connection problems being resolved, the first post received on the ODEM was only made on the 27th of June, 2006. This introduces **DAS2**: *Using the ODEM*.

4.4 Description of DAS2: Using the ODEM

Figure 4.2 graphically depicts **DAS2**: *Using the ODEM*.

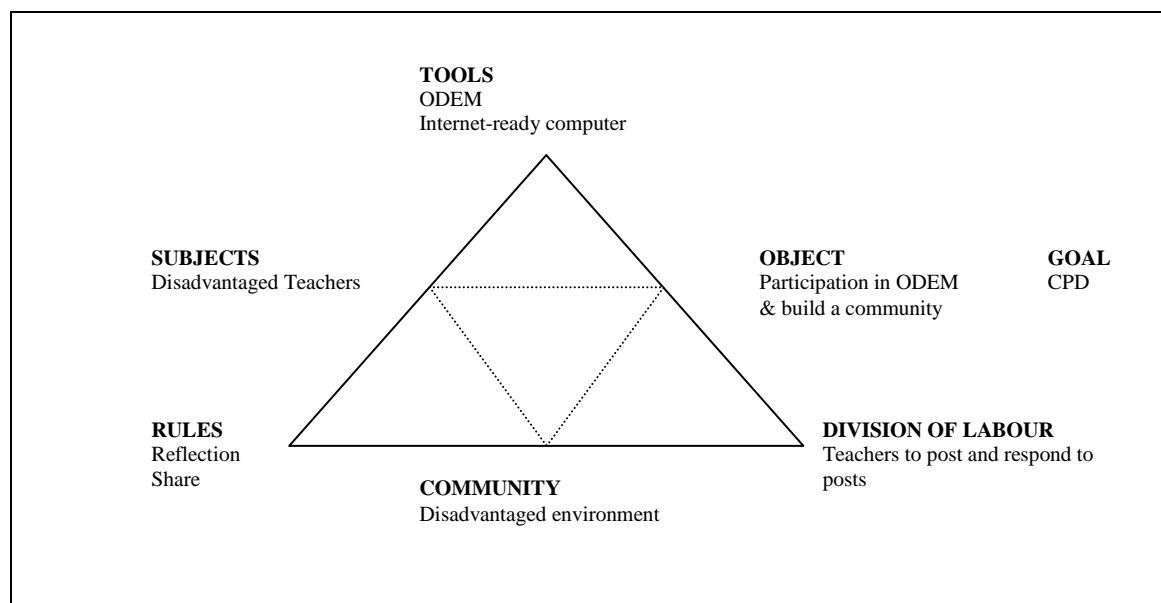


Figure 4.2 DAS2: Using the ODEM

As with **DAS1**, the central process of **DAS2**: *Using the ODEM* exists at the *Subjects* -> *Tools* -> *Object* level. Here teachers (*subjects*) had to use their Internet-ready computers (*tool*) to connect to the ODEM (another *tool*) in order to participate in the ODEM and build a community (*object*) in order to realize the *goal* of CPD. The *rules* were that teachers had to reflect on their practice and share their experiences with other teachers, although they were provided with scope to use the ODEM for whatever purposes they felt fit. The *community* was the disadvantaged environment teachers worked and lived in while the *division of labour* was to post and respond to posts.

As indicated in the previous sections, some teachers continued to experience connection problems. Individual connection problems were resolved by June, and therefore the first month of participation (June) slightly overlaps Activity Systems 1 and 2.

4.4.1 Decomposition of DAS2: Using the ODEM

In order to discover tensions in **DAS2**, it was necessary to evaluate teachers' actual posts in the ODEM. By carefully reviewing the nature and patterns of their participation and posts, clues as to which tensions existed may be uncovered. The validity of tensions, however, can only be substantiated as part of the interpretation phase.

How to evaluate the nature and patterns of participation and posts was a process of discovery as no existing framework was available. While a literature search on on-line forum use provided some clues as to a possible framework, some aspects of the framework provided here below grew out of the analysis of the current data. No specific references can be provided as it is a mixture of many unpublished resources and the my own insight into general forum use, categorized according to the type of information I wanted to extract in order to gain a clear and comprehensive understanding of the nature and patterns of participation and posts.

Evaluating teacher attempts at posting were useful in that it not only provided an indication of how easy it was for them to use the ODEM, but also provided insight into the nature of participation and posts to the ODEM. As indicated, teachers were not limited to reflective practices, thus all posts were analysed whether they were reflective in nature or not.

DAS2: Using the ODEM was evaluated within the following framework:

1. Attempts
 - a. Practice, i.e. preview before post
 - b. Successful, i.e. successfully posted
 - c. Unsuccessful, i.e. not successfully posted
2. Postings
 - a. Number of active participants
 - b. Post and response patterns (interaction)
 - c. Lurker statistics (not posting but reading)
 - d. Frequency of participation (over the period of the project)
 - e. Time of day
 - f. Nature of posts by classification
 - i. Questions
 - For clarification (to make clear, easier to understand, clear confusion/uncertainty, elucidate)
 - For support (require aid)

-
- For solutions (require an answer to a problem)
 - Support in using the ODEM
- ii. Responses
- Agreeing (grant consent with what was said)
 - Affirming (maintain that what was said is true)
 - Offering a solution (providing an answer to a question)
 - Correcting (remove/indicate/remedy errors)
- iii. Statements
- Negative (opposition, resistance, refusal, denial, disagreeable, pessimistic, hostile)
 - Positive (certainty, acceptance, confident, no doubt, very sure, practical rather than theoretical)
- iv. Reflective practices
- Descriptive reflection
 - Dialogic reflection
 - Critical reflection

The following sections deal with each of the categories.

4.4.2 Attempts

Consider Table 4.2, which shows the teachers, their number of practice posts (preview) and their submitted posts to the ODEM.

Table 4.2 Attempts

Teacher	Practise	Submitted posts	Ratio
Unisa1	25	23	1.1
Unisa2	38	2	19.0
Unisa3	23	7	3.2
Unisa4	10	7	1.4
Unisa5	30	23	1.4
Unisa6	30	10	3.0
Unisa7	34	14	2.4
Unisa8	0	0	0
Unisa 9	5	1	5.0
Total	195	86	Ave 2.3

4.4.2.1 Practise

In order to generate the MathML which the ODEM requires, a teacher was required to preview his post before submitting. Thus, for one post, a minimum of one preview is required, providing a ratio of 1. More previews imply teachers are either actively rephrasing their messages during the writing process to construct clearer or more meaningful posts, or are struggling with generating mathematical expressions (complex

mathematical expressions may require more previews in order to ensure they are correctly generated). The last option was discarded given the fact that none of the posts included any mathematical expressions (Section 4.4.1.2). Each preview effort was stored on the server in XML format with the exact date and time of the effort.

Given the difficulties experienced in contacting teachers, the ODEM was used to relay administrative news, for example, when money will be paid into their bank accounts. There were several responses to these posts, but given the purposes of this research, these posts were ignored.

With the exception of Unisa1, Unisa4 and Unisa5, most teachers previewed several times before they posted. Unisa1 and Unisa5 previewed more or less the minimum required previews in order to post, whereas Unisa2 and Unisa3, in contrast, previewed numerous times but failed to submit these previewed posts. It is interesting to note how the ratio between actual posts and previews generally increases with fewer posts. For example, Unisa1 and Unisa5, who contributed the most posts (23 each), had the lowest ratios of 1.1 and 1.4 respectively. Other ratios in descending order of number of actual posts (listed as **posts:ratio**) are **14:2.4; 10:3; 7:3.2; 7:3.2; 2:19; 1:5**. With one exception of Unisa4, (**7:1.4**) there is an inverse relationship between the number of posts and number of previews. That is, with fewer posts, more previews are generated. Overall, of 195 previews, only 86 posts were generated, providing a ratio of 2.7 previews to one submitted post.

A review of the XML-data revealed that at times, posts were prepared and previewed but not submitted. This finding indicates that teachers intended to post, but did not. Of course, it may also indicate that teachers practiced with no intention of submitting. However, since none of the XML-data contained any evidence of mathematical expressions, it is unlikely that teachers would have practised text-based posts.

Considering all the evidence thus far, a tension exists. This tension is branded as T1|**DAS2: What to Post**, indicating that teachers were unsure as to what to post, whatever the reason for their uncertainty.

4.4.2.2 Correct

A total of 85 posts were successfully posted to the ODEM over the period of 4 months. None of the posts included any mathematical expressions.

4.3.2.3 Wrong

Only one post was unsuccessfully posted, which was related to a failure to preview.

4.4.3 Postings

Several insights into the use of the ODEM were gained by reviewing the pattern and type of posts made to the ODEM.

4.4.3.1 Number of active participants

Refer to Table 4.2. In general Internet forum use an active participant is someone who maintains their membership over a period of time, regardless their number of posts. Here an active participant implies a teacher who contributed on a regular basis over the period of the project in comparison to the other teachers. Only 3 teachers, namely Unisa5, Unisa1 and Unisa7 can be considered as moderately active participants with 23, 23 and 14 posts respectively over the period of 4 months – a collective contribution of 69% of the total number of posts. Unisa3 and Unisa4 participated 7 times each, with Unisa2 twice, Unisa9 once and Unisa8 no posts at all.

From these figures it is evident that the stability of **DAS2**: Using the ODEM is threatened by a tension, which is identified as T2|DAS2: *Irregular Contributions*.

4.4.3.2 Post and response patterns

When reviewing the data on active participants, a secondary question that arose was what the post patterns were in terms of a teacher starting a thread (1st post), replying to other threads and replying to responses on a self-started thread. Table 4.3 shows the relevant data.

Table 4.3 (a) shows most posts to have originated in response to an existing thread, as opposed to a new thread being started. Only 22 threads were started whereas there were 64 replies to these threads. There were thus 2.9 times more responses than new threads. Seven posts were replies to an own thread started. Unisa5 and Unisa1 contributed the most responses (16 and 21 each), while Unisa7 started the most (8) new threads.

When it became apparent that teachers were not posting as much as hoped, I decided to start two threads, one a question on their views on lesson planning, and one a question on

how they are coping with reflective practices. The first question generated only two responses, and the second question only 4 responses.

Table 4.3 (a) Post and response patterns

Participant	1 st post	Response to other	Own thread reply	Total posts
Unisa1	4	16	3	23
Unisa2	0	2	0	2
Unisa3	4	2	1	7
Unisa4	2	4	1	7
Unisa5	1	21	1	23
Unisa6	3	7	0	10
Unisa7	8	5	1	14
Unisa8	0	0	0	0
Unisa9	0	1	0	1
Totals	22	58	7	87

Taking these questions into consideration, there were 24 threads in total. Table 4.3 (b) lists the number of responses to each thread.

Table 4.3 (b) Number of responses to each thread

Tno	1	2	3	4	5	6	7	8	9	1	1	1	1	1	1	1	1	2	2	2	2	2		
No	3	2	6	3	2	2	3	3	1	3	2	2	5	3	0	2	3	1	5	3	3	1	2	2

Key: Tno=thread number; NoR=Number of Responses

Only 3 threads had more than 3 replies each. Nine threads had 3 replies, 8 threads had 2 replies, 3 threads had only one reply while 1 thread had no reply.

The data on first threads support the existence of Tension1|**DAS2: What to Post**.

Conversely, with an average of 2.6 responses to existing threads, no longevity is visible, which not only confirms T1|**DAS2: What to post** (in either starting or responding to a thread), but indicates an inability to contribute with dynamism and eagerness. The fact that only seven own thread replies were found confirms this lack of dynamism and eagerness and T3|**DAS2: Lack of Fervour** is identified as a tension.

4.4.3.3 Lurker statistics

Server logs were unfortunately not available to indicate lurker statistics (how many times teachers visited the ODEM to read but not post) since the individual IP addresses of teachers were unknown. Telkom makes use of a proxy server address which makes it impossible to link a connecting teacher to a visit. Teachers were subsequently asked in the focus questionnaire to provide an indication of their visits without posts. Only 4 teachers

completed the questionnaire, with only one indicating that she did some lurking, the main reason being that she could not answer all posts.

4.4.3.4 Frequency of participation

Table 4.4 (a) lists the number of posts made by each teacher per month. In the first month of participation, June, only 13 posts were made to the ODEM, gradually increasing to 36 in July and reaching a high with 40 posts in August before falling to just 7 posts in the final month of September. Only Unisa1 contributed in all months, with Unisa3, Unisa5, Unisa6 and Unisa7 contributing in three of the four months. The rest of the teachers contributed over a period of one or two months, with Unisa7 being exceedingly active in August. Unisa2 and Unisa9's frequency emulate their minimal total number of posts. Unisa8 did not participate at all.

Table 4.4 (a): Frequency of participation

Month	Unisa1	Unisa2	Unisa3	Unisa4	Unisa5	Unisa6	Unisa7	Unisa8	Unisa9	Total
June	2		2			4	3		1	12
July	7		4	6	9	2				28
August	12		1	1	10	4	10			38
September	2	2			4		1			9
Total	23	2	7	7	23	10	14	0	1	87

Table 4.4 (b) show data from August, the month with most contributions, ordered by teachers and the date and times they contributed. Unisa1, who contributed 12 posts, did so on two days only, with 5 posts on the 6th, and 7 posts on the 21st. Unisa5 also contributed on only 2 days. Unisa7, with 10 posts (one post was unsuccessful explaining the total of 11 records for her in the table) posted on the 10 posts on 3 days. This pattern is repeated for most teachers, indicating teachers to have visited the ODEM irregularly. When they did visit the ODEM they answered as many posts as they could in a single session. As indicated in section 4.4.2.2, few new threads were started, explaining why contributions were limited to a day or three within the month. Interplay between T1|**DAS2: What to post** and T2|**DAS2: Irregular Contributions** is evident, with either tension contributing to or exaggerating the other.

It is likely that teacher contributions were dependent on other factors which cannot be identified from this data alone. No tension is therefore identifiable.

Table 4.4 (b): Frequency of participation (August)

Teacher	Date and time
Unisa1	08-06-06 10:01
Unisa1	08-06-06 10:03
Unisa1	08-06-06 10:06
Unisa1	08-06-06 10:07
Unisa1	08-06-06 10:13
Unisa1	08-21-06 19:41
Unisa1	08-21-06 19:43
Unisa1	08-21-06 19:44
Unisa1	08-21-06 19:48
Unisa1	08-21-06 20:00
Unisa1	08-21-06 20:01
Unisa1	08-21-06 20:03
Unisa3	08-06-06 22:03
Unisa4	08-09-06 19:22
Unisa5	08-07-06 19:50
Unisa5	08-07-06 19:54
Unisa5	08-07-06 20:01
Unisa5	08-07-06 20:05
Unisa5	08-23-06 20:00
Unisa5	08-23-06 20:05
Unisa5	08-23-06 20:08
Unisa5	08-23-06 20:10
Unisa5	08-23-06 20:13
Unisa5	08-23-06 20:15
Unisa5	08-23-06 20:22
Unisa6	08-09-06 21:22
Unisa6	08-09-06 21:41
Unisa6	08-13-06 20:55
Unisa6	08-21-06 20:47
Unisa7	08-01-06 19:43
Unisa7	08-01-06 19:45
Unisa7	08-01-06 19:55
Unisa7	08-17-06 19:06
Unisa7	08-17-06 19:14
Unisa7	08-17-06 19:19
Unisa7	08-17-06 19:25
Unisa7	08-17-06 19:37
Unisa7	08-17-06 19:44
Unisa7	08-17-06 19:47
Unisa7	08-27-06 14:16

4.4.3.5 Time of day

Teachers were limited by the Surfmore package to connection after 19h00 in the evenings.

Table 4.5 lists the number of posts per time period.

Table 4.5 Time of day

Time	Posts
<19h00	7
19h00-19h59	32
20h00-20h59	40
21h00-22h00	12
>22h00	5

Very few posts (7) were submitted outside the allotted Surfmore package time of 19h00 +. Connections to the ODEM before 19h00 meant teachers carried the connection costs themselves. Seventy-five percent of the posts were made between 19h00 and 21h00, with the timeslot 20h00-20h59 slightly more popular than the hour before. Only 5 posts were done after 22h00. No tension is identifiable on this data alone, but it is evident that teachers were not prepared to connect on their own cost.

4.4.3.6 Nature of posts by classification

Table 5.6 (a) lists the nature and patterns of the posts by classification. The number of incidences is provided there against. In general terms, a thread may contain a question, a positive or negative statement, a reflective statement or a call for ODEM support. Note that the totals supplied is not related to the total number of posts - a single post to the ODEM may contain more than one element. An example of a single post that contains 3 of the elements is provided to depict the analytical process followed. The elements identified are provided in *boldfaced italics*.

Note that throughout this study, teachers' posts to the ODEM are quoted verbatim, i.e. no editing has taken place.

I dont think that your question is complete and this might confuse the learners because there are many different solutions. Eg: $2 \times 36 = 72$, $3 \times 24 = 72$, $8 \times 9 = 72$, etc....Do you understand what I mean. *Correcting.*

Give the learners more meaningful and concrete problems . Eg; The length of a rectangle is twice the breadth. If the perimeter is 64m , Calculate the length and the breadth. *Offering solution.*

Problems like these allows the learners to firstly construct a picture and from the picture they can solve the problem. *Reflective practices.*

Try not to give learners open-ended questions like the one you used as an example. Hope this helps you. *Correcting*.

Unisa5

The above post contains a correcting response, offers a solution and provides some evidence of reflective practices.

All 104 posts to the ODEM were carefully analyzed and re-analyzed in this manner. Total incidence and percentages for questions, responses, statements, reflective practice and ODEM support are provided against the nature of the post as per the classification system.

Table 4.6 (a) Nature of posts by classification

Nature of post	Number of incidences	Totals	Percent (%)
Question – for clarification	6	29	26%
Question – for support	18		
Question – for a solution	5		
Response - agreeing	6	49	43%
Response - affirming	8		
Response – offering solution	28		
Response – correcting	6		
Response – no solution	1		
Positive statement	10	12	11%
Negative statement	2		
ODEM support	3	3	3%
Descriptive reflection	4	20	18%
Dialogic reflection	11		
Critical reflection	5		
Totals	113	113	

Table 4.6 (a) show questions to contribute 26% of the nature of posts, with *support required* the most popular. *Requesting solutions* and *clarification* were minimal with only 5 and 6 incidences each.

Responses to questions contributed 43% of the nature of the posts, with *offering solutions* the most recurring chunk (28 incidences). *Positive* and *negative statements* contributed 11% of incidences, with positive statements 5 times as common as negative statements. *ODEM support* was minimal with only 3 incidences.

Evidence of *descriptive reflection* was found in 4 instances. An example is Unisa5, who describes and justifies her preparation for lessons:

Planning lessons on a daily basis can really be a challenge. I prepare daily by looking at the activity and in my mind and on the worksheet make a few notes of how I am going to deliver the lesson, but I really feel that too much of emphasis is placed on administrative work. I personally don't see any merit in having a file full of lesson preps, written out all neatly yet little learning is taking place. I place more emphasis on how I teach and what I teach and how much my learners can gain from the lesson rather than having a beautiful prep file. Don't tell anyone, but I don't have a prep file, when I was challenged I took my learners books and portfolios and submitted it as my proof that I am working, and in fact a little harder than the teachers with beautiful files. That's just honestly the way I feel about lesson plans.

Unisa5

Dialogic reflection had 11 instances. For example, Unisa7 steps back and reflects on the problem learners have with word sums, and provides an alternative:

The problem with word sums is that learners don't understand maths language. We need as educators always use mathematical language when we teach. Let the learners also use it in class. I did tried it and it worked. They need to understand what is needed before they could solve the problem. We need also to have the knowlege of mathematical modeling cause this need it.

The process of modeling are: Identify the problem. Make assumptions. That is you identify and classify viiables and determine their interrelationship. Solve the model. Varyify the model. Implement the model. Maintain the model.

Unisa7

Critical reflective practices were found in 6 instances. Unisa1 and Unisa7 have multiple perspectives on the gap between Grade 9 and Grade 10 mathematics, and shows awareness that this gap is located in and influenced by the Department of Education (historical and socio-political context):

The problem is beyond our reach due to the fact that they are separete and different bands (GED and FET) and the knowledge depth is also different. Perhaps in a school level you agree about the year programme that will address the issue. The matter is in the hands of the deparment.

Unisa1

The problem is our learners enter the secondary schools not being ready. It is not about MATHS, all the learning areas. They dont have the basic skills and knowledge needed for grade 8. I think the problem is with the dep cause they dont do their work. They dont monitor the pregress of leaners they only interested in passing leaners who did achieve.

Unisa7

Table 4.6 (b) shows the teachers, the number of times they contributed a reflective post, the percentage of their own posts that were reflective in nature, and the total reflections per reflection category.

Table 4.6 (b) Who reflected

Teacher	Number of Reflections	%	Critical	Descriptive	Dialogic
Unisa1	6 (23)	26%	2	0	4
Unisa2	0 (2)	0%	0	0	0
Unisa3	0 (7)	0%	0	0	0
Unisa4	0 (7)	0%	0	0	0
Unisa5	8 (23)	35%	3	1	4
Unisa6	2(10)	20%	0	1	1
Unisa7	4(14)	29%	1	1	2
Unisa9	1(1)	100%	0	1	0
Total	21 (87)	24%	6	4	11

Combined, Unisa1 and Unisa5 contributed more than 66% of the reflective posts identified. Three other teachers contributed the rest with three teachers not showing any evidence of reflective practices. Dialogic reflection was the most popular type of reflection with 11, followed by critical with 6 and descriptive with 4. These totals were mostly influenced by Unisa1 and Unisa5, who seem the more accomplished reflective practitioners. Reflective practices contributed a relatively low 24% of the total nature of posts. While the efforts of teachers to make use of reflective practices are acknowledged, the ODEM was mostly used as a one-dimensional question-answer environment, supporting T3|DAS2: *Lack of Fervour*. T4|DAS2: *Lack of Reflective Practices* is identified as a tension.

4.4.4 Tensions in DAS1 and DAS2 – interview and research diary data

The following tensions were identified in the previous sections: a) T1|DAS1: *Creating Internet Accounts*, (b) T2|DAS1: *Connection Problems*, (c) T3|DAS1: *Lack of Suitable Support Structures*, (d) T1|DAS2: *What to Post*, (e) T2|DAS2: *Irregular Contributions*, (f) T3|DAS2: *Lack of Fervour*, and (g) T4|DAS2: *Lack of Reflection*.

To substantiate these and/or discover other tensions in DAS1 and DAS2, it is necessary to review the interview and research diary data.

4.5 Interpretation of interview and research diary data

The interview and research diary data provided the richest sources of information on the personal and situational tensions that impacted on the use of a mathematics-friendly online ODEM environment as a reflective tool for the CPD of disadvantaged mathematics teachers.

Table 4.1, which provides a class view of category data, is used as an outline to the following sections. Each class and its categories will be discussed first. Where applicable, for purposes of understanding, cross-reference to other classes and categories will be made. Such an approach will also aid in discovering the linkages between categories, and a possible reclassification.

Concepts, when quoted, may in some instances not be as clear if not read in conjunction with a preceding response and/or question. The reader is directed to the interview transcriptions, available at <http://osprey.unisa.ac.za/mac/phddata.zip>, if clarification is required.

4.5.1 Connecting to the ODEM

The class Connecting to the ODEM had one category, similarly named *Connecting to the ODEM*.

4.5.1.1 *Connecting to the ODEM*.

The category *Connecting to the ODEM* had 8 nodes and 23 concepts.

Connecting to ODEM (8)

- Connection problems (14)
- Connection problems - none (1)
- Hardware problem (2)
- Only reason (1)
- Setup time (2)
- Slow connection speeds (1)
- Telkom (1)
- Telkom error (1)

From Figure 4.3, and as discussed in section 4.3.1.2, Tensions in **DAS1**: Connecting to the ODEM, the majority of teachers experienced problems connecting to the ODEM. As

indicated earlier, connection problems were resolved with time. In the next paragraphs, these connection problems are presented from the perspective of the teachers.

The first observation from the interviews was that teachers who posted the least forwarded connection problems as one of the main reasons they did not participate as much as they would have liked to. Unisa2 and Unisa9, who posted the least (2 and 1 post respectively), responded to a question on their limited participation as follows:

The first reason I think I connected late because I had problems with connection.

Unisa2

I had problems in connecting.

Unisa9

These are not unexpected statements given the problems experienced, but later on in their interviews these two teachers make the following statements:

Okay hence we say except there are connection problem, computer literacy, it's very important, time is another factor, because if you, I don't know, if you look at the life of a teacher we really do not have time. There is a lot of administration that we do, so for you to take something like two hours sitting on the computer.... And I don't know, for some of us, as I say, it came at a time when we were writing exams, it came at a time when we were busy with portfolios and all that.

Unisa2

Now the problem is that I even phoned Telkom three times.

Unisa9

Regardless of the potential validity of these statements, the reason for their lack of participation is now transferred elsewhere. In a period of four months, one would have expected a user to resolve their connection issues in one way or another. While Unisa9 did phone me on two occasions and was requested to bring the computer for service, he never did. He was also the only teacher with a prepaid phone connection, which required money to be deposited in his account for him to pay his Internet use. My research diary entry of 27-06-2006 reads:

I paid money into Unisa9's account. He uses a pre-paid account. Yet 36 days later he phones me claiming it has not been paid (even if I could provide proof that it was).

Research Diary - self

I was aware that Unisa9 was blacklisted, and the initial feeling was that the money paid to him was used elsewhere. It subsequently transpired that his account was in debt, and that

the money paid into his account was absorbed by a negative balance. Later on in the interview he spends a great deal of time trying to convince me that he is in fact motivated, and that he would like to continue now, even on his own.

Given the diversity of explanations they provide and regardless the potential validity thereof, some doubt surfaces on these two teachers' motivation and/or reasons for participating. The impression gained during their interviews was that they responded in a defensive frame of mind. To put their statements into perspective, Unisa7, who posted the 3rd most of all teachers, made the following research diary entries in substantiation of T3|DAS1: *Lack of Suitable Support Structures*:

I connected (reassemble) my computer on my own and switched it on. Then I wanted to connect to the internet. But I couldn't because there was an error with my modem. I called Telkom twice and they didn't help me. What they did was to check the Telkom internet server settings. I was so frustrated and angry that I couldn't connect to the internet, which means I couldn't go to the ODEM. I slept been heart broken.

Unisa7 Research Diary.

Coming back from refresh course it was difficult and also anxious to use the computer. I was very confused when it is not working. I failed to connect to the net I phoned Telkom Help Desk but no help. The problem was a modem.

Unisa7 Research Diary.

Her motivation to participate is evident regardless her connection problems. Unisa6, who contributed the 6th most, experienced a problem beyond her control:

At one stage I had a problem of the lines in my area, I think we were having, the lines were off between 7 and 10 o'clock in the evening and it was for about a month.

Unisa6

Thus, while most teachers experienced T2|DAS1: *Connection Problems*, this tension is used in some instances as a justification for T2|DAS2: *Irregular Contributions*. The word "justification" is used frivolously here, since the purpose of this study is to discover tensions in the Activity Systems, and these "justifications" may well prove valid tensions as more data is analysed.

4.5.2 Shared

4.5.2.1 Financial factors

T5|DAS2: *Financial Factors* was identified in the previous section as a tension. *Financial factors*, as a category on its own, had 3 nodes with 13 concepts associated to it.

Financial factors (3)

- Bankrupt (1)
- Financial considerations (10)
- Prepaid problems (2)

Most concepts originated from my research diary as I became aware of these factors during the project. Some concepts were specific to the blacklisted and pre-paid use teacher.

Another teacher, however, also ran into financial problems during the project.

So another thing is that one of I became bankrupt.... and then they disconnect the phone and they took me to the lawyers

Unisa4.

As a result, Unisa4 contributed only 7 posts to the ODEM. While his and Unisa9 's financial problems were individual and may have prevented them from contributing on a regular basis, the fact remains that in a disadvantaged community financial issues are likely to play a major role in their intention to participate. It is also apparent that teachers will find it difficult to afford Internet connectivity, as supported by Unisa1 and Unisa3 who state:

First of all is the costs, so nobody will afford to use it on each and every day or on a daily basis to check (the ODEM). So there is a cost implication.

Unisa1

It will be difficult for me maybe to think of going and applying for an internet and then using it.

Unisa3

Only one teacher indicated that she has continued her account on completion of the project (Unisa6). T5|DAS2: *Financial Factors* is thus a confirmed as tension.

4.5.2.2 Support required

T3|DAS1: *Lack of Suitable Support Structures* has already been identified as a tension. *Support required*, as a category, had 5 nodes and 17 concepts to it.

Support required (5)

- Contact teachers difficult (1)
- Support - computers (4)
- Telkom support (10)
- Transport difficulties for support (1)
- Web site problems (1)

The most prevalent reference in terms of support was to the lack of Telkom support when teachers experienced connection problems. Unisa4 summed up his and my own frustration (experienced when trying to create accounts) accurately:

... because you find that someone was telling you to press this and this, that person is no more there on the line. You start again, you get another person, you can never get the same person.

Unisa4.

Unisa7 tried Telkom support 6 times and not once was her problem rectified:

I called Telkom twice and they didn't help me....I called Telkom again four times but they didn't help me.

Unisa7. Research Diary.

As indicated in section 4.3.1.2.2, my support role became crucial to the success of the project. Five teachers had to visit me after school and work hours in order to resolve their connection problems. Most of the remaining concepts were already covered in section 4.3.1. Unisa1 experienced a recurring problem related to website unavailability, the likely cause a server firewall problem, but it resolved itself.

One issue that highlighted itself several times was the difficulty in contacting teachers during the support phase. Teachers would typically send an SMS indicating their requirement for support. The “Please Call Me” service is a very popular method of making telephone calls in financially-burdened communities, yet it also impacted on me since returning cell phone calls are not without cost itself. Support thus required financial input both ways. T5|**DAS2**: *Financial Factors* is recognised as a tension while T3:**DAS1**: *Lack of Suitable Support Structures* is confirmed and also exaggerated across both Activity Systems.

4.5.3 Using the ODEM

The Using the ODEM class had 10 categories.

Preventative factors list those factors that prevented teachers from contributing the ODEM. Participation in the ODEM resulted in both *positive* and *negative effects*. Teachers also had *suggestions* as to ODEM use, while *training* in the ODEM and computer use was also frequently referred to. Teachers also commented on the *value of the ODEM* and the *ease of use* thereof. Throughout the data there was evidence of the *personal characteristics* of teachers, their *motivation for participation* and their *other use of the PC*.

4.5.3.1 Preventative factors

Preventative factors, as a category, had 11 nodes and 46 concepts associated with it.

Preventative factors (11)

- Busy family life (4)
- Busy life (12)
- Family important - comes first (1)
- Family support (1)
- Limited space at home (1)
- No study (1)
- Personal problems (6)
- School problems (11)
- Term cycles (2)
- Township problems (6)
- Transport problems (1)

School problems and a busy life surfaced as the most common concepts, although 6 concepts to school problems were made by just one teacher. This teacher indicated that he was moving to another school because of the problems he experienced at his school. Other school problems were mainly related to disciplinary problems the teachers experienced in class with pupils. Two examples are:

The townships schools is very difficult and then you find that there are people who are coming around the fence during breaks and during the lessons, they are selling these drugs to the learners... Even our learners, we are having problems with learners at school. Most of the learners are coming late, especially the first periods, you find very few learners are there and then the problem which causes this I think is the government, because the government officials used to stand in front of the national TV and tell the learners there is nothing the teacher can do to you. So even if the siren is ringing to alert them that the periods are starting, they are just strolling.

Unisa4

Then the other issue that I am afraid that needs to be addressed is the morale of the teachers, it's very, very low, they don't feel good they feel they are more or less powerless. In terms of the discipline there is a big change that has come in between the learner and the teacher, the responsibility, what is the boundary of the teacher, what is the boundary of the learner. People feel

powerless. Discipline is the problem. It's not the content itself.

Unisa1

The relevance here is that teachers felt the need to highlight these problems since it affected their motivation and participation in the ODEM. These problems, of course, could potentially contribute to T3|DAS2: *Lack of Fervour*. While some teachers saw the value of the ODEM in resolving these problems, it was not used for that purpose with the exception of one post.

A busy (teacher and family) life was another recurring statement found in this category. Already identified as tension, T6|DAS2: *A Busy Life*, is confirmed by statements such as the following:

There is a lot of administration that we do, so for you to take something like two hours sitting on the computer ... for some of us, as I say, it came at a time when we were writing exams, it came at a time when we were busy with portfolios and all that.

Unisa2

..if we post one message I don't think it's very difficult and then it takes not too much time, because sometimes the man is not always in the house, he is working, even if maybe he is not working, but you cook, you do everything and then from there you can do your checking.

Unisa3

Statements in this vein were also specific to the time period (see section 4.4.2.5) the Surfmore account allowed them to connect to the Internet:

I think the problem that I have was we were given that the timeframes should be after 7 in the evening, so as an educator you find that now you come from work and you are tired.

Unisa6

...created a bit of a problem if you are married, because that can be time, you know, the evenings.

Unisa5

But for me it was difficult, because I was busy with my parents, now I have got my new house and then we don't have telephone lines that side. So I had to come every night for a night to use the forum, it was very difficult for me so I had to after work go home, then just wait until 7 o'clock, then use the forum and go back to my house.

Unisa7

The inference is that their busy life during the day is extended to evenings, and that they would have preferred to visit the ODEM during a time that suited their schedules. Term

cycles were also forwarded as another reason, although this was from Unisa2, who provided a myriad of reasons for her low rate of participation.

Problems relating to life in a Township brought forth several concepts:

Unfortunately I got injured, I came across the thugs and then the guns were also pulled out and so on, but I survived. So I was at home for almost three months.

Unisa4

Another thing, the computers are not safe at our schools. Because our learners are the ones who are inviting people that there are computers in that room. So during the night those people are there and they break our things. You can install computers now and then after two to three weeks you can get a report that all the computers were stolen. Unless if you make a tight security for that room.

Unisa4

At one stage I had a problem of the lines in my area, I think we were having, the lines were off between 7 and 10 o'clock in the evening and it was for about a month.

Unisa6

I tried to answer other ODEM inmates and the lights went off.

Unisa2

While perhaps sporadic incidences, it does provide insight into the reality of disadvantaged Township life. That it impacts on T3|**DAS2: Lack of Fervour** is conceivable. Reviewing all the concepts (discussed and to be discussed in further sections) as listed in the introduction to this section, a new tension is identified: T7|**DAS2: School/Township Related Issues**.

There were some references to personal problems. One teacher was in the process of divorcing, while two others chose not disclose the exact nature of their problems. That personal problems can impact on the use of the ODEM is not negated, but it would be difficult to ascribe a tension to one or two personal problems. However, the potential *impact* of personal problems on a tension like T3|**DAS2: Lack of Fervour**, for example, is noted.

4.5.3.2 Negative participation effects

Negative participation effects had 9 nodes and 27 concepts.

Negative participation effects (9)

- Became demotivated (1)
- Boring (1)
- Disappointed (2)

- Disheartened about CPD (1)
- Frustrated with others (15)
- Lack of answers (1)
- Lack of input (1)
- Size of group - more (4)
- Size of group - ok (1)

Frustration with other teachers participating in the ODEM had 15 associated concepts. Five concepts were associated with Unisa5, who contributed the most posts together with Unisa1, who also voiced his frustration but in one remark only:

...because some of the questions that they asked I wouldn't have thought they were cluster leaders....just incompetent, I think that was the biggest problem. Then also some of them hardly even knew the content of maths.... I would post something then there is no response and then I say: Ag what now.

Unisa5

Somebody must say something and then you respond, or you say something and somebody responds. So if you post you cannot just keep on posting then and you end up answering yourself.

Unisa1

The above comments are strongly worded and very critical indeed, especially coming from the two most active teachers. Unisa2 and Unisa3 passed judgement by commenting as follows:

It is difficult to go on because some of my messages are not answered.

Unisa2

So unfortunately some were not participating and then maybe you find that you are always answering one person at a time, because sometimes it is boring.

If you want the forum to be successful, please ask the facilitator to help you choose the committed teachers because other teachers are not serious.

Unisa3

I thought we are going to help each other to develop our skills in teaching of mathematics. I'm disappointed to learn that some of us don't even know the content part of maths. What are we teaching our learners? Now I know why we have such a high failer rate in our subject. We as teachers we need to upgrade our maths in order to uplift the standard of teaching in our classes.... I went through the new messages but I did not see the need to answer.

Unisa3. Research Diary..

That Unisa2 only posted twice does not negate the value of her comment, since the other concepts, such as a lack of input and that the size of the group needs to be larger more or

less not only mirrors her concern, but confirm tensions such as T1|DAS2: *What to Post*, T2|DAS2: *Irregular Contributions* and T3|DAS2: *Lack of Fervour*. In addition, another tension is recognized: T8|DAS2: *Quality of Participation*. This tension does not imply incompetency – it represents all the negative participation effects that impacts on the value and depth of interaction that took place in the ODEM.

4.5.3.3 Positive participation effects

The category *Positive participation effects* had 15 nodes and 36 concepts.

Positive participation effects (15)

- Benefit from ideas (1)
- Empowered (1)
- Empowerment (7)
- Enjoyed participating (5)
- Excited (4)
- Foster communication with other teachers (2)
- Helps with maths problems (1)
- Interesting (1)
- Keen to participate (3)
- Learned from others (2)
- Learned much (3)
- Motivating (3)
- Mutual development (1)
- Daw value (1)
- Value with disciplinary problems (1)

Empowerment, enjoyment in participating and excitement are the most prevalent concepts. Much of the empowerment statements referred to the satisfaction of having and working on a computer as well as experiencing the Internet for the first time, as opposed to using the ODEM:

Every time I work on the computer, I get hooked.

Unisa7

I have never worked with computers before, just basics, but now I know how to type, to access internet and to type Mathematical expressions... I am feeling good about I have got an internet at home, it is an opportunity to have that internet.

Unisa3

There were comments that not only implicitly highlighted their perceived value of the ODEM (discussed in section 4.5.3.6), but drew attention to positive participation effects:

..the little time I had I was involved in this forum, I gained something which I benefitted from it...

Unisa4

.. learned so much from the forum, even though we didn't use it much, but some of the things that we did.

Unisa7

...but I definitely did learn a lot from it and I will definitely do it again.

Unisa5

From my own perspective I say from that little time that I have spent in that computer in that forum, I think I have gained a lot..... From my two posts and from what I was reading from what other people were writing, because it wasn't only the posting but also the information I was getting from other people.

Unisa2

.. the forum is a wonderful thing because especially the maths who were having problems.

Unisa3

In Unisa2's case, some evidence of lurking is present which indicates that active participation is not necessarily related to the number of posts submitted.

The value and the creation of community, of sharing with one another, are also evident:

It wasn't only the posting but also the information I was getting from other people.

Unisa2

..sometimes I speak the things out and I become relieved, some people come with ideas and I then I will be benefitting from those ideas.

Unisa4

...and you share things that you have written to other people... because you are helping each other, you are developing each other.

Unisa7

Tensions cannot exist in positive participation effects. At most, it can contribute to resolve existing tensions. For example, one could argue that a positive participation effect such as excitement counteracts T3|DAS2: *Lack of Fervour* to some extent.

4.5.3.4 Suggestions

Teachers, during the course of the interviews, had a number of suggestions on the ODEM.

Suggestions had 11 nodes and 13 concepts.

Suggestions (11)

- Don't want time constraints (1)

- General things (1)
- Guidance - don't want (1)
- How to teach (1)
- Learning area topics (1)
- Need for FDP (1)
- Needs pointers (1)
- Require tasks (1)
- Suggestions for further use (3)
- Too much freedom counterproductive (1)
- Want timelines (1)

In previous paragraphs the constraints forced by the Surfmore package were highlighted.

Here Unisa2 touched on the freedom she had surrounding her use of the ODEM:

I think if you have like stipulated the times and say by this date you must have posted five that would have worked. By this day you must have posted this much, I think we would have done that.

So maybe even the freedom around that was the one that did not motivate us to do it.

I think if we were not given like time constraints, for example telling us that we are supposed to use it for 10 hours months, then I know that this time and every time I need to talk to somebody.

Unisa2

She contradicts herself in these two statements in that she prefers to be told how many posts she must do per month, but then she does not want time constraints. Nevertheless, her statements indicate a need for “another way” of using the ODEM, as the following teachers concur on the issue of a “content-driven” versus ”open” ODEM:

I think it will be better if we focus on certain learning area topics.

Unisa6

My opinion will be I will be comfortable with both them...in the content part you can know the content but you will not know how to teach it in the class.

Unisa7

Other teachers are more comfortable with an open approach:

I think that would have limited us. Keeping it open was better.

