**Teachers' ideas and practice in practical work after the dawn of the new curriculum in South Africa**

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**Abstract**
The paper reports on a study which investigated how two Grade 10 physical science teachers conducted practical work after the dawn of the new curriculum in South Africa. A case study methodology was adopted and interviews and official documents in the form of laboratory reports and instruction sheets were used as sources of data. The study showed that one teacher had ideas of the nature and purpose of practical work within the framework of the investigation movement. The other teacher had ideas of the nature and purpose of practical work within the process and investigation movement respectively. However, both teachers conducted practical work tasks within the explanation model. The study showed that teachers' ideas of practical work did not shape how they conduct practical work. Possible reasons for the teachers conducting practical work tasks within the framework different to that of their ideas and the implications of the findings for the new curriculum are discussed.

**Key words:** practical work, procedural understanding, explanation model

**Introduction**
The paper reports on the study conducted in South Africa. The new curriculum (National Curriculum Statement also known as NCS) in South Africa brought with it more reinforced emphasis on the importance of practical work. In the Gauteng province, laboratory equipments were delivered to most schools by the Department of Education. The Department of Education (2005b and 2007) suggests that two practical work tasks must be conducted as part of continuous assessment. Is the energy shown by the National Department of Education through policies and the Gauteng Department of Education by delivering laboratory equipments bearing any desirable results? From the cluster meetings and NCS training workshops attended by one of us in the Gauteng province, indeed more practical work is being attempted than before the introduction of the NCS curriculum. However, comments from the teachers who attended the workshops on how practical work should be done were inundated with doubts on whether they are adhering to the requirements of the curriculum or not. Studies by Perkins-Gough (2007) Ottander and Grelsson (2006), Stoffels (2005) and Hodson (1990), show that teacher practice does have an impact on how practical work is conducted. In this study, we investigated teachers' ideas on practical work and how those ideas relate to their actual practice. The following research questions guided the study

1. What are grade 10 teachers' ideas of the nature and purpose of practical work?
2. How do grade 10 teachers' ideas of the nature of practical work and its purpose shape how he/she conducts practical work?

**THEORETICAL FRAMEWORK**

The Department of Education (2007:10) indicates that "practical investigations and experiments should assess all learning outcomes with the focus on the practical work aspects and the process skills required for scientific inquiry and problem solving". Hence, within the NCS curriculum practical work caters for the procedural understanding and substantive understanding with the goal of developing problem solving skills. The three movements as articulated by Pekmez, Johnson and Gott (2005) who investigated the thinking of teachers about practical work in the context of the English National curriculum for science in England were used to locate teacher's ideas and practice with reference to the DoE (2007) position on practical work. The summary of the movements is indicated in Table 1.

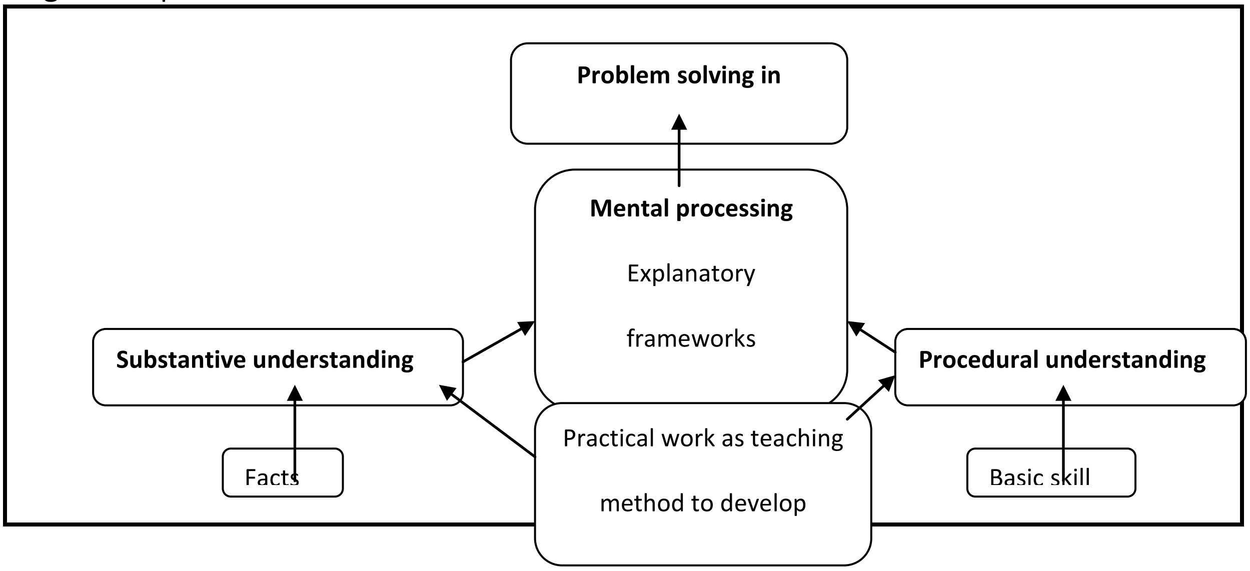
**Table 1**: Characteristics of movements influencing practical work

