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**The effect of USA-based meteorological workshops on  
the self-image and professional practice of South African teachers**

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**ABSTRACT**

**The effect of USA-based meteorological workshops on  
the self-image and professional practice of South African teachers**

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**Summary**

**This study was designed to investigate teachers' success in implementing an innovative programme (Project Atmosphere). It also investigates teachers' perceptions of self-efficacy, teacher-efficacy and teacher-perceived value of the programme. Factors related to the congruence, cost and importance of implementing the activities obtained on the Project Atmosphere workshop were also investigated to investigate whether or not participants implemented what they had learnt on the programme. Data were gathered through questionnaires and interviews with seven teachers and teacher trainers who had previously attended Project Atmosphere. This research showed that these participants were enthusiastic about the workshop and wanted to share what they had learnt with other teachers. They also felt that the workshop had improved their understanding of meteorological processes and that the activities obtained at the workshop would go a long way to improving learners' understanding of these concepts too. Recommendations in terms of setting-up a similar programme in South Africa are made in this study.**

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## Chapter 1: Introduction

### 1.1 Meteorology in South African School curriculum

Meteorology has been a component of the South African educational curriculum for many years. Prior to 1994 it was traditionally conducted as part of the geography syllabus. With the end of apartheid came curriculum changes and the National Education and Training Forum began a process of syllabus revision. The White Paper on Education and Training (Department of Education, 1995) emphasised the need for change in the approach to learning and entailed an outcomes-based approach to education. Curriculum 2005 (C2005) (Department of Education, 1997) was born. Meteorology-related studies now fall under the learning area of natural and social sciences for grades 1 to 9, but is taught in geography for grades 10 to 12. Some teachers also use meteorology-related topics in other learning areas such as languages, technology and mathematics and, as teachers become more aware that learning areas need to be integrated, so the use of meteorological topics will become less compartmentalised and not remain solely within the natural and social sciences and geography syllabus.

The meteorological concepts that learners need to grasp within the geography syllabus are developed over a number of years. The topics that are covered in the final three years of schooling include:

- droughts and floods and their effect on South Africa;
- the study of the atmosphere;
- general circulation of the atmosphere;
- weather processes resulting in thunderstorms and tornadoes;
- temperate and tropical cyclones;
- the interpretation of synoptic charts; and
- microclimatology.

Learners are thus required to have a very broad knowledge of meteorological processes by the time they write their final examinations in grade 12. In order for learners to develop this knowledge, teachers need to understand all of these concepts to impart this knowledge. However, many teachers in South Africa have problems in helping learners develop this understanding. Some speak of having to teach meteorology even though they never did the subject at school or at a tertiary institution because there is no one else to take the classes. Others admit to the fact that they never really understood the concepts behind meteorology and thus find it one of the most difficult sections in the geography syllabus to teach. Another problem is that many teachers who have to teach meteorology do not understand the science behind many of the meteorological concepts, because they never did science as a subject either at school

or during their training to become a teacher. Some teachers just teach one or two grades and thus tend to teach the meteorological topics covered in this syllabus without giving any thought to what is covered in the grades before and after theirs. This situation often leads to the teaching of meteorology being rather fragmented without there being any real linking of the concepts from one year to the next. Learners often find it difficult to see the connections between what they learnt in one grade and what they are expected to know in the next. Because of these problems, many geography teachers are often reluctant to present lessons around the topic of meteorology and would rather give their learners a project to do on the topic. The large number of telephone calls the South African Weather Service receives from parents trying to help their children with meteorological projects is a testament to this fact (personal observation). I have run numerous teacher workshops on meteorological topics where teachers have discussed these problems with me. Many have come after the workshop to ask questions and get clarity on a wide range of meteorological issues. There have also been numerous instances where teachers have approached South African Weather Service staff members at exhibitions stands and enquired about meteorological topics which they have to teach but are not sure of all their facts. Hopkins and Stein (1996) say that what distinguishes a good teacher from everyone else is their ability to successfully convey particular concepts, skills and information to students. I believe that many teachers in South Africa are looking for ways to acquire these skills and knowledge in order to become better at their jobs. There is thus a real need to find some way of developing teachers' knowledge of meteorology and to provide them with the skills and knowledge of how to get these concepts across to learners in a meaningful way.

## **1.2 Project Atmosphere**

In 1998 I was invited by the American Meteorological Society (AMS) to join twenty-five American teachers and one South African teacher on a two-week intensive workshop at the United States National Weather Service Training Center (NWSTC) in Kansas City, Missouri. The workshop, called Project Atmosphere, aimed to:

- introduce teachers to the latest technologies and techniques for sensing, analyzing, and forecasting weather;
- explore and suggest ways in which the products of these technologies and techniques could be employed in school studies of the atmospheric environment; and
- prepare workshop attendees to conduct training sessions on selected atmospheric science topics for teachers in their home areas.

The workshop included lectures and seminars presented by National Weather Service and other National Oceanic and Atmosphere Administration (NOAA) personnel. The main topics included:

- Surface and Upper-Air Observations and Analysis;
- Radar and Satellite Imagery Interpretation;
- Weather Forecasting;
- Thunderstorms and Severe Storms;
- Hurricanes; and
- Global Climate Change.

Hands-on activities, which were linked to these topics, were also presented. They were designed to help teachers transfer what they had learnt in the lectures and seminars to their learners back home. The type of hands-on activities varied, depending on the topic being discussed. One example was how to make a cloud in a plastic bottle. This activity helps learners to understand why and how clouds form. Other activities covered were linked to the topics of weather systems, hazardous weather, El Niño, high and low pressure systems, sunlight and seasons, weather satellites, weather radar, clouds, atmosphere aloft, atmosphere in the vertical, severe weather, Coriolis force and weather studies using the NOAA radio. All the activities presented could be conducted in any classroom environment and did not rely on sophisticated equipment, with the exception of the activity using the NOAA radio. The participants were given an opportunity to work through the activities during the workshop. They were encouraged to share their ideas and thoughts on how best these activities could work in their classrooms. Comprehensive notes on the weather phenomena and details on how to run the activities were given to all participants following the activity session. These notes provided a background to the topic, but were not designed to be followed like a recipe.

The participants were encouraged to integrate the activities into their normal teaching practices. They were also encouraged to pick a topic they enjoyed and research it further and thus become an expert on that topic. The AMS hopes that teachers who have completed the workshop would not only be able to conduct effective meteorologically related lessons in their own classrooms, but would be able to run workshops for fellow teachers back home, thus promoting meteorological education in their areas. The AMS views this as a cascading effect or model, where one teacher is trained but goes on to train others. These teachers are able to teach learners more effectively, thus transferring and multiplying the benefits of the training course. Dr. Donald R. Johnson, past president of the AMS, hopes that Project

Atmosphere, “will combine shirtsleeves and scientific theory, using 'hands-on' study of the real-world atmosphere to interest more young people in science, mathematics, and technology” (Stanley, 1992, p. 7). He believes that a grasp of these subjects will do much to prepare today's learners for success in a world that is increasingly technologically sophisticated, but sometimes environmentally fragile (Stanley, 1992).

Having attended the workshop myself, it was apparent that this form of in-service training was going a long way in providing teachers, not only with content knowledge with regard to meteorology, but also with methods of getting these concepts across to learners in a meaningful manner. My thoughts at the time were that it would be wonderful if we could have a similar workshop in South Africa, which would develop our teachers as this workshop was doing for American teachers. A similar thought occurred to an Australian participant after he had attended Project Atmosphere and he has subsequently started a similar project in Australia.

Since participating in Project Atmosphere in 1989, I have conducted over 40 weather-related workshops based on the materials I received from the workshop. The feedback from teachers who have attended these sessions has been extremely positive. Other South Africans who have attended Project Atmosphere in the USA over the years have also presented workshops around the country. Some have written to AMS and myself about their success at teaching other teachers and learners what they had learnt on Project Atmosphere. There has, however, been no study done in South Africa to investigate whether these workshops have benefited participants who have attended Project Atmosphere. Nothing is known about whether these teachers are now able to conduct meteorology lessons in their classroom, whether they have all been able to pass this information to other teachers and whether this has helped these teachers to conduct meteorologically related lessons. Joyce & Showers (1981) state that participation in in-service training sessions does not guarantee that newly acquired knowledge and/or skills will be put into practice. It is with this in mind that an interest arose as to whether the materials and hands-on activities presented during the Project Atmosphere workshop could assist South African teachers in teaching weather-related topics more effectively and whether these could help reach the aims and objectives of an outcomes-based philosophy of teaching.

### **1.3 Nature of the study**

For Project Atmosphere to be meaningful the materials obtained by the participants on the workshop have to bring about an improvement in teaching practices and student learning. These improvements are often difficult to measure and may differ from one situation to another. Teachers, however, have a great

deal of knowledge about what works and what does not in the classroom situation. Their perceptions and attitudes towards implementing these activities could be researched to gain an understanding of whether or not teachers perceive these workshops to be beneficial to their teaching and if they feel they will aid student learning. “Since the decision about whether or not to try recommended practices is generally a conscious one made by teachers, it is important to understand what factors influence that decision” (Guskey, 1987, p. 62).

Research by Doyle and Ponder (1977) suggests two factors that have an influence on whether or not a teacher will implement a new practice. These are (a) how well the new practice aligns with teachers’ present teaching philosophy and practices (*congruence*), and (b) the extra effort and time a teacher would need to implement the new practice (*cost*). Sparks (1983) goes further, suggesting that teachers’ perception of the *importance* of implementing the new practices and the *difficulty* of using the new method also played a role when teachers were considering whether to implement a new practice. However, Ghaith & Yaghi (1997) found that difficulty of implementation was highly individualistic and unrelated to willingness to implement new practices. These factors of congruence, cost and importance are investigated in this study to see if they had an influence on implementation practices of participants of Project Atmosphere.

General teacher efficacy and personal teacher efficacy will also be considered in this study. Guskey (1988) found that teachers’ sense of personal efficacy influenced their attitude towards new practices. He found that teachers who scored high in terms of personal efficacy rated new practices as congruent with their current practices. They considered them more important and less difficult to implement than teachers who score low in terms of personal teacher efficacy. Teachers with a strong sense of teacher efficacy are more willing and more likely to implement innovative programmes (Ghaith & Yaghi, 1997; Guskey, 1988). Personal teaching efficacy refers to the teachers’ own ability in leading learners to action whereas general teacher efficacy is the belief that the teacher population’s ability to perform these actions is limited by factors beyond the school’s control. These two factors make up what is referred to in the literature as teacher efficacy. Teacher efficacy is not a measure of self-esteem. Efficacy measures are concerned with how a person perceives their competence with respect to a task rather than their actual level of competence (Goddard, Hoy and Woolfolk Hoy, unknown). Self-esteem on the other hand is considered to be a trait whereby a person reflects on their evaluation of self (e.g. self-worth or self-liking) (Goddard, Hoy and Woolfolk Hoy, unknown). A geography teacher may feel hopelessly inefficacious at teaching history of art or accounting but this does not affect their self-esteem because the teacher has not invested self-worth in doing this activity well. It has been reported by Pajares (1997) that

individuals' self-concept or self-esteem are not good predictors of behaviour where as individual efficacy beliefs are. Two instruments have been recognised as the standard measure of teacher efficacy and there is extensive evidence for the reliability and validity of both (Ross, 1994). These two instruments consist of the Rand items and Gibson and Dembo (1984) 16 item questionnaire. The Rand instrument has one item for personal efficacy ("If I try really hard I can get through to even the most difficult or unmotivated student" and one for general teacher efficacy. ("When it comes right down to it, a teacher really can't do much because most students' motivation and performance depends on his or her home environment"). The Gibson and Dembo (1984) questionnaire contains seven items for general teacher efficacy and nine items for personal teacher efficacy. Both these questionnaire will be used in this study to ascertain if there are any difference in efficacy score between teachers and teacher trainers. Efficacy beliefs help determine how much effort people will expend on an activity, how long they will persevere when confronting obstacles, and how resilient they will prove in the face of adverse situations (Pajares, 1996).