Unisa5

.. I think it is good if you talk about general things.

Unisa4

Other comments were related to the participation of a Subject Advisor in the ODEM, and will be dealt with in the *Asked* class in section 4.5.4. Given the variety of suggestions, no tension is evident. Conversely, and once again, these suggestions may contribute to resolve tensions such as T1|DAS2: *What to Post* and T8|DAS2: *Quality of Participation*.

4.5.3.5 Training

Training had 4 nodes with 17 concepts.

Training (4)

- Practice (1)
- Scared to break computer (1)
- Software related (1)
- Training - more required (14)

It was a requirement that teachers must be PC-literate in order to participate in the study. That most were not became evident during the first workshop. PC-literacy is dealt with specifically in section 4.5.4.5. Here, PC-illiteracy impacts on training in that PC-illiteracy necessitates training. The following research diary entries highlight my frustration:

One requirement was to be PC literate to "an extent". However, most don't know and can't remember the difference between a double click, a right click and left click etc.

How many times does it take to teach someone to left and right click? Two workshops? Yes - that is what it took!

Research Diary - self

While every effort was done to minimize the influence of PC illiteracy, perhaps the fact that they are PC illiterate (they think they are not) is an important "finding"?

Left them to practice while I went to buy food (and to calm down) - two piece from Kentucky.

Threw in an extra piece as motivation. I need to get on their side. Got back - one teacher stated that practice makes perfect.

Research Diary - self

Given that teachers were required to sign a contract stating that they were PC-literate, the only conclusion is that they lacked judgement on what a minimum level of PC-literacy entails. The one teacher's statement that *practice makes perfect* seemingly held true, since teachers did not find it too difficult to post to the ODEM during the workshop practice sessions, with exception of using the equation editor, which required more practise.

At conclusion of the project, however, teachers had much to say about training:

I think that the forum has got value, but I think we need, as I say we need more workshops, especially when it comes to the literacy part of it. Maybe some of us when we said yes we are literate, we were not honest enough. So maybe we need to be honest with ourselves, have first of all the workshop ... Then that will work much better, because sometimes we want to post something, but because of a difficulty in working with the computer you don't, you cannot do that because of your own problems. So I think we need more workshops.

Unisa2

..if we had to start using the forum I think we are teachers that should be trained how to use the computers, thereafter then we go to the forum and use it, that would be helpful to the teachers..

Unisa7

I tried to do two sums and then I could not get through, but I think my problem was copying and paste, I forgot to do that.

Unisa4

I think for me it was very difficult to post an equation, solving it.

Unisa3

...it's just that the only problem is the skill behind that was the problem... So it means training of teachers to use the internet... to be computer literate.

Unisa1

I don't know, but if one started this forum, I think we were supposed to have more workshops before it starts, knowing that exactly what is it that we are going to do.

Unisa9

These comments may well be justified, but must be judged against their perceived level of PC-literacy. As with connection problems, teachers who posted less used training as a justification for their low participation rate. In an upcoming section (4.5.3.8), *Ease of Use* indicates that most teachers found the ODEM easy to use, which leaves question mark over these teachers' comments. Even then, it does not detract from the fact that a tension exists here: T9|**DAS2: Training Required**. The word training is used here to include guidance, tutoring and coaching.

4.5.3.6 Value of ODEM

The *value of the ODEM* for teachers had 4 nodes and 25 concepts associated with it.

Value of ODEM (5):

- Did not post but did visit (1)
- ODEM has value (21)
- How ODEM was used (1)
- Value gained from participation (2)

Regardless their participation and the problems experienced, all teachers saw value in the ODEM. The positive participation effects in section 4.5.3.3 already alluded to this. The value they see in the ODEM is in how it can be used to learn from others, to highlight and solve problem areas and to be able to communicate or be in community with other teachers:

That is what I am thinking, that is from my own point of view, I think it can work. I like the idea of the forum.

Though not all people are on board the communication is improving and also the topic for discussion are ... relevant and also of great concern which need a round table discussion.

Unisa2. Research Diary

.. I think it is wise to share with the other teachers, because as a teacher you do not know everything, so to share ideas with other people, that is when that you will gain a lot from people.

..if you talk about everything that is happening, like for instance the learners who are coming from the primary schools...

Yes sometimes I speak the things out and I become relieved, some people come with ideas and I then I will be benefitting from those ideas.

Unisa4

It is wonderful to have somebody to share with, without judging you.

Unisa1. Research Diary

I give information that I got from the forum to my colleagues, and they are very impressed. I think this must be an open forum to all teachers.

Immediately you encounter a problem you quickly post the message and quickly receive the message...

Unisa3

These comments imply they see *potential* value in the ODEM. As with positive participation effects no tensions are observable.

4.5.3.7 Personal characteristics

The *personal characteristics* category presented 7 nodes with 13 concepts. It is conceivable that teachers' personal characteristics will have an influence on their participation rates, contribution and patterns of posting.

Personal characteristics (7)

- Extra effort to participate (1)
- Knows her shortcomings (1)
- Leader (3)
- Over perceived literacy (1)
- Prepared to open up (2)
- Thirst for knowledge (3)
- Will ask for advice (2)

In general the teachers enjoy learning, and the ODEM is seen as a vehicle for learning:

As a teacher I believe I am a lifelong learner.

Unisa6

I just learn all the time.

Unisa5

Even now, even at school I will rather go and ask someone to come to my class and then help me. And then I tell the learners if I have a problem that other teachers will come here, I want the teachers to explain to you so you understand.

Unisa3

So with the help of those people from different, from those privileged schools, then you see now it is going to add value to us.

Unisa1

On the other hand some teachers also enjoyed being the provider of solutions:

I was able to help a lot of the people with their problems.

Unisa5

...because I was a cluster leader, so the people, they expect something from me.

Unisa1

Not surprisingly, teachers who enjoyed being a leader also contributed the most to the ODEM. No tension is evident in the personal characteristics of teachers. At most, one could argue that being a learner or being a leader could impact on T1|DAS2: *What to Post*, e.g. teachers who consider themselves learners will be less likely to answer a post in fear of derision or highlighting their perceived lack of ability, whereas leaders' will rather answer than post questions.

4.5.3.8 Ease of use

The *Ease of use* category had 7 nodes and 15 concepts.

Ease of use (7)

- Easy to use (5)
- Equation editor difficult (1)
- Equation editor easy but troublesome (1)
- Expert finds it easy (2)
- Expressions time consuming (1)
- Usage problem (4)
- Use became easier (1)

This category is self-explanatory from the concepts. Unisa1, who was identified as PC-literate early in the workshop commented:

My first day I was expecting something very complex but by the time we end the session I felt it just a matter of practice and playing around with the programme.

Unisa1. Research Diary

In general, despite the teachers' PC-illiteracy, they found the ODEM easy to use, especially with prolonged use. Using equations proved more difficult, but its use is dependent on what the ODEM is perceived to be useful for, as examined in Section 4.5.4 (Asked class, *content versus reflection* category). As such, it is difficult to identify a tension in *Ease of Use*.

Usage problems were related to non-ODEM issues such as typing the wrong password when logging in or a page being unavailable due to server problems.

4.5.3.9 Other use of PC than for ODEM

The category *Other use of PC than for ODEM* had 3 nodes and 11 concepts.

Other use of PC than for ODEM (11)

- Other software (1)
- Use PC for other tasks (9)
- Using it afterwards (1)

While this category may seem irrelevant to the purposes of the ODEM, the value of other use (software or other Internet use) is that teachers become more PC-literate, which makes ODEM use easier. That teachers would use their PC's for purposes other than the ODEM, although configured for and only having ODEM-required software installed, is to be expected. Moreover, having a PC with an Internet connection has secondary worth:

Like I am teaching maths and also I am teaching science and some of the other topics that are in the new NSC are still new to me, but through the internet I could access information

Unisa6

I want to use it for other tasks, like my question papers, the maths issues.

Unisa4

...so that it only not help me with the project but also my admin work from school like marks.

Unisa2

In this other use of the PC, a tension such as T9|**DAS2: Training Required** could thus be resolved to some extent.

But other use of the PC could also result in additional problems. Unisa1, who was perhaps the most computer-literate of all teachers, installed numerous additional software packages

which led to problems connecting to the ODEM. His software needed to be re-installed. One noteworthy problem he experienced by surfing on the Internet was infection with spy- and ad-ware. To resolve these issues required intensive support from my side:

I installed a spyware bot to clean his PC. This did not resolve the problem because of a high rate of infection. Had to reformat his hard drive and reinstall the OS. They don't have the knowledge to resolve this problem (most people don't), and clearly this affects their online efforts.

Research Diary - self

It would be unwise to ignore the impact of spyware and viruses on the teachers' ability to connect to the ODEM. Computers do pick up problems when in constant use, and connecting to the Internet opens a computer up to potential problems. To resolve these problems is not necessarily a simple matter, and it may exaggerate T3:**DAS1**: *Lack of Suitable Support Structures*, since teachers would generally not be able to solve these problems themselves.

4.5.3.10 Motivation for participation

In preceding sections teachers' motivation for participation in the project was questioned. The *motivation for participation* category had 4 nodes and 5 concepts.

Motivation for participation (4)

- Dishonest reason for participating (1)
- Motivation - computer (2)
- Motivation - to experience internet (1)
- Motivation - to learn computer (1)

It was evident that the promise of a free computer and Internet access played a significant role in their decision to participate in the project. My research diary entry after the second workshop reads:

I'm left with the feeling that it is all about the computers..... They're sitting on the chair's edge waiting to leave.

Research Diary - self

It is difficult to ascertain their real motivation if one takes into account that these teachers are from a disadvantaged background and that participation in the project was an opportunity not to pass up upon. Can one then fault Unisa2, who states quite honestly:

Maybe some of us when we said yes we are literate, we were not honest enough.

Unisa2

Unisa6 sheds even more light on the motivation issue, although it is only one perspective:

And then concerning the participation I think it also depends on an individual whether the educator was interested in using the computer or how to use it, or wanted to know about also the internet thing, getting to the forum and - because I think some of us we were only interested in getting the computer for that and not using, or how to use it.

Unisa6

Section 4.5.3.3 (*positive participation effects*) highlighted feelings of empowerment gained. How does one balance empowerment against a potentially insincere reason for participating? To do so would be judgmental on teachers' morality, which this study does not cater for. However, combined with sections 4.4.2 (attempts) and 4.4.3 (postings and its subsections) there is evidence of a lack of motivation on teachers part, for whatever reason(s). T10|DAS2: *Lack of Motivation* (to contribute to the ODEM) is thus recognised as a tension, although its true impact is unclear.

4.5.4 Asked

The Asked class covers interview data that was not specifically mined from the interviews. Throughout the project I became aware of and noted issues that gave rise to several interview and focus questionnaire questions.

The Asked class covers teacher responses to specific questions asked on:

- The preferred point of access, that is would they prefer to access the ODEM from home or from school?
- Their preference on the ODEM replacing cluster meetings, cluster meetings only, or both?
- Their thoughts on the participation of a Subject Advisor?
- Their thoughts on reflection and/or content in the ODEM?
- Their level of PC-literacy?
- Their thoughts on sharing the ODEM with teachers from an advantaged background?

5.5.4.1 Point of access

The *Point of Access* category had 4 nodes with 8 concepts.

Access point (4)

- Access - home (3)
- Access- school (3)
- Lack of facilities (1)
- No computer at school (1)

Point of access could potentially have had a significant influence on the outcome of the study. For example, if teachers could connect to the ODEM from a school laboratory, the

tensions of **DAS1** would not have existed since the computers would already have been online and support would have been initiated by the Department of Education. However, discussions with the Subject Advisor very early in the project confirmed a suspicion that few schools had functioning computer laboratories - hence the decision to provide teachers with access from home. Supplying computers to a school for teachers to connect to the ODEM would have limited teachers' access to these computers, as confirmed by the following statements:

At our school we have only two computers and then they are only used by the secretaries, we are not allowed to use them, because they said we will block the systems and so on.

Unisa6

Sometimes when you go there (laboratory) you find that they have erased almost everything.

Unisa3

Three teachers preferred the status quo of access from home, while 3 preferred access from school.

In section 4.5.3.1, *A Busy Life* was confirmed as a tension. *Point of access* may contribute towards resolving this tension since teachers can select a point of access congruent to their time schedule, making it easier to connect whenever they have time as opposed to being limited to the Surfmore package times. This split in preference indicates that T11|**DAS2**: *Point of Access* should be regarded as a tension.

4.5.4.2 ODEM versus cluster meetings

The ODEM versus cluster question had an underlying assumption on my part that using the ODEM may be a useful substitute for cluster meetings as they could use the ODEM to discuss cluster issues. Such a move will obviously require the participation of the Subject Advisor, whom did not participate in the current implementation of the ODEM. Nevertheless, after participation in the ODEM, it was felt that teachers would be able to make a considered judgment on this issue.

The *ODEM versus cluster meetings* category had 3 nodes and 9 concepts.

ODEM versus cluster (3)

- Cluster and ODEM (3)
- Cluster meeting (1)
- Replace cluster meetings (5)

Teachers who preferred the ODEM to replace the cluster meetings generally did so on the basis that it would make life easier:

According to my understanding and what I have seen, the forum is better than the cluster meetings, because the cluster meeting we have in a very short time. Because they will say from 2.00 and the school comes out at half past 2. So people are rushing for their transport, so we are doing things very quick.

Unisa4

Well because I think we have too much meetings outside, I have to travel to the meetings.

Unisa5

Other teachers saw the value of the ODEM elsewhere, but with provisions:

First of all is the costs, so nobody will afford to use it on each and every day or on a daily basis to check. So there is a cost implication. So if there was no implication like that, people will use it every day, they will respond each and every day. So in terms of the cluster we will gather once in a term after three months. So you see forum is much effective because you can interact at any minute at anything.

Unisa1

I wouldn't say totally it should be replaced by the forum, because you may pose a question and then you find that now it will take long to be answered. Unless you have a cluster, one of the district officials or some other officials who could help us with those topics. Maybe if we involved them then it will be easy.

Unisa6

Unisa2 preferred the cluster meeting, but her decision is based on the probability that not all cluster leaders will be able to afford a computer and Internet access, which makes for a valid point as supported by Unisa1. Unisa7 wanted both cluster meetings and the ODEM.

The ODEM versus cluster option does not impart any tensions in itself. At best, it has the potential to relieve some of T6|DAS2: *A Busy Life* for some teachers, depending on their busy schedules.

4.5.4.3 Subject Advisor required

The category *Subject Advisor required* had 9 nodes and 15 concepts.

Subject Advisor required (9)

- A better group (1)
- Subject Advisor promoted (1)
- Content-poor teachers (1)

- ODEM leader required (5)
- ODEM leader trust (1)
- Guidance required from Subject Advisor (3)
- Has support other than ODEM (1)
- Require guidance what to post (1)
- Role of facilitator (1)

Teachers indicated that guidance, input and direction from a leader they are familiar with will be welcomed. Moreover, they see this leader as being the Subject Advisor:

...people were not so sure what to post on that forum.

..she with the experience that she has, she can come to guide the teachers unlike where you associate with your own group.

Unisa1

If the Subject Advisor is part of this thing, I think it helps us a lot, because she is the one who is facilitating mathematics in our clusters and then she is also involved in the forum, it makes us understand better, because we will know what is required from us.

Unisa4

I think it would have been a much better group with her involved.

Then also some of them hardly even knew the content of maths.

Unisa5

The impression gained is that teachers would prefer to respond to topics posted by a Subject Advisor and relevant to their circumstances, rather than initiate topics themselves which may be less useful to the group. This would relieve some of the tension of T1|DAS2: *What to Post*. In Chapter 3 it was mentioned that the Subject Advisor for the Mamelodi region was initially targeted to participate in the ODEM, but that this never realized due to her busy schedule. After the project has completed, it transpired that she was promoted, which serves as an indication of her busy schedule and a likely reason for her not being able to participate.

What exactly the Subject Advisor's contribution should be is varied:

We will be interested because the information that which she was posting to us, would be more relevant to us.

Unisa2

Theoretically it is a good thing, but she is also needed there, because our problem is not only the classroom, there is the administration part of teaching and I think she can also help us with the administration part of teaching...

Unisa2

..because she maybe knowing what you do at school, maybe if you can add her maybe things will be easier, because we will communicate and then ask them we are going to hold a meeting, what are we going to do before we can go to the meeting.

Unisa3

I believe it was going to be much easier, because she is our coordinator, then maybe she has got something that she can tell us what she wants us to do, like we can have information for the whole cluster, of the whole district, which she doesn't have to wait for the cluster meeting and all those. So it was going to be much effective and much helpful to the teachers.

Unisa1

A clear need for a channel of communication to the Subject Advisor thus exists. This need transcends the traditional role associated with Subject Advisors and/or forum leaders. Within the ODEM, and *because* of the perceived value of the ODEM as a channel of communication to the Subject Advisor, teachers' needs are more complex. They see opportunities open up that previously did not exist. For example, information from the Subject Advisor on an upcoming cluster meeting may be useful for purposes of preparation, as will support with administrative issues. The ODEM can also serve as a convenient distribution channel for a wide variety of occupational information from the Subject Advisor's office. The Subject Advisor thus needs to adopt more of a *leadership* role in the ODEM, perhaps directing conversation and providing support on issues outside her subject area. For these reasons, the next tension is identified as T12|DAS2: *Leader Required*, rather than *Subject Advisor required*.

4.5.4.4 Content versus reflection

The primary purpose of the ODEM was to provide an environment where teachers could reflect and support one another on their practice. Since teachers showed little evidence of reflective practices, a specific question on whether the ODEM should be used for reflection or content was asked.

The *content versus reflection* category had 7 nodes and 11 concepts (Figure 4.19).

Content versus reflection (7)

- Content and reflection (1)
- Content only (1)
- Guidance and reflection (2)
- Know content (2)
- Needs content (1)
- Prefers reflection (1)
- Value of reflection (3)

Teachers' preferences on the use of the ODEM for reflective practices only, for content only, or for both, were varied.

I would have preferred for other issues except content, because content is in text books

Unisa5

Not everybody knows the contents

Unisa2

In our background you know I think most of the people will be more happy if we can discuss around the content. I think they will be most comfortable with that.

Unisa7

That some teachers expressed a need for content is noteworthy, indicating that not all felt comfortable with their content knowledge. No tension is identified, but the need for content over reflective practices is noted.

4.5.4.5 PC-literacy

PC-literacy was already discussed to some extent in section 4.5.3.5 (*Training*) since PC-illiteracy would impact directly on the amount of training required.

PC-literacy had 7 nodes and 22 concepts.

PC-literacy (7)

- Internet novice (1)
- Is experienced (1)
- Keen to learn? (2)
- Literacy problems (2)
- PC- literate (7)
- PC- novice (8)
- Support other teachers on PC (1)

Only three teachers, Unisa1, 5 and 7 have used computers before. The rest of the teachers were novices and therefore PC-illiterate. PC-literacy was a requirement for participation in the ODEM. There are indications that teachers' perception of their literacy may have been too high. Consider Unisa7 who clearly stated that she is PC-literate in the interviews, but wrote the following in her research diary:

...one of the things that we black teachers don't have the knowledge of using the computer..

When using a computer funny things happen and I need to try and correct the mistakes. This help me to know about the computer. So some phoned me how to switch on the computer.

Unisa7. Research Diary.

The promise of a free computer may have motivated some teachers to overestimate their level of PC-literacy. Even so, it is difficult to judge the veracity of teachers' real motivation for participation. The only conclusion that can be reached is that whereas the intention at the start of project was to limit the effect of PC-illiteracy, PC-literacy is a factor to contend with in disadvantaged communities due to lower computer ownership. Rather than identifying it as a separate tension, it is included as contributing factor in T9|DAS2: *Training Required*, which is then exaggerated.

4.5.4.6 Cross-cultural

The *Cross-cultural* category had 3 nodes with 7 concepts. Teachers were asked if they would gain value if advantaged teachers participate in their forum.

Cross-cultural (3)

- Cultural - other teachers yes (5)
- Cultural - yes, but with apprehension (1)
- Personality (1)

Disadvantaged teachers would have welcomed participation on the ODEM by advantaged teachers.

Yes we don't have a problem, we will learn more.

Unisa3

So with the help of those people from different, from those privileged schools, then you see now it is going to add value to us.

Unisa1

I think it should be open to everybody, not strictly on Mamelodi, because I have learnt a lot from those guys from white schools.

Unisa6

Unisa7 also concurs, but is a little bit more wary:

I would be comfortable because they will be helping us, but some of the teachers won't be comfortable because they would think they are criticising them, undermining them.

Unisa7

Without exception, they see the participation of advantaged teachers as an opportunity to learn something. It was noted in section 4.5.3.3 that most teachers were keen to learn, and these statements confirm that. Since advantaged teachers did not participate, there can be no tension here.

4.6 Synthesis

Several tensions that affected the stability of the Activity Systems were identified from **DAS1**: Connecting to the ODEM and **DAS2**: Using the ODEM. Activity Theory, of course, was firstly employed to identify these Activity Systems and its associated tensions. But Activity Theory also considers the dynamic mediation between the categories of each system.

Consider Table 4.7 which groups the tensions identified against the Activity Systems components and the *object* it impacted upon. **DAS1** tensions are presented in italics.

Table 4.7 Component Tensions of DAS1 and DAS2

AT categories	Associated tensions	Object
Rules	T1 DAS2 : What to Post T8 DAS2 : Quality of Participation T2 DAS2 : Irregular Contributions	Participation in ODEM /Community building Participation in ODEM /Community building Participation in ODEM /Community building
Subjects	T3 DAS2 : Lack of Fervour T6 DAS2 : A Busy Life T10 DAS2 : Lack of Motivation T4 DAS2 : Lack of Reflective Practices	Participation in ODEM /Community building Participation in ODEM /Community building Participation in ODEM /Community building Participation in ODEM /Community building
Community	T7 DAS2 : School/Township Related Issues T5 DAS2 : Financial Factors	Participation in ODEM /Community building Participation in ODEM /Community building
Tools	T1 <i>DAS1</i> : Creating Internet Accounts T2 <i>DAS1</i> : Connection Problems T11 DAS2 : Point of Access T9 DAS2 : Training Required	<i>Connect to ODEM</i> <i>Connect to ODEM</i> Participation in ODEM /Community building Participation in ODEM /Community building
Division of labour	T3 <i>DAS1</i> : Lack of Suitable Support Structures T12 DAS2 : Leader Required	<i>Connect to ODEM</i> Participation in ODEM /Community building

The table shows **DAS1** tensions to be limited to the *tools* and *division of labour* components, while all components of **DAS2** had associated tensions.

DAS1 tensions

For **DAS1**, the *tools* tensions are exaggerated by the *division of labour* tension. That is, a lack of suitable support structures resulted in the problems experienced in creating Internet accounts and contributed to longevity of the connection problems some teachers faced. It is reasonable to conclude that providing suitable support structures will resolve the *tool*-related tensions.

But while the classification presented in Table 4.7 is useful for focusing the impact of tensions to categories, the dynamic interaction between tensions cannot be explained at category level only. It is therefore necessary to consider each tension separately.

T1|**DAS1**: *Creating Internet Accounts* played a significant role in disrupting **DAS1**: Connecting to the ODEM, and resulted in the project being delayed for several months. This tension had several facets: the general unavailability of telephone lines and resultant difficulties in contacting teachers, the role of Telkom as service provider, and the financial limitations of teachers.

T2|**DAS1**: *Connection Problems*, similar to T1|**DAS1**: *Creating Internet Accounts* exaggerated T3|**DAS1**: *Lack of Suitable Support Structures*. The focus here is not so much on the connection problems that were experienced since connection problems occur in all communities, but rather on the difficulty in providing support when connection problems do arise. These connection problems impacted on both **DAS1**: Connecting to the ODEM and **DAS2**: Using the ODEM. If T3|**DAS1**: *Lack of Suitable Support Structures* can be resolved, T2|**DAS1**: *Connection Problems* will cause less imbalances in both Activity Systems, allowing teachers to focus on the initial *goal* of the ODEM, that is, participation and building a community.

T3|**DAS1**: *Lack of Suitable Support Structures* was exaggerated when teachers did not receive adequate support from the primary support agent which was Telkom. Here Telkom was an outside influence that became internal to the activity, and contributed to an imbalance in **DAS1**. When teachers experienced connection problems, they phoned Telkom for support as directed. In some instances the inability of the Telkom Call Center agents to provide support to PC-illiterate teachers forced me to adopt an unexpected and secondary support role. That is, when Telkom was unable to provide support, teachers were forced to rely on me as a secondary line of support. For example, when hardware problems surfaced, teachers had to make use of public transport to visit my home after hours - which is difficult if one has to haul a PC-tower along in a minibus that comfortably seats 9 passengers but accepts 16 passengers. The absence of PC-companies in Mamelodi exaggerates this tension.

The tensions of **DAS1**: Connecting to the ODEM thus all contributed towards the *object* of connecting to the Internet not being attained and the *goal* of participation and community building in the ODEM not being realized for a long period of time. In essence, these

tensions existed because the community *is* disadvantaged. “Getting online” is an arduous process that requires know-how, time, effort, support and cost. It also is evident in the lack of school computer laboratories, raising questions about the sustainability of Internet access in disadvantaged communities. When T1|DAS1: *Creating Internet Accounts* was eventually resolved and teachers were in a position to connect to the ODEM, T2|DAS1: *Connection Problems* resurfaced for some teachers throughout the project.

DAS2 tensions

As indicated in Table 4.7, all categories of **DAS2** had tensions associated with it. The majority of tensions were associated with the *rules* and *subjects* (seven of the twelve tensions identified fell into these two categories, while the other five tensions identified fell in three categories). While it is tempting to conclude that the *rules* of **DAS2** did not suit the *subjects*, such a conclusion would be premature without a review of each tension.

T1|DAS2: *What to Post* is a complex tension which was not resolved within the time frame of the current implementation. The data from attempts and nature of posts show most teachers to have previewed considerably more than what was posted and that they were more inclined to respond to as opposed to starting new threads. In the absence of mathematical expressions (which requires a higher learning curve than text-only posts) the excess previews generated here implies that teachers are continually assessing the perceived value of their contributions. Several other tensions, notably T3|DAS2: *Lack of Fervour*, T4|DAS2: *Lack of Reflective Practices* and T12|DAS2: *Leader Required* have the capacity to exaggerate this tension. Conversely, if tensions such as T9|DAS2: *Training Required*, T10|DAS2: *Lack of Motivation* and T12|DAS2: *Subject Advisor Required* can be resolved, they may (individually or collectively) resolve this tension. For example, having a knowledgeable Subject Advisor (in terms of understanding teacher needs and providing leadership) participating in the ODEM may well coerce teachers into regular contributions. The permutations between these tensions are endless. What endures is that T1|DAS2: *What to Post* exaggerated T8|DAS2: *Quality of Participation*

T2|DAS2: *Irregular Contributions* was identified when it became apparent that, with the exception of two teachers, contributions to the ODEM were minimal, even when most of **DAS1**'s tensions were resolved. Effectively all of **DAS2**'s tensions could have, collectively or in small parts, contributed to and/or exaggerated this tension. How it did would have depended on individual circumstances. For example, T8|DAS2: *Quality of*

Participation was exaggerated for Unisa1 and Unisa5 based on their perception that the other teachers responses to their posts lacked quality. For these other teachers, T1|**DAS2**: *What to Post* played an important role in exaggerating T2|**DAS2**: *Irregular Contributions*, another source of frustration for Unisa1 and Unisa5. Likewise T7|**DAS2**: *School/Township Related Issues* may well have played a significant collective or individual role in exaggerating T2|**DAS2**: *Irregular Contributions*. As with T1|**DAS2** in the previous paragraph, if some or all of the tensions are resolved, they may contribute towards resolving this tension.

T3|**DAS2**: *Lack of Fervour* surfaced as a tension given the one-dimensionality of questions and responses. This tension could have had a potential snowballing effect on T8|**DAS2**: *Quality of Participation* where feeble questions spawned feeble replies. As with T2|**DAS2**, all the tensions identified from **DAS2** could potentially have impacted on this particular tension, either in exaggerating or resolving it.

T4|**DAS2**: *Lack of Reflective Practices* was identified when the nature of the posts were investigated. A comparatively low percentage of posts contained evidence of reflective practices. In addition, teachers were somewhat divided on the value of the ODEM as a *tool* for reflective practices, preferring a content-driven approach. Some of the other tensions may have contributed to the lack of reflective practices. For example, not being able to resolve a content issue or a disciplinary problem may inhibit reflective practices by changing a teacher's focus. Nonetheless, should one value reflection as a powerful tool in the CPD of teachers, the data shows the ODEM to not have nurtured reflective practices, although their efforts at reflective practices are noticed.

T5|**DAS2**: *Financial Factors* was identified as a tension because it impacted on both connecting to and using the ODEM. This tension was specific to many teachers not having an existing telephone line (an indication that it is considered a luxurious item) and to two teachers experiencing financial problems during the project. Not having telephone lines had a major impact on **DAS1** and delayed the project substantially. Experiencing financial problems should not have affected these two teachers' participation since participation did not cost them any money. However, the one teacher had his line disconnected while the other could not use the funds provided for his pre-paid service to connect to the ODEM. Although arbitrary incidences, they serve to illustrate the fragility of the **DAS2**. With the exception of one teacher, none of the teachers continued their Internet accounts on

completion of the study, which once again raises questions on the sustainability of the ODEM in disadvantaged communities if access is not available through school laboratories.

T5|DAS2: *Financial Factors* also interacts with T3|DAS1: *Lack of Suitable Support Structures* in that there are costs involved in seeking and providing support. More often than not, I had to carry the costs of expensive cell phone calls to teachers in order to resolve problems. Teachers also had pay for public transport in order to bring their PC-towers to my home, which cannot be combined with their daily travel routine between work and home.

T6|DAS2: *A Busy Life* is generic to a demanding family- and professional life, and impacted mainly on the time teachers had available to spent on the ODEM. Providing a specific time period that they could connect to the ODEM had advantages in cost, but evidently placed more demand on teachers since they could only connect in a certain time period, thereby exaggerating this tension. There against, the potential value of the ODEM may release the impact of this tension if the ODEM can replace cluster meetings, which demand a lot of travelling and thus time. It could also be argued that by using the PC for administrative tasks (like some teachers did), even more time is saved, although this would depend on their level of PC-literacy. This tension may well have contributed to or exaggerated T2|DAS2: *Irregular Contributions*, T3|DAS2: *Lack of Fervour*, T8|DAS2: *Quality of Participation*, T11|DAS2: *Point of Access* and T10|DAS2: *Lack of Motivation*.

T7|DAS2: *School/Township Related Issues* highlighted various community-specific problems the disadvantaged teachers experienced. Disciplinary problems in school were highlighted as a major factor that affects the morale of teachers, while criminal acts were also highlighted in the case of two teachers. The fact that teachers saw value in the ODEM as an instant line of communication to a Subject Advisor indicates the need that these teachers have for support in a school system that some teachers perceived as “being in a mess”. Their needs stretch much further than just support on content-related issues or on how to reflect purposefully. It must be extremely challenging for teachers to commit to CPD opportunities when, seemingly, life is not mundane. This tension has the potential to contribute towards, or exaggerate T10|DAS2: *Lack of Motivation*.

T8|DAS2: *Quality of Participation* was identified when the value and depth of the interactions that took place in the ODEM were reviewed. As previously discussed, this

tension was specifically exaggerated by T1|**DAS2**: *What to Post* and T3|**DAS2**: *Lack of Fervour*. But other tensions from **DAS2** may also have contributed to this tension in small parts. In fact, the intensity of this tension can be viewed as an indicator of the stability of **DAS2**. More importantly, the strength of this tension represents the final conclusion one can make on the value of the ODEM in the CPD of disadvantaged teachers. This tension arose because of other tensions, implying that these tensions must be resolved first before the quality of participation will improve.

T9|**DAS2**: *Training Required* initially surfaced when it became apparent that teachers overestimated their level of PC-literacy. Despite the ease of use of the ODEM and two supporting workshops, most teachers felt they required more training on how to use their PC to post to the ODEM. Some doubt surfaced as to the worth of their statements on training since calls for more training may well have been used as a justification for poor participation rates. The argument is that if all teachers, with the exception of Unisa8, posted at least once, then there is no reason they cannot post more – except if other tensions played a role. It is then suggested that the training they require is on *how* to use the ODEM. This does not mean that PC-literacy training is not required, nor does it imply providing exact and/or regulatory pointers on what to post. Training implies that these teachers should be nurtured, encouraged and reassured. For example, while teachers were trained in and provided with a guide on reflective techniques, they either did not understand the value of reflection, or may have felt that by reflecting they would display their inadequacies, or they simply did not feel like reflecting.

T10|**DAS2**: *Lack of Motivation* refers to the awareness that teachers may have enlisted in the study for the wrong reasons (obtaining a free computer and Internet access) and that this discord may have, contrary to expectations, impacted on their motivation to participate on a regular basis. While this tension potentially contributed to T3|**DAS2**: *Lack of Fervour*, T1|**DAS2**: *What to Post* and T2|**DAS2**: *Irregular Contributions*, it may equally be the product of other tensions or processes. For example, if teachers do not receive many or hollow responses to their posts, they may become demotivated to post.

T11|**DAS2**: *Point of Access* was a tension in some instances but not in others. T6|**DAS2**: *A Busy Life* could be resolved to some extent if teachers could access the ODEM when and where it suited them. However, access from school laboratories does not present a viable

alternative for most teachers. This tension also contributes to T2|**DAS2: Irregular Contributions**.

T12|**DAS2: Leader Required** was confirmed as a tension in the Asked class. Teachers have a need for leadership within the ODEM and outside of the ODEM, with the ODEM serving as a convenient channel of communication to such a leader. An obvious leader that could fulfil both roles would be the Subject Advisor. As suggested earlier, the Subject Advisor will need to stimulate discussion, to nurture, encourage and reassure teachers. The Subject Advisor is in a primary position to provide support to teachers on a wide front, thereby resolving various tensions.

In conclusion, there is a dynamic interaction between all the existing tensions, individually and collectively. As these tensions become internal to the identified Activity Systems, some tensions had the ability to exaggerate other tensions, while other tensions, if resolved, has the potential to resolve other tensions. What would then be the core tensions of both Activity Systems?

Core tension

The core tension of **DAS1** is evident: T3|**DAS1: Lack of Suitable Support Structures**. If this tension is resolved, then T1|**DAS1: Creating Internet Accounts** and T2|**DAS1: Connection Problems** will have less impact. This core tension was situational – it affected all teachers from the disadvantaged group, and will affect all disadvantaged teachers who wish to participate in the ODEM in the future.

The core tension of **DAS2** is more complex. After considering the available data the tensions were initially regrouped into two new categories, namely ODEM-related tensions and non-ODEM-related tensions. Further sub-groupings that grew out of this initial classification became personal, situational and shared. This classification and placement of the tensions were based on what was rationalized up to this point.

Table 4.8 shows this new classification.

The table may seem to force a vertical perspective on the data. But the classification between ODEM-related and non-ODEM-related tensions is not horizontally exclusive.

Table 4.8 ODEM-related and non-ODEM-related classification of tensions

ODEM-related tensions			Non-ODEM-related tensions		
Personal	Shared	Situational	Personal	Shared	Situational
T1 DAS2: <i>What to Post</i>	T9 DAS2: <i>Training Required</i>	T12 DAS2: <i>Leader Required</i>	T6 DAS2: <i>A Busy Life</i>	T5 DAS2: <i>Financial Factors</i>	T7 DAS2: <i>School/Township Related Issues</i>
T2 DAS2: <i>Irregular Contributions</i>				T11 DAS2: <i>Point of Access</i>	
T3 DAS2: <i>Lack of Fervour</i>					
T4 DAS2: <i>Lack of Reflective Practices</i>					
T8 DAS2: <i>Quality of Participation</i>					
T10 DAS2: <i>Lack of Motivation</i>					

For example, T11|DAS2: *Point of Access* and T6|DAS2: *A Busy Life* may both exaggerate T2|DAS2: *Irregular Contributions*, while T6|DAS2: *A Busy Life* may exaggerate T2|DAS2: *Irregular Contributions*. The classification is thus vertically inclusive but horizontally dynamic.

From a vertical perspective, the tensions in the personal column in the ODEM-related category are visibly individual, even though all teachers may encounter some or all of these tensions at times. The shared tension T9|DAS2: *Training Required* is a function of the general PC-illiteracy of the teachers, all the tensions in the personal column and the requirement for a leader. T12|DAS2: *Leader Required* was placed in the situational column since a Subject Advisor functions at an elevated level.

There is just one personal tension in the non-ODEM-related category, namely T6|DAS2: *A Busy Life*. There is not much that can be done to resolve this tension – life is seemingly too busy for these teachers. However, the ODEM has the potential to make small contributions towards resolving this tension. For example, if the ODEM can replace cluster meetings, life will be less busy, which in turn may resolve T2|DAS2: *Irregular Contributions* simply because cluster interaction will occur in the ODEM. T11|DAS2: *Point of Access* was initially placed in this column as it depends on personal circumstances and/or preferences of a teacher. But is also a situational tension, and therefore shared. In a disadvantaged community a teacher does not simply make the decision to have Internet access from home

or from school. A similar line of reasoning was followed in placing T5|DAS2: *Financial Factors* in the shared column – while financial factors are personal, it is noticeably situational in a disadvantaged community. T7|DAS2: *School/Township Related Issues* is a strictly situational tension.

From a horizontal perspective, it becomes evident that tensions to the right in the table exaggerate tensions to the left. Consider the ODEM-related tensions identified. If T12|DAS2: *Leader Required* is resolved through an active Subject Advisor who provides training, guidance, encouragement and support via the ODEM, then T1|DAS2: *What to Post* will be resolved. Similarly, on the Non-ODEM side of the table, if all schools have safe and functioning computer laboratories from where teachers can access the ODEM, financial factors would play a lesser role, as would a busy life since teachers can access the ODEM in their free periods or when it suits them. Point of access is also largely resolved since teachers will have choices available.

It thus appears if situational tensions form the core tensions, that is, T12|DAS2: *Leader Required* and T7|DAS2: *School/Township Related Issues*.

That teachers had a need for a leader was pertinent throughout this chapter. In considering (and re-considering) this tension and the data available, I came to the conclusion that this need existed *because of* T7|DAS2: *School/Township Related Issues*. School and Township-related tensions were identified on the basis of a few nodes. But in trying to link the tensions, the thought that this tension is perhaps more pervasive than it appears from the interview data was supported by several entries from my research diary:

Am I demanding too much from them when I perhaps don't fully understand what happens in these schools? Perhaps the forum leader should be one of them – someone who can advise and support them on issues that really matters to them?

Research Diary - self

Teachers' workload at school seems to impact on their motivation to participate in the forum. Only yesterday I read the ratio of teacher-pupil in townships schools are 1:47! Extended families and the practice of ubuntu (sharing) may even put a greater strain on their available financial resources?

Research Diary - self

During the workshop one teacher mentioned that the computer lab was being locked, so they don't have access. All other teachers reaffirmed that they don't have access. One teacher noted that while they have PC's, the headmaster guards them as if he owns it, refusing them access!

Research Diary - self

Just one teacher arrived by car today for the interviews. The rest arrived by public transport. And I wonder why they are late!

Research Diary - self

I spent half the interview acting as his resident psychologist! He fears for his life! Would I contribute if my life was in danger? Can I blame him for his low participation rate?

Research Diary - self

These research diary entries highlight my growing awareness of the many challenges faced by disadvantaged teachers in a disadvantaged school. From this perspective, all the tensions identified could in one way or another be linked to disadvantageousness of these teachers. For example, is the lack of fervour and lack of reflective practices related to the ODEM not situational? That is, given school- and township-related issues, teachers may well display an equal lack of fervour and reflective practices in their daily practice and these tensions are then merely carried over to the ODEM. While speculative, the data points thereto.

The core tension thus points towards T7|**DAS2: School/Township Related Issues**. Teachers have a need for leadership because of their disadvantaged environment, not only in the ODEM but in their daily practice as well. While a Subject Advisor may resolve many of the personal ODEM-related tensions that surfaced and impacted on the object of participation and community building, leadership is equally needed outside the ODEM with the ODEM merely providing a much needed channel of communication. However, a Subject Advisor has limited authority outside the mathematics classroom and can, at most, only resolve some of the personal ODEM-related tensions, and some of the school-related issues as it pertain to the teaching of mathematics. For this reason, T12|**DAS2: Leader Required** is identified as the core tension impacting on **DAS2**.