| | **Movement** | | |
|---|---|---|---|
| | **Discovery Learning** | **The Process Approach** | **Investigations** |
| **Main Characteristics** | 1.Learners expected to discover things for themselves | 1. Motivates the identification of what scientists do and argue that this is what must be taught | 1. The approach was confounded on the focus that pupils should be thinking about what they are doing than simply applying the practised method |
| | 2. Practical work seen as the means in which pupils will develop their thinking | 2. Content not a priority but the scientific method | 2. The approach develops procedural and substantive understanding |
| | 3. This is a teaching method which leaves things open for discovery and also offers an opportunity for not discovering them | 3. This is a teaching method that focuses on skill and neglect content | 3. The ultimate aim is to develop problem solving skills |

From the Table 1, it is evident that the South African Department of Education's ideas of practical work can be aligned with the investigation movement. In analysing and explaining the ideas of teachers about practical work the following models used by Pekmez *et al*. (2005) were used.

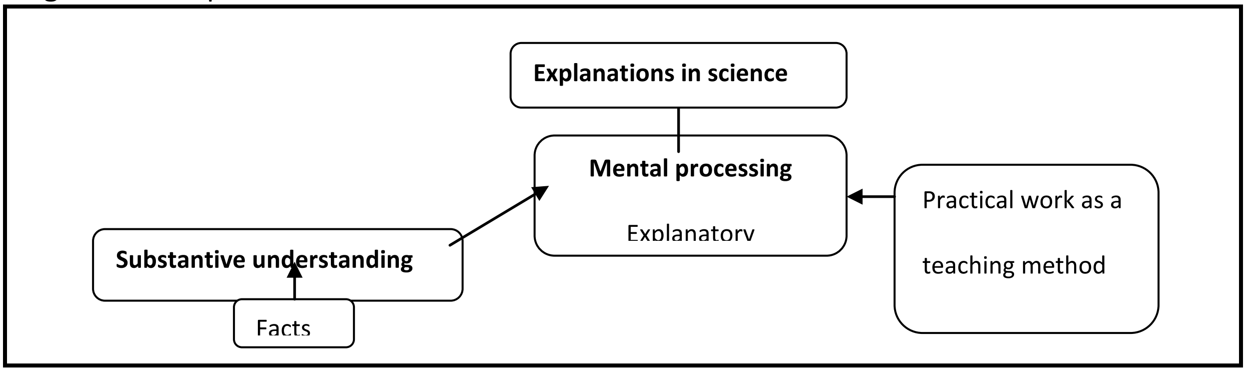
The performance model (Figure 1) is based on the investigation movement approach. From this model the teacher has the intention of developing substantive understanding as well as procedural understanding. Furthermore, practical work is used as an explanatory framework and for selection and organization of routines (skills) for mental processing. The ultimate goal of this approach is to develop problem solving skills amongst learners

