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Implementation and institutionalization of innovation and change in science education: the case of SEP.

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10.4.6 Changing relationship with the donors

Concerns were also raised in the findings that the government was too big and bureaucratic compared to smaller NGOs to handle innovation. These concerns were authenticated by inputs from informants in the debriefing phase. The debriefing phase further supported a view that showed that the channelling of funds to the government led to bottlenecks in the system which disrupt a smooth flow of funds to the provinces and ultimately to the projects. Informants argued that whereas the IDT was successful in allocating money to the NGOs, the current TNDT does not seem to be equipped to discharge this task successfully. All informants who participated in the debriefing phase confirmed earlier views that the government is by nature very bureaucratic regardless of whether it is democratically elected or not. This view further supports arguments that bureaucratic red tape in education unnecessarily interferes with the flow of the funds to the local schools. .

Consequently, SEP sponsors, the Board of Trustees and the managers in the debriefing strengthened the concerns expressed in the findings that it was unfortunate that sponsors should decide to switch their support to the government. Apparently, this decision was taken because an overwhelming majority of the people realized that there was going to be a peaceful transition and everybody wanted to ensure that it succeeded.

The other concern relating to the move to channel money to the government was its effect on the maintenance of implementers in the regions. Sponsors and members of the Board of Trustees in the debriefing phase acknowledged the problem of attempting to maintain these implementers and also admitted that the bulk of the money raised tended to be used to support the organization while schools and pupils were benefitting very little.

According to the findings, SEP had a well worked out policy to work within the education departments in the erstwhile homelands. Subsequent input from sponsors and members of the Board of Trustees in the debriefing suggested that the project would have to consider working in the provinces regarded as very poor by the government. The two provinces SEP will have to consider working in according to the informants in the debriefing phase are the Western Cape and Northern provinces.

Two scenarios emerged with respect to the relationship between the government and the NGOs in new democracies. The first one suggests that the NGO sector maybe strongly regulated by the government. The second option is the one where the NGO sector is completely unregulated. New evidence emerged from subsequent debriefings that although NGOs appear to be strongly regulated, there are indications of even firmer controls over NGOs by the government in South Africa.

10.4.7 Evaluation and accountability

The results of empirical chapters revealed that evaluation of what innovation projects were actually doing and their accountability did not emerge as primary concerns in the 1970s and 1980s. Consequently, the question as to whether SEP was making improvements in science or not in order to justify its existence was never raised. Accordingly, the Board of Trustees, sponsors and donors relied exclusively on the project's internal evaluation. It was further indicated that the project was not subjected to continual external evaluation.

All informants in the debriefing affirmed conclusions relating to the evaluation of SEP. SEP's fund-raiser in the 1970s, former sponsors and the current members of the Board of Trustees endorsed the findings on the project's evaluation in the debriefing. Informants revealed that internal evaluations were sufficient for them to make funds available to SEP and that the fact that the project was able to challenge the system and still survive was itself a reasonable ground to fund it.

Informants supported the argument that it is important to distinguish the different types of accountabilities. These include legal, professional, moral and contractual accountabilities (Lawton 1983; Sockett 1976).

The results revealed confusion regarding the attitudes of the Ministers of education towards SEP's cluster model. In the Gauteng province it was evident that the Minister of education was dissatisfied with this model mainly on grounds that it was not reaching as many schools as the authorities would have wished.

Informants comprising former SEP managers, implementers, members of the Board of Trustees and a representative of the Minister of education clarified this issue in Gauteng in the debriefing. Members of the Board of Trustees reiterated their original concern that the Minister was reluctant to use SEP's expertise. However, the representative of the Minister pointed out that SEP is treated like any other NGO and argued that maybe the project needed to market itself more vigorously to compete with other NGOs. Further, it was indicated that the Minister in the Gauteng province was concern about a significant shift of the NGOs from being partners in providing services to being consultants.

The members of the Board of Trustees participating in the debriefing surprisingly admitted that the model of a nucleus of implementers was too expensive and that it should not have been adopted in the first place.

Informants comprising the former and current donors/sponsors, members of the Board of Trustees and the former Executive Director in the debriefing endorsed earlier suggestions that SEP, like all other NGOs, enjoyed a huge degree of autonomy. They also confirmed that the project was accountable to the donors and sponsors for the funds made available but was professionally accountable to the teachers. Informants further supported a conclusion that the changed conditions have resulted in more organized reporting of how the funds are used. Informants

comprising former and current SEP staff and elite policy makers participating in the debriefing endorsed a view that accountability in a democratic system is a complex process.

10.5 RESEARCH QUESTION FOUR

How did SEP deal with the issue of institutionalizing its innovation and change?