4.7 Summary

This Chapter presented the analysis of the data obtained from the disadvantaged group. Two Activity Systems, **DAS1: Connecting to the ODEM** and **DAS2: Using the ODEM** was identified. Each Activity System was decomposed by looking at sever data, the ODEM posts, interview and research diary data. Several personal and situational (some shared) tensions were found to exist within the ODEM and outside the ODEM. A synthesis of these tensions led to the discovery that situational tensions leads to personal tensions. The core tension impacting on the disadvantaged group was also identified.

5. Case Study 2: The Advantaged Group

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 - 5.5.1 Using the ODEM
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 - 5.5.2.5 Group size
 - 5.5.2.6 Cross-cultural
 - 5.5.2.7 PC-literacy
- 5.6 Synthesis**
- 5.7 Summary**

5.1 Introduction to Case Study 2

In Chapter 4, the personal and situational tensions that impacted on the use of the ODEM by disadvantaged teachers were uncovered and discussed. In this chapter, the process is repeated with data from the advantaged group of teachers.

This chapter deals exclusively with the second research question, that is:

What are the personal and situational tensions that impact on the use of a mathematics-friendly forum discussion environment as a reflective tool for the CPD of advantaged mathematics teachers?

The same approach as specified in section 4.1.1 is followed here. The reader is referred to the corresponding sections in Chapter 4 for the method applied in presenting results.

Where applicable, the exact corresponding section from Chapter 4 will be referenced.

5.2 Identification of Case Study 2 Activity Systems

Table 5.1 provides a condensed class view of the category data on the advantaged group as it emerged after the open coding process. As in Chapter 4, *categories* are grouped in classes, with figure in brackets after each category a reference to the number of concepts that emerged during the coding process, and which gave rise to the category. The classes discovered in Case Study 2 were Using the ODEM and Asked. While a cursory glance at the categories in these classes seems to mirror that of Case Study 1 it was not arrived at on purpose. There are subtle differences in the number of categories discovered, their placement within classes and in some instances the placement of similar concepts within categories. For example, teachers were asked their thoughts on the size of the group. Disadvantaged teachers' extended responses to this direct question resulted in concepts generated being more at home in the *negative consequences* category in the Using the ODEM class, than under the Asked class, where it appears here in a new category *Group Size*. The makeup of classes and categories are thus dynamic to each case study.

Using the classes identified, only one Activity System is identifiable from Table 5.1, namely Advantaged Activity System 1 (**AAS1**): Using the ODEM. In the next sections (5.2.1 to 5.4) **AAS1** is firstly described and then decomposed without any reference to the categories.

The categories themselves will be decomposed after the Activity System has been dealt with, in section 5.5.

Before connecting to and using the ODEM, a pre-preparation phase similar to the one described in section 4.3.1.1 took place.

Table 5.1 Class view of category data

Class	<u>Using the ODEM</u>	<u>Asked</u>
Categories	Connecting to the ODEM [6] Financial factors [4] Value of ODEM [7] Positive participation effects [9] Preventative factors [24] Negative participation effects [16] Suggestions [6] Other use of PC [4] Ease of use [7] Training required [5]	Subject Advisor required [25] Cross-cultural [11] PC-literacy [6] Access point [10] Content vs Reflection [7] Group size [13]

5.2.1 Background – Pre-preparation phase

With the grant received from the NRF (Thuthuka), refurbished computers were bought. Further preparation was the same as described in section 4.3.1.1. With the advantaged teachers, the pre-preparation phase was duly completed without any significant delay. Given the difficulties experienced and lessons learned in creating Surfmore package Internet accounts for the disadvantaged group via the Telkom Call Centre, accounts were created through a local Telkom Customer store, where the relevant contact information of teachers were provided in person to an agent. This did not affect the results - it just meant that one accessible contact person was used from the start. With the exception of one teacher who's contact number was incorrect, all the accounts were created in less than a week, and the Internet-ready computers configured and ready for distribution to teachers a week later. On 25 October 2006 a workshop was held at the Unisa computer laboratory where teachers were introduced to, and received training in posting to the ODEM. One teacher required a bit more assistance than the others, but in general teachers were able to post and answer with little effort. Including mathematical expressions in posts took a while longer to achieve, but at the end of the workshop it was evident that teachers will manage without any further support.

Reflection as a practise was discussed, and teachers were provided with the same material on reflective practises as the disadvantaged group, as well as the ODEM manual. Three notes were made in the research diary. The first note was that although teachers were confident in using the ODEM, there is a feeling they are perhaps unsure about what exactly is expected of them, even if the concept of reflective practises was explained in depth. It

was as if teachers felt they had to earn their computers, and wanted to make sure that their efforts would be “good” enough. The second entry noted that the workshop was much easier to present with teachers being far more PC-literate than the disadvantaged group. The third entry note noted that all teachers were indeed advantaged, as all arrived with private vehicles which made transportation of their computers easy.

One teacher, Unisa13, experienced great difficulty in making a connection to the Internet, simply because of an incorrect access number supplied by Telkom. Despite phoning Telkom several times for support, the problem was only resolved after nearly three weeks.

No tensions are identifiable from the pre-preparation phase.

This introduces **AAS1**: Using the ODEM.

5.3 Description of AAS1: Using the ODEM

Consider Figure 5.1 which shows **AAS1**.

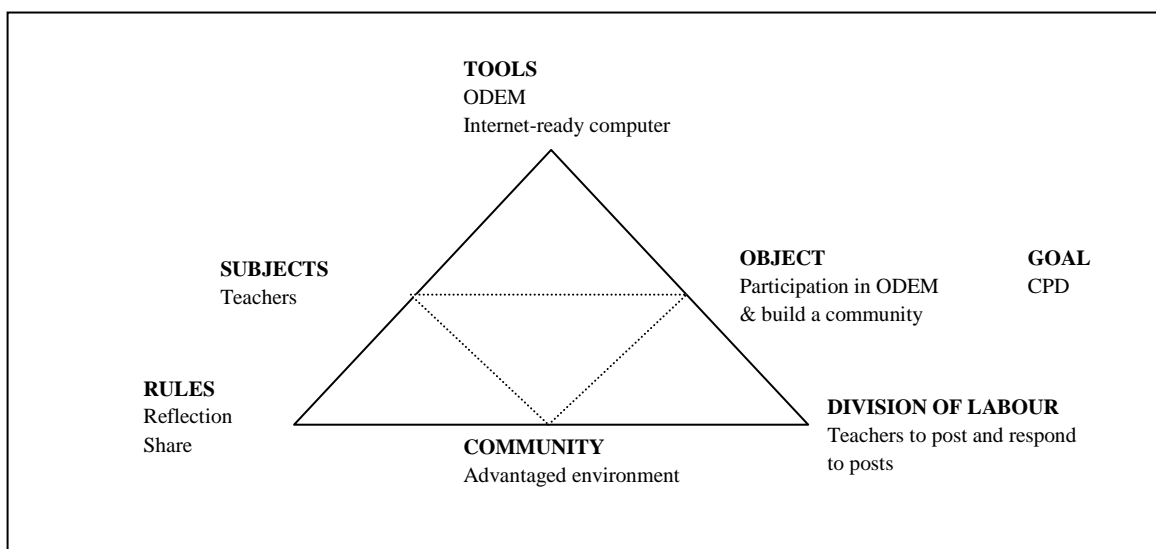


Figure 5.1 AAS1: Using the ODEM

The central process of **AAS1**: Using the ODEM is at the *Subjects* -> *Tools* -> *Object* level. Here teachers (*subjects*) had to use their Internet-ready computers (*tool*) to connect to the ODEM (another *tool*) in order to participate in the ODEM and build a community (*objective*) in order to realize the *goal* of CPD. The *rules* were that teachers had to reflect on their practise and share their experiences with other teachers. The *community* was the advantaged environment teachers worked and lived in while the *division of labour* was to post and respond to posts.

5.3.1 Decomposition of AAS1: Connecting to the ODEM

Tensions in **AAS1** can only be discovered by looking at the teachers' actual posts in the ODEM. The same framework as utilized in the disadvantaged group and as set out in section 4.4.1 was employed to decompose the Activity System.

In the following sections the results obtained are discussed per framework category.

5.3.2 Attempts

Consider Table 5.2 which shows the teachers, their number of practise posts (preview) and their actual posts to the ODEM. Following the convention employed in Chapter 4, teachers are referred to as Unisa10, Unisa11 and so on up to Unisa16.

Table 5.2: Attempts

Teacher	Practise	Actual posts	Ratio
Unisa10	23	20	1.2
Unisa11	19	19	1.0
Unisa12	0	0	0
Unisa13	14	14	1.0
Unisa14	0	0	0
Unisa15	19	18	1.1
Unisa16	19	15	1.3
Total	94	86	Ave 1.1

5.3.2.1 Practise

As with section 4.4.1.1, more previews imply teachers are either actively rephrasing their messages during the writing process to construct clearer or more meaningful posts, or are struggling to generate mathematical expressions should they wish to include these in their post.

All teachers previewed more or less the exact number of times required to post, with the exception of Unisa10 and Unisa16. A total of 86 posts were generated from 94 previews, providing a ratio of 1.1. At an individual level, none of the ratios of number of previews to actual posts exceeds 1.3, indicating teachers to be comfortable with generating posts and with the content of their posts.

A review of the XML-data did not reveal any non-submissions, that is, teachers generating posts but deciding not to submit, indicating teachers either posted or replied with

conviction. None of the XML-data contained any evidence that teachers attempted to use mathematical expressions in their posts.

Considered overall, the data suggests no tension.

5.3.2.2 Correct

A total of 86 posts were successfully posted to the ODEM over the period of 5 months. As indicated here above, none of the actual posts included any mathematical expressions.

5.3.2.3 Wrong

Only two posts were not successfully posted, both related to a failure to preview.

5.3.3 Postings

By reviewing aspects of pattern and type of posts, several insights into the use of the ODEM are gained.

5.3.3.1 Number of active participants

Table 5.2 (and section 4.4.2.1) refers. Two teachers, Unisa12 and Unisa14, did not contribute any posts to the ODEM. It subsequently transpired that these teachers never visited the ODEM. The rest of the teachers were moderately active, with posts ranging from a high of 20 (Unisa10) to a low of 14 (Unisa13). Unisa11 had nineteen posts, Unisa15 eighteen posts and Unisa16 fifteen posts.

Given the relatively even spread no tension is identified.

5.3.3.2 Post and response patterns

Section 4.4.3.2 refers. Table 5.3 shows the relevant data for the advantaged group. Note that unsuccessful posts are not included in the data. Thus Unisa13 had 17 posts in total, but 2 were empty posts due to a failure to preview' leaving her with 15 posts.

Table 5.3 (a) shows most posts to have originated in response to a new thread, as opposed to a new thread being started. Fifteen threads were started, while 71 replies (60 other and 11 own thread responses) were generated in response. This represents 4.7 times more responses than new threads.

As with the disadvantaged group, a new thread was started when participation declined.

Table 5.3 (a) Post and response patterns

Participant	1 st post [thread start]	Response to other threads	Own thread reply	Totals
Unisa10	2	16	2	20
Unisa11	3	14	2	19
Unisa12	0	0	0	0
Unisa13	4	7	3	14
Unisa14	0	0	0	0
Unisa15	3	15	0	18
Unisa16	3	8	4	15
Totals	15	60	11	87

Teachers were asked a question on novel approaches they use in class to explain difficult concepts to learners. This question generated 10 responses. A “welcome” thread was also started, but since teachers used this thread to sustain and support one another, it is included here for further analysis. There were thus 17 threads in total. Table 5.3 (b) lists the number of responses to each thread.

Table 5.3 (b) Number of responses to each thread

Tno	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
NoR	4	5	13	1	3	3	5	5	1	1	3	10	0	3	10	4	0

Key: Tno=thread number; NoR=Number of Responses

Six threads had more than 4 replies. Three threads had more than 9 replies, with a maximum of 13 replies attributed to thread 3. Four threads had 3 responses, 3 threads had 1 response only, while 2 threads elicited no response.

With a small group of participants it is acknowledged that some threads will elicit more responses than others since not all teachers may be interested in a specific thread. If they responded with equal fervour to all threads, it could well be construed as window dressing (efforts to justify their free computers). While longevity is apparent across threads with more than two-thirds (12) of all threads generating more than 3 responses each, more responses than new threads were generated. Without sufficient threads to respond to, the stability of **AAS1** is challenged. Thus, whereas teachers were generally enthusiastic in responding to the low number of threads started, T1|**AAS1**: *Starting Threads* is identified to indicate an inability to generate topics.

5.3.3.3 Lurker statistics

For the same reason as explained in section 4.4.3.3, server logs were not available to extract lurker statistics. However, three of the four teachers that complete the focus questionnaire indicated that they visited the ODEM at times without posting.

5.3.3.4 Frequency of participation

Table 5.4 (a) lists the number of posts made by each teacher per month.

In the first month of participation, October, only 17 posts were made to the ODEM, increasing to a high of 41 in November. Thereafter contributions never exceeded 10 posts per month. Only Unisa10 and Unisa11 contributed in all months, with the rest of the teachers contributing in three of the five months. Unisa12 and Unisa14 did not contribute any posts.

Table 5.4 (a): Frequency of participation

Month	Unisa10	Unisa11	Unisa12	Unisa13	Unisa14	Unisa15	Unisa16	Total
October	5	4	0	0	0	3	5	17
November	8	9	0	9	0	8	7	41
December	1	2	0	0	0	7	0	10
January	5	3	0	1	0	0	0	9
February	2	1	0	4	0	0	3	10
Total	21	19	0	14	0	18	15	86

December's limited contribution was expected since it is a traditional school holiday. Only Unisa15, with 7 out of the 10 contributions submitted that month, participated on a regular basis in December. Since a lower contribution in December was expected, the project was extended with a further month. Schools only started in the middle of January, and the low number of contributions in this month is also understandable. While it is tempting to conclude that the cycle in which the project was run was perhaps not conducive to participation, it must be kept in mind that school terms, which generally run in cycles of three months interspersed with examination periods and/or holidays, will always impact on contributions.

While the data suggests irregular frequencies of participation, Table 5.4 (b) provides another perspective of the data. A cursory glance at the data from August shows teachers to have visited and contributed to the ODEM on a regular basis throughout this month. For example, Unisa13 contributed on 7 different days within the month. Unisa10 and Unisa15

contributed on 5 different days, and Unisa11 and Unisa16 on 4 different days. This pattern, which repeats itself in other months, suggests that teachers will participate frequently throughout a particular month, provided there are threads available to respond to (see T1|AAS1: *Starting Threads*). No other tensions are identified here.

Table 5.4 (b): Frequency of participation (August)

Teacher	Date and time
Unisa13	11-06-06 21:50
Unisa13	11-07-06 20:21
Unisa13	11-08-06 15:34
Unisa13	11-11-06 09:51
Unisa13	11-11-06 09:57
Unisa13	11-13-06 19:35
Unisa13	11-22-06 19:49
Unisa13	11-29-06 16:33
Unisa13	11-29-06 16:39
Unisa11	11-04-06 17:29
Unisa11	11-04-06 17:35
Unisa11	11-07-06 20:56
Unisa11	11-14-06 19:21
Unisa11	11-14-06 19:22
Unisa11	11-14-06 19:26
Unisa11	11-14-06 19:29
Unisa11	11-20-06 19:54
Unisa11	11-20-06 19:57
Unisa10	11-06-06 19:17
Unisa10	11-13-06 20:39
Unisa10	11-13-06 20:46
Unisa10	11-13-06 20:55
Unisa10	11-13-06 21:00
Unisa10	11-19-06 14:41
Unisa10	11-27-06 22:18
Unisa10	11-30-06 06:23
Unisa16	11-12-06 21:06
Unisa16	11-12-06 21:11
Unisa16	11-13-06 21:57
Unisa16	11-13-06 22:04
Unisa16	11-13-06 22:05
Unisa16	11-13-06 22:11
Unisa16	11-23-06 21:01
Unisa16	11-30-06 21:48
Unisa15	11-01-06 20:38
Unisa15	11-01-06 20:47
Unisa15	11-01-06 21:14
Unisa15	11-05-06 18:38
Unisa15	11-07-06 20:35
Unisa15	11-10-06 19:18
Unisa15	11-10-06 19:20
Unisa15	11-17-06 06:11

5.3.3.5 Time of day

Teachers were limited by the Surfmore package to connection after 19h00 in the evenings. Table 5.5 lists the number of posts per time period.

While the majority of posts were submitted within the allotted Surfmore time period, a significant amount (36 or 42%) of posts were submitted outside this period when teachers would connect to the Internet on their own cost. The majority of these posts were

Table 5.5 Time of day

Time	Posts
<19h00	36
19h00-19h59	14
20h00-20h59	19
21h00-22h00	17
>22h00	1

submitted by Unisa10, Unisa11, Unisa13 and Unisa15, in more or less equal amounts.

Unisa13 made use of a prepaid account, which explains her participation outside Surfmore package times, while Unisa10 had made use of a GPRS and ADSL account. Unisa15 and Unisa11 made use of their Surfmore package. It subsequently transpired that Unisa15 upgraded his account to include more flexible hours.

No tension is identified here. Rather, it is noted that the advantaged group is flexible in the time periods they are willing to connect to the ODEM, even if it meant that they had to pay extra for such connections.

5.3.3.6 Nature of posts by classification

Table 5.6 lists the nature and patterns of the posts by classification. All posts to the ODEM were analyzed and re-analyzed with the classification system as provided in the Nature of post column.

The interviews were conducted in Afrikaans and translated into English. Translating text is an arduous task that could very easily result in a different meaning if not approached with care. For transparency purposes, the source text is listed in Appendix C. The superscript that appears after teacher labels (e.g. Unisa11 [1]) references this source.

An example of a single post that contains a fairly representative array of the classification elements is provided to depict the analytical process followed. The elements identified are provided in *boldfaced italics*:

I can only say good luck to you. **Affirming**

Because I have experience in both mainstream and LSEN, I know exactly what your frustrations are.

Agreeing

I would suggest you are open with parents. Let them understand that their child is struggling. Do not talk away the situation, and don't let leave them with a false impression of their child. The parents may have not accepted their child's disability, or they may have had a bad experience with a previous school.

From experience I have seen mainstream children arriving at our school with tremendous shortcomings, due to various factors. Because you have so many learners in class, you cannot give attention to all. That is when children become naughty, fall in arrears, don't get attention etc. When they arrive at our school, they really blossom. A small number of learners allow you the opportunity to give attention to everyone. This also provides the mainstream learners the opportunity to realize how fortunate they are to have educational opportunities, a sound mind and health, which they don't always use. **Reflective practises**

Good luck to you all that experience this problem – it provides education with its challenges.

Positive statement

Unisa11 ^[1]

The above post thus contains an affirming and agreeing response, offers a solution and provide evidence of reflective practises.

All posts to the ODEM were carefully analyzed and re-analyzed in this manner. Total incidence and percentages for questions, responses, statements, reflective practise and ODEM support are provided against the nature of the post as per the classification system.

Table 5.6 (a) Nature of posts by classification

Nature of post	Number of incidences	Totals	Percent [%]
Question – for clarification	6	16	13%
Question – for support	5		
Question – for a solution	5		
Response - agreeing	9	46	37%
Response - affirming	5		
Response – offering solution	27		
Response – correcting	1		
Response – no solution	0		
Positive statement	27	36	29%
Negative statement	9		
ODEM support	7	7	6%
Descriptive reflection	8	20	16%
Dialogic reflection	6		
Critical reflection	6		
Totals	125	125	

Table 5.6 (a) show questions to contribute 13% of the nature of posts, with incidences related to *clarification*, *support required* and *requesting solutions more or less* equally distributed with 6, 5 and 5 posts respectively.

Responses to questions contributed 37% of the nature of the posts, with *offering solutions* the most recurring response chunk with 27 incidences. *Positive* and *negative statements* contributed a sizeable 29% of incidences, with positive statements claiming 27 out of the 36 incidences found. This relatively high number of positive statement incidences is noteworthy. It not only shows teachers to be supportive of one another, but conceivably highlights evidence of occupational strain, especially if the general nature of the negative statements is considered:

Good luck for the week. I think we all need it. **Negative statement**
Unisa11^[2]

...am very tense about a couple of learners moving to Grade 10 mathematics. They clearly won't cope – they're behind mathematically and the disparate development of their brains makes me nervous. **Negative statement**
Please provide some positive encouragement for the junior female!
Unisa10^[3]

ODEM support posts were minimal with only 7 incidences. These requests for support were generally related to the payment of accounts, supporting a view that teachers experienced no problems using and posting to the ODEM.

Reflective practices were found in 16% of the posts, more or less equally spread across the types of practices. Examples of *descriptive reflective* practises found are:

I am of the opinion that learners are not language-proficient anymore – and therefore the teacher must use uncomplicated language.
Unisa10^[4]

I think a big problem with mathematics is that we play far too little and don't do fun stuff. It is as if we are too serious when it concerns mathematics. Maybe something like a film-study in languages must combine with mathematics.
Unisa16^[5]

An example of *dialogic reflection* is provided by Unisa13. Here she steps back, explores the event and provides a conclusion:

What I find strange, is that mathematics and mathematical literacy is not that different. I predict that in the future the clever learners will not necessarily choose mathematics, with the rest literacy. Literacy also requires reading ability and insight.
Unisa13^[6]

Unisa13 also shows evidence of *critical reflection* with her awareness that actions are located in and influenced by a social context:

I find that boys struggle with self-confidence. They try and prove their manhood by using alcohol etc. I am not sure if talking to the parents will help, since the parents of these problem children do not attend parent-evenings. Boys need role-models.
Unisa13^[7]

All teachers made use of reflective practices at least once in their posts. Table 5.6 (b) shows the teachers, the number of times they contributed a reflective post, the percentage of their own posts that were reflective in nature, and the total reflections per reflection category.

Table 5.6 (b) Who reflected

Teacher	Number of reflections [total number of posts]	% Reflections	Critical reflection	Descriptive reflection	Dialogic reflection
Unisa10	5 [20]	20%	1	1	3
Unisa11	3 [19]	16%	1	2	0
Unisa13	7 [14]	50%	1	3	3
Unisa15	1 [18]	0,06%	1	0	0
Unisa16	4 [15]	27%	2	2	0
Total	20 [86]	23%	6	8	6

Reflective posts were more or less equally spread between the categories of critical (6), descriptive (8) and dialogic (6), indicating teachers to be accomplished reflective practitioners. At an individual level, half of Unisa13's posts were reflective in nature. With the exception Unisa15, who was a PC-novice and reflected only once in his 18 posts, the other teachers reflected between 16 and 27%, with an average of 23% for the group. While there is thus evidence of reflective practises, 67% of the posts were not, with offering direct solutions in a question-answer manner the most prevalent means of participation with 27 incidences on its own. On the basis of these figures, and considering that teachers appears to be accomplished reflective practitioners, T2|AAS1: *Lack of Reflective Practises* is identified a tension.

5.4 Tensions in AAS1 – interview and research diary data

From the previous sections, only two plausible tensions were identified, namely T1|AAS1: *Starting Threads*, and T2|AAS1: *Lack of Reflective Practises*. To substantiate these tensions and/or discover other tensions in AAS1, it is necessary to review the interview and research diaries data.

5.5 Interpretation of interview and research diary data

The interview and research diaries data is likely to provide the richest sources of information on the personal and situational tensions that impact on the use the ODEM.

Table 5.1, which provides a class view of category data, is used as an outline to the following sections. Where applicable, for purposes of understanding, cross-reference to other classes and categories will be made. Such an approach will also aid in discovering the linkages between categories, and a possible reclassification.

5.5.1 Using to the ODEM

The class Connecting to the ODEM had one category, similarly named *Connecting to the ODEM*.

5.5.1.1 Connecting to the ODEM.

The category *Connecting to the ODEM* had 2 nodes and 6 concepts.

Connecting to the ODEM (2)

- No connection problems (1)
- Connection problems – Telkom (5)

Two teachers experienced intermittent problems connecting to the Internet. The frustration they experienced is evident:

But to get on the Internet. Telkom is sometimes not, there are times you struggle your butt of just to connect.

Unisa15^[8]

But you get used to it, first you're upset, because you think I have to go there, you then realise some timeperiods early in the morning, just before seven, and then everyone is on the Internet.

Unisa15^[9]

I'm lucky yes, the PC is right there where I eat and I can see it. So I switch it on, then sit there and eat or do things until it connects and stuff like that.

Unisa15^[10]

I struggled to get a line in order to connect, then it disconnects again and I have to go out en so, so it doesn't give me a line immediately en you know, I had to remove my telephone and press the mute button, then my receiver, my earpiece lies there and it zzzzzz the whole time.

Unisa11^[11]

Connection problems are common to dial-up Internet accounts. One teacher, Unisa10, found dial-up so slow that she started making use of a GPRS-enabled phone-modem connection, and later a home ADSL line in order to facilitate connection to the Internet:

There is no time and dial-up is just too slow. It is very-very slow.

Unisa10^[12]

It is interesting to note that the 3 teachers referenced here (Unisa 10, Unisa 11 and Unisa 15) were the most active on the ODEM with 20, 19 and 18 posts respectively. That Unisa10 had the most posts is not surprising, given her faster and more reliable means of

connecting. Unisa15 provides evidence of how these difficulties affected his motivation to participate:

I know I was negative for a day or two – you just cannot connect.
Unisa15^[13]

From the above, T3|AAS1: *Slow Connections* is identified. The principal effect of this tension on AAS1 is that it requires time and effort to participate in the ODEM, thereby not only having the potential to affect the participation rates of enthusiastic teachers, but also possibly exaggerating other (as yet unidentified) tensions.

5.5.1.2 Financial factors

Financial factors had 1 node and 4 concepts.

Financial factors (1)

- Financial problems (4)

In section 5.4.2.5 it was noted that the several members of the advantaged group were relatively flexible in the time periods they were prepared to connect to the ODEM. Unisa11, there against, provides evidence that for her, she was strictly limited to the Surfmore time period:

... I was a bit upset that I overspent on my telephone account.
Unisa11^[14]

Despite being upset, she and other teachers were generally willing to pay for Internet access in order to participate in a forum *if it fits their needs* as teacher:

Only if I am of the opinion that I can use it for other purposes. But for the forum only, no.
Unisa16^[15]

Yes, because I think it will have advantages for my subject.
Unisa13^[16]

Yes, any help offered to teachers is appreciated. We can only help one another.
Unisa11^[17]

Yes, I use the Internet for research as well, but then it must be a live chatroom.
Unisa10^[18]

With the exception of Unisa10 and Unisa15, who indicated that they are to continue their Internet accounts on completion of the project, the other teachers indicated that they were cancelling their accounts despite the fact that they saw value in the ODEM and in the Internet's wealth of supportive content (see section 5.1.1.1). Unisa11 indicated that she will continue her account, but only until her "money runs out". The impression gained is

that, with minor exceptions, advantaged teachers generally have the financial capacity to maintain an Internet connection, but that the ODEM must offer them real value before they will do so.

No specific tension is identifiable.

5.5.1.3 Value of ODEM

The category *Value of the ODEM* had 5 nodes and 7 concepts.

Value of ODEM (7)

- Need for forum (1)
- Need exists (2)
- Need for communication (1)
- Forum less value (1)
- Forum does not work (1)

Teachers' perceptions of the value of the ODEM were diverse. Some teachers saw the value of the ODEM in keeping up to date with current practises:

Yes, I definitely think the forum idea is better. The first reason being that training sessions are brief, there is money wasted on stuff that is not needed and the information you receive ages within 3 months....

Unisa10 ^[19]

I am behind the mountain, in a desolated place, but I can tap knowledge when I cannot get to someone. So I liked it, it enjoyed it.

Unisa11 ^[20]

Other statements explicitly highlight the value gained from interacting with teachers from other schools:

I enjoyed it tremendously and if you can share it with others by saying: Go have a look there, there you can get something on that topic, where I can't get to you personally to say go and have a look.

Unisa11 ^[21]

I would like us to share lessons so we can uplift one another to make class easier and workable, thus I enjoyed the idea of a forum and it can work for that.

Unisa12 ^[22]

I have picked up a couple of things that made me think, oh, here are lovely ideas we can use. So yes, I think the combination of different schools was a lovely idea.

Unisa13 ^[23]

Unisa16 and Unisa14 is less positive:

I once again think it may have value with your training if it is used correctly.

Unisa16 ^[24]

There are many new developments in teaching, developments and the teachers' struggle to stay with, so something like this creates more tension.

Unisa14 ^[25]

There may well be some truth in their statements. Some concepts on the *value of the ODEM* are shared with the category *ODEM versus Cluster meetings* and are standing over until section 5.5.2.4.

These value teachers see in the ODEM contribute towards stabilizing **AAS1**, and no tension is present.

5.5.1.4 Preventative factors

The *Preventative factors* category had 23 concepts that were contained in 7 nodes.

Preventative factors (23)

- Busy family life (2)
- Busy life (15)
- Family support (1)
- Phases (1)
- Phases of participation (1)
- Children access (1)
- Less busy times (2)

A busy life features as the most significant factor impacting on the stability of **AAS1**. A busy life impacts on teachers' ability and motivation to participate on a regular basis:

At times it is very demanding... every Tuesday and Thursday is term tests. That determines how much time you have available.

Unisa13 ^[26]

I must honestly say it is circumstances, where we stay is where we stay, I mean, if we arrive home at five or six o' clock, with a family of five, then it happens at pace.

Unisa12 ^[27]

All this administration, this unnecessary administration en minimal teaching....

Unisa11 ^[28]

Only time. On Tuesday nights we're at church, before that making supper, before that extra class. So Tuesdays nights are out. On Wednesdays it is orchestra. On Thursday and Monday evenings it's musical exercises. So it all has to do with time.

Unisa10 ^[29]

You know, we have meetings in the afternoons for three hours at a time....

Unisa14 ^[30]

The workload in October and November, with exam papers that needs to be marked, church choir that must be organised through the church organist, three children that are writing exams, etc. I just shifted the project to the background, but not enough that I didn't feel guilty!

Unisa14 ^[31]

All these statements are self explanatory, and are inclusive of those teachers who participated on a regular basis. T4|**AAS1**: A *busy life* is recognized as a tension.

Unisa12 and Unisa14 provide distinctive and personal reasons for not participating.

Unisa12 was renting a house on a family smallholding where the existing telephone line was not registered in her name. Attempts to facilitate a connection proved fruitless:

..then I took on Telkom. The next problem was that the Telkom line is not a landline, it works on signals. So the first time they would have come to do it, but I had to get a letter that it is not our house and not registered with us, and troubles like that, and then they would have come at a certain time, which they never did. When they did come, it was 11 o'clock while I'm at school, and the small holding is 20 kilometres from the school, so that first process took three weeks....I think I was just slack, because by that time the October holidays have passed and then it was extra classes' marking, I just, I did not continue the fight with them...I have three children with me. So in the afternoons we manage our things at school and then by six o'clock or so we go home first the first time. This may have had an influence you know, if I was at home in the afternoons then things may have worked out.

Unisa12^[32]

While her personal circumstances was perhaps out of the ordinary, coupled with a busy life it was not easy for her to manage the situation. Unisa14, whom during the interviews came forth as a deeply religious person, provided another perspective:

Only then did I realize the practical implications of a computer with Internet access in a house full of teenagers, without proper monitoring. In the afternoons, Dad is outside in his office and they are alone in the house....

Unisa14^[33]

Not only was she concerned about her children having access to the Internet without being monitored, but her husband also made constant use of the telephone line which prevented her from accessing the ODEM. It is tempting to conclude that she should not have volunteered for the project, but it appears that she did not anticipate practical difficulties specific to her situation:

..we already have an Internet connection. I did not know how these things work, I thought it was easy, but when we tried to setup the PC in the house with my husband in the out room, I realized there must be a connection. As I say, I don't understand these things. By this time I was so ashamed for not having participated that I did not have the courage to phone the project leader. Thus I asked my husband to phone, but that also took a couple of weeks. When he eventually phoned, the project was ending.

Unisa14^[34]

Neither Unisa12 nor Unisa14 made any earnest attempt to solve their problems. T4|AAS1: *A busy life* may well have contributed to their inattention, but some uncertainty remains as to their initial motivation for participation. Nevertheless, since they did not participate at all and their problems were individual, no other tensions can be identified.

5.5.1.5 Positive participation effects

The category *Positive participation effects* had 7 concepts in 4 nodes.

Positive participation effects (7)

- Anonymous place (1)
- Learned a lot (2)
- Empowered (2)
- Started to enjoy (2)

Teachers generally experienced positive outcomes from their participation in the ODEM:

I enjoyed it tremendously...

Unisa11 ^[35]

I have learned a lot.

Unisa11 ^[36]

I can say this, if this is launched nationally, you have to let us, the schools know.

Unisa11 ^[37]

...at the end, you had the feeling you wanted to participate.

Unisa13 ^[38]

When can we continue?

Unisa10 ^[39]

I managed until now with the Internet, but I will miss the forum.

Unisa10 ^[40]

It empowered me, yes, definitely yes, for sure.

Unisa15 ^[41]

Unisa10 and Unisa11 enjoyed the anonymity associated with the ODEM since it allowed them the freedom to discuss issues they otherwise would perhaps not:

...you don't necessarily have your name there. Which may be an advantage since they don't know from which school you are, they don't know you, they can't take you on, they can't gossip over you. So it's an anonymous place. I think that has advantages

Unisa10 ^[42]

But I think because it is an anonymous place you can get rid of your feelings if the gap exists.

Unisa11 ^[43]

I will not post everything, but will open up more than in a meeting, for example.

Unisa11 ^[44]

Unisa11 also reported that she enjoyed having access to other teachers and their knowledge:

I am behind a mountain, or in a desolate place, from where I can tap since I don't have easy access to others. So I like it, I enjoyed it.

Unisa11 ^[45]

Positive participation effects cannot produce tensions. At most, these effects may contribute to resolving tensions.

5.5.1.6 Negative participation effects

The category *Negative participation effects* had 9 concepts in 5 nodes.

Negative participation effects (9)

- Frustration with other teachers (5)
- Low value (1)
- Effort (1)
- Negative feelings (1)
- Impersonal (1)

Unisa10 and Unisa11, who contributed the most to the ODEM, voiced their frustration with the level of participation by other teachers:

There were times I was frustrated with people who didn't comment enough.

Unisa10 ^[46]

...there definitely are dim-witted teachers, who say I have gained my experience through sweat and tears and I will not share it. You can learn it yourself, which is a heartbreaking.

Unisa10 ^[47]

Then I go on the PC and type and have a quick look, and see nobody responded and I just continue.

Unisa10 ^[48]

...some will feel forced and some will feel I want to. I think out of ten maybe one or two will really make an effort.

Unisa11 ^[49]

In section 5.4.3.6, T1|**AAS1**: *Starting Threads* was identified. With few threads started, the quality of interaction is threatened, as Unisa13 and Unisa16 testifies:

...I cannot say I have learned a lot, since specific problems were not addressed.

Unisa13 ^[50]

... sometimes they said there is this bridging test, then we say we should try and send it to one another. You know, it sounded like effort to scan and send stuff people asked for.

Unisa13 ^[51]

You could not really get personal.

Unisa13 ^[52]

...because sometimes I felt like I had to say something, then I added something.

I would say starting off you test the waters but you want to see reaction to a post of yours as well. If people do not respond to your posts, then it will stop you from posting again.

Unisa16 ^[53]

The implication is that some teachers merely went through the “motions” – perhaps a consequence of T1|**AAS1**: *Starting Threads*. If there is a lack of threads with substance, a snowball effect where threads that are perceived as meaningless generate even more meaningless responses is likely. In this manner, the quality of participation is affected, leaving teachers with negative participation effects. T5|**AAS1**: *Quality of Participation* is thus recognised as a tension that destabilizes the Activity System.

As with the category *Value of the ODEM*, it is possible that other tensions contributed to, and/or exaggerated this tension. For example, a T4|**AAS1**: *A busy life* could impact on the time available to generate meaningful threads, contributing to and/or exaggerating

T2|AAS1: *Starting threads*, which in turn contributes to and/or exaggerates T5|AAS1: *Quality of participation*.

5.5.1.7 Suggestions

The category *Suggestions effects* had 7 concepts in 4 nodes.

Suggestions (7)

- Suggestions (4)
- Too short (1)
- Direction (1)
- Positive insets (1)

Teachers had a several suggestions on how participation rates could be improved:

But I don't have knowledge, so I don't know, I think maybe if it was someone that could join me, who could speak my "language", I would have been a leader more than a follower.

Unisa11 ^[54]

You know, there is a similar program I receive from America, Teachers' News Weekly, and they provide lessons on the Internet, they provide snippets and a joke which are teacher-oriented and that is appealing.

Unisa11 ^[55]

Yes, I definitely think there is a place [for the ODEM], but then it needs to be available in an easier and more comfortable way for teachers.

Unisa12 ^[56]

Maybe it [the timeperiod the project ran] was too short.

Unisa13 ^[57]

...then I make up things that are not really a problem. So maybe if it is directed, in a specific direction.

Unisa13 ^[58]

I think so, because you can, as I have said, here are the forms, here are the tasks, here are examples, let us share. Then you can copy and paste, and then send it to one another.

Unisa15 ^[59]

...If there a really positive insets then I will continue to use it.

Unisa16 ^[60]

Teachers also had several specific suggestions on how the ODEM can be used in order to add value to their practice:

The problems I want to discuss are remedial- and syllabus-related.

Unisa10 ^[61]

One could ask for lesson contributions and good advice, like classcontrol, discipline. Even learner projects and photo contributions can be placed on such a forum.

Unisa11 ^[62]

Ideas on examp paperscan be traded. Mathematics problems coupled to practice can be discussed.Problems/suggestionsrelated to subject didactics can be discussed. Classroom procedures can be discussed.

Unisa13 ^[63]

Questions on how a specific task on the learners portfolio must look like comes up regularly and it would be nice to ask for help from teachers from other schools.

Unisa16 ^[64]

Teachers thus have a variety of needs, and they perceive the ODEM to have the potential to fulfil these needs. Some of these suggestions are linked to categories in the Asked class, and will be taken into consideration when that class is reviewed. Given the variety of suggestions, a specific tension cannot be identified

5.5.1.8 Ease of use

The category *Ease of use* had 6 concepts in 4 nodes.

Ease of use (6)

- Formulas yes (1)
- Formulas not required (3)
- Forum fast (1)
- Easy to use (1)

Unisa13 and Unisa15 found the ODEM easy and quick to use:

As I said just now, when I got into it, then I realized it does not take, if you know how it works, [time], you go in for a minute or two.

Unisa13 ^[65]

...but I got to you [the ODEM] quickly, since it looks like [the ODEM] is programmed up to there, but to get on to the Internet...

Unisa15 ^[66]

The data from the *Value of the ODEM* category have showed teachers to not have a need for including mathematical expressions in their posts, as Unisa10 and Unisa13 confirm:

No, you figure it (mathematical problems) out yourself and you can get it in a manual, so I don't think mathematical problems, no.

Unisa13 ^[67]

I cannot think about a scenario where I would put a mathematical problem on the Internet...because you will never put a problem on the Internet asking how to solve it. That you ask your colleagues at work, or you work it out yourself, you are the teacher after all.

Unisa10 ^[68]

Only Unisa11 was of the opinion that being able to include mathematical expressions in posts is helpful, but since she taught a lower grade than the other teachers, she did not have the opportunity to test its usefulness.

No tension is identifiable here.

5.5.1.9 Other use of the PC

The category *Other use of the PC* had 4 concepts in 2 nodes.

Other use of PC (4)

- Other uses for the PC (3)
- Other tasks (1)

Teachers had other uses for the PC than merely visiting the the ODEM, and found added value therein:

...but I enjoyed it and I downloaded many school photos and stuff that I ould apply in my schoolwork and the children were hysterical about it. I downloaded it on a memory stick and showed it to them on a PC...

Unisa11^[69]

The PC I use every day, tests and marks, Excel.

Unisa13^[70]

The other weekend I found information on Phytagoras, so I downloaded it and it's all there - opposite sides, son, cos and tan .It is difficult, you must just search, but it's there, so you don't have to create new stuff.

Unisa15^[71]

Using the PC for other tasks would undoubtedly contribute towards raising teachers' level of PC-literacy, which would benefit use of the ODEM. There are hints here for a blended professional development approach where the ODEM is used jointly with the rich offerings of the WWW.

No tension is identified.

5.5.1.10 Training required

The category *Training required* had 2 concepts in 1 node.

Training required [2]

- More training [2]

Only one teacher, Unisa15, who was also the only PC-illiterate teacher, felt that more training was required. This need, however, was specific to the use of mathematical expressions in interactions:

...I say to you I did not know how to use that mathmetical – we run away from anything that we don't know. You must get used to it, that's why I say your stuff did not work...

Unisa15^[72]

In section 5.5.1.6 it was noted that teachers generally did not have a need for including mathematical expressions in their interactions, and therefore Unisa15's comments are isolated. No tension is identified.