**Figure 1** A performance model



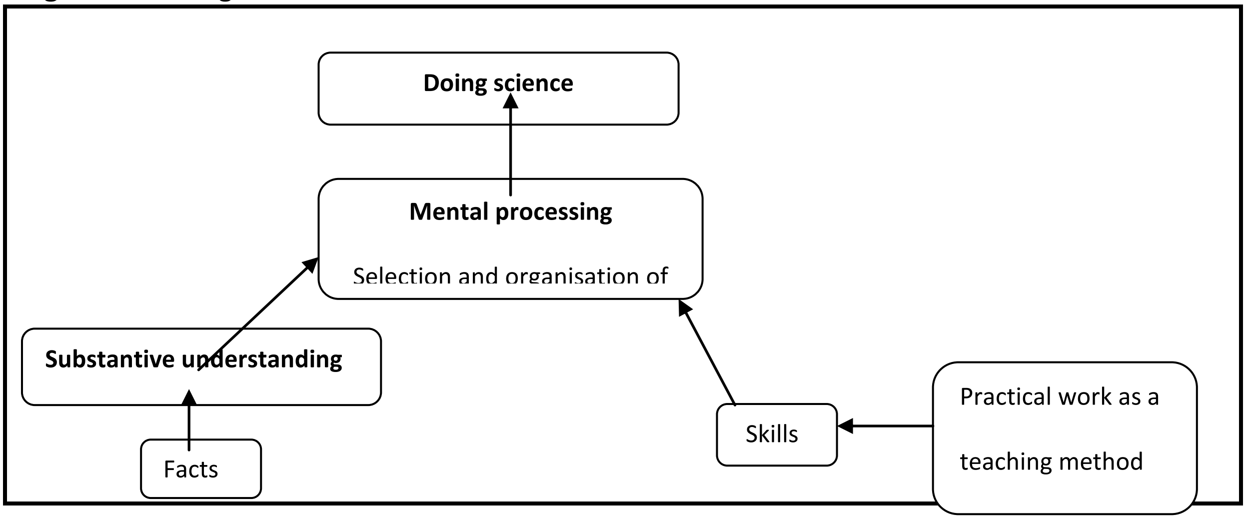

In the explanation model (Figure 2) practical work is used as a teaching method to support substantive understanding and laboratory work (Pekmez *et al.,* 2005). Therefore Practical work is used as an explanatory framework for the explanations in science.

**Figure 2** An explanation model




The doing of science model (Figure 3) uses practical work as a teaching method to support skills development. Pekmez *et al.* (2005) indicate that in this model teachers concentrate on the skills rather than ideas to be understood. In this model a teacher thinks of practical work from the process approach movement.

**Figure 3** A doing model




The movements and the models were used as frames of references for locating the teacher's ideas of practical work as they contained a wide range of teacher's perspectives on practical work encompassing ideas and practice. Furthermore the movements have already influenced practical work in the UK and US and yielded the three models used in this study. How teachers conducted practical work was analysed using the modified model on the process of developing and evaluating a labwork task by Millar *et al*. (2002). In the model, teacher's objectives and the design features of tasks (what the students are intended to learn) are influenced by the teachers' ideas of science and learning (what practical work is, and its purpose) and the practical and institutional context (e.g. availability of apparatus, class size and the requirements of the curriculum).

## Methodology

The study adopted a descriptive case study method. Hitchcock and Hughes (1995:321) indicate that "descriptive case studies have aimed at giving a narrative account of life as it is in a social situation". The choice was influenced by what can be done, what was practical, situational factors and interest. Furthermore the researchers intended to give a descriptive account of teacher's ideas on practical work and their practice. Semi-structured interviews and official documents were used to gather data for the study. Semi-structured interviews offered the opportunity to ask the question 'why' and we could also deviate from the prearranged text and wording of questions (Opie, 2004). Official documents in the form of laboratory reports and instruction sheets were used as they offered an opportunity to obtain data with little contact between the researchers and the teachers. Laboratory reports were the written reports by students after conducting practical work and instructions sheets contained the guidelines given to the students which contained amongst other things the apparatus they could use, a procedure on how to conduct the task given. Teachers chose the sample of practical work task reports (laboratory reports) and instruction sheets of what best represented what they wanted their learners to do, in our presence for authenticity (McMillan and Schumacher, 2006). Interviews and official documents were also used to compare what the teachers said they know and do with what they actually did in class. The use of interviews coupled with official documents was necessary to attain internal validity for the study so that it could be trustworthy and credible as the data from two different data collection strategies was triangulated.