Table 29: Themes and trends explored in Research Question Four and sources of data

THEMES AND TRENDS	SOURCES OF DATA
Institutionalization meant different things to different people The lodging of the project in the system was a policy in the 1980s but this changed rapidly from 1989 onwards SEP had influenced the way the teachers taught and the way pupils learnt science The usage of SEP's worksheets and approaches varied from school to school and depended on the commitment and enthusiasm of the teachers Teacher advocacy played a major role in the institutionalization of SEP's work	- interviews with former Executive Directors, members of the Board of Trustees, policy-makers within the project - interviews with former SEP staff members who got involved with the project in the 1980s and early 1990s - interviews with former and current Executive Directors - interviews with former SEP managers and implementers - interviews with former SEP managers and implementers - interviews with former SEP managers and implementers - analysis of literature
SEP was going to lose its credibility if it did not remained autonomous in the 1970s and 1980s	- analysis of SEP documents and records - interviews with the members of the Board of Trustees

THEMES AND TRENDS	SOURCES OF DATA
Schools continued to use SEP's methodology sometimes with little or no support from the education authorities Attempts to enhance institutionalization of innovation at the pre-service level never materialized The project's INSET model was the most appropriate strategy for promoting institutionalization but turn out to be costly	- analysis of SEP documents and records - interviews with the members of the Board of Trustees - interviews with former and current Executive Directors - interviews with former and SEP managers and implementers - interviews with former and current Executive Director - interviews with former managers and implementers
Teachers commitment and administrative support are necessary for sustained institutionalization of innovation The influence of administrative and the need to ward off threats to institutionalization of innovation and change SEP was accountable to its clients in the 1980s but became accountable to funders and other stakeholders in the 1990s	- analysis of literature - analysis of SEP documents - interviews with former SEP managers and implementers - analysis of literature - interviews with former SEP managers and implementers - interviews with former SEP who got involved with the project in the 1980s and early 1990s
Overcrowding, attitudes of education administrators, lack of adequate apparatus affected institutionalization negatively	- interviews with former SEP managers and implementers - interviews with elite policy-makers within the project

10.5.1 Indicators of sustained-implementation in SEP

Differing views on whether SEP's innovation and change had become part of school routine emerged from the findings.

The majority of SEP's managers, implementers and the results of internal and external evaluations during the different times concurred that the project's methodology had become part of the teachers' daily routine in most schools. The latest external evaluator in 1995 reported plenty of evidence showing that the teachers and pupils were not only using the project's worksheets and apparatus but its methodology as well.

The former SEP managers and implementers in the debriefing process authenticated the initial argument that the project had influenced the way the teachers taught and the way the pupils learnt science. However, informants further acknowledged that the usage of SEP's worksheets and apparatus varied from school to school and depended largely on the commitment and enthusiasm of the teachers. Furthermore it emerged from the results that SEP's innovation and change did survive even if it was not sanctioned at the highest level by the education authorities and that teachers' advocacy, mastery and commitment were equally important in the institutionalization of innovation and change.

Informants within SEP corroborated conclusions during debriefing that the institutionalization of the project's innovation and change should be seen against the support it did or did not receive from the authorities. Feedback from this group further endorses theories proposed by Fullan (1982) and Fullan and Stiegelbauer (1991) to the effect that teacher mastery of an innovation and their commitment to it are some of the major determinants of whether such innovation and change will become part of the teacher's curriculum or not. These informants also strengthened arguments and observations in the literature (Sikes 1992) that teacher advocacy of innovation is crucial because they are able to resist even a legally imposed change if they wish. Furthermore the debriefing authenticated theories put forward by Berman and McLaughlin (1975; 1978) suggesting that institutionalization of innovation and change should rather be explained in terms of certain patterns that may include; a situation where institutionalization is either supported by the educational administrators or not; where institutionalization by one region or one school in the region etc.

The findings suggested that the usage of innovation may vary from whether the clientele is using the new material, to whether they are using new teaching approaches without necessarily using the material and whether the programme has managed to alter the teachers' beliefs or pedagogical assumptions (Fullan and Stiegelbauer 1991). These findings were strongly supported by evidence from the debriefing.

10.5.2 Institutionalization and autonomy during the apartheid era

There was consensus in the empirical chapters that SEP was going to lose its credibility if it did not remain autonomous in the 1970s and 1980s. Consequently, SEP remained autonomous because its developers did not want it to be associated with the discredited education system of the 1970s and 1980s. Accordingly, autonomy was considered important to the project's donors, schools and staff during the 1980s because of the illegitimate education system. The autonomy of the NGOs was further perceived as part of the struggle during the 1970s and 1980s and was never an issue.

Informants who were responsible for developing the project's policy in the 1980s and who took part in the debriefing phase corroborated earlier findings that it was crucial that SEP remained autonomous during those years.