5.5.2 Asked

As with the disadvantaged group, the Asked class covers interview data on specific questions that came to mind during the project.

These questions related to:

- The preferred point of access, that is would they prefer to access the ODEM from home or from school?
- Their preference on the ODEM replacing cluster meetings, cluster meetings only, or both?
- Their thoughts on the participation of a Subject Advisor?
- Their thoughts on reflection and/or content in the ODEM?
- Their level of PC-literacy?
- Their thoughts on sharing the ODEM with teachers from an advantaged background?

5.5.2.1 Point of access

The *Point of Access* category had 4 nodes with 10 concepts.

Point of Access (10)

- Many has access (2)
- House access (7)
- No study (1)

All teachers had access to the Internet from school. Yet, without exception, they preferred access to the ODEM from home, the main reason being that they are too busy at school:

I do not have time at school. I did not even consider going on at school. I want to be undisturbed.
Unisa10^[73]

Yes,yes you know, I did not see my way open to do it from school. I had it at home and could access the Internet anytime from eight to ten at night...
Unisa11^[74]

I want to access from home, there are not really free periods.
Unisa13^[75]

At home, of course, at home. Here you are surrounded by other people and all that stuff, no, I'd rather work from home.
Unisa15^[76]

T4|AAS1: A *busy life* was identified earlier as impacting on the regular use of the ODEM. It is tempting to conclude that having access from home may resolve this tension to some extent. This may or may not be the case. Given the choice of access from school or from home, teachers may prefer access from home simply because it is “less” busy than school. At best, teachers will not access the ODEM from school, if that was their only option available. No further tension is identified.

5.5.2.2 ODEM versus cluster meetings

The *ODEM versus cluster meetings* category had 9 nodes and 15 concepts.

ODEM versus cluster meetings

- Need for forum (1)
- Value of forum over cluster (2)
- Cluster no value (1)
- Forum less value (1)
- Value of forum (3)
- Replace cluster (4)
- Leader must hear (1)
- Frustration with department (1)
- Cluster and forum (1)

Most teachers preferred the ODEM to replace the cluster meetings, for a variety of reasons:

I think the Internet would work better in some instances where you have to drive a long distance to a cluster or where it is dangerous to go to a cluster. In some residential areas different races are not treated equally, coloured, black, white, all that. When I was at FH it was definite – the coloureds do not want to go to Atteridgeville since it is dangerous for them...

Unisa10 ^[77]

...it is such a story getting to a cluster, because if the cluster leaders can start something like this it will work well, then you have it continuously. See, we have a cluster meeting once or twice a semester.

Unisa13 ^[78]

And she can send us messages so we can communicate without having to drive to a place.

Unisa14 ^[79]

You know, we have meetings in the afternoons for three hours. I we could replace those meetings with this system it would be fantastic.

Unisa14 ^[80]

For me the greatest value lies therein that we can get rid of meetings.

Unisa15 ^[81]

Let us say I was proficient on the PC, I could type fast and handle all the demands of the ODEM, then I would say you would not need a cluster meeting. You can have contact on a daily basis via the computer...we see one another once a semester at a cluster...

Unisa15 ^[82]

Teachers see great value in the ODEM replacing the cluster meetings, the main reason being that cluster meetings take up much of their time.

Some teachers preferred the ODEM over cluster meetings in that it would allow them easy and instant access to the Subject Advisor. Moreover, the Subject Advisor would gain a better understanding of what happens at grassroots level:

As an example, one week I counted, nearly 25 calls to get one answer that I needed urgently, so I think if it is a forum where, besides having more teachers onboard, having direct access to the department, it would be of great value.

Unisa12 ^[83]

Yes, they do not have to deal with physical problems. It's easy to have something work on paper, but work with it a groundlevel then it does not work as well, so maybe it is a good thing that they can hear.

Unisa11 ^[84]

If the Subject Advisor knows what is going on and what they know is what is really going on, then it would help since then it is not just a couple of people speculating on the forum, then one can say, Auntie Sannie, can you please tell us exactly how many tasks we have to do this year. Some schools say so many, others so many.

Unisa13 ^[85]

Unisa11 felt cluster meetings should not be replaced since personal contact is required:

What I feel is that with a cluster, you meet on a different level. There you are not faceless, you talk to someone and you share with someone on a personal level. I do not think life should be removed from teaching by a machine.

Unisa11 ^[86]

T4|**AAS1**: A *busy life* could be resolved to some degree if the ODEM could replace or co-exist with cluster meetings. By continually referring to the Subject Advisor in answering this question, the impression is gained that teachers have a greater need for easy and regular access to a Subject Advisor and that the ODEM's value lies primarily in providing them with an instant channel of communication. Section 5.5.2.3 continues with this notion.

5.5.2.3 Subject Advisor required

The *Subject Advisor required* category had 7 nodes with 21 concepts.

Subject Advisor required (17)

- Subject Advisor must hear (2)
- Subject Advisor required (10)
- Not sure about Subject Advisor (1)
- Must force (1)
- Not sure what to post (1-0)
- Need pointers (2-0)
- Frustration with department (4)

Teachers were asked their thoughts on the need for a Subject Advisor to direct interaction in the ODEM. While most teachers welcomed the thought of a Subject Advisor participating in the ODEM, their responses included sideswipes to Subject Advisors that, according to them, require "reality checks":

It could be a good place to have a subject advisor there where people talk on a daily or weekly basis, since the subject advisors are not really in touch with what happens at ground level.

Unisa10 ^[87]

Yes, they do not have to deal with physical problems. It's easy to have something work on paper, but work with it a groundlevel then it does not work as well, so maybe it is a good thing that they can hear.

Unisa11 ^[88]

In the current situation we find ourselves in, such a person would have been valuable...well, it is one of the big problems.

Unisa12 ^[89]

We who work at ground level and they who do not have insight into our problems.

Unisa15 ^[90]

I think they have lots of knowledge, that is why they are in that position and they are supposed to have knowledge, to provide leadership and help.

Unisa15 ^[91]

This is the problem in our country. We cannot go upstairs. Now I ask where is the new formula K we are to use in the future? Now if you can get to the subject advisor she could get to the next person. It does not help having a forum here at the lower levels only.

Unisa15 ^[92]

Teachers also felt that a subject advisor could provide valuable input into the ODEM:

...as opposed to us swallowing air and wondering what we can talk about. So maybe if a subject advisor could provide leadership and said: what do you think about the new FET, of what do you think – if he could push us in a direction.

Unisa13 ^[93]

Yes, yes, a subject advisor can be a positive input. It can be of great help, if you are in a spot you can ask without having to drive somewhere or extending an invitation to your school.

Unisa15 ^[94]

...here is the new formula K, send it out. Now I send, oh, it must be.

Unisa15 ^[95]

Unisa10 was more circumspect about Subject Advisors using the ODEM to provide support to teachers:

Last year I would have said yes, but things are so unorganised that no-one knows what is going on, and if you have a subject advisor online that says this is how it should be done, without a written confirmation, then a lot of people will end up with false illusions.

Unisa10 ^[96]

In general terms then, teachers expressed a specific need for a Subject Advisor to participate in the ODEM, and for a variety of reasons. A tension exists here: T6|AAS1: *Subject Advisor required*. The tension could have been named *Leader required*, but a leader directs top-down and these teachers' primary requirement firstly is for a "sound board", that is, a bottoms-up communication channel, and only then do they require leadership, mainly to resolve their frustrations.

5.5.2.4 Content versus reflection

The *Content versus reflection* category had 5 nodes with 10 concepts.

Content vs Reflection (10)

- Both (3)
- Need inputs (1)
- Support with presentation (3)

- Not content (2)
- Not tasks (1)

Teachers had a need for both content and reflection to be included in the ODEM:

Oh no, no, no, I 'm mad about content, yes I like content.
..but I would increase, since one's head does become void of ideas on how to teach and what to use,
I would say 60-40.

Unisa11 ^[97]

I want someone to share lessons with me, share with me then I share with you, so we can strengthen one another to make class workable and easy. Therefore I enjoy an Internet forum, since it can work well.

Unisa11 ^[98]

Yes, the lesson, the presentation thereof, different ways, does it work, for example, we currently have a problem with the order of the content.

Unisa12 ^[99]

I think there is a place for both, since you need communication to unwind and then some content too.

Unisa14 ^[100]

I think it was enjoyable to be able to talk and receive inputs from other schools, since you have certain problems in your school or class, so I think it has more value since you can resolve subject-related problems in other way. You just want to hear sometimes, do other people have the same problems as you?

Unisa15 ^[101]

Teachers enjoyed the opportunity to interact with other teachers, but required more than just interaction. In section 5.5.1.5 several suggestions on how the ODEM could add value to teachers' practice were listed. And as indicated in the previous two sections, teachers expressed a definite preference for the participation of a Subject Advisor to act as soundboard to the frustrations they experience as teachers. The impression gained is that teachers have a need to have discussion *about* content, and not *on* content.

Considering the last three sections' contributions, a tension is identified: T7|AAS1: *Substance required*. The word substance is applied broadly here to include to all those aspects that may influence the quality of (and perceived value of their interactions in) the ODEM. If there is no substance, there are no valued outcomes and the ODEM may lose its appeal.

5.5.2.5 Group size

The *Group size* category had 5 nodes with 13 concepts.

Group size (13)

- Larger group (5)
- Larger group required(5)
- Small group (1)

- Smaller group (1)
- Smaller but cooperative (1)

All teachers, with the exception of Unisa15, would have preferred a bigger group for the simple reason that more teachers provide more opportunities for interaction, as Unisa10 voices:

I think it is too small. I was frustrated when people did not repond enough. There were a few people that contributed little or none, so with a bigger group, say 20 to 25, you will have more participation and commentary if everyone goes online just once a week
Unisa10 ^[102]

Note that she does not want too many people though, indicating a need for intimacy that Unisa11 concurs with:

Yes, somewhat bigger, but not for a testprogram 50 or so, at least 20 people.
Unisa11 ^[103]

It is tempting to identify the small group size as a tension. But consider the following argument based on the relatively small increase in group numbers teachers want. In section 5.5.1.5, T5|AAS1: *Quality of Participation* was identified as a tension. If substance is added to the ODEM, even a small group of teachers will gain more value. Participation rates will increase because of the increased value, and the quality of participation may well increase. The line of reasoning forwarded here is that more participants do not necessarily guarantee substance or quality, therefore group size cannot be a tension. This does not imply that group size should be ignored - more participants may well increase the *likelihood* of more substantive inputs. Here, quality of participation is considered a more substantive tension than group size.

5.5.2.6 Cross-cultural

The *Cross-cultural* category had 5 nodes with 11 concepts.

Cross-cultural (11)

- Other cultures - problematic (1)
- Other cultures (7)
- Other cultures - no (1)
- Awarness of advantageousness (1)
- Looks down on other cultures (1)

While teachers welcomed the idea of interacting with teachers from other cultures, some were concerned as to what value there is to be gained given existing or perceived disparities:

In the first instance, our problems are totally different. From cluster experiences, the problems I have they do not yet recognise as a problem. I enter 19 marks on Excel, press a button and it is calculated, whereas they have tens lists and write everything by hand. So there problems are different to mine.

Unisa12 ^[104]

You know, they work different to us. I will tell you, and it is not a racist thing, you know, I always say we are all racist, black people are racists themselves and so are we. In our cultures we have differences. I have seen black people that are just as dedicated as us, but they have a more lax attitude. Give the child information, if he works or not, you let him be, you understand. We just push harder, work harder and do more. This is all I have to say about cultural borders. It has nothing to do with qualifications, if a child arrives at us, I do not receive the same strength child as one that arrives from a white teacher. It's not racist, it is facts. That's all I can say. I do not experience trouble with whomever, if we're on course, then there are no differences between black and white, it is the same subject field, you must provide the same content.

Unisa15 ^[105]

Unisa13 saw value in such interaction:

Yes, we could have lovely discussions,. We do this, how do you do it? As an example, my husband has worked with black teachers. Then he has this pile of transparencies only to realize they don't have a projector, they don't even have handbooks. It opens your eyes.

Unisa13 ^[106]

Unisa11 and Unisa13 thought they can gain from such interaction:

Yes, and if I have a black child in my class, and I realize it is some nickname, from another culture, I can ask the question – is this child just naughty, does it mean something, or is he just naughty?

Unisa10 ^[107]

Yes, I will have no problem interacting. I think we can learn a lot from one another.

Unisa11 ^[108]

In general then, some of the teachers had reservations about the potential value of such interactions, while others saw value therein. With the exception of Unisa11, most comments were of a top-down nature, that is, they generally felt that they will perhaps not learn as much as what they can offer disadvantaged teachers. It is difficult to identify a tension on the basis of this notion alone, more so for the reason that such cross-cultural participation did not occur within the parameters of the current study, and any tension identified will be speculative.

5.5.2.7 PC-literacy

The *PC-literacy* category had 3 nodes with 6 concepts.

PC-literacy (6)

- Internet beginner (2)
- Internet savvy (2)
- PC-illiterate (2)

Only one teacher, Unisa15, described himself as PC-illiterate, although he was a fast learner and one of the main contributors to the ODEM. Other teachers described

themselves as ranging from average to highly-literate, both in PC- and Internet-literacy. Unisa15's illiteracy prompted him to make the followings statement on the value of the ODEM in CPD:

Maybe if we are more developed and technology-literate it will become natural, but at this stage, I, and many others, are not literate with this thing. So I think in future it will be part of our lives, something you cannot do without. But at this stage South Africa is behind, we can't compare ourselves with Europe. I think there this will work.
Unisa15. ^[109]

Aside from T3|AAS1: *Slow Connections* which has been identified earlier, there is no tension identifiable that limits advantaged teachers' from connecting to and using the ODEM.

5.6 Synthesis

The tensions identified that could affect the stability of AAS1: Using the ODEM for the advantaged group was:

- T1|AAS1: *Starting Threads*
- T2|AAS1: *Lack of Reflective Practises*
- T3|AAS2: *Slow Connections*
- T4|AAS1: *A Busy life*
- T5|AAS1: *Quality of participation*
- T6|AAS1: *Subject Advisor required*
- T7|AAS1: *Substance required*

In the following paragraphs, an attempt is made to link the tensions identified, to reduce the data and to make sense all that was noted and identified.

AAS1 tensions

T1|AAS1: *Starting Threads* was identified when it became apparent that advantaged teachers preferred to respond to existing threads rather than start threads. This tension threatened the sustainability of the ODEM and contributed towards exaggerating T5|AAS1: *Quality of participation*. One plausible reason for this tension could be that teachers preferred to adopt a leader role. Their top-down view on the value disadvantaged teachers could bring to the ODEM would support such a notion. Teachers also had several suggestions on how the ODEM could be used to add value to their practice, yet few were prepared to initiate discussions along these suggestions. It was also pointed out that a snowball effect is likely to materialise, where threads that are perceived as meaningless generate even more meaningless responses, thereby further exaggerating T5|AAS1: *Quality of participation*.

T2|AAS1: *Lack of Reflective Practises* was identified when it was discovered that despite advantaged teachers showing evidence of being accomplished reflective practitioners, a low percentage of posts were reflective in nature. It may simply be that these teachers have more practical needs they want fulfilled. There was enough evidence to support such a notion. As this chapter progressed, it became more and more apparent that teachers experience immense frustrations in their practice and that they have a far greater need for the ODEM to serve as a direct channel of communication to a Subject Advisor who they perceive as being distant and ignorant to their problems. In this sense, T2|AAS1: *Lack of Reflective Practises* is a valid tension, but only as it relates to the purposes of this study.

T3|AAS1: *Slow Connections* was a source of frustrations for many teachers. The constant struggle to connect to the Internet in order to visit the ODEM exaggerated both T4|AAS1: *A Busy Life* and T5|AAS1: *Quality of participation*. That it may have affected teachers' motivation to participate is unlikely seeing that teachers participated on a fairly regular basis. However, the relatively low number of posts does highlight the overall effect this tension may have had on the stability of AAS1.

T4|AAS1: *A Busy Life* was perhaps the most pervasive tension impacting on AAS1. Not having enough time may impact on the intention to contribute meaningful threads, or even contributing to and/or exaggerating T2|AAS1: *StartingThreads*, which in turn contributes to and/or exaggerates T5|AAS1: *Quality of participation*. That some teachers connected on own cost at times outside the allotted Surfome package time serves as an indication of the importance of this tension.

T5|AAS1: *Quality of participation* has already been linked to other tensions. That the needs of the teachers are not addressed are the primary source of this tension. Teachers are merely “going through the motions” in an effort to comply with the *rules* of participation and building a community. This is not to suggest that teachers did not find value in the ODEM – the *rules* were simply not congruent to their needs.

T6|AAS1: *Subject Advisor required* was identified when teachers' real needs became apparent. These needs were mostly related to issues surrounding departmental policies and the need for Subject Advisors to act as a soundboard to their frustrations. It is reasonable to propose that if the *rules* were changed to “communicate with the Subject Advisor when a need surfaces”, then T1|AAS1: *Starting Threads*, T5|AAS1: *Quality of participation* and T4|AAS1: *A Busy Life* will be largely resolved and the *goal* of CPD will be more

obtainable. The resolution of the latter tension requires more explanation. Having access to a Subject Advisor via the ODEM will not only reduce the need for cluster meetings, but if their needs are quickly resolved they will spend less time trying to resolve these needs themselves, thereby freeing more time, which in turn may nurture more reflective practices. In such a scenario, the size of the group wouldn't matter – only the dedication of a Subject Advisor to respond to and resolve the needs of teachers will matter. Other teachers may then feed off this knowledge.

T7|AAS1: *Substance required* is closely related to T5|AAS1: *Quality of participation*. In fact, the one tension feeds off the other. If there is no quality, there can be no substance, and vice-versa. This supports the notion that teachers' real needs were not addressed by the current set of *rules*.

In conclusion, there is a dynamic interaction between all the existing tensions, individually and collectively, and both in their potential to resolve and/or exaggerate other tensions.

Core tension

In discovering the core tension – if one exists - the same procedure as used in section 4.6 was followed. That is, the tensions were re-grouped into two new categories, namely ODEM-related tensions and non-ODEM-related tensions. Further sub-groupings are personal, situational and shared. As in Chapter 54 this classification and the placement of tensions are based on what was rationalized up to this point.

Table 5.7 shows this classification.

The personal tensions in both categories are not horizontally exclusive. T4|AAS1: *A Busy life* may exaggerate all the ODEM-related tensions. If teachers had more time, most of the ODEM-related tensions may well be resolved - more so if a Subject Advisor participates in the ODEM. Conversely, if T3|AAS1: *Slow Connections* is resolved, then T4|AAS1: *A Busy life*'s impact may be lessened since contributions to the ODEM will not require teachers wasting time waiting for a connection. It is apparent that tensions to the right of the table impacts on tensions to the left.

From a vertical perspective, the tensions in the personal column in the ODEM-related category are noticeably individual, although teachers are collectively affected by each individual tension.

Thus one teacher may start a thread, but receive no quality responses, while another may post threads without any substance. There are no shared tensions in this category or in the non-ODEM-related category. T6|AAS1: *Subject Advisor required* is placed in the situational column given its elevated level. It appears the presence of a Subject Advisor in the ODEM may resolve most of the personal tensions that exists.

Table 5.7 ODEM-related and non-ODEM-related classification of tensions

ODEM-related tensions			Non-ODEM-related tensions		
Personal	Shared	Situational	Personal	Shared	Situational
T1 AAS1: <i>Starting Threads</i>		T6 AAS1: <i>Subject Advisor required</i>	T4 AAS1: A <i>Busy life</i>		T3 AAS1: <i>Slow Connections</i>
T2 AAS1: <i>Lack of Reflective Practises</i>					
T5 AAS1: <i>Quality of participation</i>					
T7 AAS1: <i>Substance required</i>					

Given the horizontal patterns identified, the situational tensions would form the core tensions. T3|AAS1: *Slow Connections* was a source of frustration for many teachers and may have exaggerated some of the personal ODEM-related tensions. However, a faster connection does not guarantee other tensions will be resolved. At best, teachers will simply arrive at the ODEM faster to face the same tensions. That slow connections are demotivating and does affect participation rates is not ignored. Some advantaged teachers did indeed upgrade to faster Internet connections, and this did not resolve their tensions.

Teachers' need for a Subject Advisor surfaced throughout the interviews, with her main role explicitly defined by some teachers as "getting in touch" with what happens at grassroots level. The implication is that teachers do not see value in the ODEM if their needs are not addressed, and that their core need is indeed the core tension of the advantaged group: T6|AAS1: *Subject Advisor required*.

5.7 Summary

This Chapter presented an analysis of the data collected on the advantaged group. Only one Activity System, AAS1: Using the ODEM, was identified. The Activity System was decomposed by looking at sever data, the ODEM posts, interview and research diary data. A few personal and situational (some shared) tensions were found to exist within the

ODEM and outside the ODEM. A synthesis of these tensions led to the discovery of the core tension of the Activity System.

6. Comparison between Disadvantaged and Advantaged Groups

- 6.1 Introduction**
- 6.2 A comparative display of the tensions**
 - 6.2.1 Organization of network
 - 6.2.1.1 Size of groups
 - 6.2.1.2 Physical location
 - 6.2.1.3 Level of education
 - 6.2.1.4 Common experience
 - 6.2.1.5 PC/Internet literacy
 - 6.2.1.6 Relationship to one another
 - 6.2.1.7 Summary
 - 6.2.2 Network task organization (Activity)
 - 6.2.3 Response opportunities
 - 6.2.4 Response obligations
 - 6.2.5 Coordination and evaluation
- 6.3 Summary**

6.1 Introduction

This chapter deals exclusively with the 3rd research question, namely:

What differences exist between the advantaged and disadvantaged groups as it relates to the personal and situational tensions identified?

In Chapters 4 and 5, individual reports on the disadvantaged and advantaged groups were provided. Several tensions impacting on the identified Activity Systems were identified in each group, and each chapter was concluded with a summary where an attempt was made to identify and explain the interplay between the tensions. Core tensions impacting on each group were also identified.

Rather than merely comparing the summaries, cognisance is taken of Miles and Huberman's (1994) warning that humans are not powerful processors of large amounts of information, and that we have a cognitive tendency to reduce complex information into selective and simplified configurations. How we display the information plays a major role in what we extract.

Figure 6.1 shows their model of the interaction between data collection, reduction, display and conclusions.

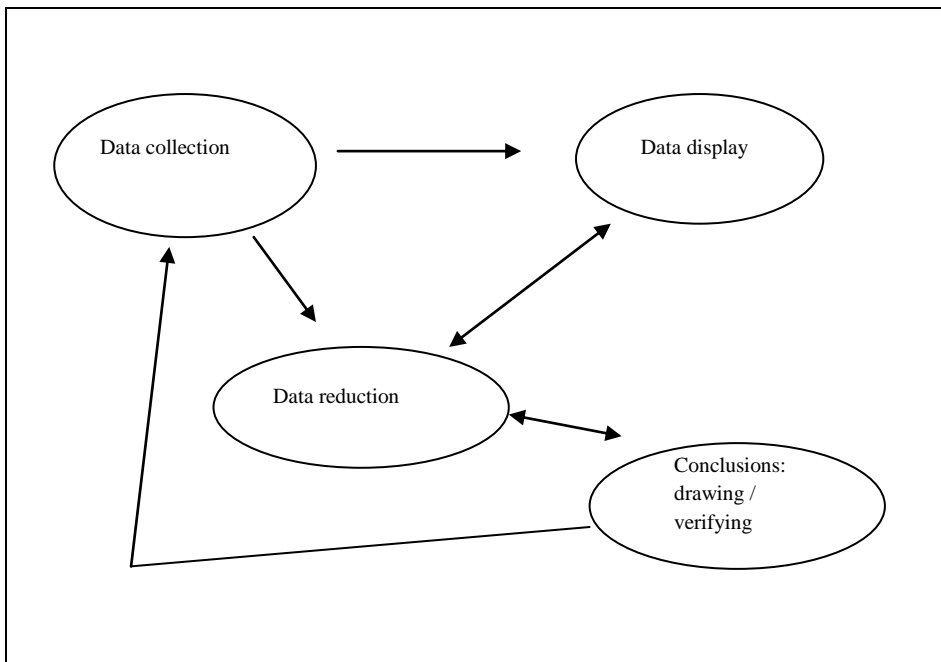


Figure 6.1 Components of Data Analysis: Interactive Model

What this model proposes is that after data collection, the analyst “shuttles” among reduction, display and conclusion drawing.

In the previous two chapters the data has been reduced once. In this chapter then, the display is changed in order to prevent a simplified comparison.

6.2 A comparative display of the tensions

Riel and Levin’s (1990) schematic framework for describing network communities was used to conceive the opening questions used in the semi-structured interviews (see Chapter 3). Since their framework directed much of the data collected, it is employed here again to isolate features that correlate with successful patterns of network interaction in each group.

Very briefly, Riel and Levin (1990) propose five network participant structures to guide analysis of group interaction on computer networks, namely:

1. Organization of the network group
2. Task organization
3. Response opportunities
4. Response obligations
5. Coordination and evaluation

Organization of the network group refers to features associated with the network group that describes the participants' background outside the network. Task organization refers to the activity pursued, which may be highly specified or broadly defined. Response opportunities covers features surrounding ease of access of access to the network, while response obligations refers to features that support a shared commitment to make productive contributions to the network. Coordination and evaluation refers to the level of control and evaluation of the success of the network, either centralized (group members) or decentralized (outside leader). They suggest that successful networks deviate from the pattern proposed by one single feature, while unsuccessful networks deviate by two or more features.

This framework is used to guide the comparison between the disadvantaged and advantaged groups as follows. In the summaries of Chapters 4 and 5 the tensions identified were linked in an attempt to “make sense of it all”. The knowledge gained in that process allows the purposeful “placement” of the tensions identified in the current framework where it is perceived to have the greatest impact on the structures. Note that this framework is employed foremost for purposes of comparison. That is, by placing the tensions in apposite containers, the comparison process is enhanced. That the framework provides insight into the success of the ODEM is a secondary by-product.

Consider Table 6.1 which lists the features and tensions associated with the disadvantaged and advantaged groups against the structures. Tensions that are shared between groups are printed in a **red** font, while other tensions are printed in a **blue** font.

Rather than analyzing the groups separately (vertically) and then doing a comparison (horizontally), these steps are combined into a single analysis. It is not necessary to describe the tensions at length as this was done in Chapters 4 and 5.

The mode of analysis will follow a set pattern. Each structure (and its substructures) is firstly described, and then, if required, concluded with a summary that attempts to interpret the data. Once all structures have been described and summarized, the chapter is concluded with an overall summary that once again attempts to “make sense of it all”.

Table 6.1 Features and tensions comparison

Structure	Disadvantaged Group	Advantaged Group
Organization of Network		
Size of groups	9 teachers, 8 active participants	7 teachers, 5 active participants
Physical location of active teachers	7 teachers from Mamelodi Township (middle to lower class) 1 teacher from Ladium, an Indian community (higher to middle class) 1 teacher from Pretoria Central (middle to lower class)	3 from Pretoria East (higher class) 2 from Pretoria North (higher to middle class) 1 from Pretoria Southwest (higher to middle class)
Level of Education	7 Diplomas, 1 Degree	1 Diploma, 4 Degrees
Common experience	All active Cluster Meetings participants Grade 7-9 phase mathematics teachers	All active Cluster Meetings participants Grade 7-9 phase mathematics teachers
Level of PC/Internet Literacy	T9 DAS2: Training Required 1 literate 7 illiterate	4 literate 1 illiterate
Relationship to one another	Horizontal	Horizontal
Network Task Organization (Activity)	Reflect, exchange information, share ideas T4 DAS2: Lack of Reflective Practices T1 DAS2: What to Post T2 DAS2: Irregular Contributions	Reflect, exchange information, share ideas T2 AAS1: Lack of Reflective Practices T1 AAS1: Starting Threads
Response Opportunities	T1 DAS1: Creating Internet Accounts T6 DAS2: A Busy Life T2 DAS1: Connection Problems T3 DAS1: Lack of Suitable Support Structures T5 DAS2: Financial Factors T7 DAS2: School/Township Related Issues T11 DAS2: Point of Access	T3 AAS1: Slow Connections T4 AAS1: A busy life
Response Obligations	T8 DAS2: Quality of Participation T10 DAS2: Lack of Motivation T3 DAS2: Lack of Fervour T9 DAS2: Training Required	T5 AAS1: Quality of participation T7 AAS1: Substance required
Coordination and evaluation	T12 DAS2: Leader Required	T6 AAS1: Subject Advisor required

6.2.1 Organization of Network

The Organization of Network refers to participant structures such as number, amount of past experience, degree of common interest and the relationships within the group (Riel

and Levin 1990). The following sub-structures were used to fully describe the above features: size of groups, physical location of active teachers, level of education, common experience, level of PC/Internet literacy and relationship to one another. Each sub-structure is descriptively dealt with in the next sections.

6.2.1.1 Size of groups

From an invitation for 10 teachers from each of the relevant Cluster Meeting groups to participate in the study, 9 teachers from the disadvantaged group and 7 from the advantaged group volunteered. Of the 9 disadvantaged teachers who received computers and Internet access, 8 contributed. From the advantaged group, 5 teachers contributed.

With both groups being relatively small, equal opportunities for tensions to surface existed. For example, the possible advantage a much larger group of 50 teachers may have in terms of participation rates (more teachers will collectively post more, even if all teachers do not post regularly) is largely negated.

The slight advantage the disadvantaged group had in numbers is offset by the number of tensions that faced this group. Both groups finished with a total of 86/87 posts, although the advantaged group participated an extra month, (the holiday month of December, with 10 posts).

6.2.1.2 Physical location

The physical location of the groups refers to the community within which they teach and does not refer to teachers' personal or financial status. There is a subtle linkage nonetheless. This linkage is set along racial lines where disadvantaged teachers, given their lower qualifications and lower income (see level of education in the next section) live in the same community they teach in. Seven disadvantaged teachers taught and lived in Mamelodi, a less affluent Township situated just outside the city of Pretoria, to the northeast. One disadvantaged teacher taught and lived in Ladium, a more affluent Indian community.

One advantaged teacher taught in a school situated in Pretoria East, a very affluent suburb. One teacher taught in Pretoria Central, a less affluent high-rise residential area. Two teachers taught in the northern region of Pretoria, in suburbs considered more affluent. The

final teacher taught in the Southwest of Pretoria, in an affluent suburb. All teachers, with the exception of two, resided in or close to the community they teach in.

Within groups, teachers thus experienced similar conditions, with the disadvantaged teachers teaching in less affluent communities, and the advantaged teachers teaching in more affluent communities.

6.2.1.3 Level of education

The level of education within each group was, with one exception each, the same. Between groups, the difference is considerable. From the seven disadvantaged teachers, only one held a university degree, with the rest holding diplomas. The opposite is true for the advantaged group. Here, four teachers held degrees and only one a diploma.

6.2.1.4 Common experience

All teachers are active Cluster Meeting participants, and were identified as motivated teachers by the Subject Advisor for Gauteng North. They can thus be regarded as committed to CPD opportunities. Teachers from Mamelodi are involved in the same Cluster group, while the advantaged group are split between various Cluster Meeting Groups. Despite this split, many advantaged teachers know one another from combined meetings. A sense of community thus existed prior to the participation in the ODEM, although the strength thereof is unknown.

Both the advantaged and disadvantaged groups teach in the Grades 7 -9 phase. One advantaged teacher teaches only Grade 8 and one disadvantaged teacher only Grade 7, whereas the other teachers all teach at least Grade 9 in combination with lower phases.

6.2.1.5 PC/Internet literacy

Although PC-literacy was a requirement for participation, the disadvantaged group, with the exception of one teacher, were PC-illiterate. In the advantaged group, 4 teachers described their level of PC-literacy ranging from very high to average, with two judging their Internet literacy to be low. One advantaged teacher considered himself to be a novice.

In general the disadvantaged group can thus be described as PC-illiterate, while the advantaged group is PC-literate. Both groups of teachers received literacy training in the workshops. The disadvantaged group received training in PC- and Internet-literacy, while

the advantaged group only required Internet literacy training as it relates to the use of the ODEM. The one advantaged teacher who was PC-illiterate required more individual attention, but was a fast learner. In general terms, the training advantaged teachers received were of a more introductory nature.

T9|DAS2: *Training Required* was identified in the disadvantaged group to indicate the higher level of PC-and Internet-literacy training required (note that this tension also refers to the need for ongoing guidance, tutoring and coaching outside PC-literacy training).

6.2.1.6 Relationship to one another

Since all participants were teachers, the relationship within groups was horizontal. No leader was appointed to oversee the ODEM, and no noticeable leader surfaced during their time online.

6.2.1.7 Summary

With reference to Table 6.1, the two groups were vertically (column-wise) identical but horizontally (row-wise) distinct as it concerns the features associated with the Organisation of Network structure. The differences noted are expected since they reflect the historical disparity that exists between disadvantaged and advantaged teachers, which is the focus of the current research. Nonetheless, the preceding sections highlight the chasm that exist between the two cases, and underlies many of the tensions that were found.

6.2.2 Network Task Organization (Activity)

Both groups of teachers were tasked to use the ODEM to reflect on their practise, to exchange ideas and to share ideas. Following this approach, it was argued that they would form and build a virtual community that is based on their needs. Network task organization also refers to the nature of the network communications.

Several tensions were associated with both groups. While both groups showed evidence of reflective practises (with the advantaged group more accomplished), it was considered inadequate when viewed against the total number of posts made, and T4|DAS2: *Lack of Reflective Practices* and T4|AAS1: *Lack of Reflective Practices* were identified. Whereas all but one advantaged teachers showed evidence of reflective practises, not all disadvantaged teachers did, with 2 teachers contributing most of the reflective posts across the reflective categories and three teachers not reflecting at all. However, there is little to

choose between the groups in terms of individual totals expressed as a percentage of total posts, with totals ranging from 50% to 16% (ignoring the one disadvantaged teacher who made just one reflective post for a total of 100% and the one advantaged teacher who returned 0, 06%) and equalling out at an average of around 23% (all posts considered). When teachers reflected, advantaged teachers were more competent reflective practitioners, and lack of reflective practices therefore is not an absolute value across groups. What the lack of reflective practices also shows is that teachers have other needs that must be fulfilled before truly reflective practices can be nurtured.

In the disadvantaged group, T1|**DAS2: What to Post** was identified. From 87 posts, only 22 threads were started, the rest of the posts being responses to these threads. While the data may suggest a “lack of threads started” as opposed to “what to post”, the low number of responses to the threads started must be taken into consideration. For example, only 3 threads had more than 3 replies, indicating that teachers “did not know what to post”, i.e. they struggled to sustain a thread beyond three replies. The same pattern was found with the advantaged group, with only 15 threads started. But here, replies to threads were more sustaining, with 6 threads having more than 4 replies, and three threads more than 9 replies. Thus advantaged teachers did not experience a problem responding to posts, i.e. they could sustain a thread. They “knew what to post” once a thread was started, but preferred to respond, to be a provider of solutions, and to give guidance rather than opening up and perhaps publically displaying their shortcomings. The tension was thus labelled T2|**AAS1: Starting Threads** in the advantaged group, rather than “what to post”.

T2|**DAS2: Irregular Contributions**, as identified in the disadvantaged group, supported this pattern. Whereas advantaged teachers contributed regularly to available threads throughout a month, the disadvantaged teachers did not, visiting and contributing mostly in a once-off manner. The two disadvantaged tensions feed of one another, underpinning the difference in labelling made in the previous paragraph.

6.2.3 Response opportunities

As Table 6.1 shows, ease of network access to the ODEM resulted in several tensions for the disadvantaged group and only two for the advantaged group. The disadvantaged tensions surfaced even before teachers had access to the Internet, and persisted once they were connected. There against, the advantaged group only experienced slow connection speeds once connected, with most converting to faster Internet connections.

Three disadvantaged group tensions are directly related to the process of getting connected, namely T1|**DAS1**: *Creating Internet Accounts*, T2|**DAS1**: *Connection Problems* and T3|**DAS1**: *Lack of Suitable Support Structures*. Few teachers had existing telephone lines, and creating Internet accounts was a drawn out process since telephone lines had to be installed. The difficulties experienced in making contact with the teachers proved a major obstacle in these processes for both me and the Telkom Call Center agents. The connection problems that plagued these teachers were mostly related to hardware problems, which were made worse by the mediocre support Telkom provided to PC-illiterate teachers. Getting physical support required additional effort from teachers with most having to rely on public transport, which is not easy when one has to haul a PC-tower along. One plausible explanation for the many hardware problems the disadvantaged group experienced is that bumpy untarred townships roads may have caused “card creep”, which resulted in the modem cards wiggling out of the motherboard busses. Most hardware problems were modem-related and were solved by re-inserting the cards.

While these tensions were resolved with time, their existence nevertheless emphasizes the chasm that existed between the disadvantaged and advantaged groups in getting connected, having access to support and the ability to upgrade the type of connection when slow connection speeds interfered with participation rates.

Once connected, the major tension impacting on response opportunities, for both groups, was a busy life. Teachers were simply too busy to visit the ODEM as much as they would have liked. Having access from home did not alleviate this tension either - rather it gave rise to T11|**DAS2**: *Point of Access* for the disadvantaged group who were split on where (and when) they preferred access. A busy life extended into the evenings for both groups and is possibly aggravated by school terms full of activity.

The disadvantaged group faced several other tensions related to response opportunities. Whereas some teachers in the advantaged group connected (at own cost) during times which suited them, the disadvantaged group could not because of financial limitations. These teachers earn much less than advantaged teachers given their qualifications, while their culture of *ubuntu* (sharing and supporting family and friends financially) is a well-documented. Only one disadvantaged teacher continued with their Internet account on completion of the project, implying that opportunities for further participation in such forums are severely limited. The disadvantaged group also faced tensions related to

School/Township life. Schools in these areas don't have accessible computer-laboratories, limiting opportunities for participation even further. While both groups experience work-related frustrations, the disadvantaged teachers' frustrations are magnified as a result of the onslaught of many other tensions. A busy life in a disadvantaged community most probably surpasses a busy life in an advantaged community by many degrees, as endorsed by the number of tensions identified.

In summary, despite both groups having a busy life, the advantaged teachers experienced fewer tensions and thus had more opportunities for participation and community building than the disadvantaged teachers.

6.2.4 Response Obligations

Response obligations refer to the desire of teachers to "make the ODEM work", thereby collecting value from their participation. All teachers were active and motivated cluster participants committed to CPD opportunities. In the previous sections some of the tensions that may have affected their participation patterns were highlighted. If those tensions did not exist, then the tensions identified and placed here may well have been very different.

The disadvantaged group experienced more response obligation-related tensions than the advantaged group. The response obligations-related tensions associated with the disadvantaged group were T10|DAS2: *Lack of Motivation*, T3|DAS2: *Lack of Fervour*, T8|DAS2: *Quality of Participation* and T9|DAS2: *Training Required*. For the advantaged group, only two tensions came forth, namely T5|DAS1: *Quality of participation* and T7|DAS1: *Substance required*.

The tension shared was *Quality of Participation*. Quality of participation is relative to the groups, of course. Compared to the disadvantaged group, the advantaged group's participation was of a higher quality. This is evident should one read through the forum messages. In both groups there were teachers that were unhappy with the efforts and contributions of other teachers. Yet there was little evidence that these teachers attempted to adopt a leadership role, thereby raising the quality of participation to a higher level. But even if they did, there is no guarantee that other teachers would have responded likewise.

A likely order of tensions leading to a reduced *quality of participation* for the disadvantaged group would be:

Other tensions => T9|DAS2: *Training Required* => T10|DAS2: *Lack of Motivation* => T3|DAS2: *Lack of Fervour* => T8|DAS2: *Quality of Participation*.

For the advantaged group, this order would simply be:

Other tensions => T7|AAS1: *Substance required* => T5|AAS1: *Quality of participation*

Quality of participation is thus an end result for both groups as it concerns response obligations. But to achieve quality in interaction there are other tensions that must be resolved first (as some or all of the individual tensions are solvable by a Subject Advisor, the impact and order of the remaining tensions may well change).

Conversely, and viewed inclusively, it is apparent that the disadvantaged teachers' quality of participation is more a product of all their tensions and their specific needs than is the case with advantaged teachers. That is, the tensions that surfaced in this and other categories for the disadvantaged group all contributed in various measures to T8|DAS2: *Quality of Participation*. With fewer tensions to resolve the advantaged group should potentially have achieved a higher level of quality of participation. This did not happen, and the only possible reason for this not happening is that these teachers also had needs that the ODEM did not meet.

In summary, as it relates to response obligations, the chasm in needs and challenges that exists between the disadvantaged and advantaged group is once again evident.