The data was collected from three Grade 10 physical science teachers. One of the teachers was used to pilot the research procedures. The pilot enabled the researchers to validate the instruments as well as develop data analysis scheme (Appendix 1). The validation and reliability of the instruments was achieved by analyzing the data collected from the teacher independently by the two researchers and comparing the outcomes. The outcomes were used by the researchers to refine the instruments. The three teachers were chosen purposefully from the workshops were the orientations on what is expected of them from the new curriculum and practical work in particular was done. To eliminate lack of confidence, training, apparatus and teachers' background, teachers teaching at schools that have a fairly equipped laboratory and qualified to teach physical science with at least two years of experience at a particular school were purposefully chosen. These factors were eliminated because Rogan and Grayson (2003) indicate that they do influence the implementation of so called new curriculum. The two teachers from whom the data was collected one of them taught at a township school and the other at a suburban school. The choice of the differing environments was done to see if the environment did shape how practical work was conducted

Data was analysed and interpreted using the typology model. Hatch (2002:148) indicates that this is the method where in data is interrogated and organized "…in ways that allow the researchers to see patterns, identify themes, discover relationships, develop explanations, make interpretations…". The first research question (teacher's ideas of the nature of practical work and teacher's ideas of the purpose of practical work) was used as the first and second typology for the study. The third typology was how practical work was conducted and was based on Millar's model of developing and evaluating lab task (Millar *et al.*, 2002). The typology took into consideration how teacher's ideas of science and learning (which in this context were the nature of practical work and its purpose and the practical and institutional context) influenced the objectives and design of the practical work task (what the teacher intended the students learn).

The definitions of practical work and its purpose from the literature reviewed in this study were used as categories for analysing the interviews and the official documents (Appendix 1). Practical and institutional context like class size amongst others were developed from personal experience, common sense and the theoretical and conceptual framework of the study. However some categories for example 'to cater for different learners' which was the purpose of practical work and 'discipline' which was the practical and institutional context, amongst others emerged as the data was being analysed and were used (Stake, 1995). Categories were given codes as shown in Appendix 1. The categories and codes were validated by a peer.

**Results**

The interviews were read with one typology in mind and a summary sheet created for each typology per teacher (Hatch, 2002). The summary sheet contained only the main ideas of the respondent with no interpretation. This was done to attain primary descriptive validity

(Maxwell, 1992). The summaries for each typology from the interviews were then coded using the categories developed (appendix 1). The official documents were also coded using the same coding systems used for the interviews. On table 2 researchers present an example of the described official document (instructional sheet and laboratory report) from one of the teacher and his student and in table 3 they present an example of the table showing the coded official document of the same teacher and student.

**Table 2**: An example of the official document presentation

| CODE | TYPE OF DOCUMENT | | DESCRIPTION |
|---|---|---|---|
| P1M | Instruction sheet | | The instruction sheet has a heading indicating the knowledge area: electricity and magnetism and Activity: magnetic field of permanent magnets. In The second paragraph there is the statement, to investigate: the magnetic field around permanent magnets. Thereafter apparatus to be used for the task are indicated. A description of what learners are expected to do follows. The diagrams and illustrations are also include in the what to do section. The last paragraph has the assessment questions |
| | Learners practical reports (students worksheet) | PR1L1M | The name of the learner on top. Grade class follows and the teacher's name. The aim is given (*to investigate the magnetic fields around permanent magnets*). Apparatus are then listed. The method is then outlined. Results and observations are then given: *part A, the magnetic iron filings form a pattern that looks like the filings are round the magnet. The filings form a circle around the magnet. They move anti-clockwise. Most filings surround on the edge of each corner. Part B, the magnets attracts the arrows which causes them to move in a certain direction. The arrows form from the north pole direction to the south pole*. The conclusion is then given: *the magnetic filings take a s-shape. The arrows move from north to south then back north.* Diagrams of two magnets with lines around them are drawn at the end of the report |