It is therefore proposed that this study investigates the extent to which the South African teachers who attended the Project Atmosphere in the USA since 1998, were able to use what they learnt at the workshop in their own classrooms. It is also proposed to investigate the extent to which they were able to train other teachers to use these activities. If these participants experienced difficulties in transferring what they learnt from the workshop into their own classrooms, it is difficult to see how they would be able to help other teachers implement the activities or use the materials even if they did run workshops on their return. It is thus important to find out if these participants experienced difficulties and if they did what they were in order to improve the Project Atmosphere training from a South African perspective.

### **1.3.1 Objectives of the study were to:**

- a) investigate how much the South African participants of Project Atmosphere have benefited from the training they had received at Project Atmosphere and to what extent they have been able to implement what they have learnt in their classrooms;
- b) find out to what extent South African participants in Project Atmosphere have been able to share their newly acquired knowledge and skills with other teachers;
- c) investigate if factors such as the congruence (similarity of the activities learnt to what was usually done by the participant in the classroom); cost in terms of extra work and time of implementing the activities; difficulty and importance of implementing the activities received at Project

Atmosphere had an influence on teacher ability to implement what was learnt on Project Atmosphere;

- d) investigate if the activities presented at Project Atmosphere help South African teachers to reach the aims and objective of an outcomes-based philosophy of teaching; and
- e) comment on possible improvements to the training offered and provide insights into the possibility of setting up a similar workshop programme in South Africa.

### **1.3.2 Limitations of the study**

- a) The study was limited to the South African participants in Project Atmosphere.
- b) No pilot study could be conducted as there have been only 15 South African participants on Project Atmosphere and it was felt that the sample size would have been further reduced if a pilot study were conducted.
- c) The Project Atmosphere participants were the only sources of information as to whether the materials obtained on Project Atmosphere were beneficial to the South African situation.
- d) No study was carried out to see if the learners benefited from the activities in terms of understanding meteorology.

## **Chapter 2: What the literature has to say about Teacher Professional Development**

### **2.1 What is teacher professional development?**

Professional development is a complex enterprise which is full of ethical, structural, and cultural dilemmas (Richardson, 2003). This complexity often makes it hard to pin down exactly what authors of professional development research mean when they talk about professional development. There are very few definitions of teacher development to be found in the teacher development literature (Evans, 2002). Ling & Mackenzie (2001) are among the few who do provide a definition. They see professional development as a means of empowering teachers by providing them with an ability to update and upgrade their knowledge and qualifications. They also say that one of the ‘major purposes for which professional development is designed is to facilitate positive change in the education system and in the theoretical and practical knowledge and attitudes of individuals of whom the system is composed’ (p. 401).

Joyce and Showers (1981) state that it is not enough that teachers learn new knowledge, skills or strategies at a training course. These aspects need to be implemented in the classroom in such a way that learning is facilitated. Van Tulder, Veeman & Sieben, (1998) agree but add that in-service training also serves to implement politically agreed-upon innovations in schools. Thus professional development needs to provide teachers ‘with a bridge to new understandings.’ (Davis, 2001, p. 27). Professional development must be influenced by professional learning goals and by the particular context in which this learning takes place (Loucks-Horsley, Hewson, Love & Stiles, 1998).

There are many ways in which teachers can develop as professionals. These range from formal interventions such as courses, workshops, lectures seminars and field trips, to casual everyday encounters such as sharing of information, watching others teach and feedback from peers, parents and learners. The way in which these interventions or encounters lead to some sort of professional development differs with regard to different groups of teachers and indeed individuals. One teacher may be encouraged to develop his/her practice because of knowledge obtained while attending an in-service course while others attending the same course may be unaffected. Others may be influenced by talks held with a fellow teacher while some may change by reflecting on learners’ responses (Evans, 2002). Thus the types of professional development are as varied as the teachers who are engaged in them (Bintrim, 2002).



Evans (2002) sees professional development as change that can be categorized as learning and would not include change that was detrimental to teachers' professionalism and/or the profession. Thus, although teachers may change during their careers, professional development is seen as inclusive of every change that teachers make which helps them improve as professionals. The problem here is that different people view change differently and everyone may not agree on which changes are and are not considered to be professional development. Thus, teachers may view professional development as something very different from what the government, parents or even school governors do (Evans, 2002). But one thing is clear. Changing one's beliefs and attitude about teaching and learning can come about only by practising the new behaviour (Davis, 2001). Teachers, not only learners, need to become life-long learners with a view that there will always be important things to learn (Loucks-Horsley et al., 1998)

## **2.2 Why is teacher professional development needed?**

It is by understanding why teachers need professional development that the nature and definition of professional development can truly become clear. According to Harris (1998), in-service training is needed because people are required for building and maintaining the quality of educational programmes and people need to have their knowledge and skills upgraded from time to time. Teachers also need to feel competent and comfortable in creating the right learning environments for the learners (Loucks-Horsley et al., 1998). As educational developments take place, so teachers need to learn how to create these new learning environments.

Another reason for professional development is that some teachers may feel they have been inadequately prepared for the task of teaching. Debby Saintil (2001), a teacher turned researcher, stated that she needed professional development because she realised she did not know how to teach even though she had received training to become a teacher. She goes on to say that teachers need professional development to "hone their craft" (p. 22).

Due to the fact that the content making-up subjects does change as new discoveries are made, teachers especially those teaching the sciences, economics, computers and technologies, need to up-date their knowledge so as not to teach out-of-date theories or passing on incorrect information. For this reason it is important that teachers are brought up-to date, especially those who have been teaching for some time and may not be aware of the changes taking place in their subject.

Schools are also being asked to teach learners about an ever-increasing number of social aspects that affect society today. These include AIDS education, substance abuse, dealing with issues relating to

environment. Thus the areas of knowledge for which teachers are responsible are increasing and professional development is seen as a way to keep teachers informed of these topics.

There is also a need in some countries, especially developing countries, to improve teachers' knowledge of the subjects they teach to increase the quality of education that is offered. In-service training is seen as an important aspect in achieving this (Harvey, 1999).

### **2.3 Types of teacher professional development programmes**

Professional development programmes can take on many forms, because the professional developers running these programmes try to cater for the needs of specific groups of teachers who attend. According to Loucks-Horsley et al. (1989), formal professional development sessions can use any of three main strategies. The first are sometimes referred to as in-house programmes, which cater for teachers of a particular school and focus on their specific developmental needs. The focus of this development is to address the needs of that particular school staff either as intact groups of teachers such as leadership teams, single departments and grade levels, or it could be used to develop all the teachers at that school. The second type is where teachers from different schools come together to build their own professional communities amongst themselves. These communities are seen as forums in which teachers can share ideas and problems, and come up with their own solutions. One of the goals of this type of professional development programme is to help build relationships among the participants and encourage the teachers to maintain these relationships long after the professional development programme has taken place. The third type is to develop teachers so that, once they return to their schools, they will be able to build their own professional communities. This type of professional development has to encourage the participants on their return to talk to others about what they have learnt. They must work with management structures to gain their support and explain to these structures what to expect from what they have learnt and to encourage other teachers to participate in similar learning experiences.

Evans, (2002) goes further and identifies two constituent elements of teacher development, which she refers to as *attitudinal development* and *functional development*. The difference between the two is related to the focus of what type of change the professional developers hope the teachers will undergo. In attitudinal development it's the teachers' attitude to their work that is the focus of the development process whereas the functional development is seen as the improvement of the teachers' professional performances. Evans does not stop here but divides both attitudinal and functional development into two constituent change features. Attitudinal development is divided into *intellectual development* - where the teacher would for example become more reflective and/or analytical, and *motivational development* - where the teacher becomes more highly motivated in general or in relation to specific aspects of her/his

work. Functional development incorporates *procedural* and *productive* as its two constituent change features. By *procedural* Evans refers to some change, no matter how small, to the way a teacher carries out some aspect of his/her job. *Productive* development would be seen as a teacher doing more than he/she had done before attending the training e.g. works longer hours to produce more resources. Evans makes the point that only positive developments are seen in the light of these foci of change and teacher development needs to enhance teachers' professionalism.

Professional development programmes can address one of the foci above or may choose to incorporate a few such foci. Davis (2001) believes that professional development should incorporate subject matter knowledge, because it is hard for teachers to develop strategies and techniques that will aid student learning without it. She also believes that teachers who attend professional development programmes should be challenged to address what they know and believe about teaching, learning, learners and subject matter. They should be given a context in which to examine, critique, and weave new ideas obtained at the training into their teaching.

Although subject matter knowledge is important, teacher knowledge needs to go beyond this to the dimension of how to teach that subject matter (Schempp, 1995). This knowledge is extraordinarily resistant to change. It is often protected by the mystique of the profession and hidden behind classroom doors (Griffin, 1983). Stuata and Tatto (2000) noted that teachers tended to teach as they had been taught unless deliberate steps were taken, not only to challenge their assumptions but also to ensure that they themselves experienced alternative methods so they understood them properly. Lange and Burroughs-Lange (1994) found that challenging a teacher's existing knowledge and learning process and their role within in it, caused them to develop professionally. Teachers' perception of their own professional identity can affect the efficacy and professional development. It can also affect their ability and willingness to cope with educational change and to implement innovations in their own teaching practice (Beijaard, Verloop & Vermunt, 2000). Thus, understanding the theory behind the teaching approach could contribute to the development and ultimate use of skill (Joyce & Showers, 1981) and thus should be part of professional development programmes.

Understanding how teachers learn is also important if professional developers are going to help facilitate teachers to develop as professionals. Millar (1988) suggests that work on children's learning could provide guidance for the designing of learning activities for adults. There may however, be great differences between how a child and how an adult learns. Ward (1985) said that if we are to develop training approaches that are effective we must pay attention to what is known about adult learning, cognition, and change as well as about effective teachers per se. Darling-Hammond (1985) argues that

the most neglected aspect of educational pre-service training is the understanding learners and how they learn. This is what is needed if teachers are to become more than information transmitters, and learners more than passive receptacles. It can be argued that this aspect of understanding is vital not only for pre-service training but for all in-service programmes as well.

Schempp (1995) in his study of one teacher revealed that this teacher looked for curricular content that fitted his teaching style, and was inclined to select new activities that fitted his mode of teaching rather than seeking new ways to teach old subject matter. Romanowski and Oldenski (1998) also found that teachers tend to approach their subject matter from their own perspective, selecting some objectives or pieces of knowledge at the expense of others. Their views determine not only what they choose to teach but also the methods they use. Another interesting finding from Schempp's research was that the teacher in question expressed frustration at suggested changes to the way he taught, because these seemed to negate previous work. This observation may explain why teachers are reluctant to implement what they have learnt in in-service training programmes if it is contrary to what they have been doing. Further research into whether this claim is in fact valid needs to be conducted. Lange and Burroughs-Lange (1994) believe that the way teachers acquire and use knowledge is contextual, interactive and speculative.

Joyce & Showers (1981) state that the provision of coaching and psychological support from professional developers to teachers was also an important aspect in the implementation of professional development programmes. They see this transfer process as being positive or negative, depending on whether prior learning facilitates or retards future learning. Thus professional developers need to take note of prior learning and try to show how what they want teachers to learn or take away from their courses negates or fits in with this prior learning.