6.2.5 Coordination and evaluation

The level of control and evaluation of the success of the network was dependent on the group members. In the absence of a leader rising from within the ODEM, the tensions T12|DAS2: *Leader Required* and T6|AAS1: *Subject Advisor Required* were identified.

While both groups saw value in the ODEM, too many tensions were associated with this absence of a Leader/Subject Advisor, which impacted on the level of control that existed. This does not imply a complete failure of the network. Rather, for the network to have been more successful, a Leader/Subject Advisor was required. The control that this Leader/Subject Advisor need to exert lies mainly in fulfilling the teachers' needs as it relate to their practice, that is, for them to have an open channel of communication to a Leader/Subject Advisor specific to their needs, and for a Leader/Subject Advisor to gain insight into their practice, i.e. what really happens at grassroots level.

6.3 Summary

By comparing the two groups, another display of the data was rendered which will be helpful in drawing final conclusions.

In terms of the characteristics of electronic communities as described by (Riel and Levin 1990), both groups were partially successful. The organisation of network was particularly successful. For the rest of the network structures, there were too many tensions and unfulfilled needs that prevented other structures from being realized.

What this chapter particularly highlighted was the chasms that exist between the disadvantaged and advantaged groups. These chasms existed outside the ODEM (for the disadvantaged group) and within the ODEM (for both groups). It may be argued that such chasms can be expected – after all, one group is advantaged and the other is not. But despite their advantageousness, the advantaged group also faced tensions. The major difference, besides the number of tensions each group faced, seems to lie in the *sources* of these tensions. In the case of the disadvantaged group, there is a possibility that their tensions were carried over from practice into the ODEM, where it was exacerbated by the need for leadership within the ODEM. There against, the advantaged group tensions resulted mostly from issues outside the ODEM. Either way, both groups' participation in the ODEM was affected by the tensions identified.

In this sense, the ODEM community was a microcosm of real communities. Even in the few “similarities” that existed, there were differences. A busy life for advantaged teachers is different to the busy life of disadvantaged teachers. Given other tensions, quality of participation and the lack of reflective practises attained different intensities in the two groups.

Considering the background and nature of the tensions that faced the disadvantaged group, the advantaged group was in a better position to build on their community, but did not. In this lack of progression lies the realisation that communities and education itself may need reform before the ODEM can become a successful *tool* for CPD. The next chapter explores this notion by evaluating the value of the ODEM in its current implementation.

7. The Value of the ODEM as a Reflective Tool

- 7.1 Introduction**
- 7.2. Judging the value of the ODEM**
- 7.3 Comparative discussion of elements, dimensions and markers**
 - 7.3.1 Formation of group identity and norms for interaction
 - 7.3.2 In-depth dialogue among participants
 - 7.3.2.1 Taking communal responsibility for individuals' growth
 - 7.3.2.2 Negotiating the essential tension
 - 7.3.2.3 Understanding differences/Navigating fault lines
 - 7.3.3 An environment that support responsiveness, trust and insight
 - 7.3.4 The ability of the technology employed
- 7.4 Synthesis**
- 7.5 Summary**

7.1 Introduction

In the previous three chapters various displays of the data were employed in order to find answers to the first three research questions. In Chapters 4 and 5 research questions one and two were explored by identifying tensions that impacted on the use of the ODEM per group. Tensions were also linked in an attempt to discover the core tensions. Research question three was dealt with in Chapter 6. There Riel and Levin's (1990) framework was used to group and compare tensions with features that correlate with successful patterns of network interaction. The current chapter revisits that data by adopting another display in an effort to answer the fourth research question:

Is a mathematics-friendly online discussion environment valuable as a tool for the CPD of disadvantaged and advantaged mathematics teachers?

Note the use of the word “valuable” as opposed to “successful”. Whereas success is the achievement of something desired, planned or attempted, value refers to worth in usefulness. If the ODEM has “value”, it would be sustainable since teachers will find it useful and will want to continue using it. This is not necessarily the case with “success”, since the ODEM might be successful for the period of implementation, but not sustainable thereafter.

In sections 4.5.3.6 and 5.5.1.3 it was reported that most teachers saw value in the ODEM, and they provided suggestions on how to enhance its value. That the tensions identified had an impact on the current value of the ODEM is thus inferential. But it would be

injudicious to ignore the potential value of the ODEM if the tensions identified could be resolved and some level of sustainability could be achieved. It would be equally unwise to assume that no value was gained from its current implementation. A more detailed examination of the data is thus required.

The next section explains the approach followed in answering the 4th research question. In section 7.3 and its sub-sections a comparative discussion of the elements, dimensions and markers used to determine the value of the ODEM is presented. In the final section a synthesis of the main findings and a decision on the value (which implies sustainability) of the ODEM is provided.

7.2 Judging the value of the ODEM

A search of the literature for guidelines on how to evaluate the value of an online (or virtual) community brought forth few guidelines. Even a cursory review of the literature reveals a pre-occupation with the *success* of online ventures as opposed to the *value* thereof. As Lynch (2005) points out in an aptly titled paper “Success Versus Value: What do we Mean by the Business of Online Education” the market and need for online education force institutions to approach online endeavours as a business. There is thus a “must-work-at-all-cost” approach that prevents us from being comfortable with failing. The result, as Leimesiter, Sidiras and Krcmar (2004) note, is that research on online success factors generally focuses on a search for methods and models that will explain success and how to maximize it.

While some guidelines are provided, these factors cannot explain all the correlations of every application of community and such research thus typically provide ideas for new approaches (“how-to’s”) that will hopefully result in more “effective” online communities. In the next chapter I argue that the context of the current research precluded much of the applicability of the extant literature. In order to judge the value of the ODEM within the current data set, essential elements that accurately describe the interactions and resultant relationships that did take place and were formed in the ODEM will be evaluated. Following this route, the focus remains on the value that was gained, no matter how small or insignificant it was.

Keegan (1996) recommended that the evaluation of any distance program should focus on four aspects, namely:

1. The quantity of learning,
2. The quality of learning (here the effectiveness of the CPD that took place based on the quality of interaction),
3. The status of the learning (here the transferability to practice), and
4. The relative costs of the learning (here the cost effectiveness of providing teachers with access against the benefits).

While the ODEM is not a distance program *per se*, there are similarities in that the goals of learning (distance program) and CPD (online) are both pursued over distance. Rephrased for the ODEM these four aspects would read (a) The amount of CPD that took place, (b) the quality of CPD that took place, based on the quality of interaction, (c) the transferability to practice, and (d) the cost effectiveness of providing teachers with access against the benefits achieved.

King (2002), after a comprehensive review of the literature on teacher education programs, adult learning and online learning, identified several elements that can be used to identify success in professional development programs:

1. Presentation of accurate, current and substantial content
2. In-depth dialogue among participants about the content meaning, application and implication
3. The ability for learners to be able to ask questions and share responses in an environment that support responsiveness, trust and insight
4. The ability of the technology employed to work smoothly enough to not detract from learning
5. The capability to facilitate collaborative work among learner easily, and
6. The development of assignments that can both apply to the classroom and to academic research

Element 2 above is complementary to aspects (a) and (b) from the Keegan model, while element 5 is complimentary to aspect (d). Given the current chapters' focus on *value* as opposed to *success*, elements 2-5 are adapted to read as follows:

1. In-depth dialogue among participants
2. The ability of teachers to be able to ask questions and share responses in an environment that support responsiveness, trust and insight

3. The ability of the technology employed to work smoothly enough to not detract from interaction

The above elements provide a one-dimensional display of the data. To provide more dimension and depth, selected elements of a model proposed by Grossman, Wineberg and Woolworth (2000) that aims to provide schematic markers of community formation, i.e. whether a community is in a beginning, evolving or mature phase, were also used. The relevance of their model here is that an indication of the phase of community achieved in the ODEM would be an indication of the (potential) value of the ODEM. That is, if the ODEM supports the formation of a community wherein CPD can occur, then it has (potential) value. Since many of the dimensions of the Grossman et al. (2000) model can only be recognized via a completely different research focus, only dimensions that are recognizable within the current data set are employed.

These dimensions are:

- spread across the formation of a group identity and the norms for interaction;
- the navigation of fault lines which is related to conflict and differences in opinion; the negotiation of an essential tension (not to be confused with the tensions of the current study); and
- the willingness of its members to take responsibility for colleagues' growth and development. Depending on the level of maturity, a group may be classified as being beginning, evolving or mature in terms of their community formation.

7.3 Comparative discussion of elements, dimensions and markers

Table 7.1 lists the elements, dimensions and its associated markers as discussed in the next section. King's (2002) elements are indicated in a **red** font, while the Grossman et al. (2000) dimensions and markers are in a **blue** and **green** font respectively.

The elements/dimensions as presented in the table are discussed in the following sections.

7.3.1 Formation of group identity and norms for interaction

Grossman et al. (2000) view identification with the whole group as a mature sign of community. It is recognized that in the disadvantaged group, identification with the whole group was already established as a result of teachers' participation in cluster meetings.

Teachers shared a common desire to develop professionally and their voluntary participation in the ODEM showed that they anticipated the ODEM to be a useful tool in their CPD. The many positive participation effects experienced also indicate that they

Table 7.1 Elements, dimensions and associated markers per group

Elements/dimensions	Disadvantaged group markers	Advantaged group markers
1. Formation of group identity and norms for interaction	<ul style="list-style-type: none"> • Identification with whole group as a result of cluster meetings -> Mature • Recognition of need for regulation of group behavior (need for Subject Advisor) -> Evolving 	<ul style="list-style-type: none"> • Identification with whole group as a result of cluster meetings -> Mature • Recognition of need for regulation of group behavior (need for Subject Advisor) -> Evolving
<p>2. In-depth dialogue among participants</p> <p>Taking communal responsibility for individuals' growth</p> <p>Negotiating the essential tension</p> <p>Understanding difference / Navigating fault lines</p>	<ul style="list-style-type: none"> • Acts of individual volition -> Beginning • No recognition that colleagues are resources for one's learning -> Beginning • Belief that teacher's responsibility is to students, not colleagues -> Beginning • Little recognition that teacher and student learning are fundamentally intertwined -> Beginning • Conflict goes backstage -> Beginning 	<ul style="list-style-type: none"> • Recognition that participation is expected for all -> Evolving • Commitments to colleagues growth -> Mature • Recognition that teacher and student learning are fundamentally intertwined -> Mature • Conflict goes backstage -> Beginning
3. The ability for teachers to be able to ask questions and share responses in an environment that support responsiveness, trust and insight	<ul style="list-style-type: none"> • Evidence from tensions 	<ul style="list-style-type: none"> • Evidence from tensions
4. The ability of the technology employed to work smoothly enough to not detract from interaction	<ul style="list-style-type: none"> • Evidence from tensions 	<ul style="list-style-type: none"> • Evidence from tensions

found some value in the ODEM. The marker “recognition of the need for regulation of group behavior” was expressed as a need for Subject Advisor to participate, which is a sign of an evolving community.

The advantaged group mirrored the disadvantaged group in all dimensions and markers related to the formation of a group identity and norms for interaction. That is, identification

within each group was already established as a result of teachers' participation in cluster meetings; a common desire to develop professionally; and the need for a Subject Advisor. These markers do not contribute towards the value of the ODEM, except for the fact that the ODEM exposed both groups' need for communication with a Subject Advisor.

7.3.2 In-depth dialogue among participants

An examination of the dialogue that took place between teachers may provide more clues as to the level of maturity reached in the ODEM. Three dimensions are used to judge the depth of discussion, namely:

- Taking communal responsibility for individuals' growth;
- Negotiating the essential tension; and
- Understanding difference/ Navigating fault lines.

7.3.2.1 Taking communal responsibility for individuals' growth

Tensions of the disadvantaged group such as T3|**DAS2**: *Lack of Fervour*, T4|**DAS2**: *Lack of Reflective Practices*, T8| **DAS2**: *Quality of Participation* and T10| **DAS2**: *Lack of Motivation* implies that their dialogue was superficial and even one-dimensional by choice. But to do so would be to ignore the *reasons* for the existence of these tensions. As indicated in Chapter 4, situational tensions, both ODEM and non-ODEM related, exaggerated the personal tensions listed here above which may have contributed to the lack of depth of discussion. The number of responses to each thread (see Table 4.3 (b)) does indeed indicate a lack of depth, with only three threads having more than three responses. A topic may, of course, be closed quickly with an appropriate response. Nevertheless, an evolving community will have recognized that participation is expected of all, and that by adding to the discussion they recognize colleagues as resources for professional development. Here contributions are mere acts of individual volition, indicating signs of a beginning community.

In order to evaluate the next elements (and dimensions), consider Table 7.2 and Table 7.3, which lists the general descriptions of the disadvantaged and advantaged topics against the type of response teachers required.

Table 7.2 General descriptions of disadvantageded topics and response required.

Topic	Response required
Projective geometry question	Help with Content
Probability question	Help with Content
Word problems question	Help with Content
Gap between Grade 9 and 10	How to deal with
CTA assessment tool	How to use
How to approach an Investigation-type question	Help with methodology
Assistance to Grade 8 and 9 pupils	How to deal with
How to get learners to participate in class	How to deal with
Request guidelines for marking of a project	How to deal with
Require recording sheet of Grade 9	I need it
Help with NCS Training GED band	How to deal with
Suggestions required on investigations tasks	How to deal with
Help on NCS Workshop	How to deal with
Dealing with learners not submitting portfolios	How to deal with
Dealing with changes in education	How to deal with
Explain RNCS policy	More information
Word sum help	Help with content

Table 7.3 General descriptions of advantaged topics and response required.

Topic	Response required
Remedial classes	How to deal with
Inclusive education	How to deal with
Gap from primary to secondary	How to deal with
DVD need	Idea
Boys are left behind	Provides support
Start Grade 8	How to deal with
End of semester	Supportive post
Mathematics games	Supportive post
DVD's in Maths	Supportive post
Assessing	Supportive post
CTA	How to deal with
Grade 10 paper	How to deal with
Grade. 10, 11 en 12, NCS	Supportive post
Grade 11 Learners	How to deal with

From Table 7.2 (the disadvantageded group), there is no evidence that colleagues are seen as resources for learning. Most of the topics were of the question-answer type, i.e. there is little evidence that teachers attempted to *tap* into their colleagues' knowledge base.

Consider the following three questions, the first two posted by disadvantageded teachers and the last by an advantaged teacher:

Q: I need your vews on how to teach probability. How you introduse it and how you explain it to learners. We need to give the grade 8 and 9 a good basic of probability in order for them to master it in FET.

Disadvantageded teacher

Q: Give me guideline of marking project, especially if they are first collecting data, must i ask the to submit the data first or they must finish up the project and then i must mark everything after that or how am i going to do.

Disadvantaged teacher

Q: I would like your opinion on the following topic. Last year I had two down syndrome boys in my Grade 9 class. They adapted socially and could continue on their own when work was handed out. However, the following bothers me: I could not give them work that is new since there is no time to waste on explaining concepts to them – most of the time is spent on majority of the learners. Their learning is thus low – most of the time they are basically kept busy. But I have to spend a few minutes to explain new concepts and to answer questions during a lesson (normally just when I start explaining a difficult topic). At the end of the year I promised myself – never again! You cannot give quality learning to a Down syndrome learner, it requires much preparation, you cannot give all your attention to normal learners, and it also requires extra preparation to keep these learners busy! Now I have a Down syndrome girl in my class. She is emotionally unprepared for high school, no one wants to play with her, and she cries the whole day and is attention-demanding. Her parents insist that she remains in a mainstream school, and pretends it is a feast for the little girl to go to school. How do I handle this? HELP!!

Advantaged teacher ^[110]

The above examples serve as prototypes for most of the disadvantaged and advantaged topic and posts. There were simply more depth to advantaged teachers' questions which required more thought before responding. The general student-centered nature of disadvantaged topics also highlights the fact that teachers believe their responsibility to lie with students and not with colleagues. The ODEM was primarily intended to support CPD, for teachers to reflect and share with colleagues. While the presence of a Subject Advisor may resolve some of the tensions and result in more meaningful discussions, the lack of depth of the disadvantaged dialogue points towards a beginning community.

For the advantaged group, T1|**AAS1**: *Starting Threads*, T2| **AAS1**: *Lack of Reflective Practices*, T5| **AAS1**: *Quality of participation* and T7| **AAS1**: *Substance required* was identified as tensions in Chapter 6. As with the disadvantaged group, these tensions suggest superficial discussions. However, the number of responses to each thread (see Table 5.3 (b)), was generally higher than for the disadvantaged group, indicating recognition by the members that participation is expected of all, and a move towards an evolving community. Evidence of communal responsibility for colleagues' growth was found particularly in the supportive posts where teachers generally provided alternative approaches to practice, sometimes not being specifically asked for such inputs. Most responses to "how to deal with" posts also provided such alternative approaches which reflect a responsibility for growth. Although it can be argued that such responses are guided by how the question was asked, the larger number of responses to such questions compared to disadvantaged teachers indicates advantaged teachers to be more sensitive to their colleagues' growth, placing this group within a mature community. The higher

number of positive statements (36 from 125 compared to 12 from 113 incidences) supports this contention. That there were not *more* such instances are what the tensions highlight. As with the disadvantaged group, the presence of a Subject Advisor may resolve some of the tensions and result in even deeper discussions.

7.3.2.2 Negotiating the essential tension

The dimension “negotiating the essential tension” (tension here not referring to the tensions identified) is also discussed from Tables 7.2 and 7.3. Consideration of the topics and the responses required in Table 7.1 reveals disadvantaged teachers to be more concerned with their own learning than with student learning. The large number of “How to deal with” and “Help with content” topics indicate that these teachers used the ODEM primarily to fill gaps in their own knowledge. A mature community will recognize the interrelationship of teacher and student learning, which is not the case here. The knowledge gained here may well be used to delve more deeply into student teaching, curriculum and learning issues, but there is no evidence that they did so, and the disadvantaged group is therefore placed in the beginning phase of community. However, it would be abrupt to view teachers’ failure of the recognition of this interrelationship without consideration of the role their disadvantaged background, inclusive of their vocational training, played. The topics they raise closely reflect their shortcomings and they need support and guidance in overcoming these inadequacies. The immaturity of their community is thus perhaps more the result of the situational circumstances that the ODEM is proxy to, rather than the ODEM being a vehicle of community change.

The topics and responses in Table 7.3 show advantaged teachers to locate themselves towards the upper part of the continuum that describes the attention teachers give to student learning and their own learning. There is a balance between the topics and responses required, indicating that teachers recognize the interrelationship of teacher and student learning. The advantaged group is therefore in the mature phase of community.

7.3.2.3 Understanding differences/Navigating fault lines

The third dimension that is used to describe the depth of the dialogue patterns is Understanding difference/Navigating fault lines. Section 4.5.3.2 (Negative participation effects) revealed that some disadvantaged teachers (notably the two teachers who contributed the most posts) does not understand the significance of the questions asked,

choosing to denigrate such contributions in the interviews (backstage) and thereby situating the group as a whole towards a beginning community.

Despite their general higher level of community, the advantaged group displayed a similar level of community when it concerned this dimension. Here the two teachers that contributed the most posts also voiced their dissatisfaction with the level of participation of the other teachers in the interviews. As with the disadvantaged group, conflict was hidden from view in order to preserve the sense of a united front, a sign of a community in the beginning phase. An understanding and productive use of differences would indicate a more mature community. It is possible that the limited period of participation prevented conflict to erupt within the ODEM, thereby allowing the opportunity for teachers to deal with such conflict, which would have provided more concrete evidence of where exactly the community is situated. Regardless, a false sense of unity is apparent, placing both groups in the beginning phase of community.

7.3.3 An environment that support responsiveness, trust and insight

King's (2002) second element is the ability for teachers to be able to ask questions and share responses in an environment that support responsiveness, trust and insight are applicable. The majority of disadvantaged topics were questions on "How to deal with" and "Help with content". In publically demonstrating their shortcomings, the ODEM thus allowed an environment where teachers felt comfortable asking questions - even if fortuitously and regardless the general lack of responsiveness and insight. The same holds true for the advantaged group, with the difference that responsiveness and insight were more enhanced.

7.3.4 The ability of the technology employed

King's (2002) third element, the ability of the technology employed to work smoothly enough to not detract from interaction, is fairly straight forward. Disadvantaged teachers did not experience any difficulty in using the ODEM once they were able to connect to it. It is acknowledged that teachers did not make use of mathematical expressions in their discussions, which is slightly more involved and may have revealed more difficulties. These teachers' PC-illiteracy also affected their initial use of the ODEM until they were comfortable with using a computer. While the tensions identified for this group, T3|AAS1: *Lack of Suitable Support Structures* and T9|AS2: *Training Required* has more to do with

technology outside the ODEM than with the ODEM itself, these challenges must be met before sustainability of the ODEM is realizable.

For the advantaged group, the only challenges they faced were the slowness of connections and their busy life.

7.4 Synthesis

To determine if the ODEM was valuable as a reflective tool, evidence of elements associated with the value of online endeavours, as well as dimensions of community as supported by the ODEM, were considered.

Both groups of teachers came into the online community already in some form of community due to their involvement in cluster meetings. At minimum, both groups were already in the beginning phase of community formation. As indicated by the markers of in-depth dialogue, the ODEM supported responsiveness, trust and insight, which advantaged teachers used more effectively. Their more effective use of the ODEM in terms of CPD opportunities suggests an evolving to mature community, whereas the disadvantaged group was more in the beginning to evolving phase of community formation. As such, and since there is no evidence that either group grew during participation in the ODEM, the inference is that the disadvantaged group came into the ODEM as a beginning/evolving community and the advantaged group as an evolving/mature community. In the former case, the ODEM did not support evolution into a mature community, while in the latter case they did not regress towards an evolving or beginning community. In both cases then, the ODEM did not support community formation, but merely *maintained* the pre-ODEM community.

Considering all the evidence from the previous three chapters, as well as this chapter, the ODEM is perceived to have *potential* value. The many unresolved tensions in the case of the disadvantaged group indubitably prevented further community formation. Because of their higher level of community, the advantaged group faced fewer, but equally influential tensions. If these tensions can be resolved, the value of the ODEM may well increase. This notion is supported by teachers' generally positive responses to the interview question on the value of the ODEM.

In both groups the way in which the ODEM can attain value is through the direct line of communication it offers to the Subject Advisor. Without the participation of a Subject Advisor, the ODEM appears less sustainable and its value decreases.

In its current implementation the ODEM did not have value as a reflective tool because of the tensions teachers faced. That is, until tensions are resolved, reflective practises remain a higher order skill and need. However, if the definition of reflection is broadened to firstly include opportunities for collaborative communication with colleagues and the exchange of knowledge and ideas, then the ODEM also has potential value as a reflective tool.

One issue important to the value of the ODEM that was not specifically addressed in this chapter was the non-use of mathematical expressions in posts. The ODEM was primarily developed to allow teachers to include mathematical expressions should they wish to do so and presented one of the main motivations for this study. But teachers were also encouraged to use the ODEM as they see fit. That they did not use mathematical expressions does not imply that the mathematics-friendly forum environment did not have value. As with the value of the ODEM as a reflective tool, the ODEM has potential value in terms of its ability to accommodate mathematical expressions. The current sets of tensions simply prevented this potential from being reached.

7.5 Summary

This chapter attempted to answer the 4th research question on the value of the ODEM as a tool in the CPD of mathematics teachers. A comparative discussion of the elements, dimensions and its associated markers as it relates to the formation of group identity and norms for interaction, the depth of dialogue, the supportiveness of the environment and the ability of the technology employed was offered.

8. Contribution

- 8.1 Introduction**
- 8.2 Summary of research from an Activity Theory perspective**
 - 8.2.1 Research question 1
 - 8.2.2 Research question 2
 - 8.2.3 Research question 3
 - 8.2.4 Research question 4
- 8.3 A strategic model for successful online CPD of teachers in the South African context**
 - 8.3.1 Introduction to model
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 - 8.3.3 Narrative walkthrough of the model
- 8.4 Implications for existing theory**
- 8.5 Methodological contribution**
- 8.6 Summary**

8.1 Introduction

This chapter presents the main contributions of the current research. In section 8.2 summaries of Chapters 4 to 7 are presented per research question from an Activity Theory perspective. The purpose is to present the background which led to the development of a strategic model to ensure successful online CPD of mathematics teachers in the South African context. This model is presented in section 8.3. Implications for existing theory are presented in section 8.4. The research approach and methodology followed is also viewed as a contribution of the current research, and is dealt with in section 8.5

8.2 Summary of the research from an Activity Theory perspective

The motivation for this study was derived from several axioms:

- the poor results obtained by South African mathematics teachers in TIMMS studies;
- the promise of the Internet as a tool for CPD;
- the lack of usefulness of the WWW for spontaneous mathematical interaction;
- the importance of reflection as a tool for CPD;
- the belief in bottoms-up approach to creating an online community; and

- the disparities (context) of South African communities as it relates to the use and value of online CPD efforts.

From these axioms, the main purpose of the current study was formulated to read:

To discover personal and situational tensions impacting on the use and value of an appropriate online discussion forum environment as a reflective tool for the CPD of advantaged and disadvantaged teachers in South Africa.

Several research questions were conceived in order to ensure a purposeful investigation.

Focussing on mathematics teachers, the research questions were:

1. *What are the personal and situational tensions that impact on the use of a mathematics-friendly online forum environment as a reflective tool for the CPD of disadvantaged mathematics teachers?*
2. *What are the personal and situational tensions that impact on the use of a mathematics-friendly forum discussion environment as a reflective tool for the CPD of advantaged mathematics teachers?*
3. *What differences exist between the advantaged and disadvantaged groups as it relates to the personal and situational tensions identified?*
4. *Is a mathematics-friendly online discussion environment valuable as a tool for the CPD of disadvantaged and advantaged mathematics teachers?*

To investigate these research questions, a group of disadvantaged and disadvantaged teachers (the *communities*) were separately provided with Personal Computers and Internet access (the *tools*) allowing them access a mathematics-friendly forum environment (the ODEM *tool*) from home, and which allowed them to include mathematical expressions in their posts to the ODEM should the need exist. Teachers were tasked to reflect on and share their practise (the *rules*) thereby providing opportunities for collaborative collegial interaction through participation in the ODEM and building a community (the *object*) in pursuit of CPD (the *goal*). However, teachers were not limited to reflective contributions only. They were also encouraged to use the ODEM as they saw fit (a bottoms-up approach), thereby presenting opportunities for communication, learning, and the exchange of knowledge and ideas. All the above formed the intended Activity System.

Each individual research question is dealt with in the following sections.

8.2.1 Research question 1

What are the personal and situational tensions that impact on the use of a mathematics-friendly online forum environment as a reflective tool for the CPD of disadvantaged mathematics teachers?

Using elements of a Grounded Theory approach in a case study context, two Activity Systems were identified from the interview data, posts to the forum, research diaries and server data.

The first Activity System discovered (**DAS1**) was related to the preparation phase that had as its *object* connecting teachers to the ODEM. It became an Activity System given the numerous difficulties experience in providing Internet access to disadvantaged teachers and for them maintaining a connection to the ODEM. Three tensions were identified from **DAS1**:

- T1|**DAS1**: *Creating Internet Accounts*
- T2|**DAS1**: *Connection Problems*
- T3|**DAS1**: *Lack of Suitable Support Structures*

The second Activity System identified (**DAS2**) was related to the original *object* of participation in the ODEM and building a community through reflective practises thereby contributing to teachers' CPD. The tensions identified there cut across the **DAS2** components of *rules, tools, subjects, community* and the *division of labour*. The twelve tensions identified were:

- T1|**DAS2**: *What to Post*
- T2|**DAS2**: *Irregular Contributions*
- T3|**DAS2**: *Lack of Fervour*
- T4|**DAS2**: *Lack of Reflective Practises*
- T5|**DAS2**: *Financial Factors*
- T6|**DAS2**: *A Busy Life*
- T7|**DAS2**: *School/Township Related Issues*
- T8|**DAS2**: *Quality of Participation*
- T9|**DAS2**: *Training Required*
- T10|**DAS2**: *Lack of Motivation*
- T11|**DAS2**: *Point of Access*
- T12|**DAS2**: *Leader Required*

In section 4.9 an attempt was made to link all these tensions with one another. It was observed that the majority of tensions contributed to or exaggerated other tensions. A strong dynamism was evident, with tensions feeding of one another and affecting the rate and quality of participation.

Based on that understanding of the tensions gained there, Table 8.1 shows a combined view of the tensions categorized according to Activity System components, ODEM-relatedness, and whether they are personal, shared or situational.

The core tension identified from **DAS1** was along the *division of labour* component, ODEM-related and situational: T3|**DAS1**: *Lack of Suitable Support Structures*. These structures were directly related to the disadvantaged community (situational) and the difficulty teachers experienced in accessing available support structures. The core tension identified highlighted the difficulties that can be expected in providing access and support to disadvantaged and generally PC-illiterate teachers accessing the ODEM from home. Although teachers attended two training workshops and were able to post to the ODEM with ease, their general PC-illiteracy and several hardware-related problems played an important role throughout the project and placed extra demand on the available support structures.

T5|**DAS2**: *Financial Factors* indicated that most teachers will not be able to afford a home Internet connection. For these teachers, access to the ODEM is thus only realizable from school laboratories, of which there are few. One powerful non-ODEM-related tension that impacted at a personal and *subject* level was T6|**DAS2**: *A Busy Life*. Teachers' lifestyles are seemingly too busy to take advantage of the Internet access provided from home. Their busy lifestyles are exacerbated by their dependency on public transport that not only puts pressure on their time, but cuts across Activity Systems to limit their physical access to support on hardware-related problems that arises from time to time, with suitable support structures not being available in their immediate communities.

In Chapter 4 it was reported that for **DAS2** both ODEM- and non-ODEM-related situational tensions impacted on the personal tensions identified. These situational tensions were T12|**DAS2**: *Leader Required* and T7|**DAS2**: *School/Township Related Issues*.

The first tension was along the *division of labour* component and was ODEM-related. The latter was along the *community* component and was non-ODEM-related. The core tension identified was the need these teachers had for a leader, not only within the ODEM but also outside the ODEM within their practice, which is influenced by school and township

Table 8.1 Combined view of DAS1 and DAS2 tensions categorized according to AS components, ODEM-related tensions and non-ODEM-related tensions.

AS Components	ODEM-related tensions			Non-ODEM-related tensions		
	Personal	Shared	Situational	Personal	Shared	Situational
Rules	T3 DAS2: <i>Lack of Fervour</i> T4 DAS2: <i>Lack of Reflective Practises</i> T10 DAS2: <i>Lack of Motivation</i>				T11 DAS2: <i>Point of Access</i>	
Subjects	T1 DAS2: <i>What to Post</i> T8 DAS2: <i>Quality of Participation</i> T2 DAS2: <i>Irregular Contributions</i>			T6 DAS2: <i>A Busy Life</i>		
Community					T5 DAS2: <i>Financial Factors</i>	T7 DAS2: <i>School/Township Related Issues</i>
Tools		T9 DAS2: <i>Training Required</i>	T1 DAS1: <i>Creating Internet Accounts</i> T2 DAS1: <i>Connection Problems</i>			
Division of labour			T12 DAS2: <i>Leader Required</i> T3 DAS1: <i>Lack of Suitable Support Structures</i>			

related issues. Disadvantaged teachers require active and continuing leadership to help them cope with their role and duties as teachers within a disadvantaged community and its immediate school environments. That is exactly where they failed in the ODEM (or where the ODEM failed them) as they were unable to grow into a reflective (or other) on-line community when their real needs were not addressed. Stated differently, the *rules* of DAS2 resulted in several personal tensions surfacing, namely T3|DAS2: *Lack of Fervour*, T4|DAS2: *Lack of Reflective Practises* and T10|DAS2: *Lack of Motivation*. These tensions all point towards teachers' needs not being fulfilled. Moreover, it resulted in personal tensions surfacing at the *subject* level of DAS2. If teacher needs are not addressed, tensions such as T1|DAS2: *What to Post*, T8|DAS2: *Quality of Participation* and T2|DAS2: *Irregular Contributions* can be expected.

Despite being allowed for and trusted to build a sharing community that suited their needs, there were simply too many tensions that impacted on the *object* of the participation and community building. As such, the *goal* of CPD was not obtainable.

8.2.2 Research question 2

What are the personal and situational tensions that impact on the use of a mathematics-friendly forum discussion environment as a reflective tool for the CPD of advantaged mathematics teachers?

Only one Activity System (**AAS1**: Using the ODEM) was identified from the interview data, reflective journals and server data. Several tensions that impacted on **AAS1** were uncovered:

- T1|**AAS1**: *Starting Threads*
- T2|**AAS1**: *Lack of Reflective Practises*
- T3|**AAS2**: *Slow Connections*
- T4|**AAS1**: *A Busy life*
- T5|**AAS1**: *Quality of participation*
- T6|**AAS1**: *Subject Advisor required*
- T7|**AAS1**: *Substance required*

In section 5.6 these tensions were linked and it was shown how some tensions exaggerated and/or contributed to other tensions. Table 8.2 repeats the layout of Table 8.1, this time for the advantaged group of teachers.

Table 8.2 shows that advantaged teachers did not experience any tensions related to the *community* they work, live and practise in. Only two tensions were not ODEM-related, these being T3|**AAS1**: *Slow Connections* and T4|**AAS1**: *A Busy life*. Slow connections (related to the *tools*) merely served as an irritation to teachers when connecting to the Internet, but may well have contributed negatively to the *object* of participation in the ODEM and building a community. Only two tensions were related to the *subjects* themselves, these being T4|**AAS1**: *A Busy life* and T5|**AAS1**: *Quality of participation*. Subject's busy lives clearly had an impact on the *object* of the Activity System. T5|**AAS1**: *Quality of participation*, a personal and ODEM-related tension, was the result of several *rule*-related tensions (see next paragraph), while T4|**AAS1**: *A Busy life* was personal and non-ODEM-related.

Table 8.2 Combined view of AAS1 tensions categorized according to AS components, ODEM-related tensions and non-ODEM-related tensions.

AS Components	ODEM-related tensions			Non-ODEM-related tensions		
	Personal	Shared	Situational	Personal	Shared	Situational
Rules	T1 AAS1: <i>Starting Threads</i> T2 AAS1: <i>Lack of Reflective Practises</i> T7 AAS1: <i>Substance required</i>					
Subjects	T5 AAS1: <i>Quality of participation</i>			T4 AAS1: <i>A Busy life</i>		
Community						
Tools						T3 AAS1: <i>Slow Connections</i>
Division of labour			T6 AAS1: <i>Subject Advisor required</i>			

The personal and ODEM-related tensions that surfaced from the *rules* of AAS1 were T1|AAS1: *Starting Threads*, T2|AAS1: *Lack of Reflective Practises* and T7|AAS1: *Substance required*. These tensions were the direct result of the impact of the core tension identified in AAS1, T6|AAS1: *Subject Advisor required*. The absence of a Subject Advisor in the ODEM meant that the community did not grow (the *object*) even though teachers were moderately active participants. These ODEM-related tensions exist because teachers have non-ODEM-related needs which are situationally specific to their practice. To fulfil these needs and to negate the tensions experienced, a Subject Advisor is a requirement if CPD (the *goal*) is to occur.

8.2.3 Research question 3

What differences exist between the advantaged and disadvantaged groups as it relates to the personal and situational tensions identified?

In Chapter 6 the disadvantaged and advantage groups were compared according to their network organization, response opportunities, response obligations and coordination and evaluation. That chapter highlighted the chasm that exist between the disadvantaged and advantaged groups with respect to their make-up and the tensions they experienced. These chasms existed both within and outside the ODEM. Between-group differences were extensive while within-group the similarities were noteworthy. The groups only shared their cluster experiences and the horizontal nature of within-group relationships. The

chasms between the groups indicated the importance the make-up of a group played in bringing a variety (and in the case of the disadvantaged group – more) tensions to the fore. The sources of the tensions uncovered were diverse between groups. Table 8.3 list the sources of the tensions found for both groups from an Activity Theory perspective.

What emerges from Table 8.3 is that the disadvantaged group's sources of tensions are spread throughout their Activity Systems components, while the advantaged group sources of tensions are more limited and specific. All disadvantaged AS-component intersections contain at least one tension, with most being ODEM-related (11 of 15 tensions). For the advantaged group, the tensions are far less spread amongst AS-components, although most of their sources are also ODEM-related (5 of 7 tensions).

It is only in the Personal|*Rules* intersection, with 3 ODEM-related tensions each, that strong similarities are found. Minor similarities are found in the Situational|*Division of labour* and Personal|*Subjects* intersections. These tensions impacted on both groups' *object* of participation and community building. The only other similarities found between the groups were their lack of reflective practises and their busy life schedules.

Table 8.3 Sources of tensions

Type AS component	Disadvantaged group		Advantaged group		Totals
	Number of ODEM-related tensions	Number of non-ODEM-related tensions	Number of ODEM-related tensions	Number of non-ODEM-related tensions	
Personal <i>Subjects</i>	3	1	1	1	6
Situational <i>Tools</i>	2			1	2
Personal <i>Rules</i>	3		3		6
Shared <i>Tools</i>	1				1
Situational <i>Division of labour</i>	2		1		3
Shared <i>Rules</i>		1			1
Shared <i>Community</i>		1			1
Situational <i>Community</i>		1			1
TOTALS	11	4	5	2	22

The majority of tensions (12 of the 22 tensions in total) were found along the Personal|*Subjects* and Personal|*Rules* intersections (see shaded table cells in the totals column). This spread indicates that the *rules* of the current Activity Systems (reflecting on and sharing their practice) did not fit the current *subjects*, resulting in several personal

tensions surfacing that impacted on the *object* of participation and community building. The core tension that contributed to these personal (and other) tensions was similar across groups. While both groups were able to sustain the level of community they entered into the ODEM, and participated at a reasonable level (given their tensions) a Subject Advisor was required to resolve the numerous personal tensions that existed in order for the *goal* of CPD to be reached. It is important to note that whereas tensions within the ODEM affected participation, the sources of these tensions existed mainly outside the ODEM.

The exact role of the Subject Advisor within each group is very different though - the main notable variation being that the disadvantaged group requires *macro leadership* to solve their diverse tensions within and outside the ODEM, whereas the advantaged group, while also experiencing many ODEM-related tensions, merely requires the *participation* of a Subject Advisor - most notably as a soundboard for their frustrations experienced outside the ODEM. The Subject Advisor is ideally placed to fulfil the leadership role required by the disadvantaged teachers.

8.2.4 Research question 4

Is a mathematics-friendly online discussion environment valuable as a tool for the CPD of disadvantaged and advantaged mathematics teachers?

Because of their commitment to cluster meetings, both groups were already in some form of community when they entered the ODEM. From the nature of posts it was observed that disadvantaged teachers were largely in a beginning phase of community formation, while the advantaged group were in the evolving phase. From the evidence presented in Chapter 7, it was apparent that the ODEM succeeded in maintaining their phase of community. However, the *object* of participation in the ODEM and building a community was only partially met when they failed to build upon their level of community. The *goal* of CPD could thus not be achieved.

The reason for this failure is found in the answers to the previous three research questions. There were simply too many tensions in the case of the disadvantaged group, while the advantaged group faced fewer but more specific tensions. For the *object* and *goal* to be met the participation of a Leader/Subject Advisor is an absolute requirement. For both groups, the value such a Leader/Subject Advisor will bring to the ODEM lies both in and outside the ODEM for the disadvantaged group, and outside the ODEM for the advantaged group

(note that T6|AAS1: *Subject Advisor required* and T12|DAS2: *Leader Required* were marked as a situational and ODEM-related tensions *because of its effect within the ODEM*. The real needs of teachers lie outside the ODEM, and the input required from the Subject Advisor are thus initially focussed outside the ODEM but will impact within the ODEM). As such, the ODEM is perceived to have *potential* value, but only when teacher needs are being met, which will resolve tensions.

Two final remarks are necessary. The mathematics-friendly ODEM, as implemented in the current study with its specific *object* and *goal*, was not used by teachers to reflect on their practise simply because their immediate needs, discovered in this implementation, lied elsewhere. In addition, their immediate needs did not include the need to use mathematical expressions in their posts. This does not mean such a facility is not required - it simply was not required within the current implementation.

Throughout the previous sections the relationship between tensions and teacher needs have been highlighted. How to discover tensions that point at teacher forum needs is best presented by a strategic model, which the next section outlines.

8.3 A strategic model for successful online CPD of teachers in the South African context

The following five deductions, derived from the preceding sections, offer powerful clues as to a strategic model for successful online CPD of teachers. While mathematics teachers were the focus of the current research, the model is equally valid for teachers of other school subjects. For this purpose, and given that mathematics teacher needs may not include the need to use mathematical expressions in posts, “ODEM” is replaced by “forum” in the model.