Key: P1M- means practical work 1 for teacher M
PR1L1M- means practical work report 1 for learner 1taught by teacher M

**Table 3**: Example of coded official document

| CODE | TYPE OF DOCUMENT | | CODE |
|---|---|---|---|
| P1M | Instruction sheet | | HW,HE,TI,PA |
| | Learners practical reports (students worksheet) | PR1L1M | PP,HE |

Teacher's ideas based on the codes were then tallied and frequency tables generated per typology per research procedure. Below is an example of the frequency table generated for the typology of purpose of practical work using categories and codes from appendix 1.

**Table 4**: Grade 10 teachers' ideas of the purpose of practical work

| Code | Frequency of ideas for teacher M from official documents | Frequency of ideas from interview for teacher M | Frequency of ideas for teacher B ideas from official documents | Frequency of ideas from interview for teacher B |
|---|---|---|---|---|
| PS | 4 | 6 | 1 | 11 |
| PP | 7 | 9 | 1 | 7 |
| PM | | 5 | | |
| PE | | 4 | | 2 |
| PA | 1 | | 1 | |
| PDC | | | | 1 |
| PG | | 3 | | 2 |
| PD | | 2 | | |

The frequency table enabled us to identify the main ideas from each typology based on the tallies. There was one minor difference in terms of coding between the researchers, which was if teacher M conducted practical work in the explanation model or demonstration model. In the end we concluded to include both models. However this did not change the results significantly.

Teachers' ideas of the nature of practical work and its purpose

The ideas of the nature of practical work, for teacher M partially fit within the parameters of investigation movement (Pekmez *et al*. 2005) because according to this teacher, practical work develops procedural understanding as well as enhancing the understanding of the content. This is evident from this explanation which the teacher gave of what practical work is:

> Practical work as it says practical is something that they do it by themselves. Eh they use equipment which we call them apparatus and then to prove or to reinforce what they have learnt in class. So practical work I will take it that way. It is when they are using apparatus and equipments to reinforce what they have learnt during the lesson or sometimes you can use it. It depend which method you are either using deductive or inductive method. So you can start with the practical so that you can explain some concepts or you start with the concepts and use practical to explain it. (Teacher M interview, line 9-14)

However as there was no evidence of developing problem solving skill, the ideas partially fit within the investigation movement. However there was also some characteristic of discovery movement even though it was not significant throughout the interview and in the documents. Teacher B's ideas of the nature of practical work best fit within the parameters of process movement (Pekmez *et al*. 2005), because he stressed the doing of science neglecting the content.

This is evident from this statement:

> According to my understanding practical work is that investigation that you engage learners into the investigation, practical something that they will do themselves, they are involved in conducting that kind of practical work and they do a particular research, not really a research they investigate but to investigate something they are given until they prove that particular thing. Right they see the results they observe what is happening, they collect or gather the apparatus or chemicals and each one of them touch. They have a feel of those particular results they were looking for. (Teacher B interview, line 10-16)

There were also some characteristics of the investigation movement in the official documents. Even though the documents showed that substantive understanding and procedural understanding were developed, there was no attempt as in teacher M of developing problem solving skills. Both teachers M and B's understanding of the types of practical work varied from observations, illustration and investigation (Bennett, 2003). The types of practical work helped to understand the ideas that teachers have about practical work because if the teacher indicated that he is conducting investigations whilst performing demonstration like teacher B, it presented another perspective on the teacher's understanding of the nature of practical work.