There seems to be no consensus on the best way to set up professional development programmes that will train teachers to become more effective in the classroom. The literature reveals that programmes evolve, change, and develop out of the perceived needs of teachers, of time and of the place (Stuarta & Tatto, 2000). Ling and MacKenzie (2001) feel that a flexible approach is needed where the people giving the course need to adapt to teacher differences. There are trends that evolve with regard to professional development, and Stuarta and Tatto (2000) see a move away from a behaviourist to a constructivist view of knowledge. This trend will affect how training is conducted and may cause problems for those who believe that knowledge is fixed and that teachers are there to transfer what they know to their learners. This could account for some of the negative reactions of teachers to new programmes. Griffin (1983) said that professional development will not occur unless teachers are willing to take their teaching out of

the closet of the classroom, admit that it needs improving and then make it the focus of their development.

## **2.4 Teachers' response to professional development**

Teachers differ from one another in terms of their personalities, their experiences and the teaching environment in which they find themselves. It can thus be expected that they will respond differently as to how they want to develop as teachers and thus it is naive to expect that teachers will change their ways simply by attending a course. Teachers, especially experienced teachers, have developed ways of doing things that work for them in their particular situations. They may therefore not want to give up these tried and tested methods for new ones which they may feel will fail (Sparks, 1983). Many teachers screen information for its usefulness, rejecting what is unfamiliar, accepting what is tried and true (Galloway, Seltzer & Whitfield, 1980). There thus needs to be an openness to and an acceptance of change by teachers if professional development is to occur (Ling & MacKenzie, 2001)

Davis (2001) argued that teachers' beliefs on learning and teaching experience can act as a 'filter' when teachers look at new knowledge and decide whether to incorporate it into their practice or disregard it (p. 5). In Korthagen's (2001) review of the book "Developing Teachers, the Challenges of Lifelong Learning" we are reminded that teachers' development must deal with the natural emotional reaction of human beings to the threat of losing certainty, predictability or stability if we want to contribute positively to teacher development. Change can be a painful process and in some ways reflects dissatisfaction with the past. To admit that there is a better way to do something is often hard, especially if, for many years, you have been doing what needs to change. This dissatisfaction with the past is seen by Feldman (2000) as being the first step or condition needed for teachers to change the practices that govern their teaching. Without this dissatisfaction there is little to motivate a teacher to change. They may see no reason not to continue to teach as they have always done. Teachers are also not likely to become dissatisfied with existing practices if they deem them to be successful and will not discard them for another approach which they feel will be "educationally unsound and unsuccessful with learners" (Davis, 2001 p. 23).

A lot of teachers are not dissatisfied with the way they teach. This, however, does not mean they are not changing or developing as teachers. Richardson (2003) states that there is considerable research that indicates that teachers change all the time

*they (teachers) reorganize their classrooms, try different activities and texts, change the order of topics in the curriculum, emphasize different interpersonal skills, and so on -- all on a voluntary*

*basis. When teachers experiment with new activities in their classrooms, they judge the new practices according to whether or not they "work." When these new activities engage the students, do not violate the teacher's particular need for control, match the teacher's beliefs about teaching and learning, and help the teacher respond to system-determined demands for such outcomes as high test scores, they are deemed to work. If they do, they are internalized and absorbed into the teacher's repertoire (p. 404).*

These changes can be seen as professional development if they assist learners to learn more effectively.

Korthagen (2001) calls for a need to take teachers seriously and to aim at working with them on the basis of their needs and concerns. He goes on to say that teachers do not develop passively and it is therefore essential to involve them in decisions concerning the direction and process of their own teaching. There is a need to integrate with what is already there. Teachers change based on who they are and what they have experienced (Lange & Burroughs-Lange, 1994). We need to recognise that teachers have valuable existing experiences and these should not be overlooked or brushed aside. Professional developers are encouraged to try and incorporate these experiences into their programmes. This will help to assist teachers to see things in a new way and to develop additional methods of teaching rather than forcing teachers to choose between the way they have always done something and a new way of doing it. Professional development must therefore be viewed as part of a continuous process of follow-up and feedback. A once-off activity is not effective in changing teachers' behaviour (Howey & Vaughan, 1983).

Van Tulder et al (1988) found that teachers were more likely to benefit from programmes in which they chose their own goals and activities rather than from programmes in which goals and activities were pre-planned. The teachers in their study, however, did not want to take control completely - just have a greater say in the decision-making regarding in-service training. Ward's (1985) findings differed; he found that when the instructor took almost exclusive responsibility for the design and teaching of the class, it proved to be successful. These differences may be attributed to the types of courses being offered as well as the ways these teachers prefer to be taught.

In a study of physics educators it was reported that the teachers felt that, if implementation was to take place, the in-service training should be closely linked to the realities of practice. Training should be compatible with the syllabus followed by the teachers and should be realistic in terms of the school situation (staffing, technical support, quantity and quality of equipment and support) (Millar, 1988). Feldman (2000) found that the new practice must appear reasonable, it should be understandable,

sensible, beneficial to teachers' particular situation and be in line with the teachers' goals. Teachers must also be convinced that, adopting a programme or adapting their behaviour, skills or attitude will not result in a loss or reduction of something which is more important to them (Howey & Vaughan, 1983). One of the major mistakes underlying many attempts to implement professional development programmes is failure to meet the needs and concerns of the teachers and failure to take their work circumstances into account (Korthagen, 2001). Ling and MacKenzie (2001) found that teachers differed on how professional development should be offered although many thought that long-term professional development was effective. The teachers in this study valued presenter expertise, relevant content and appropriate handouts.

In-service training has been thought to be a solution to getting teachers to accept change and to show them alternatives to the way they do things. However, it must be remembered that just because a teacher attends a course is no guarantee that newly acquired knowledge, insights and skills will be put into practice (Van Tulder et al., 1988 and Joyce & Showers, 1981). 'Change occurs only when beliefs are restructured through new understandings of teaching and experimentation with new behaviours' (Loucks-Horsley et al, 1989 p. 39).

## **2.5 Teacher experience plays a role in teacher professional development**

A large proportion of the literature on professional development deals with how either novice or experienced or expert teachers develop as professionals. The literature seems to suggest that teachers starting out in the profession are more concerned about how others see them as teachers. However, as experience is gained, teachers begin to be more concerned with teaching tasks and reporting increasing problems with administrators and parents (Adam, 1982). These concerns may influence the type of professional development training a teacher will attend. The teachers' conceptions may also influence the interpretation of the new information and experiences and thus influence what is learnt from training courses (Anderson, Smith & Peasley, 2000). Selective attention may prevent teachers from perceiving the value or worth of what is being presented. They may also pay attention to familiar ideas and not consider other ideas, and thus miss-out on the learning opportunities (Anderson et al., 2000). It has been noted in some studies that older teachers are more resistant to change, and they are less likely to believe that the new ideas would work (Sparks, 1983). On the other hand younger teachers may be enthusiastic and committed to the changes but often lack the skills and expertise of the older teachers to implement the changes (Sparks, 1983).

## **2.6 The context in which professional development takes place is important**

Ward (1985) states that it is the context within which a development programme or activity operates that gives it meaning and significance. Thus the nature of the school in which teachers teach can have important implications for the continuing development of teachers' skill and knowledge (Clement & Vandenberghe, 1999; Howey & Vaughan, 1983; Saintil, 2001 and Ward, 1985). Kaufman (1988) noted that "teachers require a professional environment that is organised to enhance learning and development, supports inquiry into practice, and allows for the exploration and dissemination of ideas that contribute to the knowledge base of the profession" (p. 84). Schools need to address these issues and maintain a productive educational environment, a satisfying place to work for professional development to take place. It is thus important that any professional development programme takes into consideration the context within it wishes to operate.

## **2.7 Support and feedback from peers and managers**

A lack of feedback from peers, courses providers, principals and teacher trainers on how well teachers are doing in the classroom seemed to be a limiting factor with regard to teachers' professional development (Dunn & Shriner, 1999), resulting in a repetition of the same teaching practices year after year (Ward, 1985). If feedback was part of the development process this problem could be addressed. Reflection on experience of applying new learning skills, knowledge and strategies is also seen as very important in promoting professional development (Oja, 1991). This reflection can support individuals who are confronting old assumptions with new learning (Oja, 1991). According to Osterman and Kottkamp, (1993) reflection enables teachers to focus on their own work in an effort to develop a deeper understanding and a higher level of competence. As they share ideas and information, they increase their sense of efficacy and effectiveness. It is also important for professional development that continual, consistent, on-site peer supervision and advising of teachers by colleagues and staff developers is done (Oja, 1991). Course developers would be wise to include enough time in their course structure to enable this reflection by both participants and trainers to take place. It has been noted that when teachers are able to reflect on newly acquired content and pedagogical knowledge with their peers in a collaborative and supportive atmosphere, they can and do modify their classroom practice (Swafford, Jones, Thornton, Stump & Miller, 1999). Kaufman (1988) goes on to state that, too frequently, teachers are isolated from one another and forced to operate with minimal resources to exchange, share, discuss, coach, think out aloud, and test ideas. Seeking advice from other teachers is viewed as an admission of incompetence (Ward, 1985). This reluctance to ask for help can be a huge barrier to professional development. Therefore professional development could and should provide for an opportunity to break down these barriers and let educators share where they are at and what they know.



Good leadership is also seen as a positive influence for professional development. Howey & Vaughan (1983). Van Tulder et al. (1988) found that schools that successfully implement staff development programmes have the active involvement and support of their principal. Ward (1985) also found that an effective principal is important in creating a positive environment for professional development. There needs to be trust between principal and teachers, good staff relations and teacher support for professional development to be successful (Clement & Vandenberghe, 1999; Griffin, 1983).

## **2.8 Criticisms of teacher professional development**

In the literature, many researchers have highlighted weakness with regard to professional development. Evans (2002) feels that there is a lack of conceptual clarity with regard to teacher development and that there is a need for clearer definitions as to what is meant by this term ‘professional development’. By clarifying and defining it, a shared understanding can be established. Evans goes on to say that “teacher development, as an area of study, tends for the most part to be dominated by issues, while the concept itself and the methods that may effect teacher development remain comparatively neglected” (p. 123)

The effectiveness of programmes has often been measured on the basis of participants’ satisfaction and not the degree of changed teacher behaviour or increased student learning (Schlechty & Whitford, 1983). Wade (1985) calls for effectiveness of programmes to be measured not only at the level of participants but also at the level of students they teach.

Other criticisms of professional development programmes, according to Schlechty and Whitford (1983), have been that courses do not take into account the students, school or classroom context of the participants. There is little continuity and coordination of programmes. Teachers who attend courses rarely receive feedback and are often unaware of whether or not they have made any improvements (Howey & Vaughan, 1983). Professional development is often presented and seen as a way to correct a fault or shortcoming of the teacher rather than as a normal growth experience. There is a lack of attention given to support systems in the development process and the courses often do not take into consideration what is known about effective teaching and professional development (Howey & Vaughan, 1983).

Stein & Wang (1988) stated that teachers play a central role in the effective implementation of innovations and thus require training support. However, Edmonds and Lee (2002) found that teachers’ own development priorities are not always taken into account, and teachers often feel they do not have much individual choice in terms of which course they would like to attend. Many teachers feel that insufficient time and resources make it difficult to attend professional development courses. A further

criticism of professional development has often been that there is little external incentive for teachers to attend these courses or programmes. Whether they work towards developing as a teacher or not they receive the same salary and/or decision-making power as teachers who continue to teach as they have always done (Saintil, 2002). Thus the motivation to attend training courses is often not there. This may not be an issue that professional developers can solve, and is something that educational authorities need to address.

Howey and Vaughan, (1983) and Halpin, Croll and Redman (1990) found that very few programmes have conclusive evidence of the impact of their effects on changing the behaviour of teachers and other staff or increasing student learning. Howey and Vaughan do however admit that there is no appropriate method of exactly tracking the impact of programmes. Loucks-Horsley et al. (1998) think that there is a general lack of evidence about how effective professional development is because professional developers do not write about their work enough. When consulting the literature on what makes a workshop or teacher training session effective it was found that most of the research has been conducted in so-called first world countries with little consideration being given to developing countries. It is hoped that professional developers in developing countries will begin to write about their work so that a knowledge base on professional development in this context can be built up.