1. Participation by teachers in an online forum in pursuit of CPD is influenced by forum- and non-forum-related tensions, the sources thereof being either personal or situational.
2. Situational tensions form the core tensions, resulting in several personal tensions surfacing within the forum environment.
3. Disadvantaged teachers face more tensions than advantaged teachers, the sources and impact of these tensions being very different. The major sources of

tensions are closely related to the real forum needs of teachers, which differs for groups of disadvantaged and advantaged teachers.

4. A Subject Advisor is best positioned to fulfil these real forum needs by selecting an appropriate online CPD strategy which requires a careful consideration of the *subjects*, the *object* of activities in the forum, and the *community* within which they occur. Once these have been considered an appropriate set of *rules*, *division of labour* and *tools* can be decided upon.
5. It follows that an online forum environment cannot be shared between heterogeneous communities, except if the *object* is interaction between such communities. “Heterogeneous” is defined along diversity rather than advantageousness, with diversity referring to factors such as rural or urban, level of education, level of PC-literacy, training requirements and access to the Internet. Combined, these factors may incidentally reflect the level of advantageousness, which is contextual.

8.3.1 Introduction to model

Given these deductions and having considered all the evidence presented thus far, a strategic model to ensure successful online CPD is offered in Figure 8.1. This strategic model can be used by a leader/Subject Advisor to firstly anticipate and secondly discover tensions that point at teachers’ real forum needs, thereby ensuring an online CPD strategy that is concomitant to the community for which the online forum is offered. The model presupposes that teachers have ease of access to the Internet, most likely from functioning school laboratories.

8.3.2 Key flow processes

The key flow processes of the model are as follows:

1. A preliminary *object* and *goal* is defined. It is considered preliminary since the *object* and *goal* themselves may also contribute to tensions, given a particular *subject* and *community* profile.
2. A *subject* and *community* profile is drawn in order to anticipate tensions that will impact on teachers forum needs. This profile is drawn by answering several questions related to the setting of the group (urban or rural), the socio-economic class of the area wherein teachers practice, the teachers’ level of education, their

general level of PC-literacy, their training requirements and whether they have ease of access to the Internet. Other sources are dependent on what is available to the Subject Advisor. For example, her experiences from cluster meetings, year reports from headmasters, past teacher evaluations and relevant research reports may offer more insight into the profile. The tensions thus discovered provide insight into teachers' anticipated forum needs.

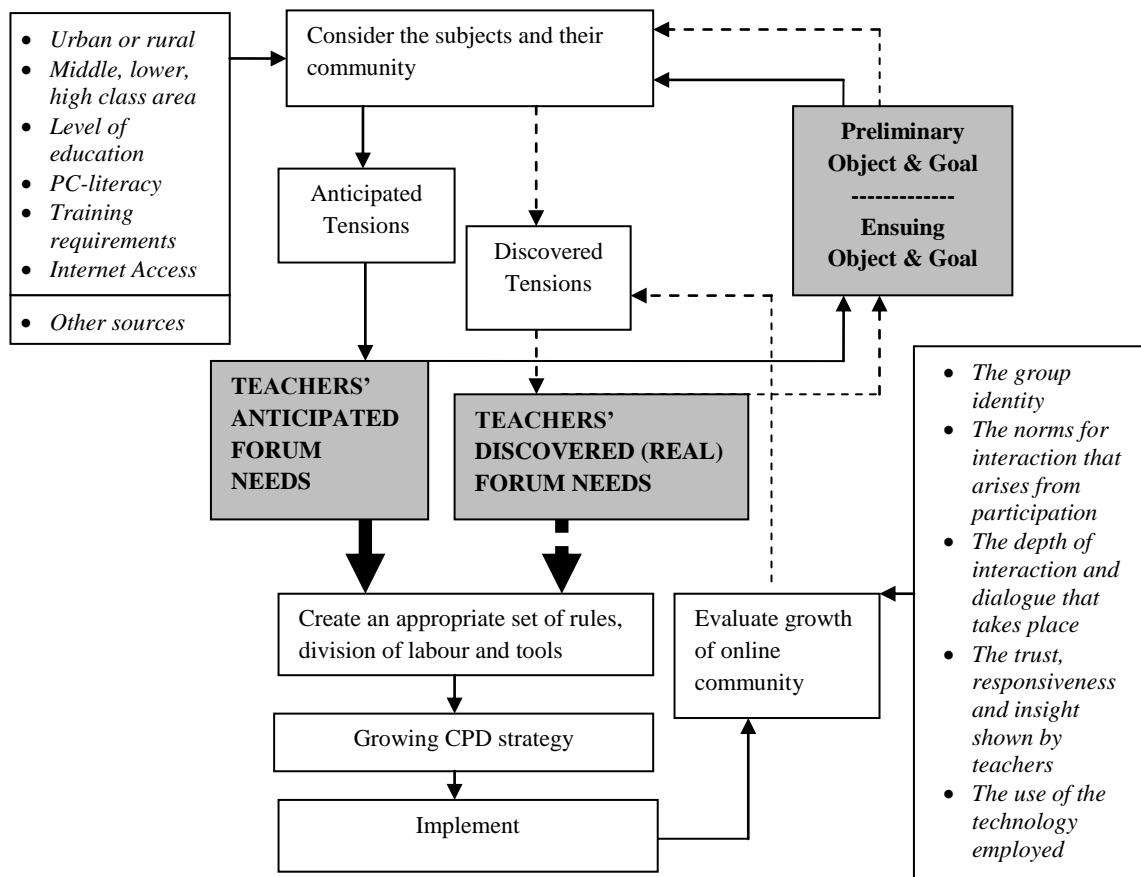


Figure 8.1 A strategic model for successful online CPD of teachers in the South African context

- These anticipated forum needs may well require a redefinition of the initial *object* and *goal*. Since the ensuing *object* and *goal* may result in further tensions, a first inner cycle is run in order to ensure a fit between the ensuing *object* and *goal*, the *subject* and *community*, the (latest) anticipated tensions and teachers' (latest) anticipated forum needs. This cycle is repeated until the Subject Advisor is comfortable with the balance of elements of this first inner cycle.

4. Based on the result of this first inner cycle of anticipated needs, a set of *rules*, *division of labour* and *tools* is created, which presents the growing CPD strategy.
5. Once implemented, the growth of the online community is evaluated. The combined (King, 2002) and Grossman et al. (2000) model provided in Table 7.1 provides a useful starting point to evaluate the current level of community formation and to discover additional tensions. Some evaluation elements to consider are the group identity, the norms for interaction that arises from participation, the depth of interaction and dialogue that takes place, the trust, responsiveness and insight shown by teachers, and the use of the (appropriate) technology employed.
6. The real forum needs discovered may once again force a redefinition of the *object* and *goal*. A second inner cycle is initiated where the ensuing *object* and *goal* is firstly redefined, which starts a new cycle that aims to discover teachers' real forum needs.

The model is thus cyclic in nature, allowing a Subject Advisor to initiate the process but also allowing space for a bottoms-up approach to community formation where teachers' real needs ultimately dictate the appropriate CPD strategy to follow. This does not imply that teachers force the CPD strategy. Rather, the model recognizes that a chosen CPD strategy may not suit the immediate needs of teachers. If these needs are not met, the chosen CPD strategy is bound to fail. For this reason, the model refers to a growing CPD strategy.

Also, as discussed in Chapter 2, there is considerable disagreement in the literature on what constitutes a successful online community. This is partly so because context is complex. Determining the level of growth that occurs within a community over a specific time period provides a more robust and reliable benchmark of the success of that online community since such evaluation is based on the community's specific and contextual needs.

A walkthrough of how the model is practically employed is provided in the next section.

8.3.3 A narrative walkthrough of the model

Assume the Subject Advisor for mathematics wishes to make use of the forum environment to stimulate discussion and reflection about Outcomes-Based Education (OBE) in the Senior Phase. This presents the preliminary *object* of the forum, the *goal* being for teachers to become more confident with the OBE approach.

Her target community is Grades 7-9 mathematics teachers from disadvantaged schools in the Gauteng North area. In drawing up a subject and community profile, she relies on her experience from working with these teachers and schools, and also decides to review research that has been done on OBE in South Africa.

For example, she considers the following issues as identified in a recent research project by Velupillai (2006):

- Teaching materials were either non-existent or insufficient for addressing specific outcomes;
- A lack of textbooks and resources;
- No calculators or mathematical instruments are available;
- Many classrooms do not have enough desks and benches, which may hinder the achievement of the outcomes;
- Regarding the teaching resources, in most of the classes very little has changed after introduction of Curriculum 2005;
- The actual planning of lessons show little improvement;
- There are gaps in the educators' content knowledge. Some teachers are not confident in their subject matter.

From her experience as Subject Advisor she also knows that:

- The majority of schools are located in or close to urban areas ;
- The general socio-economic statuses of the areas teachers teach in are lower to middle class;
- The level of education of teachers is low, with few holding degrees;
- The classrooms are overcrowded;
- PC-literacy levels are low, while about 50% of the school have functioning computer laboratories.

All these issues present potential sources for tensions. She anticipates the following plausible tensions:

- Not all teachers will have access to the forum, and those that do probably have a low level of PC-literacy;
- The general lack of resources, textbooks, teaching material and mathematical instruments presents a major source of tensions that will probably dominate discussions;
- Teachers' lack of content knowledge will detract from the value of the discussions;

She realizes that many other tensions possibly exist, but unsure what these are, she anticipate teachers' forums needs to centre around training in using the forum, a need for OBE material and guidance, OBE approaches fitted to the urban character of schools, and active leadership by herself.

Given these anticipated needs, she realizes that the *goal* should probably change from "teachers being confident with OBE approaches" to "fitted OBE approaches".

Reconsidering the *subjects*, the *community* and the anticipated tensions that result from his new *goal*, she comes to the conclusion that a best fit is achieved given what she knows and understands.

Based on the anticipated forum needs, her initial CPD-strategy considers the appropriate rules, division of labour and the tools required. She considers the following:

- Teachers that have access to the forum will require exact guidelines and a basic PC-literacy workshop focusing on the use of the forum;
- Headmasters of schools with computer laboratories will have to buy into the strategy to ensure support for teachers wishing to make use of these facilities;
- A blended approach is required. She will make use of the forum and printed material to reach all teachers. In particular, she will distribute a monthly manual with content, guidelines and exercises for teachers that focus on the urban and socio-economic character of the schools. She tailors an initial learning programme that makes use of examples which both teachers and pupils can identify with, and which in subsequent issues takes into consideration the discussions generated by teachers. These manuals are posted to all schools, meaning that teachers who do not have access to the forum can share in these discussions. She also collects inputs

from these teachers, which is posted on the forum by her assistant for other teachers to respond to.

- Given the general lack of teaching materials, textbooks, mathematical instruments and over-crowded classrooms, she decides to focus on group work techniques in OBE;
- She asks teachers to make use of the exercises provided in the first manual, and to provide specific feedback on what works and what does not work.

She defines the rules, division and labour and tools, which present her CPD-strategy:

- Rules:
 - Teachers: attend workshops, work through material, report back on forum or written report; group work focus.
- Division of labour:
 - Subject Advisor: Prepare OBE material, run workshops, leadership in forum;
 - Teachers: As above in rules;
 - Headmasters: Ensure laboratory access;
 - Assistant: Manage written reports.
- Tools:
 - Workshops, OBE material, forums, written reports.

She implements this strategy, initiating workshops in preparation for the launch of the forum environment, where teachers with access receive training in the forum environment. She also uses the workshops to relay the CPD strategy to teachers.

A two months of implementation, she evaluates the online community and recognizes that while teachers are actively involved, the depth of interaction and dialogue that takes place is relatively shallow. Discussion focuses largely on disciplinary problems in class, while a lot of posts and written reports contain questions about the OBE exercises.

She discovers 2 additional tensions: group work leads to disciplinary problems and teachers demonstrate a lack of independent reasoning in applying the exercises, which is carried over to learners and possibly results in the disciplinary problems. It is apparent that teachers' needs are leadership on how to handle disciplinary problems, and how to reason independently.

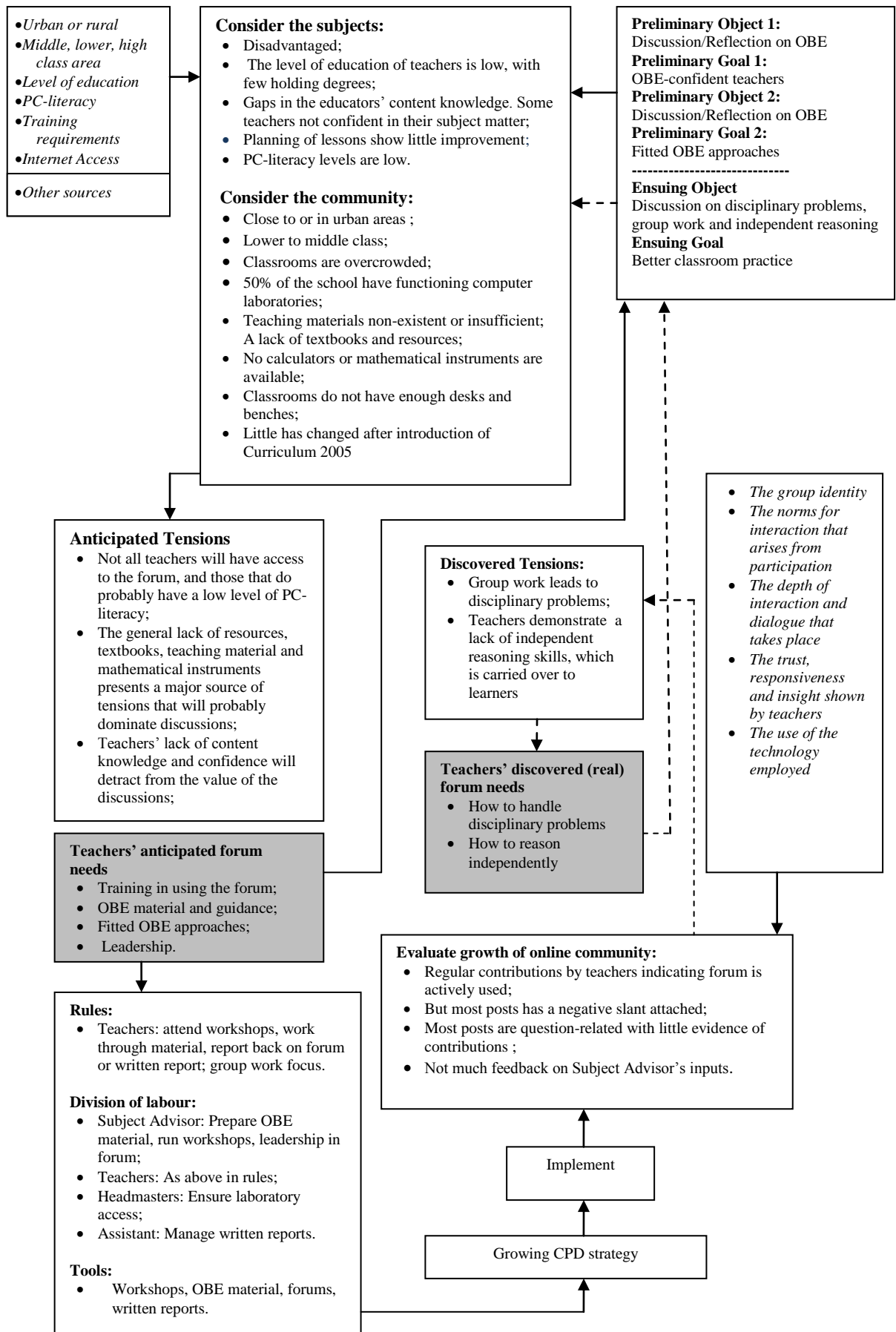


Figure 8.2 Hypothetical example of implementation of the model

Knowing teachers' real needs, she changes the *object* to discussion on group work, disciplinary problems and independent reasoning. The *goal* is better classroom practice wherein. In this process, a new cycle is initiated, which may very well create a different set of tensions, needs and an adapted CPD strategy.

The value of such an approach to an online forum for CPD goes further than implementing a successful forum environment - Subject Advisors get to understand that context leads to tensions, tensions to needs, and needs dictate the appropriate CPD strategy to follow.

Figure 8.2 presents the above walkthrough in model format.

8.4 Implications for existing theory

Chapter 2 considered some of the relevant existing theory as it relates to CPD in general, to collaborative approaches in pursuit of CPD, to reflection as a strategy in CPD, to online collaboration in pursuit of CPD and to the South African context.

Cole and Knowles (2001) state that the analytical process required in contextual research is not one of dissection but one of immersion and that rationality and intuition have a role to play in analysis. They articulate this process as follows:

“We become surrounded and washed by the material, we bathe in it, live it, and breathe it. Like getting to know a good friend, because we have spent so much time together and come to know so much about her, eventually we begin to think, just a little, like her”. (p.106)

This description fits the revelatory, interpretive and rich descriptive approach this study followed (see Chapter 3) in describing the two cases. A comprehensive review of the literature would therefore have forced existing theoretical overlays on the analysis process by “contaminating” the processing and interpretation of contextual data. Stated differently, since there was no *theory* to be discovered or approved, a concise overview of the literature as it relates to framing the research questions and the scope of the current study was considered appropriate in Chapter 2. In essence, I wanted to discover the tensions in context – not anticipate or prevent them by applying guidelines discovered in other contexts.

A conscious decision was thus made to cite, where appropriate, from the “review”-type literature, which is by nature not only more abstract, but also more comprehensive since it

provides consensus about the general characteristics of the topics of interest. The reader should guard against confusing the conciseness of that approach with a lack of review, nor assume that cross-checking of literature did not take place. Rather, some of the relevant literature is integrated into the current section where it makes sense to “compare” the current research findings with the extant literature.

There is yet another compelling reason for having followed this approach. It is evident from the literature that the majority of research related to the online CPD of teachers was done in the 1990’s, when the WWW as we know it today became accessible to the general population. Examples of such research are Casey (1994), Sunal and Sunal (1992), Weir (1992), Bos, Krajick and Patrick (1995), Caggiano, Audet and Abegg (1995), Russet (1995), Schlagal, Trathen and Blanton (1996), McMahon (1997) and Komito (1998) with seemingly useful focuses such as “The Impact of Network Communication Technology on Science Teacher Education”, “From Isolation to Interaction: Network-Based Professional Development and Teacher Professional Communication” and “Electronic Communities of Learners: Fact or Fiction”.

New millennium researchers consistently draw on this research in their reviews of the literature base. Since WWW-offerings and its technologies was in its infancy in the 1990’s, one should take care in blindly adopting the conclusions of these studies into new designs without considering the context and range of today’s web-based technologies. For example, Harasim, Hiltz, Teles and Turoff (1995) identified confusion around the sending of messages to the correct topic area as an obstacle to the successful implementation of an electronic network. With the advanced software available today such confusion is unlikely since reply forms are now linked to threads. This is not to say that such research is not relevant or should be discarded, but given the purposes of the current study, research on the sociological aspects of collaboration in pursuit of CPD, whether in person or online, offered a more pertinent lineage for review in Chapter 2 since it transcends contextual applications thereof.

This study thus steered away from research guidelines on how to ensure “effective online professional development” not only for the above reasons, but because there are as many suggestions in the literature as there are research efforts. In addition, this research also did not attempt to discover or promote a new approach to CPD. As already stated, the interest

was in the context and the personal and situational tensions that prevented disadvantaged and advantaged teachers from utilizing a forum environment to its full potential.

However, existing theory cannot be denied, and the remainder of this section thus approaches the literature from a non-sociological perspective, pointing out the agreements and differences between the current study's results and some of the main works on the online CPD of mathematics teachers in an attempt to add to the existing theory.

Clarke (2003), after an intensive review of the research literature, listed several key principles that correlate with professional growth of mathematics teachers. These key principles (in italics) are embodied in the proposed model, as follows:

1. *Addressing issues of concern.* The current research allowed for a bottoms-up approach to community formation that followed this principle. Context has repeatedly been forwarded as the driving force behind the bottoms-up approach. The results and model developed confirm this principle as seen in the requirement to determine teachers' real needs.
2. *Groups of teachers and links to school administration and community.* Whereas the current study made use of cluster teachers, allowing for some form of community to exist before participation in the ODEM, the proposed model underscores the importance of *homogenous* groups of teachers participating in a forum as opposed to heterogeneous communities. The current study not only confirmed the needs teachers had for links to administrative procedures, but is inherent in the model which allows for links to school administration and community.
3. *Addressing impediments.* At the center of the model is the recognition and addressing of the many impediments to CPD (here as the tensions).
4. *Modelling classroom practice.* Intended to mean "using teachers as participants in classroom activities", the model never removes classroom practices from its vision. Rather, the model invites a consideration of classroom practice and needs by considering the context of participating teachers.
5. *Soliciting commitment.* If teachers' needs are addressed, then commitment is ensured. A bottoms-up approach also invites commitment since teachers' needs are addressed.

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6. *Validating new approaches through classroom practise.* The model attempts to validate new approaches through classroom practise, leading to the discovery of needs that not only validate the approach, but *adds* to it.
 7. *Time for planning, reflection and feedback.* These principles are built into the model. In fact, it encapsulates most elements of the model. For example, a Subject Advisor plans a new strategy, implements it, reflects on the feedback received and replans if necessary.
 8. *Ownership.* In following a bottoms-up approach, ownership is inherent in the model.
 9. *Change is gradual and difficult.* The need for regular evaluation of the level of community formation testifies an adoption of this truism. There are no quick-fit or quick-fix solutions, hence the need for and value of the model which allows for several cycles and a growing CPD-strategy.
 10. *Setting future goals.* Build into the model where goals are open to redefinition when tensions arise and teachers' real needs are discovered.

The current research and model thus not only confirms these key principles, but *extends* its application from general CPD efforts to online efforts.

Li (2004) provides a useful list of strategies for using online forums based on the available literature. These strategies are based on context, content, role of facilitator, format, organization of the ODEM, and design and development. Using her list of strategies as pointers, the next paragraphs briefly highlights some of the prominent literature and points out similarities and difference between the current research findings and the implications thereof for existing theory.

Context

Context was the driving force behind the current research. Whereas traditional cognitive research paradigms take a narrow view and tries to control the multiple factors that are thought to influence success of online endeavours, Activity Theory operates within the social-historical context of the individual and the collective, thus affording a wider view. Factors related to context that have been reported include access (Casey, 1994; McMahan, 1997), especially from home (Schrum, 1995); a need by participants to be on the cutting edge of the information explosion and feeling competent; time limitations (Schrum, 1995);

IT support and induction and training courses in the use of technology (Maor, 2003); flexibility and convenience of participation (Lowry, Koneman, Osman-Jouchoux and Wilson, 1994); a lack of time (Schrum, 1995; Carboni, 1999); and the high workload of facilitators preventing constant attention (Phillips and Santoro, 1989). All of these factors were present in the current study.

What the current study adds to theory lies beyond the identification and prevention of such factors itself. That is, there is an order to factors (or tensions). Failure to control a core factor (or tension) leads to and exaggerates other factors. In the current study, the absence of a Leader/Subject Advisor (as opposed to a facilitator as research suggests) resulted in several other tensions arising. The need for this Leader/Advisor arose from the fact that teachers had needs which the ODEM could not address. If these needs are addressed, then tensions are resolved. The benefits arrived at is tangible. For example, if a teacher knows that her needs will be addressed in the forum, she will make an effort to access the forum from wherever she can and as often as she can, thereby resolving the access tension.

Content

In terms of content, both Merryfield (2001) and Li (2003) note that previous research indicates that online discussions works particularly well with sensitive and prickly issues. It is exactly these prickly issues that gave rise to many tensions and the direct need for a Leader/Subject Advisor. Although these issues were not raised or discussed in the ODEM, they influenced the quality of participation. Why these issues were not discussed in the ODEM is open to speculation. It is possible that teachers did not feel comfortable expressing themselves in writing as they would verbally, did not want to sound unintelligent or leave a record of these issues (Zorfass, Remz, Gold, Ethier and Corley, 1998) or it may simply have been that uncertainties about whether it is appropriate led the group to construct an online social norm not to do so (Ahern, Peck and Laycock, 1992). Both groups, especially, the advantaged group, wanted to (but did not) raise these issues in the ODEM simply because the person “who needs to hear” (the Subject Advisor) was not participating. The lack of responses from other teachers may also have resulted in them not raising these such sensitive issues (Romiszowski and de Haas, 1989).

From the current study’s results, the implication for existing theory in terms of content is that the more advantaged a teacher is the more need they have for discussions around

prickly issues. Disadvantaged teachers also have this need, but they tend to have more pressing needs, some related to content and presentation, that they first want resolved.

Casey (1994) and Spitzer and Wedding (1994) propose that the nature of online discussion may promote reflection. The current study's findings indicate otherwise, with the implication that reflective practises are unlikely to occur in an environment where teachers' needs are not addressed or resolved first.

Facilitator

The presence of a facilitator as a key component in online interaction is recognised throughout the literature (Romiszowski et al., 1989; Ahern et al., 1992; McMahan, 1997; Zorfass et al., 1998). The Subject Advisor for the participating groups of teachers was initially intended to participate in ODEM but could not due to a busy schedule. This failure is mirrored in Phillips et al.'s (1989) decree that a high workload of facilitators prevents constant attention. An irony exists here: should a Subject Advisor participate in the forum, she would reach more teachers more often and much faster, resolving not only their needs but perhaps much of her workload.

Li (2004) proposes that while a facilitator plays a vital role in online forums, the facilitator needs to have a balanced pattern of appearances in the discussion forum. This viewpoint is supported by Leimeister, Sidiras and Krcmar (2004) who investigated success factors of virtual communities and suggested that while community managers should intervene in community life as little as possible, they should be able to react quickly to problems. The current results showed both groups of teachers having a definite need for an active Leader/SubjectAdvisor. A less-strategy would make sense only when it is evident that the online community is able to mature on the evidence of its own inputs.

The current research thus confirms the importance of a facilitator, but highlights her main role to lie mainly in resolving many of the tensions that arise when teachers' needs are not addressed. As such, the term facilitator may not be an accurate description of the role required. Hence Warms, Cothrel and Underberg (2000), in an unpublished white paper, refer to a need for *active management* that requires constant iteration and innovation, measurement and target improvement. Core elements are program creation, execution and iteration while supporting processes (active listening, interpretation, measurement and reporting) provide the information needed to drive the iterative cycle. The requirements of

active management include expertise, the right tools, processes for all elements of the community, infrastructure and scaling. All the above are embedded into the model provided. Active management is thus confirmed as an appropriate term.

Format

In terms of the format, Pallof and Pratt (1999) recommend the best size for an online discussion group is between 5-15 students, basing their argument that too many students in a group may create an excessive number of messages which may cause frustration for students who cannot keep up and too few students usually have difficulty generating meaningful discussions. The sizes of the groups in the current study were mainly dictated by the costs involved in providing Internet-ready computers and Internet access. Although falling within the group sizes suggested, most teachers preferred a larger group, although the reason for this desire probably lied more in the frustrations with other teachers who responded infrequently and without zeal.

A bottoms-up approach to community formation was a cornerstone of the current study. The results showed teachers to be unable to build a community from the bottom-up because they were unable to provide the leadership required to resolve their own within-group needs. This does not imply a failure of the bottoms-up approach. A bottoms-up approach is needed in order for teachers' needs to surface. But active management is required if the community is to grow, or at least until the community has matured to the extent where it can resolve most or all of its own needs.

Organization

In terms of organization of the forum, the original intention was for teachers to nurture and maintain horizontal relationships with colleagues. While not entirely successful because of the need for a vertical relationship with a Leader/Subject Advisor, teachers demonstrated enough evidence of community to facilitate the establishment and maintenance of horizontal relationships - as long as their needs are met.

Organization of the forum necessarily includes support structures to be in place (Maor, 2003). A lack of user training and support, as well as a lack of access to the appropriate technology has been identified as major reasons for the failure of online projects (Carboni, 1999). The current research tried to address these issues in providing workshops, support and providing access from home. Addressing these issues was not an attempt to prevent

them as much as it was an attempt to get teachers online in order to discover tensions. Despite these best intentions, the disadvantaged group experienced many tensions directly related to the organizational aspect. The implication is that organizational issues require more consideration and planning in disadvantaged implementations of the forum.

Design and development

In terms of design and development, Raleigh (2000) proposes that online forums be used in creative ways to help students internalize knowledge and share ideas in enjoyable and exchange environments. This can only be achieved through thoughtful planning and careful implementation (Li, 2004). The current model confirms such an approach but emphasises the need for a continuous and cyclic process of assessments of teacher need, and appropriate remodelling.

The model itself as presented in the previous section adds to the existing theory in various ways.

Contribution of the model

What this model firstly adds to existing theory, as supported by the results, is that context plays an important role when an online forum environment is offered to teachers. This context largely dictates the online CPD-strategy that needs to be followed since the context gives rise to tensions that determine teachers' real forum needs. These tensions may lie within the forum environment or outside the forum environment, but cannot be separated because there is an order to tensions that give rise to needs. Since these tensions differ for disadvantaged and advantaged communities, it follows that an online CPD-strategy must be linked to a community. There cannot be a single strategy for all communities since tensions and needs are remarkably similar within a specific community.

The model secondly adds to the existing theory in the role that the Leader/Subject Advisor plays in the CPD of teachers in an online setting. A paradigm shift from traditional approaches to CPD occurs whereby data to inform CPD strategy is collected within a naturalistic environment as opposed to controlled environments. Assessment is conducted by a consideration of the context of users (*subjects, community, rules, and division of labour*) and the *tools* employed. There is a shift away from knowledge storage to knowledge construction, with users being active partners in the CPD process and the Subject Advisor assumes the role of active manager.

The model thirdly proposes that reflective practises will only arise when teacher real forum needs have been satisfied. Unfulfilled needs result in a shift of focus away from reflective practises, indicating that reflective practises should be considered a higher-order need that is only achieved when lower-order needs are fulfilled.

8.5 The research approach and methodology followed

The research approach and methodology followed was unique in many ways and offers its own contributions to further studies of online CPD.

Chapters 1 and 2 expressed the viewpoint that a forum environment cannot be offered without a consideration of the context within which it is implemented. In order to discover the influence of the context, a holistic approach had to be adopted - one that was grounded in the reality of the cases and one that tacitly illuminated the meaning of what occurred through thick description. While the former is typically achieved through the application of Grounded Theory, the latter approach is generally true of case studies. With no theory to discover, a case study approach alone would have contributed to bias in the interpretation of data because of the inherent subjectivity associated with its method (Merriam, 1988).

The use of Activity Theory to identify Activity Systems (as units of analysis) by employing elements of Grounded Theory techniques meant that the data could be grounded in context because context is always included in the unit of analysis. Moreover, in order to discover Activity Systems, the data had to be compartmentalized which removed the subjectivity associated with case studies.

An Activity Systems approach further focused data analysis. In the current study it ensured that the discovery of tensions occurred within appropriate sets of data. The border between “cases within cases” is thus more precise. Since tensions were linked to *objects* and *goals*, *subjects*, *community*, *rules* and *the division of labour*, there existed no uncertainty as to the exact sources of the tensions found. A further advantage is that the contextual realities in one Activity System are separated from contextual realities in other Activity Systems, allowing tensions to be sourced more reliably.

Perhaps the greatest contribution of the combination of Activity Theory and Grounded Theory in a Case Study context brought to the current study lied in the variety of data views it offered, especially when combined with the framework developed to analyse the posts to the ODEM (presented in section 4.2.3.4 and offered here as another contribution

of the current research). Through Chapters 4 to 7, as well as the present chapter, the data was looked and relooked at from various perspectives. Together with the multiple data sources this study employed, this afforded a higher level of data triangulation than typically achieved. This led to more robust findings, which in turn allowed the exact framing of the interrelationship between the elements of the model offered.

8.6 Summary

This chapter presented the main contributions of the current research. A synthesis of the previous summaries of Chapters 4 – 7 resulted in several deductions which led to the discovery of a strategic model to ensure successful online CPD of teachers in the South African context. Implications for existing theory were provided with reference to the current literature. The contribution of the research approach and methodology followed to further studies of online CPD was also highlighted.

9. Conclusions

- 9.1 Introduction**
- 9.2 Overview of the research**
- 9.3 Conclusions reached**
- 9.4 Summary of contributions**
- 9.5 Discussion of problems**
- 9.6 Suggestions for further research**
- 9.7 Summary/Concluding remark**

9.1 Introduction

This concluding chapter builds on Chapter 8 (Contribution) where a summary of the research was offered from an Activity Theory perspective, which led to the development and presentation of a strategic model for successful online CPD of teachers in the South African context. Implications for existing theory was offered, while the research approach and methodology followed was also offered as a contribution.

This final chapter limits itself to a reflection of the research. In section 9.2 an overview of the research is offered. Section 9.3 provides final conclusions. A summary of the contributions of the research is provided in section 9.4. In section 9.5 problems that were experienced and could have affected the results are discussed. The chapter concludes by looking at research opportunities arising from the present research.

9.2 Overview of the research

In Chapter 2, the need for CPD of South African mathematics teachers was reiterated based on the poor result of the 1994/1995 TIMSS study. Given the promise of the Internet to transform traditional approaches to CPD, this study investigated personal and situational tensions that impact on the use and value of an appropriate forum environment as a reflective tool for CPD. A mathematics-friendly forum environment (ODEM) was developed which allowed mathematics teachers to include mathematical expressions in their posts to the forum. Two groups of teachers, one from a disadvantaged and one from an advantaged background were provided with Internet-ready computers and Internet access from home, and tasked to reflect on their practice, thereby providing opportunities for collegial interaction and growth and thus CPD. The intention was to provide an opportunity for a bottoms-up approach to community formation and participation and for tensions that impact on the use and value of the ODEM to surface naturally.

Data was obtained from several sources, including semi-structured interviews, research diaries, and server data as well as from an analysis of ODEM posts. Making use of various data views afforded by the use of Grounded Theory and Activity Theory in a Case Study context, an attempt was made in the analysis chapters to discover, link and interpret these tensions. In Chapter 4 several tensions that impacted on the use of the ODEM by disadvantaged teachers were discovered. These tensions existed in two Activity Systems, one related to securing access to the Internet and the other to using the ODEM. In Chapter 5 tensions related to the advantaged group were discovered in one Activity System. In Chapter 6 the two groups' were compared along various dimensions, highlighting the chasm that existed between disadvantaged and advantaged teachers coming into the ODEM and in the ODEM. In particular, disadvantaged teachers faced far more tensions from more sources than did advantaged teachers. These tensions were related to teachers' forum needs, highlighted by the discovery of the core tension in both groups that teachers required the participation of a Leader/Subject Advisor in order to solve their real needs and for the online community to grow. In Chapter 7, it was concluded that the ODEM has potential value, but only if teachers' needs are solved.

In Chapter 8, where contributions were discussed, a cyclic model was forwarded that can be used by a Leader/Subject Advisor to inform her of tensions and teachers forum needs. That information can be used to develop an appropriate online CPD-strategy which needs to be constantly evaluated against evidence of community formation.

9.3 Conclusions reached

A variety of tensions that impacted on the use and value of the ODEM and its value as a reflective tool were found. The major sources of these tensions were found in teachers' real forum needs which were not addressed. These needs differ between disadvantaged and advantaged communities, and thus inform the appropriate online CPD strategy that must be followed. Until these needs are resolved teachers will not have a need for a mathematics-friendly forum environment that allows them to include mathematical expressions in their posts. Teachers will also not pursue truly reflective practices as intended by its definition until their real needs are addressed. In order to resolve these tensions and discover teachers' real needs, a Leader/Subject Advisor that demonstrates active management is required. Embedded in this management process is a cyclic process that considers the subjects, their community and the tensions that arise there from, leading to a discovery of

their anticipated forum needs and an appropriate online CPD-strategy set along rules, division of labour and the tools to effect this strategy. Once the strategy is implemented, the Subject Advisor needs to evaluate the online community on a regular basis for evidence (or lack of evidence) of community growth. In the process the object and goal may need to be redefined, starting a new cycle where teachers' real forum needs are discovered.

What the research has particularly demonstrated, is that context plays an important role in the formation of online communities in pursuit of the online CPD of teachers, and that this context needs to be discovered and considered through the application of an appropriate model.

9.4 Summary of contributions

As discussed in section 8.4, the current research added in several ways to the existing body of knowledge. Most importantly, the importance of context and how context results in personal and situational tensions that impact on teachers' real forum needs and on the subsequent use and value of an online forum in pursuit of CPD has been highlighted.

The main scientific contribution of the current research lies in the provision of a model that considers this context within which a forum is implemented and which informs an appropriate online CPD-strategy.

Several contributions were made to existing theory in section 8.4:

1. The current research results and model confirmed several key principles associated with the CPD of mathematics teachers. More importantly, it extended its application from general CPD efforts to online efforts.
2. The research showed that there is an order to tensions that leads to and exaggerates other tensions. As such, a core tension/s that leads to other tensions may exist. If resolved, it is likely to resolve many of the other tensions.
3. Disadvantaged and advantaged teachers have different needs. The more advantaged a teacher is, the more their needs move from the *how* of teaching (content and presentation) to the *why* of teaching (strategy, policy, frustration etc).
4. Fourthly, reflective practices as per definition are a higher-order needs that is unlikely to occur in an environment where teachers' lower-order needs are not addressed or resolved first.

5. The term “facilitator” to refer to a leader in a forum may in certain contexts be inappropriate. A forum leader needs to pursue active management principles if an online community is to grow.
6. A bottoms-up approach is needed in order for teachers’ needs to surface.
7. Organizational issues require more consideration and planning in disadvantaged implementations of the forum.
8. Thoughtful planning and careful implementation of online communities emphasizes a need for a continuous and cyclic process of assessments of teachers’ needs, and appropriate remodeling.
9. An online CPD-strategy must be linked to a community. There cannot be a single strategy for all communities.
10. A paradigm shift from traditional approaches to CPD occurs in online approaches whereby the data to inform CPD strategy should be collected within a naturalistic environment as opposed to controlled environments. There is a shift away from knowledge storage to knowledge construction, with teachers being active partners in the CPD process and where the Subject Advisor assumes the role of active manager.

The framework developed to analyse the posts to the ODEM (as presented in section 4.2.3.4) offered another contribution. Its usefulness was particularly evident in the many data views it afforded together with the innovative use of elements of Grounded Theory and Activity Theory in a Case Study context. Together with multiple data sources, the framework and methodology allowed for multiple data views that not only resulted in robust findings, but led to the design of the proposed model. The good retro-fit achieved between the model and the findings of this research underscores the strength of this contribution.

Some important practical contributions arose from the research. The value of a forum environment to support cluster meetings is evident in the communication channel it provides between teachers and a Subject Advisor. Such a channel of communication is bi-directional: it allows all parties instant access to one another in an evidently volatile educational environment. For teachers, it allows access to a Subject Advisor that is perceived as distant to the problems experienced at grassroots level, while for the Subject Advisor it provides opportunities to discover and support teachers in their real needs,

thereby informing appropriate off- and on-line CPD strategies. It is not improbable to suggest that if all teachers have access to the forum, it may well replace cluster meetings, thereby placing less demand on teachers' and Subject Advisors' time. The challenge, of course, is for all teachers to have access to the forum. Here the government has publically committed itself to providing all schools with Internet access, and thus the current research has provided a much needed foundation to build upon when that happens.

Another practical contribution relates to the issue of support required when teachers connect to the Internet. Dial-up accounts from home were not a feasible option, largely because of other problems such as financial constraints and the level of support offered by Telkom. The difficulties experienced in adopting a secondary support role to especially disadvantaged teachers highlights the importance of functioning school laboratories if a forum for CPD is to be successfully pursued. Given current crime levels in townships, portable notebooks (with 3G wireless-connection cards for access from home) present the best solution, but it is an expensive route which will require subsidies by relevant roleplayers.

9.5 Discussion of problems

This research was built on the belief that in the South African context, there are bound to be personal and situational tensions that will impact on the use and value of an online forum environment as a reflective tool by disadvantaged and advantaged teachers in pursuit of CPD. In order to discover these tensions, a bottoms-up approach to community formation was considered best practice. This approach may well have invited several problems, especially since earlier research has uncovered many factors that influence community formation. However, it was argued that by allowing tensions to rise naturally, the complete set of tensions that did arise led to the robust findings of the current study.

Nevertheless, the following problems may have unintentionally contributed to some of the tensions discovered:

1. Home Internet access was the only viable option given that most disadvantaged teachers did not have access from school laboratories. In order to achieve a valid comparison, this decision forced access from home for advantaged teachers. The costs associated with Internet Access forced the adoption of packaged access from home after 19h00 in the evenings, which may have impacted on the participation

rates of teachers with time constraints and family responsibilities. However, the difficulties experienced in providing home access, while resulting in several disadvantaged tensions, highlighted realities that form important considerations for future implementations.