Developing both general procedural and substantive understanding was the main purpose for both teachers M and B. However procedural understanding was merely write-up skills (Gauteng Department of Education, 2006).They also used practical work as a tool to develop group work skills. Teacher M used practical work also to develop his lesson, motivate learners and for enjoyment. This is evident from this statement

> The reasons most learners they love science because it is fun. Practical work it is fun. It is entertaining to them because if you teach and don't do practical work they don't enjoy it (Teacher M interview, line 53-54)

How the Grade 10 teacher's ideas of the nature of practical work and its purpose shape how he/she conduct practical work

The idea of the nature of practical work and its purpose for teacher M best fit within the investigation movement (Pekmez *et al*., 2005) even though there was no attempt to develop problem solving skill. His understanding of the purpose of practical work was also largely based on developing procedural and substantive understanding. Hence the teacher should have conducted practical work within the performance model (Pekmez *et al*., 2005). However how he conducted practical work best fit within the explanation model (Pekmez *et al*., 2005). How he conducted practical work does not fit within the performance model because the teacher did not focus on developing procedural understanding (Pekmez *et al*., 2005) and problem solving skills but focused on developing substantive understanding. Hence he used practical work as the teaching method to support the understanding of the content by learners. The write-up skills the teacher was aiming for were for the lab reports which would indicate to him that they (learners) understood the content better by producing well written lab reports. This is evident from this statement:

> Hey ja, interpretation skills, observation, analysing because those skills you will get it back when they are doing their lab reports, because after they have done everything, they have to present it to you, explain it to you, what does it mean…. (Teacher M interview, line 94-97)

The ideas of teacher B of the nature of practical work best fit within the process movement (Pekmez *et al*., 2005) whilst his ideas of the purpose of practical work best fit within the investigation movement (Pekmez *et al*., 2005). This teacher did not attempt to develop problem solving skills. The teacher conducted practical work within the explanation model (Pekmez *et al*., 2005) and used practical work to explain the content. Hence the teacher also conducted practical work to enhance the understanding of the learners The teacher focused on the substantive understanding with procedural understanding just part of the greater idea of enhancing the former. Hence, even though there was an attempt to develop procedural understanding in practice the emphasis was on enhancing the content which is substantive understanding. This is evident from this statement "… it assisted me in a way to make them understand the subject content more" (Teacher B interview, line 142-143)

**Analysis of results**

Grade 10 teachers' ideas of the nature of practical work and its purpose do not necessarily shape how teachers conduct practical work. The ideas of teacher M are within the investigation movement but he conducted practical work within the explanation model. For teacher B the ideas are within the process movement and the investigation movement but conducted practical work within the explanation model. The findings show another perspective to Millar *et al*'s (2002) assertion that teachers views of science and learning which in this context referred to what practical work and its purpose are about, influence the design and objectives of a practical work task. Even though teachers' views influenced what they intended their students to learn, in practice that was not evident. Their ideas were in a framework different from the one they conducted the practical work tasks on.

The table below shows the summaries of the two teachers' ideas of the nature of practical work; types, its purpose and how they conducted practical work.

**Table 5**: Summaries of the ideas of practical work

| | Teacher M | Teacher B |
|---|---|---|
| Nature of practical work | Investigation movement<br>Discovery movement | Investigation movement<br>Process movement |
| Types of practical work | Illustration, investigation, observations (demonstrations) | Illustration, investigation, observations (demonstrations) |
| Purpose of practical work | Develop procedural understanding, substantive understanding, group work, enjoyment and motivation | Substantive understanding, procedural understanding, group work skills |
| How practical work was conducted | Explanation model<br>Demonstrations | Explanation model |

The following may be some of the reasons for the difference between the teachers' ideas of the nature of practical work and how they conducted practical work:

1. Lack of procedural understanding
   Both teachers demonstrated lack of procedural understanding in terms of classroom practice (Pekmez *et al*., 2005). Their instruction sheets were focused on what learners were expected to do and not on the outcomes (Ottander and Grelsson, 2006). This perpetuated a limited focus on developing procedural understanding. Because of this lack of focus of procedural understanding and its comprehension, the attempt to develop them became just the demonstration of using or seeing how apparatus are used. Hence this may have resulted in the difference between the views teachers had of the nature of practical work and how they conducted practical work.