## **2.9 Concluding remarks about teacher professional development**

Professional development is not an easy process and requires a lot of planning and forethought. Professional developers need to know what experiences and activities will cause teachers to re-evaluate their knowledge and strategies if they hope to influence teachers' teaching methods (Lange & Burroughs-Lange, 1994). The course design also needs to take into account the importance of individual characteristics, school environments, prior learning and development if they are to be successful (Lange & Burroughs-Lange, 1994; Millar, 1988; Saintil, 2001).

Saintil (2001) believes that in-service professional development must be teacher-driven. She feels that teachers must be given the independence to identify their own pedagogical questions, and be provided with the opportunity to come-up with the answers to their own questions. She sums this position up nicely by saying

*“To improve my teaching, I needed to develop techniques for identifying my classroom challenges, proposing informed solutions, implementing my solutions and assessing the outcome. I had to be at the centre of my professional development because I was the only expert on my classroom challenges” (p. 22).*

The perception that educational reform could occur simply by creating more finely-tuned regulations to be imposed on schools has long gone (Darling-Hammond, 1995). The failure of these efforts to transform life in the classroom has been apparent. It seems that legislation and regulations prescribing what educators should do, has failed to transform educational practices in the United States of America (USA). The policy community within the USA have come to understand that building the capacity of teachers is the only hope for transforming the nature of teaching and learning, and this is causing a rethink with regard to educational training (Darling-Hammond, 1995). In South Africa, if we want teachers to adopt a more outcomes-based approach to teaching, then we need to find ways of building capacity not by simply imposing new policies upon schools but by leading teachers to want to develop the skills that will enable them to reach the goals set out by the policy makers.

The first way to encourage teachers to take part in professional development initiatives is to make such opportunities available to teachers. Many teachers in South Africa receive all the training they are ever going to get during their in-service training. After this they are on their own as it were.

Professional development initiatives should not be developed as a knee-jerk reaction to a need. They should be carefully designed to meet the needs of the teachers they hope to develop, taking into account the environment in which these teachers teach. It is risky to adapt courses and to use materials from other countries as a way to get development programmes set up quickly. These courses may not meet the needs of South African teachers and may suggest ideas that cannot be implemented in the South African context. We can, however, adapt and develop overseas programmes to suit our needs in order to benefit from these. It is thus hoped that, by studying participants who have attended Project Atmosphere, which is an American programme, we in South Africa can adapt the programme to suit the specific needs of South African teachers who want to improve their teaching of meteorology.

## **Chapter 3: Method**

Project Atmosphere was designed to assist American teachers in teaching meteorological concepts to their learners. The idea was to give the teachers a sound theoretical understanding of the broad concepts that are central to an understanding of meteorological processes and then to provide teachers with activities which they could use to get these concepts across to their learners in a meaningful manner. This programme was designed with American teachers and their learning environments in mind and thus it can not be taken for granted that, just because it helped to develop American teachers, it will do the same for South African teachers. It is hoped that this study will bring to light aspects of the training that helped South African teachers to develop. These aspects can then help to implement the type of training we need to develop in South Africa that will assist teachers of meteorology to teach the subject more effectively.

### **3.1: Sample group**

Fifteen South Africans attended the Project Atmosphere workshops from 1998 to 2003. These participants all applied and were selected by the AMS to attend a two-week training workshop in meteorology in Kansas City, USA. The data for this study were gathered from seven (N=7) of these participants. Of the others, six could not be located, one is a weather observer and it was felt that he could not be compared to teachers or teacher trainers. I did not include myself in the study group although I did add comments where I thought they would further illustrate a point raised by the other study group members. Three of the participants in this study were high-school teachers and four were teacher trainers when they attended Project Atmosphere. Three are male and four are female. They were considered to be experienced teachers having an average of eleven years' teaching experience at the time that they attended the training. All the teachers taught grade 12 geography, while a few of them were also responsible for other grades. The teacher trainers had contact with a wide range of teachers who taught different grade levels. These participants did not all attend the course at the same time. I attended the course in 1998, one participant attended in 2000 and there were two participants in each year from 2001 to 2003.

### **3.2: Procedure**

The participants in the study were asked to complete a questionnaire. The first part of the questionnaire measured teachers' sense of efficacy (see appendix 1). The questionnaire was developed by Gibson & Dembo in 1984 and originally contained thirty items. Gibson and Dembo found that only 16 of these items had acceptable reliability coefficients. These 16 items, together with 4 items that related to the

adequacy of teacher's preparation or training, were used in this study. It was felt that the 4 items were of particular relevance to this study. In addition the two original Rand items were also included. The questionnaire totalled 22 items. Each item asked the participants to indicate their feelings regarding a particular statement on a five-point scale from strongly agree to strongly disagree. Thirteen statements dealt with personal teaching efficacy and the remaining nine dealt with general teaching efficacy. The responses to the teacher efficacy items were reversed so that a high score on both the personal efficacy and teacher efficacy indicated a more efficacious response. Scores for personal teaching efficacy and general teaching efficacy were computed for each participant by adding the scores on the thirteen and ten items separately. In a study by Woolfolk and Hoy (1990), using the same instrument, the Cronbach's alpha was .74 for the teacher efficacy scales and .82 for the personal efficacy scales.

The second part of the questionnaire assessed the participants' attitudes towards the implementation of activities learnt at the Project Atmosphere workshop (see appendix 2). Guskey's (1988) measure of teachers' attitude towards innovation was used. Participants had to rate four statements on a series of five-point Likert-type scale. The four statements dealt with:

- the congruence (similarity of the activities learnt to what was usually done by the participant in the classroom);
- cost in terms of extra work and time of implementing the activities; and
- difficulty and importance of implementing the activities received at Project Atmosphere.

Congruence was measured by asking the participants to rate on a scale of 1 to 5 "How similar were the activities learnt on Project Atmosphere to the way you conducted your classes before attending the workshop?" To assess cost, participants were asked, "how much extra work will it take for you to implement the activities in your classes?" Ratings ranged from no extra work to lots of extra work. The item addressing difficulty was measured by asking the participant "how difficult will it be to implement the activities in your classroom?" The ratings ranged from very easy to very difficult. To test importance participants were asked "how important do you believe it is for participants to use the activities?" Ratings ranged from unimportant to very important.

All participants were then interviewed over the telephone, in order to gain more detailed information on the extent to which ideas and practices emerging from the in-service training were transferred to the participants' own classrooms and more widely throughout their schools and their district. Questions asked can be found in appendix 3. The complete responses of the participants to each and every question were written down as the participant answered the questions.

The study was also concerned with whether participants experienced changes in their meteorological knowledge after attending Project Atmosphere. It was decided not to use any form of test or examination to do this as this would have been unacceptable to the participants. Also, not all participants could be tested before and after they attended the training. Participants were thus asked to what degree they thought their knowledge of meteorology had improved by attending the training.

The results of this study were developed from analyses of the questionnaire responses and the interview transcripts. The interview data were analysed to assess what proportion of teachers attributed particular effects to their attendance of Project Atmosphere. These effects were then grouped to determine common themes and ideas for the study.

## **Chapter 4: Results**

As discussed in Chapter 1, Project Atmosphere provides in-service training for individual teachers who are interested in meteorologically related topics. It seeks to develop teachers to become specialists in the teaching of meteorological topics and to provide them with the skills to share with others what they learnt on the course. The South African participants in this study were very enthusiastic about Project Atmosphere. The results show that all the South African participants felt they had gained a lot from the experience (teachers' own words) and that they were able to pass on what they had learnt to both learners and fellow teachers. They viewed the workshop as an excellent vehicle through which teachers could be empowered to teach meteorological topics more effectively. The positive and negative aspects of the workshop will be discussed below. Also included in the discussion will be: the role the workshop played in improving knowledge of meteorological concepts; the impacts of the material received on teaching methods; how the workshop assisted with the implementation of C2005; participants' sense of teacher efficacy; and supervisory support for the workshop.

### **4.1: Perceived positive aspects of the Project Atmosphere workshop**

Project Atmosphere, although designed by Americans for Americans, is helping to provide much-needed information and activities around the topic of meteorology to South African teachers. All the South African Project Atmosphere participants speak of the important contribution Project Atmosphere has made in their lives and the lives of other teachers with whom they were able to share what they had learnt. Participants talk of the "high standard" (participants own words) of the material both presented and provided to them. One participant explained that one can always read a book, but when information is explained to one, then real understanding takes place. Five out of the seven participants mentioned the high standard of the content material received. Special mention was made by three of the participants of the high quality of the presenters of the components of the workshop programme. Three of the participants explained that because the presenters knew what they were talking about, and were able to convey what they needed to get across to the participants, they themselves became confident to present workshops to other teachers on their return to South Africa. They felt they had acquired the knowledge they needed in order to present workshops to other teachers. One participant stated that the Project Atmosphere presenters motivated him to present workshops on his return.

The participants also talked about the workshop not only helping them professionally but instilling in them that what they learnt was fascinating and valuable to know as a person. One participant tells the story of how, while she was flying over the equator on her way to attend the Project Atmosphere workshop, the aircraft experienced some turbulence. She said she thought she might die. On the course one of the

presenters talked about the Intertropical Convergence Zone and she suddenly realised why she had experienced what she did. On the trip home she asked one of the airhostesses to explain what the doldrums were. The airhostess said she would go and find out. This participant was then asked to join the pilot of the aircraft in the cockpit and he proceeded to explain the concept to her. “We talked for a long time”, she said. What was for her the most important thing was she now knew what questions to ask, whereas before she had no idea. It is this broadening of the participants’ scope of knowledge that many of them alluded to.

Meeting and talking to other teachers was of particular importance to three of the participants. One participant was eager to see how the South African educational standards compared with those of the Americans. He was pleased to find from discussion with American teachers that the South African standard of education was not as bad as he first thought. Others liked the fact that they were able to share work experiences, resources and lesson ideas with other teachers. They liked hearing of other teachers’ “success stories” as they called them, and discussing common problems. Many researchers (Dunn & Shriner, 1999; Halpin et al., 1990; Loucks-Horsley et al, 1998; Van Tuler & Veenman, 1991) have found that teachers value the opportunity to discuss problems of mutual interest with other teachers and they believed this to be one of the most relevant activities during professional development training. One of the participants who went on the workshop three years ago still has contact with a fellow participant from the USA and they continue to share resources and information. I am also still in contact with one of the American participants who attended the workshop with me and we share information and ideas by e-mail from time to time.

#### **4.2 Perceived negative aspects of the Project Atmosphere workshop**

Participants had only two negative comments to make about the workshop. Three participants felt that there was “too much information” (participants own words) to be covered in the two-week period. They felt the course could have been extended by as much as a week. They went on to say that this was not really a negative point as they realised there was not much else the organisers could do, unless the course could be extended. It was noted that none of the participants who made this comment, mentioned cutting anything from the workshop programme.

The other negative comment related to the actual material covered in that it “did not correspond or align with” (participants own words) what was taught in the South Africa syllabus. However, the participants who made this comment did admit that a lot of what was covered was in the South African syllabus. It must be remembered that Project Atmosphere was designed with American teachers in mind. South African participants were invited because donor funding allowed for two or three South Africans to attend



per year. This comment may be of specific interest to anyone wanting to set-up a similar programme in South Africa.