2. Some difficulty was experienced in conducting and transcribing interviews with teachers from disadvantaged communities due to interviewer and vernacular effects.

- Interviewer effects:

As a (previously) advantaged person, conducting interviews with teachers from a disadvantaged community may have prevented these teachers from revealing tensions to someone they may have perceived as being “distant” to their cultural dispositions.

Vernacular effects:

Sections of the disadvantaged interviewee responses could not be clearly transcribed due to vernacular effects and had to be discarded. Some data may have been lost in this process. Fortunately, because I had to rephrase many of these teachers’ answers in order to generate more clarity as to their meaning, my rephrased (and clearer for purposes of transcription) replies to teachers’ answers provided some clues to some of the lost data, but this clearly does not represent an ideal approach.

To account for interviewer and vernacular effects and to ensure data integrity, key concepts discovered during analysis were revisited via a focus questionnaire to both the disadvantaged and advantaged groups.

3. Initially intended to act as a facilitator, the failure to secure a Subject Advisor for participation in the ODEM resulted in the core tension in both groups. However, there is no guarantee that her participation will have resolved many of the tensions, or that she will have recognized their needs.
4. Given that some connection problems teachers experienced were easily resolved, it would probably have been wise to provide a problem-solving guide to teachers.

9.6 Suggestions for further research

The most important suggestion for further research is perhaps the most obvious. This research should be repeated with a Subject Advisor being part of the implementation.

What tensions were found were important to the purpose of the current research. More important, however, is that these tensions were related to teachers' real forum needs. There is thus no need for further research in order to discover more tensions. Rather, further research should aim at building upon and testing the model offered. How to evaluate community formation given context presents another opportunity for research. This will lead to Subject Advisor's understanding of teachers and the community they teach in.

9.7 Summary/Concluding remark

This chapter provided a brief overview of the main findings and contributions of the research. Problems experienced during the research were highlighted, while suggestions for further research were offered.

In concluding this research, *several personal and situational tensions impacting on the use of an appropriate online discussion forum environment as a reflective tool for the CPD of advantaged and disadvantaged teachers in South Africa were discovered. These tensions were closely related to teachers real forum needs and resulted in the forum environment not being used for reflective purposes. Until teacher tensions and needs are resolved through the participation of a Subject Advisor, the online forum environment is perceived to have potential value.*

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ANNEXURE A: ODEM DESIGN REPORT

- 2.1 Introduction
- 2.2 System overview
- 2.3 Design considerations
- 2.4 Assumptions and dependencies
- 2.5 General constraints
- 2.6 Goals and guidelines
- 2.7 Development methods
- 2.8 System design architecture

2.1 Introduction

The purpose of this report is to present a walkthrough on the design of mathematics-friendly on-line forum environment (ODEM) as implemented in the current study. To cater for non-technical readers in the field of Technology Education, this report presents the information in a relaxed format. The reader is referred to Chapter 1 for an introductory background to the need for this ODEM environment.

The rest of this report is divided as follows. In section 2.2, a system overview is provided by way of a practical example on the use of the ODEM. Section 2.3 lists the major design considerations, while section 2.4 highlights assumptions that directed the design process. Section 5.2 lists the general constraints that had an impact on the software implementation. In section 2.6, the development methods followed are listed. Section 2.7 lists the freeware applications and open software used to construct the ODEM and describes the communication mechanism between these.

2.2. System Overview

The ODEM was developed in order to allow user to include mathematical expressions in their posts, thereby allowing for interactivity. The functionality of the ODEM can best be described by way of an example, presented in a series of steps for a user wishing to post to the forum:

1. The user connects to the Internet and types the URL of the forum.
2. On his first visit, the user is required to complete a registration form, which requires him to enter a pseudonym as user name, and a password. On subsequent visits, a cookie will remember his login credentials.
3. After registration, he can immediately log in with his chosen credentials, there being no email authentication process.
4. He selects the appropriate forum to visit from a forum list.
5. Topics in a forum are presented in collapsed threads in an ordered list, with the latest topic at the top of the list, and any unread topics marked with the word “new!” in red.
6. He decides to post a new topic or to reply to an existing topic, and wants to include a mathematical expression. If he does not want to include an expression, he proceeds to step 7.
 - a. Two options are available. If he is familiar with LaTeX, he may type his expression in that language. If he is not familiar with LaTeX, he opens up a desktop application that provides a WYSIWYG (What You See Is What You Get) interface. The application has several drop-down menus with visual elements that, when selected, generates pre-defined formula containers wherein he can type the required numerals and text the expression requires.
 - b. A further two options are available here. He can either type the complete topic with mathematical expressions included, or just the expression. In either case, the application generates LaTeX math of his text in the background, which is copied to his clipboard when he selects and copies his text from the WYSIWYG interface.
 - c. He copies the LaTeX-math to a topic form in the ODEM. If he only copied the expression to his clipboard, he can type his message body and insert the expression by a simple paste action when required.
7. To ensure his text (and optional expression/s) are generated correctly, he previews his post.
 - a. If an expression is included, the preview process makes use of back-end Common Gateway Interface (CGI) and converter scripts that converts the LaTeX-math into MathML code, while a browser plug-in for Internet Explorer

displays the text and generated expression in an inline frame on the screen. The latest Mozilla browsers natively display MathML, and a plug-in is not required.

8. If the text (and expression) is displayed to his satisfaction, he posts the message.

2.3. Design considerations

The prominent design considerations which dominated and embodied the design of the system's software were as follows:

1. Although Internet Explorer remains the most popular browser in use, the system had to cater for Mozilla-based browsers, which placed extra demands on the back-end functionality.
2. The forum interface had to be user-friendly and intuitive to novice users.
3. The inclusion of mathematical expressions in posts should not require a steep learning curve.
4. The ODEM had to be text-based to take advantage of slow connections speeds through dial-up connections.
5. The software had to allow implementers open access to code in order to upgrade the software when required (see section 2.5). The software thus had to be open sourced or freeware, thereby freeing it from the restrictive and financial constraints currently associated with commercial products. By making use of open sourced software and freeware applications, development time would be greatly reduced.
6. For purposes of analysis as required by the current study, all teacher activity on the ODEM had to be recorded in separate server space. This required XML versions of all user efforts whether posted or not, as well as the time and day of each post.

2.4 Assumptions

The major assumption adhered to covered end-user characteristics. The assumption was that most teachers will be Internet novices, and the system was foremost designed with this notion in mind. As users gained expertise with the environment, modular and highly configurable software that allowed for advanced functionality was required. The principle of technological minimalism was employed which dictated that one should consider the lowest level of technological readiness offered by a user, and that this level should provide the highest level of technological know-how required with implementation.

2.5 General Constraints

Global limitations or constraints that had an impact on the portability and (long) term use of the environment were imposed by the following:

1. The prominent programming language and database software used (see section 2.8) are version susceptible. In a controlled environment such as this study, this limitation did not offer any constraints as the developer and researcher had full control over the server environment used during the implementation phase. In a hosted environment, however, programmable changes may be required when vendors upgrade programming, database and server softwares.
2. The success of the ODEM as a software environment was dependent on its accessibility. While every effort was made to increase accessibility, the software has no control over general network constraints that slowed down connection speeds.
3. Incremental and sustained increases in automated software robots targeting and distributing spam to forum environments are a reality of Internet connectivity. Every effort was made to prevent this from happening, as failure would have increased the demand on bandwidth availability and would require users to screen invalid from valid posts, thereby placing a higher demand on participation. Over longer periods of implementation, this threat will require the constant upgrading of captcha-enabled registration forms, which requires users to match the exact combination of words and/or numbers generated in a "captcha"-image, thereby preventing spam-robots from posting to the ODEM.

2.6 Development

The development depended entirely on the availability and compatibility of appropriate Open Source software and freeware applications that met the design considerations, system design and architectural strategies (section 2.7). No formal or published method of development was appropriate given this approach.

Availability of appropriate applications and software was done through intensive Internet searches. Three main searches were done. Firstly, a search was conducted for freeware applications that will generate LaTeX-math in a WYSIWIG environment. The next search was for a converter that will convert the LaTeX-math into MathML. A final search was conducted for appropriate open source forum software.

Since appropriateness does not necessarily imply fit, the next step was to determine the compatibility of applications and converter software to forum software. Once compatibility has been established, the next step was to adapt and integrate the applications and software into a beta version of the ODEM.

The next step required extensive testing, tweaking and evaluation of the environment by end-users to determine deficiencies. Several colleagues were asked to test the ODEM for simplicity and usability. Minor recommendations to the user interface were implemented, most notably to integrate the preview-window into the post form.

The final step was to implement the ODEM for use by teachers. The system was evaluated for effectiveness throughout the implementation phases.

2.7 System design and architecture

The system design made use of the freeware applications and open source software presented in Table 2.1.

Table 2.1: Freeware applications and open source software used in designing ODEM

Requirement	Application/Software	Developers	Notes
Forum software	Phorum version 3.4	http://www.phorum.org	Requires PHP and a MySQL database
LaTeX WYSIWIG Editor	TextAide	http://www.dessci.com/en/products/texaide/	
MathML-converter	itex2mml (includes HTML tidy)	http://pear.math.pitt.edu/mathzilla http://www.w3c.org/People/Raggett/tidy/	Written in ANSI C
MathML Plug-in	MathPlayer 2.0	http://www.dessci.com/webmath/mathplayer	Enables Microsoft Internet Explorer to display mathematical notation in web pages
CGI-scripts		Self-written.	Written in Perl

The communication mechanism, inclusive of the architecture where applicable, can be described as follows:

1. When a user previews text and/or a mathematical expression, the generated HTML, inclusive of the LaTeX-math, is contained in a HTML file, designated with the user name, e.g. JoeDoe.html. Additional information sent with this file include the browser agent information and the new thread ID as reserved by the MySQL database.
2. This file is directed to the CGI-scripts residing in the CGI-bin on an Apache server running the forum software,
3. The CGI-script receives and opens the incoming files for reading. It firstly evaluates the browser agent and directs further processing to the relevant code section.
4. The code sections are responsible for processing the incoming HTML file to MathML in a series of sequential steps:

- a. The MathML-converter firstly tidies the incoming HTML with the HTML Tidy application, and then creates the correct header (Doctype etc) as required by the IE and Mozilla browsers, and saves the output into a temporary XHTML file.
 - b. The XHTML file with embedded LaTeX-math is converted to MathML with itex2mml, and saved as an XML file.
 - c. The XML file is opened for reading and displayed in an inline frame using the MathML plug-in. A copy of this file is simultaneously saved in a back-up directory on the server for later analysis, thereby providing an exact history of user efforts.
 - d. Should the user wish to make changes, the process is repeated from step (a).
 - e. Should the user accept the generated output, he submits the post, in which case the MATHML content from the XML-file is saved in the database without the required header, as directed by the thread ID.
5. Subsequent visits to the thread evaluate the browser agent, add the correct header and retrieve the MATHML from the MySQL database. The combination of header and MATHML is then displayed in an inline frame within the Phorum application.

While LaTeX-math is used to generate the MathML, a dialect thereof is available for the more advanced user who wishes to generate mathematical expressions without the TextAide application. This dialect is embedded “itex”, a superset of WebEq’s webtex. Itex offers natural synonyms for WebTex’s and LaTeX’s less obvious but more concise control sequences: for example ‘\infinity’ as well as ‘\infty’, ‘\Union’ as a synonym for ‘\bigcup’ etc. Not all aspects of LaTeX fit within the structure of MathML, however, and in one known example users are required to update the generated LaTeX with an itex control sequence: TextAide generate \sqrt{x} , whereas MathML requires \sqrt{x} .

Design Science TeXaide™ is a special version of the familiar Equation Editor offered by Microsoft Word that generates TeX and LaTeX using MathType’s translator technology. The major difference between these two versions is that whereas Equation Editor can be used with any application that supports OLE or can paste a graphic from the clipboard, TeXaide only generates TeX/LaTeX on the clipboard, from where it can be pasted into any TeX/LaTeX system (such as the ODEM).

An example of LaTeX code to MathML code is:

LaTeX code: $f(z) = \sum_{n=0}^{\infty} \frac{f^{(n)}(a)}{n!} (z-a)^n$.

The MathML code of the above would be:

```
<math xmlns='http://www.w3.org/1998/Math/MathML' mode='display'>
<mi>f</mi><mo>(</mo><mi>z</mi><mo>)</mo>
<mo>=</mo>
<msubsup>
<mo>&Sum;</mo>
<mrow><mi>n</mi><mo>=</mo><mn>0</mn></mrow>
<mn>&infin;</mn>
</msubsup>
<mfrac>
<mrow>
<msup><mi>f</mi> <mrow><mo>(</mo><mi>n</mi><mo>)</mo></mrow> </msup>
<mo>(</mo><mi>a</mi><mo>)</mo>
</mrow>
<mrow><mi>n</mi><mo>!</mo></mrow>
</mfrac>
<mo>(</mo><mi>z</mi><mo>-</mo><mi>a</mi>
<msup><mo>)</mo> <mi>n</mi></msup>
</math>
```

In concluding this chapter, the reader is referred to Appendix B for a detailed user manual with accompanying screen shots.

ANNEXURE B: ODEM USERS MANUAL

MATHS INTERNET DISCUSSION FORUM

<http://osprey.unisa.ac.za/maths>

It is strongly advised that you read through this entire document before attempting to use the discussion forum.

Our forum (discussion) environment allows you to include mathematical expressions in your discussions.

In order to **VIEW** mathematical expressions in the discussion forums, your browser may require a few fonts and/or a plug-in (small program) installed. If you use the latest versions of the Mozilla browser and Netscape, as opposed to Internet Explorer, you will not require the plug-in. We suggest you use Internet Explorer. You require version 6 or higher.

To test if your browser is able to display mathematical expressions, visit <http://osprey.unisa.ac.za/maths>.


- Click on the “Go to the maths forum environment”.
- Click on the “Notice Board” forum.
- In this forum, click the “Test your Browser” topic. If you can view the expression included here without any errors, your browser is able to display mathematical expressions.
- If you **cannot** view the expression and/or an error of any sort is generated, visit the download area <http://osprey.unisa.ac.za/maths/downloads> (or click the download link on the page <http://osprey.unisa.ac.za/maths>). Follow the instructions to download the plug-in (Internet Explorer) and/or fonts required.

To **INCLUDE** mathematical expressions in your discussions, irrespective of the browser you are using, please visit <http://osprey.unisa.ac.za/maths/downloads> and follow the instructions to download and install an editor, *TextAide 4*, which you will use to generate the mathematical expressions that you are going to include in your discussions. You also need to Download and install some *fonts for TextAide*, which will allow you to view special maths characters within the TextAide application.

For all queries and problems, please post a message in the **Notice Board Forum** where your questions will be answered.

This rest of this document will show you:

- How to **access** and **use** the forum environment over the Internet
- How to **generate mathematical expressions** to include in your discussions on the forum

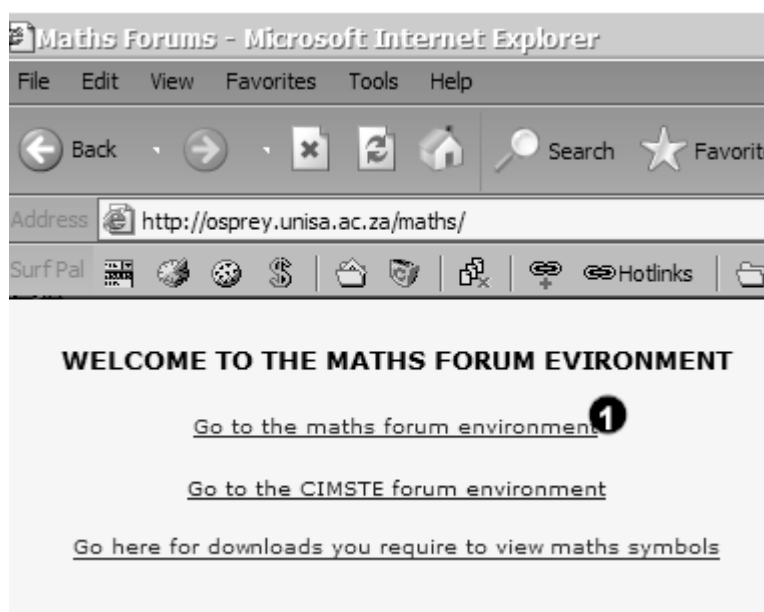
In this guide, wherever the  appears, it means that you should return to this image since all further references point to this image..

STEP 1

VISIT OUR FORUM

1. Start Internet Explorer or Netscape or Mozilla.

🔗 Image 1 (a) Getting to the forum environment



2. Type in the following URL in the address bar **1**: <http://osprey.unisa.ac.za/math/> and wait for the page to load.
3. Click on the “Go to the maths forum environment” to go to our forums.

🔗 Image 1 (b) Getting to the forum environment

Log In

Available Forums	
<u>CIMSTE</u>	M & D Support Group
<u>Gauteng Group</u> 2	Research Study Group - 2005
<u>Notice Board</u>	Problems, news on using these forums
<u>Post Grad Hons</u>	Hons BEd Maths
<u>Post Grad Masters</u>	MEd Maths
<u>Practice Area</u>	Practice your mathml here
<u>Pre-Calculus</u>	Ronél's Students
<u>WWW2004</u>	Presentation area
<u>Z-Development</u>	Development area

4. A list of available forums will appear. Select the one you are interested in or have been told to use – in this case click the **Gauteng Group** **2** forum.
5. A page with topics available **2** should appear on the screen after a while. This is the forum environment in which you will communicate with your colleagues. We'll explain the terms *forum* and *topic* a little later on this document. It is perhaps a good idea to add this page to your favorites (Click Favorites on your browser toolbar, then Add to favorites). This will allow you to access this page directly without having to go through all the previous steps each time you visit the forum.

🔗 Image 1 (c) Getting to the forum environment



6. In this example, “Welcome” is the only topic in the forum “Gauteng Group”. The more the forum is used, the more topics will appear.
7. Each topic will have several posts (messages) inside it. For example, another topic may be “Help me with equivalent equations please!”

Reading messages within topics

🔗 Image 2: Examples of topics available in the forum

New Topic Go to Top Search				Older Messages
Topics	Author	Replies	Last Post	
Help me please!	mac	1	11-08-04 12:18	
Welcome	mac	0	11-08-04 10:23	
Forum List View Threads Mark All Read Log Out My Profile				Older Messages

1. In this example, the forum now has two topics – *Help me please* (posted by Mac on the 08th of November 2004 at 12:18) and *Welcome* (posted by Mac on the 08th of November 2004 at 10:23)
2. **A topic refers to a “group of messages” that discusses the same issue (topic).**
3. If you look at the times these two topics were posted, you will notice that the most recent topic appears at the top. When there are several topics, any message to any topic will cause that topic to rise to the top of the list. In addition, the word *new!* will appear in red next to the topic, to indicate that someone has added new content to a topic and that you have not read it yet.
4. Also note that in the example here above, there has been 1 reply to the *Help me please* topic and none to the *Welcome!* topic.
8. Click on the topic you are interested in (note that are examples and may or may not be present when you visit the forum). For example, click on the *Welcome* topic
 - a. The page will expand so you can view all the messages that were added by others (and maybe even more messages by you on the topic!). All these messages have one thing in common – they are all discussing the same topic – *Welcome!* We say they belong to the same *thread*. A thread is like a piece of string that connects all messages that belong in that topic.
 - b. You can also expand all the threads of all the topics automatically by clicking the *View Threads* words that appears bottom left in image 4. Clicking it again (it is now named *Collapse threads*) retracts the threads.

Image 3 (a): Inside a topic

Gauteng Group

[New Topic](#) | [Go to Top](#) | [Go to Topic](#) | [Search](#)

Help me please!

Author: [mac](#) ()
Date: 11-08-04 10:27 **1**

Is the following statement true?
If x and y are even numbers, then $x + y$ is divisible by 4.

Re: Help me please!

Author: [mac](#) ()
Date: 11-08-04 12:18 **2**

One can check the validity of the statement by specialising, e.g.: $6 + 2 = 8$ $2 + 10 = 12$ $4 + 16 = 20$

These are all pairs of even numbers whose sum is divisible by 4, so the statement seems reasonable. To find even numbers for which the sum is not divisible by 4, e.g.: $4 + 2 = 6$ $2 + 8 = 10$ $4 + 10 = 14$

[Forum List](#) | [Threaded View](#) | [Log Out](#) | [My Profile](#)

- c. Message **1**, being at the very top, is an example of the first post in the topic *Welcome*.
- d. **2** is a reply to the first message.

Reply To This Message

Your Name:
Your E-mail:
Subject:

Preview Window

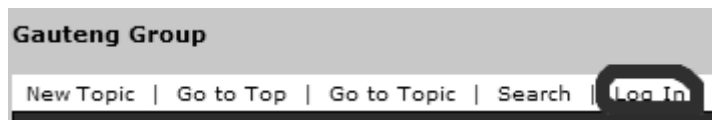
3

E-mail replies to this thread, to the address above.

- e. **3** is where you reply to any of the messages already posted.
- f. **How to reply to an existing message, but not including mathematical expressions, is dealt with in the next section.**

Posting a new topic and contributing to an existing topic

🔗 Image 3 (b): Logging in to post a reply or start a topic



1. To be able to **post** a new topic or reply to an existing message in a topic, you must be a registered user, and you must be logged in.
 - a. **Register as a user** by clicking on the link *Log In* on top of the forums list box (see image 3 b).
 - b. On the next page click the link *Need a Login? Register here.*
 - c. On the next page, complete the following fields: *Username* (your first name would be a good choice), your *Email address*, a *Password* (any word with at least 6 letters). You will need to retype the password you have chosen in the next field to ensure (since you cannot see what you've typed when you type the password) that you did not type something you did not mean.
 - d. In the *Signature* field, type in the name of the school where you teach, and the town (or nearest town).
 - e. Ignore the rest of the fields.
 - f. Click the register button.
 - g. If you get an error message saying that the passwords did not match, start afresh. If not, click the link that says it will take you back to the forums.
 - h. You are now logged in and can post messages to the forum.
2. After registration, you will be logged in automatically, and should be logged in automatically every time you visit the forum. You will know you are logged in when the *Log In* link here above is replaced by a *Log Out* link. If you are not logged in:
 - a. Click the *Log In* link.
 - b. Enter your username and password. If you forgot your password, you can request a new password to be emailed to you. When you receive the new password and gave logged in with it, you can click *My Profile* (see image 3 a) and change your password to one you'll remember more easily.
 - c. Click the *Remember my login* checkbox (a tick should appear). When it is ticked it will remember you on your next visit and thus you would not have to log in again.
 - d. Click the *Login* button.
3. You may choose to expand all the threads (as discussed earlier)
4. Click on the *Welcome* topic.

🔗 Refer to Image 3 (a): Replying to an existing message

5. Assuming there is a message in a topic and you wish to post a reply.
 - a. No **1** in the image represents the first posting in this topic.
 - b. No **2** is a reply to this posting.
 - c. If you want to add a reply, you would simply type your message into **3**, and click the **4** **Preview** button. **This is a required step, which we will explain later on in this document.** View your input in the **5** preview window, look for mistakes and correct. If you make corrections, click the Preview button again.
 - d. If you are happy with the preview, you can now post your reply by clicking the post button **6**.
 - e. You can start afresh at any time by clicking the **7** Clear Form button,

Image 3 (c): Replying to an existing message

Reply To This Message

Your Name: mac

Your E-mail: vdmertm@unisa.ac.za

Subject:

Preview Window

Here is my reply. I must preview it first before I can post it. 5

📄 📄 ✂ 📄 📄 ✖ 🔍 ↶ ↷ 🔗 🔄

B *I* U ~~S~~ x_2 x^2 A 🔗

📄 📄 📄 📄 📄 📄 📄 📄 📄 📄 📄 📄 📄 📄 📄 📄 📄 📄 📄 📄

Here is my reply. I must preview it first before I can post it. 3

Preview
Clear Form
Post

6. Off course you may wish to incorporate an expression into your message. The next section on TexAide will show you how to do this.

STEP 2

USING TEXAIDE 4 TO INCLUDE EXPRESSIONS IN YOUR POSTS

The **main steps** you will follow to include mathematical expressions in your messages are as follows (**more detail follows** – read the entire document first):

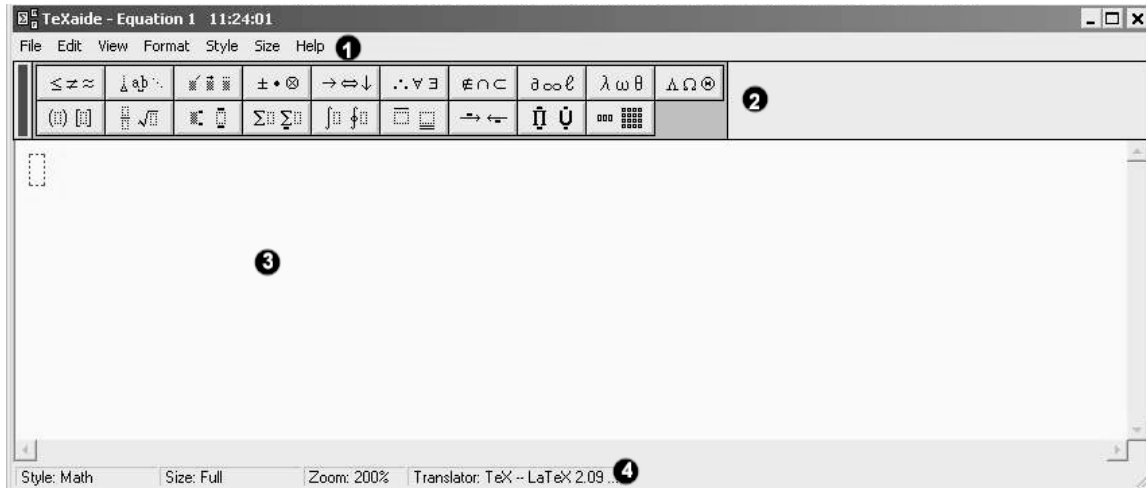
1. **Open up the TexAide** application from your start menu and change some of its settings.
2. **Generate your expression** with TexAide 4.
3. **Copy the expression** from TexAide to the forum.
4. **Add any other information** you want to include with the expression.
5. **Test** if the code is correct using the *Preview* button.
6. If your expression is generated without errors in the *Preview section* click the *Post* button.
7. If your expression is not generated correctly, you will have to find the error (see **A Brief Introduction to Tex code** and **Some rules to remember** later on in this document).

Step 1: Open TexAide 4 and change some of its settings

Click the *Start* button, *All Programs*, *TeXaide 4*, and *TeXaide*. When the program starts, you may receive an error message about fonts not being assigned. Ignore the message by clicking the OK button.

If you have used the Equation Editor in Microsoft Word before, you will find TexAide very easy to use. In fact, this is that very equation editor used in Word outside Word!

Image 4: The TexAide environment



- 1 is the menu bar
- 2 is a toolbar that you will use to generate your mathematical expressions
- 3 is your workspace
- 4 shows what type of code TexAide will generate. **It must be set for Tex-LaTeX 2.09**

Let's set the translator now (we also need to set the format).

Image 5 a: Setting the translator in TexAide 4

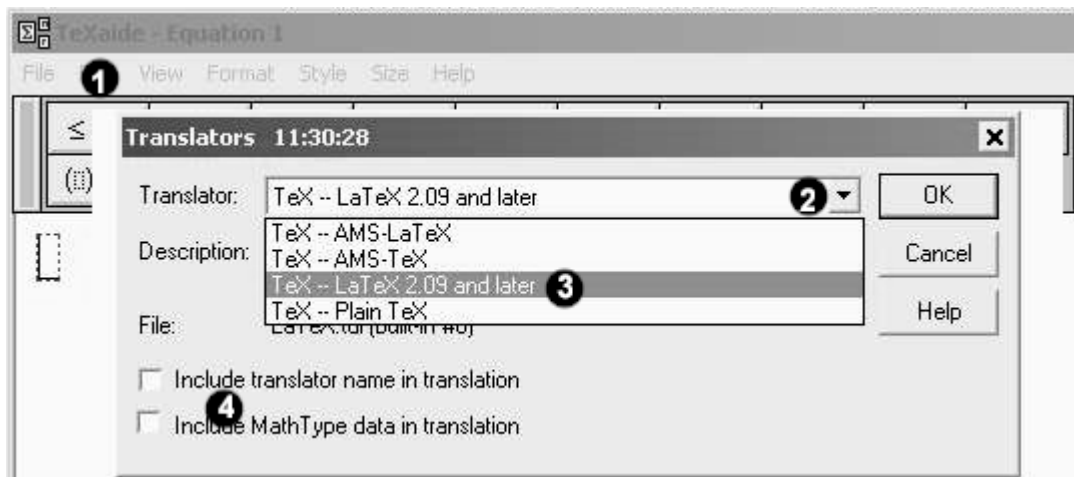
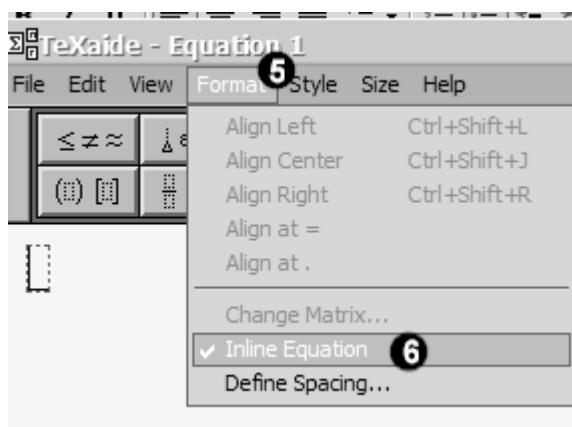



Image 5 b: Setting the format in TexAide 4



- Click Edit **1** from menu bar.
- Select Translators from the sub-menu
- Click  to open the drop-down box **2**.
- Select **3** “Tex – LaTeX 2.09 and later”. Ensure neither the checkboxes **4** are ticked. If one or either is ticked, just click in the checkbox to remove the tick.
- Click OK.
- Click Format from the menu bar, and ensure Inline Equation has a tick next to it (tick to place a tick).

Step2: Generate your expression using TeXaide

It is a good idea to generate your code *before* you connect to the Internet, so that you don't spent unnecessary time on-line. It is an even better idea to become familiar with the TexAide environment by playing around with it on your own. Like any new program, you need to get used to it. TexAide 4 is not that difficult to use, however. You just need to get comfortable using it! Soon, you will write the code TextAide generate without using TextAide!

A Brief Introduction to Tex code

TexAide generates code named “LaTeX, a very popular language used by scientists and mathematicians to generate scientific and mathematical documents with. This LaTeX code is what you will paste into the forum environment, and what converter programs on our server will use to generate mathematical expressions that you can view over the Internet.

Example 1:

$\frac{6}{3} = 2$ is written in TeX code as follows:

`\[\frac{6}{3} = 2 \]`

The above can also be written as follows:

`\$ \frac{6}{3} = 2 \$`

Huh? Let's look at this example code a bit more in detail.

The only difference between the two examples here above is that one starts with `\[` and ends with `\]`, while the other starts and ends with `\$`. TexAide generates `\[` and `\]` or `\$` as a container (i.e. it contains your expression within and tells our server that it must expect LaTeX code from here on).

Earlier we've set the format to Inline Equation (remember?). This will put a `\$` before and after the code. If we untick it, it will put a `\[\]` before and after the code.

`\[` and `\]` is supposed to be used when an expression is presented alone and centered on the page (or on its own line and, without any text directly before and after it)

Example:

$$\left[\frac{6}{3} = 2 \right] \quad (\text{alone})$$

Or

My grade ones cannot understand that

$$\left[\frac{6}{3} = 2 \right] \quad (\text{alone on its own line})$$

Any ideas how to approach this?

When you want to include an expression as part of a line of text (an inline expression), your supposed to replace `\[` and `\]` with `$`, as in

My grade ones cannot understand that `\frac{6}{3} = 2` `$`. Any ideas how to approach this?

We suggest that you use `$...$` at ALL times since you can include the expression on its own or as part of a sentence. For you to use `$` you must set the format to Inline Equation every time you open TexAide!!

Let's look at the rest of the code:

Tex Code	Explanation
<code>\[</code> or <code>\$</code>	All mathematical expressions generated with TeXaide will START with <code>\[</code> (or <code>\$</code>)
<code>\frac{6}{3}</code>	The fraction of 6 and 3, i.e. <code>\frac</code> = fraction <code>{6}</code> = 6 <code>{3}</code> = 3
<code>=</code>	<code>=</code>
<code>2</code>	<code>2</code>
<code>\]</code> or <code>\$</code>	All mathematical expressions generated with TeXaide will END with <code>\]</code> (or <code>\$</code>)

Example 2:

$$\alpha\phi\gamma$$

is written in LaTeX as

$$\left[\alpha \beta \gamma \right] \text{ or } \$ \alpha \beta \gamma \$$$

Example 3:

$$\frac{f(7) - f(2)}{7 - 2}$$

The code that TexAide generate is:

$$\left[\frac{\{f(7) - f(2)\}}{\{7 - 2\}} \right]$$

or

```
\frac{{f(7) - f(2)}}{{7 - 2}} $
```

If we space the expression parts a bit to make it a bit easier to read, we see

```
/frac { {f(7) - f(2)} } { {7-2} }
```

which, if we simplify it by removing some code, is

```
/frac {} {}
```

Note:

```
/frac { f(7) - f(2) } { 7-2 }
```

will work as well (here we removed the inner pairs of brackets). Like all computer applications, TexAide has its irritations!

Example 4:

$$\frac{ac + 2b^2}{bc} = \frac{c^2 + 2bd}{dc}$$

```
\[\frac{{ac + 2b^2 }}{{bc}} = \frac{{c^2 + 2bd}}{dc}\]
```

Or

```
$\frac{{ac + 2b^2 }}{{bc}} = \frac{{c^2 + 2bd}}{dc}$
```

Once again

```
\[\frac{ac + 2b^2 }{bc} = \frac{c^2 + 2bd}{dc}\]
```

Or

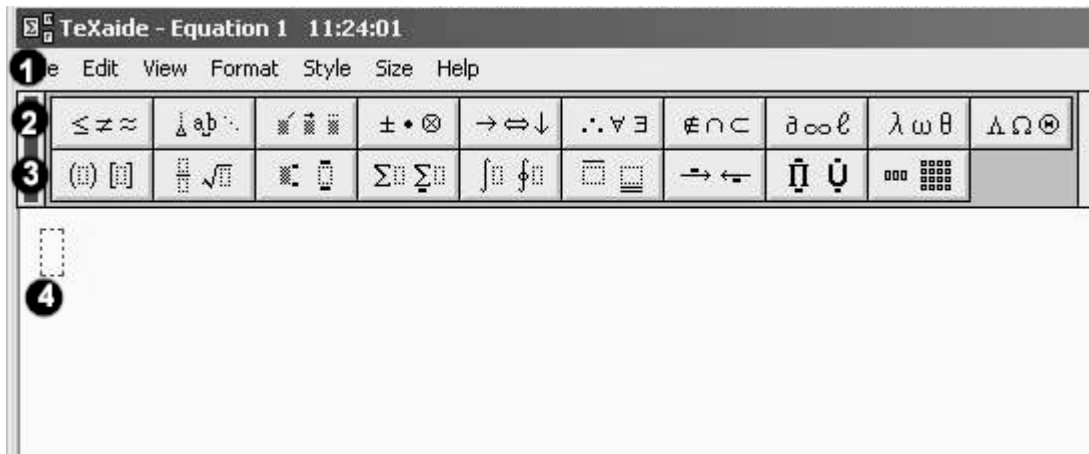
```
$\frac{ac + 2b^2 }{bc} = \frac{c^2 + 2bd}{dc}$
```

will work when we remove some of the excess brackets (we don't have to!)

Generate code using TexAide

1. Open *TexAide 4* if it is not open.

Image 6: TexAide Environment

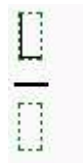


2. There are 4 areas in TeXaide that you will use:

- 1 the main menu
- 2 the symbols toolbar
- 3 the template toolbar
- 4 the workspace

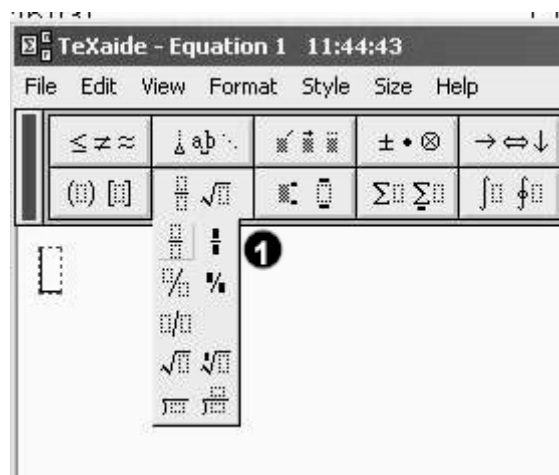
The **main menu** is not used that often, other than to select your code

3. The **symbols menu** has buttons for inserting more than 150 mathematical symbols. To insert a symbol in an expression, click a button on the symbols toolbar, and then click the specific symbol from the palette (menu) that appears under the button.
4. The **template toolbar** has buttons for inserting templates (a map to layout your mathematical expressions) such as fractions, summations, integrals, products. Many templates contain slots — spaces into which you type text and insert symbols. There are about 120 templates, grouped on palettes. You can insert templates in the slots of other templates — to build complex hierarchical formulas.
5. The **workspace** is where you will type your mathematical expressions. Here, there is one slot in the workspace where you can start typing or insert another template of your choice.
6. On the toolbar, click the second button in the template row 1. Select the two slots template that looks like this (we want to type a fraction)



7. In the top slot type $f(7)-f(2)$ using your keyboard.

Image 7: Example



8. Click in the bottom slot with your mouse and type 7-2.
9. Click on *edit* on the main menu of TeXaide and click on *Select All* to select your expression (alternatively, you can use the keyboard to select the content by pressing the Ctrl key and the A key on your keyboard simultaneously)
10. Click on *edit* on the main menu of TeXaide again and click on *Copy* on the menu that appears to copy the content (alternatively, you can use the keyboard to copy the content by pressing the Ctrl key and the C key on your keyboard simultaneously).
11. You can also right-click your mouse and select *Copy* from the menu that appears

Step 3: Copy the expression

1. Normally, you will now paste the code you have copied here above into the forum environment – for now, let's copy it somewhere else for practice.

- a. Open up your favourite word processing application. If you don't have a word processing program, open up *Notepad* (click on *Start, Programs, Accessories, Notepad*). When the application is open, *paste* the contents of TeXaide into Notepad (or whatever) by pressing the *Ctrl* and *V* keys on your keyboard simultaneously (alternatively click on *edit* on the top menu of *Notepad* and click on *Paste* to paste the content into *Notepad*)
- b. If you did not set the format to Inline Equation, you should get the following:

```
\[
\frac{{f(7) - f(2)}}{{7 - 2}}
\]
```

2. **When you paste this into the MathML window in the forum environment (see section below), you must rearrange the code so that it appears on one line, without spaces**

```
\[ \frac{{f(7) - f(2)}}{{7 - 2}} \]
```

3. Place your cursor behind the first `\[` and then use the *Del* key on your keyboard. Now place the cursor behind `2}` and do the same until the `\]` moves up behind `2}`.
4. Make sure that nowhere in the expression there is more than one white space between any characters. If there are two or more white spaces between any characters, remove them by clicking in that space and using your *Del* key. ***In general, if an error or a red box is generated (around the expression in Internet Explorer - in other browsers it will either generate an error or you will see "unknown character") you can bet that most of the time the error is the result of too many white spaces!***
5. If you are using Inline Equation as the format, everything will already be on one line, and you can just remove the excess spaces.
6. More step-by-step examples are provided at the end of the accompanying document in the PRACTICE section.
7. **Let's return to the forum environment, and paste the code there**

3. If your expression is generated correctly in the Preview Pane **6**, then you can click the *Post* button **7**.

Step 7: Fix errors, if any

4. Otherwise look for a possible error in your code. Correct and try again from step 3.

Some rules to remember when using TeXaide

- **IMPORTANT!** *To move the insertion point around in an expression to where you want to enter text or numbers or symbols, use the Tab key.* The Tab key makes the insertion point “jump” from position to position in the expression.