2. Institutional and practical context
   Each teacher had a class lasting for 35 minutes and sometimes the classes lasted 70 minutes. No much can be done within that limited time hence it may also be the reason the teachers resorted to demonstrations. The topics in grade 10 are many and Perkins-Gough (2007: 93) indicates that "extensive lists of science topics in a given grade may discourage teachers from adopting more effective approaches to laboratory instruction". Hence many topics to be covered with the external examinations to be written may have resulted in teachers resorting to demonstrations. Teacher M also indicated that disciplinary issues (Stoffels, 2005) also made him to conduct demonstrations. Teacher B indicated that the unavailability of the lab assistant stops him from conducting many practical work tasks. This sentiment was also echoed by teacher M who also indicated that he resorts to demonstrations because of the unavailability of the lab assistant who will clean after him. The need to satisfy the requirement of the portfolio and Continuous assessment (CASS) also influenced the teachers to resort to demonstrations. Kapenda *et al.* (2002) also indicated that a large class was also reason Namibian teachers gave for conducting demonstrations, and both teachers in this study had large classes. Resorting to demonstrations, in turn resulted in the differentiation between the two teachers' views of the nature of practical work and how they conducted practical work.

3. Lack of knowledge or skill to develop problem-solving skills and ensuring that tasks are learner-centered
   Both teachers were in charge of the tasks and to a large extent demonstrating the tasks. Their approach was teacher-centered (Stoffels, 2005). In an inquiry approach the activities have to be student-centered (Kask and Rannikmäe, 2006) and develop problem solving skills (Department of Education, 2003, 2005a and 2007). This deficiency in both teachers may also have resulted in the differences between the framework of teachers' views and how they conducted practical work.

**Discussion**

According to Department of Education (2005a and 2007) practical work should be conducted within the framework of scientific inquiry where learners perform investigations.

However this study showed that teachers conducted what they call investigations which are not entirely investigations. They did not attempt to develop problem solving skills by developing both procedural and substantive skills simultaneously. Pekmez e*t al.* (2005: 20) indicate that when "operating within a faulty framework, practical work could only succeed by accident rather than design". Indeed teachers had their intentions to develop substantive and procedural understanding which is in line with what is scientific enquiry (Kask and Rannikmäe, 2006). However it was evident from this study that how the two teachers conducted practical work was not a reflection of their views of the nature and purpose of practical work. They thought that they were doing investigations whilst they were conducting practical work within the framework of the explanation model. The ideas are present in their minds but putting them into practice was not evident. Teacher B's ideas were a bit more uncoordinated than teacher M. His ideas did not flow as that of teacher M whose understanding of the nature of practical work and its purpose where within the same framework of investigation movement. Both teachers did not have learners designing the practical work tasks as required by the NCS. This then defeat the intentions of Department of Education (2003, 2005a).

This brings into question the implementation of the curriculum. Rogan and Grayson (2003) indicate that South Africa is in danger of falling into the trap of designing visionary and educational sound policies for the national curriculum whilst not focusing on the part of how to implement those policies. In their theory of curriculum implementation Rogan and Grayson (2003) identified three profiles which are; profile of implementation, profile of capacity to support innovation and profile of support from outside agencies. Both the teachers in profile of curriculum implementation are operating largely at level 2; they use demonstrations to promote a limited form of inquiry. At the profile of capacity to support innovation both the teachers satisfy this requirement hence they operate at level 3 to 4. They are well-qualified, Support from outside agencies is sufficient for the implementation of the new curriculum, both teachers have adequately fitted laboratories but the design of the professional development can be questioned. The above analysis shows that not much is done in terms of implementation. Rogan and Grayson (2003) indicate that this is usually the case with the developing countries. This study has shown that there is course of concern on curriculum implementation with regard to practical work.

Teachers' ideas of what practical work and its purpose is, do not necessarily ensure that they conduct practical work according to their ideas. What became evident in this study was that teachers were doing what they thought was developing procedural understanding whilst they were not. This could mean that they lack proper understanding of what procedural understanding is. This finding was also reported by Kapenda *et al.* (2002). Furthermore Pekmez *et al.* (2005) found that there is need "... to develop a deeper understanding of the procedural knowledge base amongst a significant proportion of science teachers". This assertion is also reported by Bennett (2003).