### **4.3 The role the workshop played in improving knowledge of meteorological concepts**

All the participants indicated that their understanding of meteorologically related concepts had improved following their attendance of Project Atmosphere. Comments like “it enlightened and equipped me, I gathered a lot”, “helped with in-depth understanding”, “did not understand El Niño and how to teach it. Now I know”, all testify to the fact that participants gained from attending the workshop. One participant explained “I never looked at clouds before, never even looked up, what for?” she goes on to say she never even knew there was a weather office near her and was honest enough to say she had never really thought about it until she attended the workshop. The course enabled her to think about the topic of meteorology more broadly and deeply so that she was able to understand the many different aspects that make-up meteorology and how they fit together. She brought a book back for her young child on the weather “so she does not grow-up like I did, not knowing about these things”. Two participants made special mention of their cultural background and the fact that meteorology was often talked about in their culture in the form of ‘beliefs’ but now they are able to understand these processes from a scientific perspective. They talked of being “misled” before.

I was worried that the participants may not have been aware that in the Southern Hemisphere high and low pressure systems revolve the other way around and that fronts are reversed as it were, when compared with those of the Northern Hemisphere. Because most of Project Atmosphere’s participants are from the Northern Hemisphere, the workshop concentrates on how meteorological phenomena occur in this hemisphere. There is thus a risk that Southern Hemisphere participants may become confused. I was pleasantly surprised that this was not the case. Some of the participants stated that it was confusing at times when listening to the lectures. One participant suggested that the lecturers use one or two more Southern Hemisphere examples now and again, but once they had returned to South Africa and worked with the materials it was not a problem.

Being shown how ‘sophisticated technologies’ (participants own words) like radar and satellites worked and how these has applications in meteorology was a highlight for many of the participants as these were totally new to most of them. They stated that they are not normally exposed to these types of technology, even at tertiary institutions where they had studied. It is interesting to note that, although this was one of the highlights of the workshop, this information was not readily transferred to their learners or other

teachers in the form of workshops on their return home. This lack of passing on information with regard to satellites and radar is probably because these technologies are not covered in the syllabus in any great detail and are only briefly mentioned in most geography textbooks.

The participants all agreed that their learners would benefit from what they had learnt on the workshop. Many of them talked of how, before attending the workshop, their lessons in geography were “theory-type lessons”. Some even suggested that learners did not find geography exciting because it was not very activity based. One participant pointed out that “teachers don’t use teaching aids when teaching weather”. Having attended the workshop the participants explained that their lessons were now more activity based and this change “encourages understanding because learners are able to see and to touch the materials – this makes a difference.”

The workshop activity that was mentioned the most with respect to learners’ understanding of meteorology was the cardboard slides. These consist of A4 sleeves in which another cardboard sheet slides. As the inner cardboard sheet is slowly pulled out one can view different aspects change through cut-out windows in the front sleeve. There are two of these slides, one for the topic of El Niño and one for frontal systems. Some participants had acquired enough of the El Niño slides to have their learners work in groups and look at the slides. Others explained they had only one or two slides and this made sharing with their class difficult. The transparency copies of the El Niño slide concerning the position of the conditions during El Niño and during the long term average (not an El Niño) were thus useful when explaining this concept to their classes when there were not enough cardboard slides to go around. The frontal system slide depicts the conditions in the Northern Hemisphere and could be confusing to learners. It was interesting to note that none of the participants interviewed thought about making their own slides depicting the conditions in the Southern Hemisphere. I have constructed a slide for the Southern Hemisphere and, on hearing this, all the participants interviewed got very excited and requested a copy. Mohlman, Coladarci & Gage, (1982) said that recommended practices that are seen as practical are likely to be incorporated into teachers’ plans, and this is evident from the comments made above.

Four participants made mention of how the lecture and activity on El Niño had specifically helped them to understand this topic. They spoke of having very little access to information on El Niño as it was not in the textbooks, and yet they were supposed to teach it.

#### **4.4 Assisting with the implementation of C2005**

Participants were particularly excited by the fact that the materials obtained on Project Atmosphere helped them to implement C2005. They responded as if this was the whole object of the workshop and explained how, because the activities suggested were hands-on, they were able to get learners involved and move away from a text-book way of conducting lessons. One participant said, “In township schools it’s chalk and talk, whereas the new curriculum wants learners to participate in the learning process”. Most of the participants testified to the fact that before attending Project Atmosphere they were chalk-and-talk type teachers, in other words reading from the text-book and having learners copy information off the blackboard. The learning was teacher driven with very little interaction from the learners in the learning process other than answering a few questions posed by the teacher from the front of the class. Group work was limited if at all present. Having attended the workshop, the participants, now feel they are able to introduce activity-based learning to supplement their teaching style. Teachers reported using much more group-work type activities where learners became involved in the learning process. Learners conducted the activities and the teachers facilitated the lessons rather than doing all the talking as was the case before attending the course. “This material helps with [learner] participation” said one participant. Another explained that in geography everything is theoretically based (textbook driven) with the exception of map work and that “Project Atmosphere creates more scope for learners to work on the materials”.

One of the participants also explained that although the presenters of the activities did not mention the specific outcomes linked to C2005 that could be reached by using these particular activities, she could think of them in her head. She also said that, when running workshops for fellow teachers, these teachers would come up with the specific outcomes too, and link these to the activity by themselves. Another participant highlighted the fact that learners have different learning styles and that, by using different activities such as those acquired on Project Atmosphere, different learning styles could be catered for. This participant also mentioned that, because of a focus on new technologies and the use of computers in some instances, learners who like computers would enjoy this way of learning.

#### **4.5 Impacts of the material received on Project Atmosphere with regard to teaching**

With all but one of the participants, teaching directly from the textbook was the main method of teaching before attending Project Atmosphere. They all stated that they now included more hands-on activities in their teaching of geography. Topics that were reported to have been used in the classroom were:

- El Niño;
- high and low pressure systems;
- surface weather maps;

- tropical cyclone (hazardous weather);
- sunlight and seasons;
- cloud in a bottle; and
- the Coriolis Effect.

The teachers said they used these specific topics because they had direct links to the grade 12 syllabus. One participant said that she used the cloud activity for her grade 9 classes.

The teachers indicated that implementing the activities obtained on Project Atmosphere would not cost much in terms of effort and time, and that they were fairly easy to implement. All the trainers indicated that implementation is also not too costly and that the activities are easier to implement than the teachers thought. All the participants thought that Project Atmosphere was very important and rated it a 5 on the scale 1 to 5, where 5 was ‘very important’.

**Table 1: Results of participants’ attitudes towards implementation of Project Atmosphere activities.**

| <b>Questions asked</b>   |             |           |
|--|-------------|-----------|
| <b>For the 4 trainers</b>  | <b>mean</b> | <b>SD</b> |
| How similar are the activities outlined in the AMS Workshops compared to the way you presented your classes before attending Project Atmosphere? (score 1 = very different, 5 = the same)                                  | 2.25        | 1.26      |
| How much extra work does it take for you to implement the activities outlined in the AMS workshops in your classes compared to the way you used to conduct your classes? (score 1 = no extra work, 5 = lots of extra work) | 2.75        | 0.5       |
| How difficult has it been to implement the activities outlined in the AMS workshops in your classes? (score 1 = very easy, 5 very difficult)   | 2           | 0.81      |
| How important do you believe it is for teachers to use the activities outlined in the AMS workshops? (score 1 = unimportant, 5 very important)   | 5           | 0         |
| <b>For the 3 teachers</b>  |             |           |
| How similar are the activities outlined in the AMS Workshops compared to the way you presented your classes before attending Project Atmosphere? (score 1 = very different, 5 = the same)                                  | 2.67        | 0.58      |
| How much extra work does it take for you to implement the activities outlined in the AMS workshops in your classes compared to the way you used to conduct your classes? (score 1 = no extra work, 5 = lots of extra work) | 3.33        | 1.15      |
| How difficult has it been to implement the activities outlined in the AMS workshops in your classes? (score 1 = very easy, 5 very difficult)   | 2.67        | 0.58      |
| How important do you believe it is for teachers to use the activities outlined in the AMS workshops? (score 1 = unimportant, 5 very important)   | 5           | 0         |

All the participants seemed to have their own methods and ideas for implementing the material received. These were linked to their needs and circumstances. The presenters encouraged participants to come up with their own ideas and methods of implementing what they had learnt. Thus some teachers may focus on the activity as a means of getting the ideas contained in the lesson across to their learners, whereas others may present the lesson in a traditional chalk-and-talk way but use the activity to reinforce what has been taught. Some teachers may use the activity as an introduction whereas others may use it to confirm aspects that the learners have already covered. There are thus many ways in which teachers can adapt what they have learnt to suit their teaching styles. This flexibility links with research by Joyce & Showers (1981) who found that newly acquired skills must be combined with an existing repertoire of skills for them to be useful. None of the participants mentioned that they had totally changed the way they taught meteorology but rather they had integrated what they had learnt into their existing teaching styles. As teachers acquire new capacities they continue to use the ones they previously had, and as the profession takes on new functions it continues to practise the former ones (Hopkins & Stern, 1996).

#### **4.6 To what extent were the participants able to run workshops for other teachers?**

Whether the participant was a teacher trainer or a teacher had an influence on the number of workshops that they were able to present. Most teachers reported running three workshops on their return. Only one teacher mentioned that he was going to be conducting more workshops this year. The teachers generally passed on information learnt at Project Atmosphere to other teachers by way of formal workshops. One teacher did, however, pass on information to two other teachers who did not attend any of the workshops she presented.

The teacher trainers reported running an average of seven workshops on their return and two of them mentioned that they would be running additional workshops this year. None of them reported just passing on information obtained at Project Atmosphere without it being in a workshop situation.

The number of people attending these workshops presented by both teachers and teacher trainers differed dramatically, with one participant having three teachers at a workshop while another reported well over a hundred. The average number of people attending a workshop was about 40. Participants invited other teachers to their workshops by way of letters. All the participants organised a venue either at their school or training facility and they offered the workshops free of charge.

In terms of sharing what they had learnt on the workshop it was interesting to see that teachers and teacher trainers were able to do this in different ways. Teachers ran workshops for other teachers at their school

and in the immediate surroundings. None of the teachers first ran the workshops for teachers at their own school as a sort of practice run before inviting other teachers from different schools in the area. This mode of operation may have been to save running the workshop a number of times for small groups of people. It does, however, show that all the teachers had confidence in the materials and in their ability to run successful workshops for others. They did not deem it necessary to practise giving the workshop to a small group of familiar teachers first. The teacher trainers were able to reach teachers from a large area and tended to combine a workshop on meteorology with one on implementation of the new curriculum.

Most of the teacher trainers were of the opinion that they should be the ones selected to attend Project Atmosphere in the United States of America in future rather than teachers. One teacher trainer said she felt sorry for 'ordinary teachers' because no one would come to their workshops. She spoke of what she called 'jealousy'. She said that other teachers were jealous of each other and would think, "What do they know? They are the same as us" and thus not attend workshops run by another teacher. She went on to say that, if you are outside the school environment, you are seen to be credible and know what you are talking about. Another teacher trainer pointed out that teachers are over-loaded and would not give up an afternoon or Saturday to come to a "casual workshop" run by a fellow teacher. They will come to a workshop on curriculum implementation because they know they have to. It was also pointed out by the teacher trainers that they have the structures and authority to invite teachers. "We can say to teachers that they have to be there." The teacher trainers, who thought that teacher trainers should be giving the workshops, said that participants in Project Atmosphere should be from an institution or the Education Department. They believe that "teachers will expect to get something from these people whereas they will see other teachers as knowing what they know even if they have been to America". Teachers did not make mention of this fact although one teacher did say that only a few teachers came to the first workshop he presented but after that more teachers heard about it and phoned to find out when the next workshop was going to take place. This is a very interesting finding and further research is needed to see if declining to attend a workshop because it is being presented by a fellow teacher is a widespread phenomenon among South African teachers.