Example

I want to type the following

$$a = b \Leftrightarrow \sqrt[n]{a} = 3$$

If you type the above in TeXaide, when you get to the following point:

$$a = b \Leftrightarrow \sqrt[n]{a}$$

you need to type a “=” outside the $\sqrt{}$. Note above that the insertion point is clearly behind the “a” and still under the $\sqrt{}$. If you continue to type, the following will happen

$$a = b \Leftrightarrow \sqrt[n]{a=}$$

We don’t want the “=” inside the $\sqrt{}$, so if I press the *Tab* key once, the insertion point will jump to here

$$a = b \Leftrightarrow \sqrt[n]{}$$

and if I press it one more time, it will move behind $\sqrt{}$

$$a = b \Leftrightarrow \sqrt[n]{a}$$

Now I can type the “=” and it will appear in the correct spot.

THUS – use the *Tab* key to move the insertion point....

Other TeXaide tips

- While TeXaide does a good job in generating TeX, there is **one exception** you must keep in mind - TeXaide generate `\[\sqrt[3]{4}\]` for $\sqrt[3]{4}$. Use `\root 3` in place of `\sqrt[3]`

Example:

`\[a = b \Leftrightarrow \sqrt[n]{a} = \sqrt[n]{b} \]`

generated by TeXaide must be rewritten

`\[a = b \Leftrightarrow \root n {a} = \root n {b} \]`


- Use the *Backspace* key to delete characters to the left or the *Del* key to remove characters to the right of the insertion point.
- A \div sign is not available in TeXaide. To generate one, do as follows: ensure the *Num Lock* light on your keyboard is on. If not, press *Num Lock* once on your keyboard. While holding the Alt key depressed, type 246 on the number pad of your keyboard (don't use the row of numbers above the letters on your keyboard).
- To avoid ambiguity, group together mathematical expressions using `{ ... }`. For example, to get 'x to the power of n +1' (i.e. x^{n+1}) enter `\$x^{n+1}\$`. If you type `\$x^n+1\$` instead, you will get 'x to the power of n, added to 1 (i.e. x^n+1).
- `_` is used for subscript
e.g. `\[5_2 \]` will generate 5_2 and `\[5_{-1} \]` will generate 5_{-1}
- `^` is used for superscript
e.g. e.g. `\[5^2 \]` will generate 5^2 and `\[5^{2-1} \]` will generate 5^{2-1}
- If you want `{ }` to show as part of your math expression, prefix the `{` and `}` with a `\`. Thus, to display the expression `{ x : x^2 < 2 }` exactly as it appears here with the braces, enter a `\` before each brace - like this `\{ x : x^2 < 2 \}`
- In general, if there is no easily accessible key on the keyboard for a symbol, type `\`` and the name of the symbol (no space between `\`` and the symbol name).
Examples:
 - `\alpha` `\beta` `\gamma` are the first few Greek letters;
 - `\sum_{n=0}^{\infty}` is 'the sum from 0 to infinity';
 - `\int f(x) dx` is 'the integral of f(x)';
 - See the Symbols section in the adjoining document for more

Common reasons for errors

- Extra white space in an expression. For example, `\frac {{f(7)-f(2)}}{{7-2}}` will generate an error because of the 3 white spaces between `\frac` and `{{7...`. Remove at least one white space. Generally, if TeXaide has generated code with white space you should leave it as such. However, if an error is generated, check carefully where the error appears. Remove one of the spaces and test again.

`\frac{ {\sqrt 9 + 3} }{ {8 - 2} } = 1`

generates in Mozilla the following error in the forum environment



This is because TeXaide generated 2 white spaces after $\sqrt{9}$. Remove one and the expression will preview correctly.

- Use only TeXaide to generate your mathematical expressions. You can't cut and paste an expression from your word processor to the MathML window ... it will generate many errors. You can type code directly into the MathML window, however.
- Make sure you have deleted all characters in the MathML window when you want to paste new TeX. Rather use the *Clear Form* button before pasting.
- Visit the Tips and Tricks topic on the forum!

Finally, please post any problems you are experiencing in using this environment on the Notice Board, where it will be answered.

ANNEXURE C: AFRIKAANS INTERVIEW DATA USED

[1] Ek kan net sê baie sterkte vir jou.

Omdat ek ondervinding in beide hoofstroom en LSEN onderwys het, weet ek presies met watsie frustrasie jy te doen het.

Ek sou aanbeveel dat jy baie openlik met die ouers is. Laat hulle verstaan dat hul kind sukkel, moet nie die situasie wegpraat nie, en hul onder valse denke oor hul kind laat verkeer nie. Die ouers het dalk nog net nie hul kind se gestremdheid aanvaar nie, of 'n slegte verhouding met 'n vorige skool gehad.

Ek het al uit ondervinding gesien dat leerders uit hoofstroom by ons beland met 'n geweldige agterstand agv verskeie faktore. Omdat jul met so baie leerders voor jul sit, is dit werklik moeilik om aan almal aandag te gee, dit is wanneer kinders stout raak, agter raak, nie aandag kry nie, ens.

Beland hul by ons, vorder hul regtig. Min leerders in die klas veroorsaak dat jy goeie aandag aan almal kan gee.

Dit bied tog 'n geleentheid aan die hoofstroom leerders om agter te kom hoe bevoorreg hul is - ook opvoedings geleentheid- om gesondheid en verstand te kan hê, wat hul ook nie altyd gebruik nie.

Baie sterkte vir jul almal wat met so 'n probleem worstel - dit bied ook in die onderwys sy uitdagings.

[2] Sterkte vir die week. Ek dink ons almal het dit nodig.

[3] ... is vreeslik op my senuwees oor 'n paar leerders wat nou moet Gr 10 toe gaan en wiskunde doen, terwyl hulle werklik nie kan nie - die agterstand en wiskundig en andersinse ontwikkeling van hulle breine maak my op my senuwees. Help asb met 'n bietjie positiewe aanmoediging vir die junior juffrou!

[4] Ek is van mening dat die leerders nie meer so sterk taalvaardig is soos altyd nie - en daarom moet die onderwyser eenvoudige woordeskat gebruik.

[5] Ek dink 'n groot probleem met wiskunde is dat ons heeltemal te min speel in die vak en goed doen wat dit vir kinders lekker maak. Dis asof almal so ernstig is as dit by wiskunde kom. Miskien kan mens iets soos 'n 'film-studie' in die tale met wiskunde kombineer.

[6] Al wat vir my snaaks is, is dat die wiskunde en wiskunde geletterdheid nie so ver verwyderd is van mekaar nie. Ek voorspel dat in die toekoms nie noodwendig die slimmer leerders wisk gaan vat en die ander geletterdheid nie. Vir geletterdheid word ook soveel leesvermoë en insig vereis.

[7] Ek vind ook dat die seuns geweldig sukkel met selfvertroue. Hulle probeer hulle manlikheid bewys deur drank ens. te gebruik. Ek weet nie of dit sal help om op oueraande te praat want in meeste gevalle waar daar regtig probleme by seuns is vind ek dat die ouers of nie ouer aand toe kom nie of hulle ma's kom. Seuns het rolmodelle nodig.

[8] Maar om op die internet in te kom, Telkom is partykeer net nie, daar is tye wat jy net jou gat af sukkel om in te kom.

[9] Maar ag, jy raak dit later gewoon, eers word jy kwaad want jy dink jis jy moet daar in kom, jy kom later agter sekere tye, vroeg in die oggend, hier net voor 7, dan is almal op die internet.

[10] Ek is gelukkig ja, hy staan (onduidelik) waar ek eet en alles kan ek hom sien. So ek sit hom aan en dan kan ek daar gaan sit en eet en wat tot die goeters nou inskakel en sulke goeters.

[11] Ek het gekyk en gesukkel om 'n lyn te kry, om te connect, dan disconnect hy weer dan moet ek weer uitgaan en so, so hy gee nie dadelik 'n lyn en weet jy my telefoon moes ek ook afhaal en die mute knoppie druk, dan lê my receiver, my gehoorstuk daar en hy zzzz die hele tyd.

[12] Tyd is min en dial-up is net stadig. Dit is baie-baie stadig.

[13] Ek weet ek was negatief, vir een of twee dae, jy kan net nie in kom nie.

[14] ...daar het ek 'n bietjie my telefoonrekening opgestoot waaroor ek vir myself vies was.

[15] Net as ek van mening is dat ek dit sinvol vir ander doeleindes ook sal kan gebruik. Dus nie net vir die forum nie, nee.

[16] Ja, want ek dink vir my vakgebied kan dit baie voordelig raak.

[17] Ja, enige hulp vir onderwysers word waardeer. Ons kan mekaar net help.

[18] Ja, ek gebruik die Internet ook vir navorsing, maar dan moet dit 'n lewendige chatroom wees.

[19] Ja, ek dink definitief die forum idee is beter. Die eerste rede is so 'n opleiding sessie is kort, daar is baie geld wat gemors word op goeters wat onnodig is en die inligting wat jy daar kry is binne drie maande verouderd

- [20] Ek sit agter die berg, of ek sit in 'n afgeleë plekkie, maar ek kan baie tap waar ek andersins nie maklik kan uitkom by iemand nie. So ek hou daarvan, dit was vir my lekker.
- [21] Dit was vir my verskriklik lekker en as 'n mens dit kan deel met ander en sê: Maar hoor hierso gaan kyk daar, daar kan jy iets kry oor hierdie onderwerp, waar ek nie persoonlik by jou kan uitkom en vir jou sê gaan kyk net.
- [22] Ek soek soos byvoorbeeld deel met my 'n les en ek sal met jou 'n les deel, dat ons mekaar se hande kan versterk om die klas werkbaar en maklik te maak en daarom is so 'n internet forum vir my lekker, want hy kan lekker werk.
- [23] Ek het al 'n paar goedjies opgetel wat ek dink o maar dit is 'n paar idees wat ek gedink nogal oulik is wat ons kan gebruik. Ja so ek dis baie oulik van die kombinasie van die verskillende skole.
- [24] Ek dink weereens dit kan waarde he met jou opleiding as dit reg gebruik word.
- [25] ..daar is baie nuwe verwikkelings vir die onderwys, ontwikkelings, en die onderwysers sukkel om by te kom en so iets ekstra maak nog meer spanning.
- [26] Daar is sekere tye wat baie rof is..kyk ons skryf elke Dinsdag en elke Donderdag is dit kwartaal toets. So dit bepaal eintlik hoeveel vrye tyd jy het.
- [27] Ek moet jou eerlik sê die omstandighede, die feit dat waar ons bly is waar ons bly, ek bedoel as ons vyf uur of ses uur vir die eerste keer by die huis kom met 'n gesin van vyf dan hardloop dit redelik vinnig teen daardie tyd.
- [28] Al hierdie admin, hierdie onnodige admin en min skoolhou...
- [29] Net tyd. Op Dinsdae aande is ons die hele aand by die kerk en voor dit is kos maak en voor dit is ekstra klas. So op 'n Dinsdag aand gaan daar nie tyd wees om op te gaan nie. Op 'n Woensdag aand is daar orkes. Op 'n Donderdag aan en 'n Maandag aand is musical oefening, so dit is heeltemal met tyd.
- [30] Jy weet ons het vergaderings in die middag vir drie ure aanmekaar.....
- [31] ...Die werkslading in Oktober en November, met vraestelle wat gemerk moet word, kerksangdiens wat gereel moet word deur die gemeente orrelis, drie kinders in die huis wat eksamen skryf ens, het ek die projek op die agtergrond geskuif, maar nie genoeg dat ek skuldig gevoel het daarvoor nie!
- [32] ...toe het ek Telkom aangevat en goed. Nou die volgende probleem is, ons Telkom telefoon is nie 'n landlyn of wat ook al nie, dit werk ook met seine wat opvang. So toe, die eerste keer sou hulle nou gekom het en dit kom doen het, wel ek moes toe nou eers hierdie, 'n brief natuurlik kry omdat dit nou nie ons woning is en daarin geregistreer is nie en al die moeilikheid en toe sou hulle 'n sekere tyd gekom het wat hulle toe nou nooit gedoen het nie. Die volgende was toe daag hulle 11 uur op terwyl ek by die skool is, ons bly op 'n plot so nou is dit 20 kilometer van die skool af, so dit was nou die eerste, ek wil net sê daardie hele proses het amper drie weke gevat..... ek dink dalk was ek nou net treurig gewees, want op daardie stadium, ek het toe weer met van die mense gepraat.... toe was dit al hier verby die Oktober vakansie gewees en toe was dit ekstra klasse en nasien, ek was net, ek het net nie weer die fight opgesit met hulle nie. ...ek het drie kinders wat daarso saam met my is. So ons bestuur ons goed eintlik in die middag klaar by die skool en dan gaan ons hierso ses uur so of wat se kant gaan ons die eerste keer huistoe ry. Dit het dalk 'n invloed gehad jy weet, plaas van dat as ek by die huis was elke middag jy weet dat dit makliker sou kon gewerk het.
- [33] Toe eers besef ek die praktiese implikasies van 'n rekenaar met Internet toegang in 'n huis met tieners, sonder behoorlike toesig. Pa is buite in sy werkskantoor en hulle is smiddae alleen in die huis...
- [34] ... ons het reeds internet toegang So in my onkunde, ek weet ook nie hoe die goeters werk nie, het ek gedink dit is maklik, maar toe ons nou die ding in die huis sit en my man werk in die buitekamer, toe besef ek maar daar moet 'n koppeling wees, soos ek sê ek verstaan nie hierdie goeters nie. Teen hierdie tyd was ek al so skaam dat ek nog nie aan die gang gekom het nie, dat ek nie die moed gehad het om die projekteier te kontak nie. Daarom het ek gevra dat my man skakel, maar dit het ook 'n paar weke geneem. Toe daar geskakel is, is verneem dat die projek in elk geval op sy einde is.
- [35] Dit was vir my verskriklik lekker...
- [36] Ek het baie geleer.
- [37] Ek kan dit maar sê, weet jy as julle so iets loods, dat so iets via Suid-Afrika op die internet gaan, dat julle 'n mens moet laat weet, die skole laat weet dalk.
- [38] ...maar op die einde het jy half so die gevoel jy wil deelneem.
- [39] Wanneer kan ons weer aan gaan?
- [40] Ek het reggekrom tot nou toe net met die internet, maar ek gaan die forum mis.

- [41] Dit het my ge-empower ja, definitief, ja vir seker.
- [42] ... jy het nie noodwendig jou naam daar nie. Wat 'n voordeel kan wees, hulle weet nie van watter skool jy is nie, hulle ken jou nie, hulle kan jou nie aanvat, hulle kan nie rêrig skinder oor jou nie. So dis half 'n anonieme plek. Ek dink dit het sy voordeel.
- [43] Maar ek dink omdat dit 'n gesiglose ding is kan jy makliker van jou gevoelens ontslae raak as daar so 'n gap is
- [44] Ek sal nie alles pos nie, maar jy sal meer oop maak as byvoorbeeld in 'n vergadering.
- [45] Ek sit agter die berg, of ek sit in 'n afgeleë plekkie, maar ek kan baie tap waar ek andersins nie maklik kan uitkom by iemand nie. So ek hou daarvan, dit was vir my lekker
- [46] Ek was met tye gefrustreer omdat die mense nie genoeg kommentaar lewer nie.
- [47] ... daar is definitief onderwysers wat toe is, wat sê ek het my ervaring opgedoen deur swoeg en sweet en ek gaan dit nie deel nie. Jy kan dit op jou eie leer, wat hartseer is.
- [48] Want ek gaan op die rekenaar en ek tik en ek is daar en ek kyk vinnig en ek sien niemand het gereageer nie en ek gaan aan.
- [49] ...party voel gedwing en party voel: ek wil graag. Ek dink miskien uit tien sal een of twee regtig moeite doen.
- [50] ...ek sal nie sê ek het verskriklik baie geleer daar uit nie, want daar was nie rêrig spesifiek probleme wat aangespreek is nie.
- [51] ... soms het hulle gesê daar is 'n oorbruggingstoets, dan sê ons nouja ons sal probeer om vir mekaar te stuur. Jy sien daardie, dit het half na moeite geklink so daarby het ons nooit uitgekom dat jy moet begin goeters inscan en stuur vir ander wat gevra het.
- [52] Jy kon nie rêrig soort van persoonlik raak nie.
- [53] ...want partykeer het dit vir my gevoel ek moet nou ietsie sê, so nou sit ek iets op.
Ek sou sê aan die begin toets 'n mens half 'n bietjie die water en jy wil maar ook ietsie daarop sit en kyk vir die reaksie. En as daar nou nie baie mense is wat reageer nie, dan gaan dit jou keer om volgende keer weer ietsie daarop te sit.
- [54] Maar ek het nie kennis, so ek weet nie, ek dink miskien as dit uit iemand wat by my kon aansluit, wat my taal praat, sou ek miskien meer 'n leidende rol gespeel het as a volg rol.
- [55] Weet jy daar is 'n ander soortgelyke program wat van Amerika af loop wat ek Teachers' News Weekly kry, en hulle gee lesse, lesse op die internet en hulle gee 'n pitkos en 'n grappie en alles onderwys-georiënteerd, en dit is nogal vir my oulik.
- [56] Ja ek dink definitief daar is plek, maar dit sal op 'n baie makliker en gerieflike manier vir die onderwysers beskikbaar moet wees
- [57] So miskien was dit 'n bietjie te kort ook gewees.
- [58] ...dan dink maar goedjies uit wat nou nie rêrig 'n probleem is nie. So as hy miskien meer rig, spesifieke rigting.
- [59] Ek dink so, want jy kan al hierdie dokumentasie, soos ek gesê het, hier is die vorms, hier is die take, hier is voorbeelde, kom ons deel. Dan kan jy maar spoeg en plak en dan stuur jy dit vir mekaar.
- [60] ...as daar rêrige positiewe insette is sal ek aanhou om dit te gebruik.
- [61] Die probleme wat ek will bespreek is eerder remedierend en syllabus verwant.
- [62] Daar kan gevra word vir lesbydraes en goeie raad, byvoorbeeld klasbeheer, disipline. Selfs leerder projekte en foto bydraes kan op so 'n forum geplaas word.
- [63] Idees oor vraestelle kan uitgeruil word. Wiskunde probleem wat gekoppel word aan die praktyk daarbuite kan bespreek word. Probleme/voorstelle in verband met die vakdidaktiek kan bespreek word. Klaskamer prosedures kan bespreek word.
- [64] Vrae oor hoe 'n spesifieke opdrag in die leerders protefeulje moet lyk duik gereel op en dit sal lekker wees om dit vir ander skole se onderwysers te kan vra.
- [65] Maar soos ek nou gesê het tyd, maar later toe ek eers in die ding is toe kom ek agter maar dit vat nie eintlik, as jy net weet hoe dit werk, jy gaan in en jy gaan vir 'n minuut of twee.
- [66] ...maar ek het by jou vinnig uitgekom want jou goed lyk my is geprogrammeer tot daar by jou, maar om op die Internet in te kom...
- [67] Nee dit figure jy uit self en jy kan dit in 'n handleiding kry, so ek dink nie die somme self nie.

[68] Maar ek kan nie aan 'n scenario dink wat ek 'n som sommer op die internet sal sit nie,...want jy gaan nooit vir iemand 'n som op die internet sit en sê hoe doen ek hierdie ding nie. Dit vra jy sommer vir jou kollegas by die werk, of jy werk dit self uit, jy is immers die juffrou.

[69] ...maar dit was vir my lekker en ek het baie, ek het nogal baie skool foto's en goed kon aftrek wat ek kan toepas in my skoolwerk en die kinders was histories daarvoor want dan laai ek dit op 'n stokkie en ek kom wys dit vir hulle hier op 'n rekenaar.....

[70] Die rekenaar gebruik ek nou elke dag, toetse en punt, Excel.

[71] Nou die naweek toe trek ek 'n ding oor Pythagoras, toe trek ek dit af, toe staan alles daar, teenoorstaande sye, sin, cos en tan, want eintlik is natuurlik ingewikkeld, jy moet dit maar net soek, die goed is daar, dan hoef jy nie weer nuwe goed te gaan maak nie.

[72] ...ek sê mos nou vir jou ek weet glad nie hoe om met hierdie wiskundige - ons hol weg van enige ding af wat ons nie ken nie. Jy moet hom eers gewoond raak, dis hoekom ek sê nie jou goed het nie gewerk nie.

[73] Ek het nie tyd by die skool nie. Ek het dit nooit eers oorweeg om in te gaan nie. Ek wil rustig wees.

[74] Ja, ja weet jy ek het nie kans gesien om dit by die skool te doen nie en ek het hom by my huis gehou en ek kon enige tyd van agt uur tot tien uur in die aand op die internet gaan....

[75] Ek sal eintlik by die huis, daar is nie regtig af periodes.

[76] By my huis natuurlik, by my huis, hierso sit jy met ander mense om jou en al daardie goed, nee ek werk eerder by my huis.

[77] Maar ek dink die manier op die internet kan dalk beter werk in sekere gevalle waar jy ver moet ry na 'n cluster toe of waar dit gevaarlik is om na 'n cluster toe te gaan. In sekere woongebiede word verskillende rasse nie ewe goed hanteer, kleurling, swart, wit, al daardie. Toe ek by FH was was dit definitief, die kleurlinge wil nie Atteridgeville toe gaan want dit is gevaarlik vir hulle ...

[78] ... want dit is so 'n groot storie net om by 'n cluster uit te kom, want ek dink as 'n cluster leier so iets kan begin sal dit baie goed werk, dan het jy dit deurlopend. Kyk ons hou omtrent net een of twee keer 'n kwartaal 'n cluster.

[79] En ook dat sy vir ons kan boodskappe deur stuur dat ons met mekaar kan kommunikeer sonder om te ry na 'n plek toe.

[80] Jy weet ons het vergaderings in die middag vir drie ure aanmekaar. As 'n mens dit kon uitskakel met hierdie stelsel sou dit fantasties wees.

[81] Vir my die grootste waarde is dat dit kan vergaderings uitskakel.

[82] Kom ons sê ek was nou goed op 'n rekenaar, ek kon nou lekker vinnig tik en al daardie programme hanteer, sou ek sê het jy nie eers 'n cluster meeting nodig nie. Jy kan hierdie goeters baie meer kontak op 'n dag tot dag basis hê met almal met rekenaars en alles... ons sien mekaar een maal in 'n kwartaal op 'n cluster....

[83] Ek byvoorbeeld het amper een week, ek dink ek het opgetel 25 oproepe gemaak om een antwoord te kry wat ek dringend moes kry, so ek dink as dit so 'n forum is waar 'n ou, behalwe dat daar meer onderwysers, maar as jy direk met die departement kan kontak sal dit baie help, 'n groot hulp wees.

[84] Ja en hulle sit nie met die fisiese probleme nie. Dit is baie maklik om op papier 'n ding te laat werk, maar werk hom 'n bietjie op grondvlak dan werk hy nie so lekker nie en dit is miskien goed as hulle dit ook kan hoor.

[85] As die vak adviseur weet wat aan gaan en dit wat hulle weet is rêrig dit wat aan gaan, dan kan dit baie help, want dit is nie 'n klomp mense wat op die forum spekulêr, dan kan 'n mens sê maar Tannie Sannie, kan jy net vir ons sê presies hoeveel take moet ons hierdie jaar doen. Party skole sê soveel en ander sê soveel.

[86] Wat ek voel sê nou maar 'n cluster, 'n bymeekaarkom verkeer jy weer op 'n ander vlak. Dan praat jy nie gesigloos nie, dan praat jy met iemand en jy deel met iemand persoonlik. Ek dink nie 'n mens moet die lewe uit onderwys uit verwyder nie en net 'n masjien hê nie.

[87] Dit kan 'n goeie plek wees om 'n vak adviseur ook daar te hê waar die mense die gesprek het op 'n daaglikse basis, of dan weekliks, want die vak adviseurs, hulle is nie rêrig in kontak met dit wat in die klassituasie gebeur nie.

[88] Ja en hulle sit nie met die fisiese probleme nie. Dit is baie maklik om op papier 'n ding te laat werk, maar werk hom 'n bietjie op grondvlak dan werk hy nie so lekker nie en dit is miskien goed as hulle dit ook kan hoor.

[89] In die huidige situasie waarin ons is, sal so 'n persoon baie waardevol gewees het, in die opsig ek, wel dit is een van die groot probleme.

[90] Ons wat op voetvlak werk en hulle het nie altyd begrip vir ons ook nie.

[91] Ek dink hulle het baie kennis dit is hoekom hulle daarbo sit, en hulle veronderstel is om baie kennis te hê, en leiding te gee en hulp te gee.

[92] Op die oomblik is dit ons moeilikheid in die land. Ons kan nie boontoe nie. Nou sê ek waar is die nuwe formule K's wat ons in die toekoms gaan gebruik. Nou as jy by die adviseur kon uitkom kon sy by die volgende ou uitgekome het. So jy moet, dit help nie jy het 'n forum hier onder tussen nie.

[93] ...in plaas van net dat ons rond hap en wonder waarom sal ons nou praat. So as hy miskien as 'n vak adviseur wat meer leiding kon gegee het en gesê het: wat dink julle oor die nuwe FET, of wat dink julle - so as hy ons meer in 'n rigting gedwing het.

[94] Ja, ja, 'n vakadviseur kan baie positief wees. Dit kan van baie hulp wees, as 'n ou vashak kan jy vra sonder om te bel of sonder om te ry of uit te nooi na jou skool toe.

[95] hier is die nuwe formule K, stuur hom uit. Nou stuur ek, ag, dit moet wees.

[96] Ek verlede jaar gesê het ja, maar die dinge is so ongeorganiseerd dat niemand weet rêrig wat aangaan nie en as jy nou iemand soos 'n vak adviseur het op die lyn wat sê nou maar dit is hoe dit moet wees, sonder 'n skriftelike bewys daarvan, dan gaan 'n mens dalk 'n klomp mense onder vals illusies sit.

[97] O nee, nee, nee, ek is mal oor content, en ja ek hou van inhoud.
...maar ek sou daardie gewig 'n bietjie meer, omdat 'n ou se kop 'n bietjie plat raak met idees van hoe om aan te bied en wat om te gebruik, dink ek sal ek sê 60-40.

[98] Ek soek soos byvoorbeeld deel met my 'n les en ek sal met jou 'n les deel, dat ons mekaar se hande kan versterk om die klas werkbaar en maklik te maak en daarom is so 'n internet forum vir my lekker, want hy kan lekker werk.

[99] Ja, les, die aanbieding daarvan, verskillende maniere, werk dit tipe van, byvoorbeeld, ons het op hierdie stadium 'n groot probleem met die inhoud se volgorde.

[100] Ek dink dit het plek vir al twee, want 'n mens het kommunikasie nodig om 'n bietjie te ontlai en dan vir content ook.

[101] Ek dink dit was lekker om net 'n bietjie te kan gesels en veral ander mense van ander skole se inset te kry, want 'n mens het sekere probleme in jou skool of in jou klas situasies, so dit dink ek het 'n groter waarde, want ek bedoel vakgerigte probleme kan 'n mens maklik op ander maniere oplos, maar jy wil net partykeer hoor, sukkel ander mense darem ook met dit waarmee jy sukkel.

[102] Ek dink dit is te klein. Ek was met tye gefrustreer omdat die mense nie genoeg kommentaar lewer nie. Daar was veral 'n paar mense in die groep wat min tot geen kommentaar gelewer het nie en dan kan dit lekker wees as die groep groter is, sê as 'n mens 20 tot 25 onderwysers is behoort jy meer deelname te hê as elkeen net een keer 'n week op gaan, dan het jy meer kommentaar.

[103] Ja bietjie groter, maar nie vir 'n toetsprogram of so iets 50 nie, maar ten minste so 20 mense.

[104] Ek dink dat in die eerste plek verskil ons probleme totaal en al, wat ek met die cluster en al die tipe van goed te doen gekry het, is dat dit wat vir my 'n probleem is, dink hulle nog nie aan as 'n probleem, om hulle, byvoorbeeld om punte te verwerk, ek het 19 punte op Excel ingelees, ek druk 'n knoppie hy werk dit vir my uit, waar hulle sit met die praktiese probleem, hulle het tien lyste en hulle skryf elke ding met die hand. So sy probleem is daar heeltemal anders as myne.

[105] Weet jy hulle werk anders as ons. Ek sal nou vir jou sê, dit is nie 'n rassitiese ding nie, ek sê altyd weet jy ons almal is rassities, swart is rassities op hulleself en ons is rassities op ons self. Ons het in die kulture het ons verskille. Volgens my, ek het swart mense gesien wat net so toegewyd is soos ons, hulle het net 'n meer laat maar gaan houding, verstaan jy. Gee vir die kind die informasie, of hy nou werk of nie, dan los jy hom. Ons druk net harder en werk harder en doen meer. Dit is al wat ek oor die kultuurgrense sê, dit gaan nie oor bekwaamheid nie, dit gaan nie oor kwalifikasies nie, as 'n kind van hulle af kom kry ek nie dieselfde sterkte kind as 'n kind wat van 'n blanke onderwyser af kom. Dit is nie rassitiese nie, dit is feite. Dit is al wat ek vir jou kan sê. Ek het nie moeilikheid met wie nie, as ons by 'n kursus kom, dan is daar nie verskille tussen wit of swart mense nie, dit is dieselfde vakgebied, jy moet dieselfde inhoude gaan gee.

[106] Ja ek dink daarvoor sal ons lekker met mekaar kan praat. Ons doen nou dit en hoe werk dit by julle. Byvoorbeeld my man het meer, hy het baie met swart onderwysers gewerk, dan het hy hierdie hele pakket van transparante en alles dan kom later agter maar hulle het nie eers 'n projektor nie, hulle het nie eers handboeke nie. Dit maak jou oë oop.

[107] Ja en ook as 'n swartetjie in my klas het kan ek dalk as ek agtergekome het, dit is een of ander skuilnaam, dis van 'n ander kultuur, kan ek vir haar vrae vra, hierdie outjie doen hierdie ding, beteken dit iets of is hy net stout?

[108] Ja. Glad nie 'n probleem hê om interaksie te hê met mekaar nie, want ek dink 'n mens kan baie by mekaar leer.

[109] ... dalk as ons 'n bietjie meer ontwikkel is en bietjie meer geletterd is met tegnologie en so aan, sal dit 'n natuurlike ding word, maar op hierdie stadium, ekself is nie geletterd rêrig met die ding nie en baie van ons ander mense ook nie. So ek dink later gaan dit

deel wees van ons lewe, so jy sal nie daarsonder kan nie. Maar op hierdie stadium is Suid-Afrika nog terug, jy weet ons kan ons byvoorbeeld nie vergelyk met Europa nie. Ek dink daar sou so iets gewerk.

[110] Q: Ek sou baie graag julle opinie wou hê op die volgende onderwerp. Ek het verlede jaar 2 downsindroom seuns in my graad 9 klas gehad. Hulle was relatief goed sosiaal aangepas en kon op hulle eie aangaan wanneer daar vir hulle werk gegee word. Die volgende pla my egter: ek kon nie vir hulle werk gee wat nuut is nie, want daar is nie tyd om konsepte aan hulle te verduidelik nie - die meeste van die tyd moet tog egter aan die meerderheid van die leerders spandeer word. Hulle leer dus min - hulle word basies besig gehou. Maar ek moet 'n paar minute spandeer om vir hulle die nuwe werk te gee, en vroeë beantwoord gedurende die les (gewoonlik net soos ons intens begin verduidelik aan faktorisering of 'n soortgelyke moeilike onderwerp!). Aan die einde van die jaar het ek myself belowe - nooit weer nie! Jy kan nie die kwaliteit onderrig gee aan die downleerder nie, jy kan nie jou volle aandag aan die gewone leerder gee nie, en dit is baie ekstra voorbereiding net om die spesiale leerder besig te hou dat hulle nie pla nie. Nou sit ek met 'n nuwe downsindroom meisie in my gr 8 klas!!! Sy is emosioneel totaal onopgewasse vir hoërskool, niemand wil met haar speel nie, sy huil die heeltid en is aandag intensief. Die ouers is vasberade om haar in 'n hoofstroomskool te hê, en gee voor asof dit vir haar 'n groot fees is om skool toe te kom. Hoe hanteer 'n juffrou die saak? – HELP!!

ANNEXURE D: INTERVIEW QUESTIONS

Interviewer notes:

Stay with open ended questions, i.e. do not guide them to an answer. Hear what they say and then ask more questions. Keep in mind their history and cultural background throughout.

Entrance statement: Keep in mind and tell me where appropriate, how your history and culture plays a role in your answer.

Questions:

Organization of the network group

- Number (small group) – what are your thoughts on the size of the group?
- Past experience – what past experience do you have of networking via electronic means? Do you use a computer for other tasks? Did this make participation easier? Do you think your experience as a cluster leader had an impact on your participation?
- Degree of common interest – compare your participation in the forum with your participation in cluster leader meetings in terms of your interaction (comfortability, ease of interaction and sharing of ideas/problems) with the other teachers.
- Relationship to one another (horizontal) – (all are cluster leaders) – the fact that you are all cluster leaders – how did it affect our participation and interaction?
- Relationship to one another (vertical) – what are your thoughts on the absence or participation of a curriculum advisor in this network?
- Physical location – seeing that you are in different schools, what value do you see for the forum? Would you share a forum with teachers from a different cultural group?
- Interests – what are your views on FPD and electronic interaction?
- Knowledge – what knowledge did you bring to the forum?
- Professional status – your highest qualifications?

Task organization

- The task was specified in the broadest terms (exchange information and/or share ideas/problems/reflective thoughts) – how did this impact on your participation? Would specified tasks have influenced your participation?
- What prevented you from reflecting on your classroom practices with other teachers?
- Inclusion of math symbols in discussions – is it important or valuable compared to discussions that does not require symbols?

Response opportunities

- Presence of electronic equipment – what value does the forum have compared to your normal cluster meetings? How do you feel about electronic interaction?
- Ease of access – tell me about the PC in your home. In what room? Quiet? Noisy? What problems did you have accessing the forum? Forum access from school? At night or during day?
- Expertise required – how easy was it for you participating in the forum?

Response obligations

- I expected you to participate as regularly as you could – what prevented you from participating more?

Evaluation/coordination

- Were you a leader or a follower in the forum?

ANNEXURE E

Reflective teaching: Exploring our own classroom practice

Reflective teaching means:

- looking at what you do in the classroom,
- thinking about why you do it, and
- thinking about if it works - a process of self-observation and self-evaluation.

By collecting information about what goes on in our classroom, and by analysing and evaluating this information, we identify and explore our own practices and underlying beliefs. This may then lead to changes and improvements in our teaching. Reflective teaching is therefore a means of professional development which begins in our classroom.

The next section explores reflective teaching under the following headings:

1. Why it is important
2. Beginning the process of reflection
 - a. Teacher diary
 - b. Peer observation
 - c. Recording lessons
 - d. Student feedback
3. What to do next
 - a. Think
 - b. Talk
 - c. Read
 - d. Ask
4. Conclusion

1. Why it is important

Many teachers already think about their teaching and talk to colleagues about it too. You might think or tell someone that *"My lesson went well"* or *"My students didn't seem to understand"* or *"My students were so badly behaved today."*

However, without more time spent focussing on or discussing what has happened, we may tend to jump to conclusions about why things are happening. We may only notice reactions of the louder students. Reflective teaching therefore implies a more systematic process of collecting, recording and analysing our thoughts and observations, as well as those of our students, and then going onto making changes.

- If a lesson went well we can describe it and think about why it was successful.
- If the students didn't understand a language point we introduced we need to think about what we did and why it may have been unclear.
- If students are misbehaving - what were they doing, when and why?

2. Beginning the process of reflection

You may begin a process of reflection in response to a particular problem that has arisen with one or your classes, or simply as a way of finding out more about your teaching. You may decide to focus on a particular class of students, or to look at a feature of your teaching - for example how you deal with incidents of misbehaviour or how you can encourage your students.

The first step is to gather information about what happens in the class. Here are some different ways of doing this.

(a) *Teacher diary*

This is the easiest way to begin a process of reflection since it is purely personal. After each lesson you write in a notebook about what happened. You may also describe your own reactions and feelings and those you observed on the part of the students. You are likely to begin to pose questions about what you have observed. Diary writing does require a certain discipline in taking the time to do it on a regular basis.

Here are some suggestions for areas to focus on to help you start your diary.

Writing a teaching diary - here are some general questions to get you started:

Objectives

- Did the students understand what we did in the lesson?
- Was what we did too easy or too difficult?

- What problems did the students have (if any)?
- Was there a clear outcome for the students?
- What did they learn or practise in the lesson? Was it useful for them?

Activities and materials

- What different materials and activities did we use?
- Did the materials and activities keep the students interested?
- Could I have done any parts of the lesson differently?

Students

- Were all the students on task (i.e. doing what they were supposed to be doing)?
- If not, when was that and why did it happen?
- Which parts of the lesson did the students seem to enjoy most? And least?
- How much English did the students use?

Classroom management

- Did activities last the right length of time?
- Was the pace of the lesson right?
- Did I use whole class work, group work, pair work or individual work?
- What did I use it for? Did it work?
- Did the students understand what to do in the lesson?
- Were my instructions clear?
- Did I provide opportunities for all the students to participate?
- Was I aware of how all of the students were progressing?

Overall

If I taught the lesson again, what would I do differently?

(b) *Peer observation*

Invite a colleague to come into your class to collect information about your lesson. This may be with a simple observation task or through note taking. This will relate back to the area you have identified to reflect upon. For example, you might ask your colleague to focus on which students contribute most in the lesson, what different patterns of interaction occur or how you deal with errors.

(c) *Recording lessons (if you have access to a audio or video recorder)*

Video or audio recordings of lessons can provide very useful information for reflection. You may do things in class you are not aware of or there may be things happening in the class that as the teacher you do not normally see.

(a) Audio recordings can be useful for considering aspects of teacher talk.

- How much do you talk?
- What about?
- Are instructions and explanations clear?
- How much time do you allocate to student talk?
- How do you respond to student talk?

(b) Video recordings can be useful in showing you aspects of your own behaviour.

- Where do you stand?
- Who do you speak to?
- How do you come across to the students?

(d) *Student feedback*

You can also ask your students what they think about what goes on in the classroom. Their opinions and perceptions can add a different and valuable perspective. This can be done with simple questionnaires or learning diaries for example.

3. What to do next

Once you have some information recorded about what goes on in your classroom, what do you do?

- **Think**

You may have noticed patterns occurring in your teaching through your observation. You may also have noticed things that

you were previously unaware of. You may have been surprised by some of your students' feedback. You may already have ideas for changes to implement.

- **Talk**

Just by talking about what you have discovered - to a supportive colleague or even a friend - you may be able to come up with some ideas for how to do things differently.

- If you have colleagues who also wish to develop their teaching using reflection as a tool, you can meet to discuss issues. Discussion can be based around scenarios from your own classes.
- Using a list of statements about teaching beliefs (for example, algebra is more important than....) you can discuss which ones you agree or disagree with, and which ones are reflected in your own teaching giving evidence from your self-observation.

- **Read**

You may decide that you need to find out more about a certain area. There are plenty of websites for teachers of mathematics now where you can find useful teaching ideas, or more academic articles. There are also magazines for teachers where you can find articles on a wide range of topics. Or if you have access to a library or bookshop, there are plenty of books for mathematics teachers.

- **Ask**

Pose questions to websites or magazines to get ideas from other teachers. Or if you have a local teachers' association or other opportunities for in-service training, ask for a session on an area that interests you.

4. Conclusion

Reflective teaching is a cyclical process, because once you start to implement changes, then the reflective and evaluative cycle begins again.

- What are you doing?
- Why are you doing it?
- How effective is it?
- How are the students responding?
- How can you do it better?

As a result of your reflection you may decide to do something in a different way, or you may just decide that what are you are doing is the best way. And that is what professional development is all about.

Source:

<http://www.teachingenglish.org.uk/think/methodology/reflection.shtml>

ANNEXURE F**CONTRACT BETWEEN THE UNDERSIGNED AND T.M. VAN DER MERWE REGARDING PARTICIPATION IN THE UNISA MATHEMATICS TEACHERS ON-LINE PROFESSIONAL DEVELOPMENT PROJECT**

I, the undersigned, hereby agree to the following:

1. I will attend all training workshops on the days agreed upon.
2. I will make myself available for a follow-up interview at Unisa on a day agreed upon.
3. I will make every effort to ensure that the computer is stored/kept in a safe place.
4. I will keep and make available a research diary of my experiences on this project.
5. I will use the Internet connection for purposes of the project only.
6. I confirm that I am PC-literate, and that I have an existing telephone line.

In return I will:

- Provide you with an Internet-ready personal Computer, which you may keep after the project.
- Provide you with and pay for an Internet dial-up account for the period of the project

Signed at.....in thisday of2006

Name (print)

Signature.....

Witness Name.....

Witness Signature.....

.....

TM van der Merwe

14 February 2006