Kask and Rannikmäe (2006) also indicate that the collaboration within schools of the best practices in practical work should be taken into consideration. Teachers are encouraged not to be derailed by the contextual factors but to stand up and introspect themselves and seek advice where necessary. Rogan and Grayson (2003: 1200) indicate that "changing teaching and leaning practices should be viewed as a change of culture rather than merely a technical matter". Hence teachers themselves have a challenge of accepting the new approach, allow it to live in them and practice it. Rogan and Grayson (2003) further indicate that if teachers attend workshops and fail to implement what they have learned there will be no change.

The study by Kask and Rannikmäe (2006) has shown that intervention is very important in the evolution of the teachers towards inquiry approaches. Bennett also (2003: 96) indicates that "the messages emerging from current thinking on practical work are that the emphasis needs to shift from doing to discussions". Therefore there is need for extended time than what has been done to engage teachers in discussions on how to put the Department of Education learning area and assessment guideline policy on science enquiry into practice. Hence intervention through the cluster meetings is recommended.

However Rogan and Grayson (2003) indicate that the reason for the failure of well designed and well intentioned curricular in developing countries is the lack of clearly thought out implementation strategy. It is necessary to engage teachers on meaningful, planned discussion on scientific inquiry which would encompass both procedural and substantive understanding. Cluster meetings should be organized such that teachers in the end are able to operate at level 4 of all the profiles of theory of implementation (Rogan and Grayson, 2003). This could be achieved by implementing the policies of practical work in manageable steps wherein teachers are scaffolded (Rogan and Grayson, 2003) into how to design and conduct practical work. Rogan and Grayson (2003: 1197) further indicate that "to build capacity without linking it to implementation is fruitless". Cluster leaders or facilitators should take into consideration that practical work tasks moderated reflect the ideas discussed in the previous meetings and assist teachers accordingly. The ultimate ideal situation should be to establish communities that "develop shared values and goals regarding educational practice and a commitment to put these into practice" (Rogan and Grayson, 2003: 1194).

## Conclusion

The study showed that there is an attempt to conduct practical work even though it is happening within a faulty framework. Stoffels (2005) indicated that teachers need their confidence to be boosted for them to operate competently. The study has shown that there is need for this. How the results of the study best represent the majority of science teachers is debatable but the findings can provoke the understanding of practical work and its implementation. The study has shown that there is a need for the link between the teachers' ideas of practical work and actual classroom practice for the enquiry approach to be a success. Hence it calls into question the current methods that are used to help in-service physical science teachers on how to conduct practical work.

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**Appendix 1:** The categories and codes used for the data analysis

| CATEGORY | CODE |
|---|---|
| **What practical work is** | |
| Learning situation that offers learners an opportunity to practice the process of investigation | WS |
| Teaching and learning activities in science which involves students at some point in handling or observing real objects or materials they are studying | WH |
| Individual or small group pupil laboratory work | WG |
| Practical work is the means for discovery learning where in learners develop their thinking | WD |
| Methodology that will give opportunities to learners to practice what scientist do when they are being scientist | WP |
| An approach that develops process skills and enhance their understanding of concepts, laws and theories of physical science | WI |
| Difficult to classify | WDC |
| Teacher demonstrations to enhance learning | WT |
| **Types of practical work** | |
| Skills | TS |
| Observations | TO |
| Enquiry | TE |
| Illustration | TI |
| Investigation | TV |
| **Purpose of practical work** | |
| Substantive understanding | PS |
| Procedural understanding | PP |
| Motivation | PM |
| Communication | PC |
| Enjoyment | PE |
| Assessment | PA |
| Develop group work skills | PG |
| To cater for different learning styles | PD |
| **How practical work was conducted** | |
| Practical and institutional context | |
| Class size | HC |
| Apparatus | HA |
| Requirements of the curriculum | HR |
| Discipline | HN |
| How students were intended to learn | |
| Performance model | HP |
| Explanation model | HE |
| Doing model | HM |
| Outcomes | HO |
| Demonstration | HD |
| Group work | HG |
| Work sheet to be followed | HW |