The most popular topic presented by the participants of this study to other teachers was El Niño. The reason for this could be that teachers are required to teach this topic but there is no information currently available in the majority of geography textbooks used by schools in South Africa. El Niño is frequently mentioned in the South African media especially when there are droughts and floods. It is thus a topic that is familiar to teachers and learners but is seen as being very scientific in nature and thus difficult to understand. The workshop and cardboard slide explain the concept in easy-to-understand language.

Teachers can see what is happening when using the slide and hence they are able to understand the topic very quickly. Many of the people who have attended workshops I have presented on El Niño have exclaimed after the workshop. “Is that all there is to it?” Most people I have run the workshop for have expected it to be very complicated and difficult to understand. It is also interesting to note that this is the topic that generally attracts both teacher and the general public when I have presented it at exhibitions. People, whether they are teachers or not, seem fascinated by this topic.

**Table 2: The number and topics of workshops run by the South African participants in Project Atmosphere for other teachers**

| <b>Workshop topic</b>  | <b>Number of workshops presented</b> | <b>By teacher</b> | <b>By teacher trainer</b> |
|--|--------------------------------------|-------------------|---------------------------|
| El Niño  | 5**                                  | 3                 | 1                         |
| Tropical cyclone (hazardous weather)   | 1                                    |                   | 1                         |
| High and low pressure systems  | 1                                    | 1                 |                           |
| Clouds   | 1                                    | 1                 |                           |
| Mixture of activities linked to topics in the grade 12 syllabus (including topics above) | 20**                                 | 1                 | 2                         |

two of the participants (both teacher trainers) have just returned from the training and have yet to run workshops, but they indicated that these would be linked to the syllabus.

\*\* a teacher or teacher trainer may have run a workshop more than once and thus are counted once in the teacher/trainer column but two or more workshops are indicated in the “Number of workshop presented” column.

Most of the participants like the idea of presenting workshops that were an hour in length and covered just one topic. I found this was a good idea too, as most teachers are tired in the afternoons (when I tended to present workshops) and could only concentrate effectively for an hour, two at most. I generally present one-hour workshops at exhibitions where teachers do not have much time. When I am asked to give workshops at a school in the afternoons I generally present two workshops on different topics of an hour each, back to back, with a short five-minute break between workshops. There are usually teachers who use this break to ask more questions. The break also provides teachers who are bored with the opportunity to leave. On the odd occasion the teachers have asked me to run another workshop after I have completed a topic and if I had material with me I would generally oblige.

When participants were asked what the teachers who attended their workshops felt about the material they had presented, most said the teachers were impressed. Most of the participants, however, did not know if the teachers who attended their workshops had used the materials in their classrooms or whether they had passed them on to other teachers. One teacher said, “Yes the good teachers will use them but others just take the materials”. A teacher trainer felt that teachers who attended the workshops run by the participants would not run workshops for other teachers outside their school as there was no incentive (remuneration, credit or recognition for doing extra work) for teachers to do so. The participant went on to say “It is different for the Americans; I can see the cascade model will work there but not in South Africa”. The feeling was that more incentives should be given to teachers who help train others and the South African Education Department should look at this.

Another interesting fact mentioned by the participants was that teachers who attend their workshops like to go home with something. Most of the participants make photocopies of the materials to hand out to teachers who attend their workshop. This finding is encouraging, as Project Atmosphere materials are definitely being circulated amongst a good number of teachers in South Africa.

#### **4.7 Participants’ sense of teacher efficacy**

Teachers and trainers scored very similar on the personal and general teaching efficacy scores (see table 3). If one group had scored higher in terms of teacher efficacy it could have been argued that participants from this group should be chosen for future training programmes, as Guskey (1988) found that more efficacious teachers rated new practices as more important and less difficult to implement than their less efficacious counterparts. However, it must be said that efficacy scores can be highly individualistic and just because a group of teachers or teacher trainers score high in terms of efficacy does not mean the whole population will score equally high. Thus efficacy scores could be seen in light of the challenges that each group faces and how these challenges affects the participant’s ability to implement what they have learnt. This is however a very small study and it would be useful in future studies to include large numbers of participants. Participants’ efficacy should be measured before and after the training to see if this effect is enhanced in any particular group of participants. It may also be useful to compare the South African teacher efficacy scores with those of the American participants and look at these in relation to the number of workshops each group was able to conduct. This may provide additional insights in terms of using these scores to choose future Project Atmosphere participants.



**Table 3: Efficacy scores**

| Participant         | Personal Teaching Efficacy score |             | General Teaching Efficacy score |             |
|---------------------|----------------------------------|-------------|---------------------------------|-------------|
|                     | Mean                             | SD          | Mean                            | SD          |
| Teacher 1           | 4.46                             | 0.88        | 3.33                            | 1.22        |
| Teacher 2           | 5.08                             | 0.64        | 4.22                            | 0.83        |
| Teacher 3           | 5                                | 0.58        | 2.22                            | 1.56        |
| <b>All teachers</b> | <b>4.84</b>                      | <b>0.34</b> | <b>3.26</b>                     | <b>1.00</b> |
| Trainer 1           | 4.1                              | 1.6         | 4.11                            | 1.9         |
| Trainer 2           | 4.85                             | 1.68        | 5.89                            | 0.33        |
| Trainer 3           | 5                                | 1.08        | 2.33                            | 1.11        |
| Trainer 4           | 4                                | 1.41        | 3.33                            | 1.93        |
| <b>All trainers</b> | <b>4.48</b>                      | <b>0.51</b> | <b>3.91</b>                     | <b>1.50</b> |

Note. The efficacy scores are based on a rating scale which ranges from 1 to 6. 1 indicated low personal or general teacher efficacy and 6 indicates high personal or general teacher efficacy

## 4.8 Supervisory support

All participants spoke of their supervisors or heads of department as being very supportive about them attending Project Atmosphere. Two participants mentioned that their supervisors had attended at least one of their workshops they had presented. One teacher trainer explained that she could easily stand up in front of teachers and talk but felt very shy and extremely frightened of doing so in front of fellow staff members and her supervisors. However, after attending Project Atmosphere she was asked to run a workshop for all the fellow staff members of the organisation at which she worked. She said, “Attending Project Atmosphere gave me the confidence to do this. I never thought I was able to stand-up in front of these people and talk, but I did it”. Henderson (1976) found that outcomes that benefit schools are more likely to occur when participants in a course have the conscious support of their colleagues, in particular the head teachers or other senior staff. Clement & Vandenberghe, (2000) go on to say

*“School leaders should create an atmosphere of trust fostering teachers’ commitment and they should take them seriously. Furthermore the taking of risks, the development of creativity and the engagement in innovations should be stimulated. These structures and cultural interventions to empower teachers can be considered as measures to create a learning space. When teachers are recognised as professionals and can work in an atmosphere of trust where neither participative decision making nor autonomy are taboo, they are supported at the same time to tackle learning opportunities in a constructive way. Then professional development is possible” (p. 108).*

## 4.9 Enjoyment versus learning

Henderson (1976) mentions a specific problem of teachers who, having attended an in-service training course, frequently talk in terms “enjoyment” with respect to the course. His concern is that there is a

distinction between enjoying a course and profiting from it. The participants in Project Atmosphere never used the word “enjoyment”. They chose to focus their discussions around the professional development side of the workshop, stating its importance in terms of personal growth and the improvement to their teaching methods. Their enthusiasm for the lectures and course material as well as the course in general is an indication that they did enjoy the experience as well, but for them it seemed far more important that they had gained from the experience rather than just having a good time. This finding was surprising as I was expecting them to be very excited that they had had the opportunity to experience another country. In some cases it was their first opportunity to travel overseas and I wondered if this would have overshadowed their experience of the workshop itself. This, however, did not seem to be the case. The participants never mentioned the trip and were content to discuss the impact the workshop and its material had on their teaching and to what extent they could pass this knowledge on to others.

## Chapter 5: Discussion and conclusions

All the study participants were extremely enthusiastic about Project Atmosphere and what it had done for them in terms of their development as geography teachers. Although they did not use the words “professional development” when talking about the benefits of attending Project Atmosphere it is clear that Project Atmosphere did aid in their development as teachers. It can be argued that this development was linked to their teaching of meteorology and may or may not have influenced their teaching in other areas. They were able to update and upgrade their meteorological knowledge and learn new skills and strategies for implementing this knowledge in their classrooms. This is in line with what the professional development research says about what needs to take place for professional development to be successful.

In terms of Evans (2002) classification of teacher development Project Atmosphere can be seen as both attitudinal and functional. Attitudinal development took place because teachers’ attitudes towards teaching developed. They developed intellectually and showed signs of becoming reflective and analytical in terms of their teaching. One participant said that he had managed to raise the matric pass rate from 60 to 100 percent. However, after attending Project Atmosphere he realised that this was not good enough as the top mark was only a C. He now wanted to help pupils to achieve an A instead. Project Atmosphere also provides the participants with much-needed motivation to get creative about their teaching of the subject of meteorology. This is indeed very encouraging and as Harvey (1999) stated ‘The adoption of innovative teaching methods is clearly more than just a matter of gaining creative command of new skills and knowledge. The teacher’s own motivation to implement is also crucial, and that is determined by their own practical appraisal of the innovation’. This motivational development of the participants was enhanced by the course presenters and their enthusiasm for the material they were presenting. One participant stated that this motivation, shown by the course presenter, had shown him that he too could present meteorology in an ‘exciting’ way. With regards to functional development as Evans (2002) calls it, participants talked of how they had changed the way they conducted their lessons around the topic of meteorology from chalk-and-talk to more activity based lessons where learners become more involved in the learning process.

All the participants were eager to implement some of the activities obtained on Project Atmosphere in their classrooms, even though these activities were not congruent with the way they had conducted their lessons before attending the training. This is in line with what Joyce and Showers (1981) say about professional development; that new knowledge obtained on training courses needs to be implemented in the classroom for it to be seen as effective. It could be said that the activities on Project Atmosphere seemed to help solve the problem these teachers had of finding ways and means to teach in a way that is seen to be outcomes-based. The participants were all very aware of the requirements of the new curriculum and the whole move

to a focus on outcomes-based learning. They seem to equate this type of learning with activities that learners must do. “Learners must be actively involved” was the comment made. It may therefore be that the activities learnt on Project Atmosphere are implemented because they help the participants to comply with the new curriculum. The participants feel that, after attending Project Atmosphere, they are able to implement more activity-based lessons around the topic of meteorology and thus are able to implement what the government requires of them in terms of the new curriculum. It can be argued that these participants want to transform their teaching into what is outlined in the C2005 policy and thus there is congruence between the activities present at Project Atmosphere and the implementation of C2005. Without this need by the participants to be seen implementing the new curriculum, it is hard to say whether they would have embraced what they learnt at Project Atmosphere with such enthusiasm, or if indeed they would have implemented what they learnt at all. These findings are somewhat different from that of Guskey (1988) who found that teachers who perceived the new practices as different from their current practices rated them as difficult to implement, required lots of extra work and were less important. In this study, although the activities were not congruent with the way the participants conducted their lesson before training, these participants said that the activities were not difficult to implement, did not require a lot of work to implement and were very important. Mohlman, Coladarci and Gage (1982) see the cost of implementation as teachers weighing the ease with which a procedure can be implemented against the potential return it will yield. Participants did not see this cost as very high in light of the fact that they as teachers needed to find activities that were learner-centered. Thus, in deciding whether to adopt a new procedure, teachers consider the amount of role change involved in implementing the recommendations and the philosophical and practical value of making the change (Mohlman et al., 1982).

The participants were all positive that the activities would help their learners to learn meteorological concepts more effectively. However, they seemed willing to implement what they had learnt only if it had direct relevance to what their learners were supposed to be learning in the Geography syllabus. I believe that, because South African teachers are very aware of what needs to be covered in the syllabus and are reluctant to stray from it, a course that does not take this into account in South Africa would fail to attract participants. The course could go further than the syllabus and show teachers how to diversify lessons, but the core components need to be seen by teachers as valuable and worthwhile. As long as there is a syllabus in place, this will be what teachers see as important.

Teacher trainers seemed also to focus on the workshop activities that were linked directly to the syllabus and run these for the teachers they were responsible for training. This focus on topics related to the syllabus may be because they see teachers only for limited time periods during the year and must use these

opportunities effectively to train teachers on a number of issues. There may not be enough time to cover topics that are not directly linked to the syllabus.

All the participants had the support of their supervisors, which also contributed to them being able to implement what they had learnt at Project Atmosphere. Without this support the activities may not have seen the light of day in the South African classroom situation.

The participants came from various school environments and it is encouraging to see that the participants were able to adapt what they had learnt to these various environments. The course thus allows participants to develop in such away that they are able to adapt this knowledge to their specific situation. Participants thus do not become frustrated at not being able to implement what they learnt because of local condition. This could be one of the main strength of the Project Atmosphere that you do not need sophisticated equipment or specifically designed environment to implement the activities. The participants were all experienced teachers, which may have helped them in being able to integrate what they had learnt into existing repertoire of skills. They did not seem to be set in their ways as some researchers have suggested of experienced teachers but were more open to what the course could teach them.

Teachers believe they are able to pass on what they learnt to other teachers while teacher trainers disagree, saying that they as recognized teacher trainers, should be the ones being equipped to pass on this knowledge to others. What has come out in this study is that teacher trainers run workshops as part of their job and can in some cases add a Project Atmosphere workshop to their existing workshop programme and thereby reach a greater number of teachers. They also have extensive networks, which can be used to invite teachers from large areas to attend workshops. Teachers have a much smaller network of people they can run workshops for, and this can become saturated quickly if they stay in the same area for a long period of time. However, because teachers are able to see and work with a smaller group of teachers, they may be in a better position to set-up community-like structures where these teachers can come together more frequently to discuss problems and share ideas. Feldman (2000) feels that, when teachers become part of communities of practitioners, they can develop professionally. There was however no evidence of such communities being set-up by the South African teachers who attended Project Atmosphere. It might be that more training in this regard is needed before such communities could get off the ground. Further study is needed to see if there is any difference in the way teacher trainers and teachers transfer what they have learnt to others. Quantity is nothing if the quality of what is being passed on is lacking. There is thus a need to see the effectiveness of the training that teachers and teacher trainers of Project Atmosphere present rather than merely comparing how many workshops each group has or is able to present.

Teacher efficacy has been positively related to teachers' willingness to implement instructional innovations Guskey (1988). However, because there has not been any other studies done in South Africa in terms of efficacy and because efficacy beliefs are domain specific it is difficult to say whether the participants in this study score high on the scale or not. There was also not much difference between teachers and trainers in terms of their efficacy beliefs and thus this measure can not be used to motivate whether teachers or trainers are better candidate for Project Atmosphere or not. Studies by Stein and Wang (1988) and Ross (1994) have shown that teacher efficacy is enhanced through in-service training so it would be interesting in future studies to see if Project Atmosphere did enhance efficacy beliefs. Ghaith and Shaaban (1999) have suggested that staff development programmes and their staff should try developing and enhancing a strong sense of personal efficacy among participants. It would thus be interesting, for future studies, to investigate if there was any difference between efficacy score between American and South African participants before and after training and whether this can be attributed to any other factors.

The participants all saw tremendous value in the workshop and want to ensure that meteorology is maintained as a component of the Geography syllabus. This is indeed encouraging for all who believe that meteorology is an essential part of the curriculum. It also shows that with the right training teachers can become excited about teaching meteorology rather than shying away from the subject.

The findings of this study are very similar to those of Cole and Ormro, (1995). They investigated how effective a state geographic Alliance Summer Geography Institute (ASGI) had been at changing the classroom teaching behavior of participants and to what extent the institutes reflected characteristics of effective in-services training programmes. Their findings were that participants felt they were more informed about geography and more enthusiastic about sharing what they had learnt with others. They mentioned that the strengths of the programme were the specific content presented, the opportunity to interact and exchange ideas with peers, and that the institute generated an enthusiasm for teaching geography. These are similar to this study's results. Negative comments made by a majority of the participants were also the same as this study, where participants felt that too much material was presented in too short a time. Most of the teachers in the Cole and Ormro study also mentioned that most of the teachers who attended this training had learnt that geography is a subject that, by using hands-on activities, can be taught more effectively. They also reported that teachers who had relied on the textbook-driven and teacher-directed geography pedagogy had developed new and more interactive ways of teaching. Their participants had conducted between zero and seven (mean 1.9) workshops for other teachers after they had returned home. The present study had slightly higher results with teachers running an average of three workshops each. A few individuals in the Cole and Ormro study also reported that they had become

“valuable resources for their school or district with regard to geography education”. They illustrate this with an example of one of their participants being called the “Geography Lady” by her colleagues as she was someone they could go to for advice on strategies for teaching geography. A similar case was reported by one of the South African participants of Project Atmosphere. She said that fellow teachers are always contacting her for activities as they term her the “Lady from God” as she is always able to help them with lesson ideas. The reason for the similar finding in these two studies may be the similar nature of both programmes: the programmes focus on geographical content and on the most useful ways in which these topics can be presented to learners. All ASGI graduates, like Project Atmosphere participants, are expected to run workshops for other teachers on their return home. It may be important for anyone setting-up similar types of in-service training in the area of geography to be aware of both these studies and to include elements that made these programmes successful in their training approaches.

### **5.1: Why I believe Project Atmosphere is a successful programme**

1. The participants were given in-depth, but easy to understand notes on all the topics covered in the seminars and lectures. This is important if teachers are to understand meteorological concepts properly. It is not good enough for teachers to know only what is in the textbook and what relates to the grade level they are teaching. Teachers of meteorology should have a broad understanding of the processes happening in the atmosphere. Not only will they be able to teach the subject more effectively but they will be able to link these concepts with others and thus integrate the topic of meteorology into other areas of study. They will also be in a better position to answer learners’ questions. Having a command of the subject matter also translates into teachers being confident in teaching the subject.
2. The second important point with regards to Project Atmosphere is that it does not stop at providing quality information about meteorological concepts, but gives teachers activities which are easy to present and implement and which will aid in learners understanding of meteorological concepts. These activities are also clearly demonstrated during the workshop and participants have the opportunity to try-out the activities. Joyce and Showers (1981) stress the importance of providing clear demonstrations of recommended practices and argue that little change is likely to occur without them.
3. For teachers to adopt new teaching practices it is important that the recommendations are stated in language that is easily understood, that concepts are clearly explained, a philosophical acceptance of the practices is developed and finally that teachers are convinced that the time and effort is worth

it in terms of learners' improved achievement (Mohlman, et al, 1982). I believe that Project Atmosphere meets these criteria in that every activity comes with a complete booklet stating what the learners should know at the end of the activity, background information related to the concept is covered and the activities are clearly and explicitly laid out. In terms of philosophical acceptance of the practices I believe the activities speak for themselves and provide teachers with hands-on tools to improve their teaching of meteorology. Due to the nature of the activities and the fact that one does not require fancy equipment to implement them the cost and effort of implementation are not very high and so these activities are very attractive to implement. Mohlman, Coladarici and Gage (1982) stated that if the workshop is informative, facilitates understanding and is acceptable and not implausible, this experience would improve implementation.

4. A few participants mentioned “being treated as equals by the presenters” (participants own words) and how the presenters' enthusiasm for the subject of meteorology was wonderful. Being valued as a professional and being exposed to people who are passionate about their subject were clearly motivational factors for the participants in this study. This presenter professionalism (my own term) is a positive aspect of the course that enhanced the professional development of the participants.
5. Project Atmosphere provides an opportunity for teachers to share their ideas and experiences related to the teaching of meteorology. This opportunity to talk about teaching and what works and what does not in terms of student learning is important for professional development of teachers. Teachers can learn a lot from each other. Realising that teachers struggle with the same challenges regardless of whether they are in America or South Africa often leads to discussions and a chance to share thoughts on how to overcome these challenges. This is an extremely valuable part of any professional development programme.
6. The AMS selects participants for its Project Atmosphere workshop from a number of applicants. Wade, (1985) in her meta-analysis of in-service teacher education, found that when participants were selected to take part in training the effect of size was significantly greater than for all other incentives studied. She put this down to the fact that maybe the best people are chosen to participate or it could be that once these participants were chosen they worked harder. This second factor could play a role here, as some of the South African participants felt they were representing South Africa at the training course. One participant stated that she would try to be a good ambassador for South Africa. Selecting participants for the training sessions seems to motivate participants to become part of the developmental process. By applying for a course they have not



been forced to attend something that they have no interest in and they may thus be more open to change.

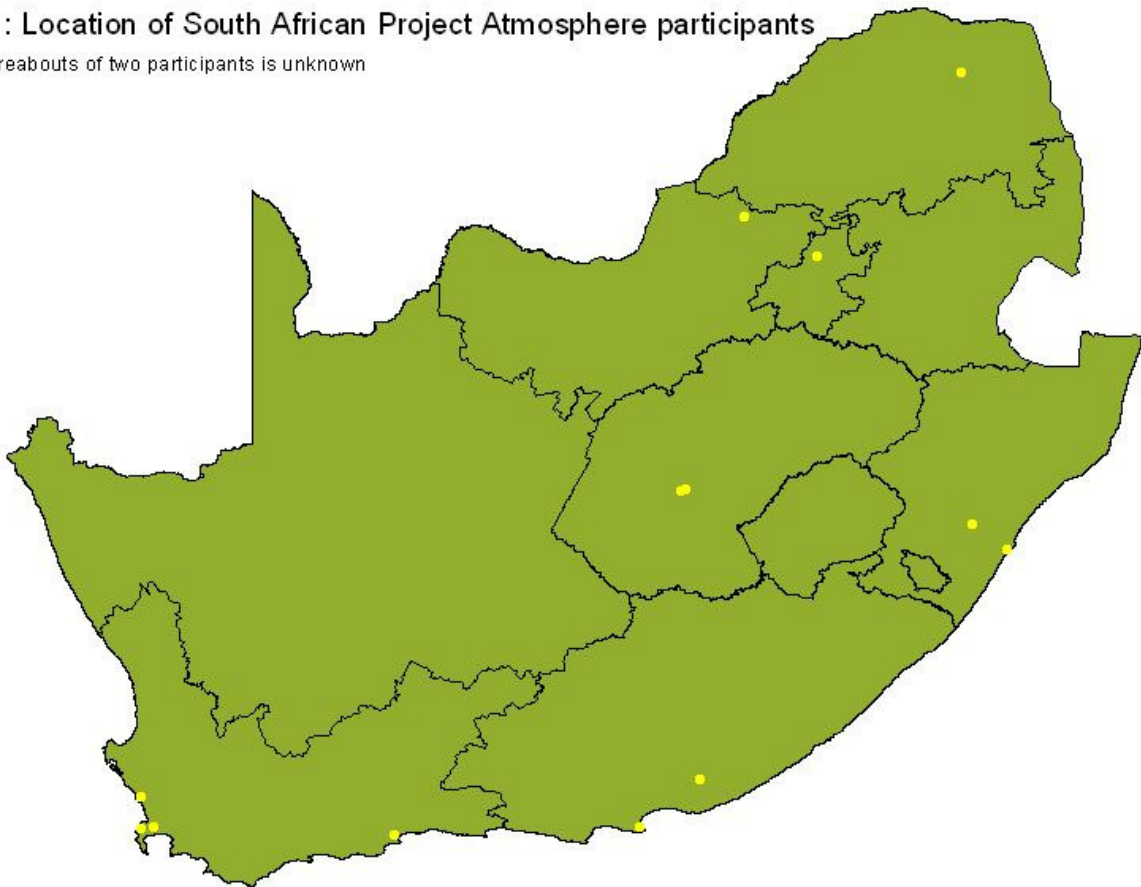
## Chapter 6: Recommendations

### 6.1 In terms of Project Atmosphere

1. Teachers loved the cardboard slide idea\* and it would be good to try and expand this type of activity to other topics.
2. No Project Atmosphere participant has come from the Northern Cape or Mpumalanga and it is recommended that participants be invited from these regions in the near future (see map 1).

Map 1: Location of South African Project Atmosphere participants

The whereabouts of two participants is unknown



3. All South African Project Atmosphere participants should be given each other's contact details (email address, telephone number and address) so that they can form a Project Atmosphere network across South Africa. This would assist these teachers/trainers in terms of sharing success stories and ideas, and helping to motivate each other. New participants in Project Atmosphere could be

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\* These consist of A4 sleeves in which another cardboard sheet slides. As the inner cardboard sheet is slowly pulled out one can view different aspects change through cut-out windows in the front sleeve. There are two of these slides, one for the topic of El Niño and one for frontal systems.

asked to contact previous attendees in order to benefit from their experience of implementing Project Atmosphere activities. This may help to stimulate the setting up of knowledge communities with respect to the teaching of meteorology in South Africa.

4. It would be a good idea to include a session on how participants can go about setting up support structures once they have returned home. These support structures could take the form of setting up knowledge communities within their home areas where the participants and the teachers they train could come together to discuss issues and problems, and seek solutions together. Previous Project Atmosphere participants who have been successful in forming this type of initiative could give a short presentation at future Project Atmosphere workshops on how they went about creating such structures. The idea of knowledge communities is a forum where teachers get together to develop their collective knowledge and skills and facilitate their learning of new knowledge and skills (Supovitz, 2002). The main reason, according to Supovitz (2002), why teachers do not develop these communities is the lack of access to opportunities and experiences that show them how to go about setting up and sustaining such communities. There is thus a real need to provide training in this regard. Participants will be able not only to run workshops for other teachers, but empower them and their colleagues to continue their efforts to learn new skills and ways of bringing about learning of meteorological concepts. This will also help teachers whose teaching environment may not encourage professional development. These teachers will be able to share their frustrations and possibly learn how to change the system within which they work so that professional development can be facilitated within their school environment.
  
5. Another way to engage teachers and participants and get them to share ideas, experiences and find solutions to the problems of teaching meteorology would be to create a “Project Atmosphere” newsletter. This newsletter could be written by Project Atmosphere participants for participants and other interested teachers. Articles on growth experiences using activities suggested on Project Atmosphere, questions about meteorological concepts, success stories, advertisements for upcoming workshops, reviews of meteorologically related web pages and books, etc could be featured in the newsletter. This could be a quarterly newsletter with the idea of bringing together teachers interested in meteorology to stimulate further discussions, collaborations and the sharing of information and ideas. It is suggested that a meteorological institution such as the South African Weather Service or the American Meteorological Society, if it was to be a newsletter aimed at all participants of Project Atmosphere, take the custodian role of this publication and collate the information into a newsletter. It could be distributed via e-mail, web pages and in printed form for those not having access to the Internet.

6. There is a real need to set-up a similar 'Project Atmosphere' programme in South Africa. Only two or three participants per year get the opportunity to attend the workshop held in the USA and this is dependent on funding. The amount of teachers they are able to reach is relatively small and confined to limited areas, see map 1. If we could develop our own workshop and invite 20 to 25 teachers or teacher trainers every year, we would be in a position to increase the impact that Project Atmosphere is able to make in South Africa. Howey and others (1983) suggest that institutes research and study specific modes of professional development in order to help develop programmes, work with schools to improve programmes and to work with local educational agencies. This will ensure a closer and more coherent articulation between pre-service and in-service staff development. I believe that the South African Weather Service has a role to play in this regard and needs to get various stakeholders together to discuss ways of developing a Project Atmosphere for South Africa. This could later be extended to include inviting participants from other African countries. Chapter 7 will outline possible ways to bring about such a programme in South Africa.

## **6.2 In terms of future studies**

1. Future studies are needed to increase the scope of this research to investigate whether these changes as reported by participants were in effect being realised in the classroom. This would require in-depth classroom observations.
2. It would also be beneficial to look at whether learners' achievements in meteorology improved due to the Project Atmosphere activities. This type of study may help to shed further light onto just how effective Project Atmosphere is at transforming the teaching of meteorology in South African schools.
3. There is a need to investigate the methods used by teachers and teacher trainers in training other teachers in South Africa. The purpose would be to investigate if there is any truth in the assertion that teacher trainers are able to have a greater impact in educating other teachers with respect to Project Atmosphere activities.
4. Also suggested is a longitudinal study to see the extent to which South African teachers maintain the use of the Project Atmosphere activities over time, and how they go about integrating them into their teaching programmes.

5. It may be interesting to compare South African participants in Project Atmosphere with their American counterparts to see if there are any differences or similarities between the two groups. This may help to determine whether programmes transferred from one country to another are successful in helping teachers from different countries, cultures etc in terms of professional development.

## **Chapter 7: Setting up a Project Atmosphere in South Africa**

From the findings of the study it is evident that a South African Project Atmosphere would go a long way to improving both the teaching and learning of meteorologically related concepts in South African schools. There is a very real need within South Africa to develop teachers professionally and to provide them with training opportunities that cater to their specific needs. The meteorological community of South Africa thus has a responsibility to provide these opportunities if they want meteorology to be an aspect of the teaching curriculum that is better understood rather than merely touched on because it happens to be in the syllabus.

All South Africans are exposed to some aspect of weather science, even if it's just the odd occasion when they happen to hear or see a weather forecast. A population that understands some aspect of meteorology is important if we as the meteorological community hope to continue our existence. Without public support for meteorological activities and programmes these could be reduced to the very fringes of the scientific arena, and this will ultimately affect their funding, sphere of influence and capacity to help shape the future of this country. We, the meteorological community, thus need to find ways of educating the public on the need for meteorologically related activities and to foster in them some understanding of the process so that they may be in a better position to make use of weather-related knowledge. What better way to do this than provide teachers with the knowledge they need about meteorology so that they can in turn help learners understand these concepts more effectively?

Setting up such a programme would require money and the amount of money required would depend on the way the programme is structured and set-up. A scaled-down version of the American Project Atmosphere workshop could be offered here in South Africa and could take place over two or three days. The focus of the workshops would be to help South African teachers to teach the meteorological components in the syllabus more effectively. This would help cut costs and be a more manageable task than conducting a full two-week workshop to begin with. The format of the workshop could be similar to the American one, with lectures and talks presented by various people within the meteorological community e.g. Weather Service personnel, retired meteorologists, University personnel, to name a few.

There are many ways in which this South African workshop could be structured and the following three ways are seen as possible examples.

#### Option 1

The South African Weather Service has a modern training facility which could provide lecture rooms for about 20 participants. Personnel within the South African Weather Service could run the lecture programme and I could assist with running the activity sessions. Field trips to look at a weather camp (where the instruments are housed) together with a visit to the central forecasting office would be possible. In addition to the cost of running the programme, funding would need to be found for transporting the teachers to the workshop, accommodation and meals. Schools or Universities with hostel accommodation may be a cost-effective option that could be explored. This would mean that the workshop would have to take place in school or University holidays. This may affect attendance figures because many teachers are often reluctant to attend courses during school holidays.

#### Option 2

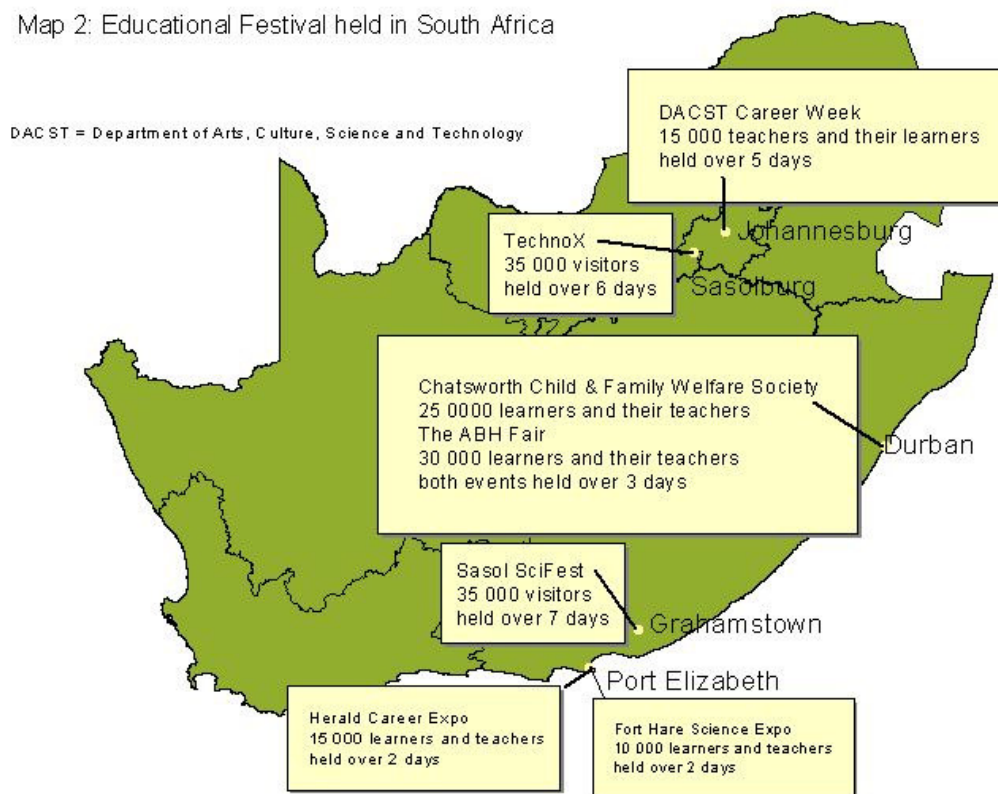
Partnerships between the Department of Education and the meteorology community could be explored where the Education Department provided the venue for the training and the South African Weather Service provided the personnel to run the workshop sessions. The participants could be invited from the surrounding areas and thus money would be saved in terms of their transportation and accommodation. Lunch and teas would be the only expense in terms of food. Travel and accommodation costs would need to be paid for the presenters of the workshop.

#### Option 3

Set-up partnerships between the South African Weather Service or other meteorological community member/s and science and/or career festivals. The venue would be provided by the festival and by the South African Weather Service and/or other meteorological institutions such as university departments. In addition to having an exhibition stand at the festival, there would be a full two or three day programme for teachers. This would be somewhat different from what now happens when the South African Weather Service attends a festival and runs separate ad hoc one-hour weather workshops. In the South African Project Atmosphere programme, the teachers would sign on for two or three full days of training. The teachers' learners can be involved in other aspects of the festival and this will free the teachers to take part in the

workshop. To reduce costs, the presenters of the course could be the ones the meteorological institutions send to man its exhibition stand. The participants can go home after the day's session and thus reduce accommodation costs by participants. The only negative aspect of running Project Atmosphere at science festivals is that not all provinces (see map 2) have such events and thus there is a need to reach other provinces. However, the festival route could be a way of launching the workshop while funding for additional South African Project Atmosphere courses is being sought.

Map 2: Educational Festival held in South Africa



Irrespective of the way the workshop is structured, funds for printed material aids would also have to be found as well as general administrative cost and the cost of advertising the workshops. Sponsorships could be sought to cover these expenses.

The workshop content needs to follow what teachers are expected to cover in the syllabus and it would be a good idea to cover all aspects which learners are required to know in order to pass their final grade 12 examinations. Possible course outline can be found in appendix 4.



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