10.5.3 Institutionalization of innovation and change in the post-election era.

It became evident in the results of empirical chapters that SEP had to review the nature of its autonomy in the new dispensation. The results also suggested:

- shifts in the debate about institutionalizing innovation and change in general and within SEP after the election.

- that institutionalization in general and in SEP in particular depended largely on whether schools and teachers were and are committed to it.
- that in some cases, schools continued to use SEP's methodology sometimes with little or no support from the education authorities was supported by SEP's staff as well as by results of an external evaluator.
- that institutionalization is a process and that one needs to identify the levels at which the process is on the sites. Following the 'levels of use' framework it is inappropriate to think in terms of complete failure or complete usage of SEP's innovation at the sites (Hall et al. 1975). The observation that facets of the project might have become part of the school routine in some cases but not in others reinforced arguments that the levels of use of innovation and change should be an overriding criterion when one evaluates whether an innovation has become part of the daily routine or not.

SEP's former Executive director, managers and implementers who participated in the debriefing endorsed the findings in respect of teacher advocacy and commitment to sustained-implementation. They further authenticated evidence that the project's methodology had become institutionalized in the Transkei more than in any other region. Informants also confirmed the level of use of SEP in the various schools and regions.

10.5.4 Strategies adopted to institutionalize innovation and change

The results of empirical chapters suggested that institutionalization could be enhanced by introducing innovation at the pre-service level of training teachers. It was further pointed out that the policy of introducing SEP's methodology in the erstwhile colleges of education never materialized. However, the findings acknowledged SEP's success in promoting sustained-implementation through its INSET. The project's unique INSET model was, according to the findings, the best strategy for promoting institutionalization of its methodology.

Informants comprising former SEP managers and implementers participating in the debriefing phase confirmed that SEP had never succeeded in introducing its methodology in pre-service training. All informants concurred that SEP's model of INSET was perhaps the best strategy for promoting institutionalization.

10.5.5 Contact with education administrators

The findings derived from the literature (Berman and McLaughlin 1975; Miles 1983) and from empirical evidence suggested that although the teachers should be committed to implementing a new innovation, the administrative support is still crucial. It became evident that teacher motivation and adequate resources are not in themselves sufficient for successful sustained-implementation of innovation and change. Informants all concurred that support from the education administrators is crucial and that the project's innovation could not be quickly institutionalized because of lack of support from individual education administrators, usually the one in charge of science. Following these findings, the investigator concluded that major factors which might have contributed to the failure of innovation and change have been identified. Further, the results supported previous research (Berman and McLaughlin 1975; Miles 1983) on the influence of administrators and the need to ward off threats to the institutionalization of innovation and change. It was also shown that SEP operated even in cases where it was not explicitly supported by the administrators at higher level.

Elite policy makers, a former Executive Director, former research staff and former implementers participating in the debriefing phase all concurred that the administrators' support of innovation is crucial for this success. These informants specifically endorsed the view that threats to innovation must be warded off.

10.5.6 Factors which influenced sustained-implementation of innovation and change

Factors in the system and in SEP influenced sustained-implementation (Berman McLaughlin 1975; 1978; Fullan and Stiegelbauer 1992; Miles 1983). Factors identified were overcrowding, attitudes of authorities towards innovation, lack of adequate apparatus and non-recognition of the burden facing science teachers.

Elite policy makers, SEP's members of the Board of Trustees and the project's policy developers who participated in the debriefing phase authenticated initial findings about the influence of factors in the system and within the project. It was also found that the impact of such factors is useful for change agents in measuring the success of programmes against their intended outcomes.

10.6 SUMMARY

This chapter pulled together findings from the four empirical chapters and attempted to provide a general picture of what was discussed in those chapters. The findings from the four empirical chapters of this thesis were subjected to further interpretation through the process of debriefing of what was earlier reported about SEP. It has been pointed out previously that twelve informants as well evidence from the project's documents and records were identified and used in the debriefing session.

Miles and Huberman's (1994) procedures used in this chapter are: weighing the evidence, checking for the existence of extreme cases, following surprises, looking for negative evidence, checking rival explanations and getting feedback from informants about SEP. Accordingly, this chapter validated, verified and confirmed the findings in each of the four research questions and explored any convergences or divergences in the findings.

CHAPTER ELEVEN

SYNOPSIS

The investigation focused on the evaluation of the vision, intention, policy, implementation and institutionalization of innovation and change undertaken by the Science Education Project in the four selected research regions from 1980 to 1995. The period under review covers the development, expansion and consolidation phases of SEP. A transactional framework was utilized that conceptualizes curriculum as a dynamic interaction between the vision and policy of those involved in curriculum development on the one hand and the implementation thereof on the other. This framework suggests three levels in the evaluation process and the levels of use of innovation was also used. The three levels are: (i) vision, intention and policy; (ii) curriculum conceptualization and (iii) implementation. Further, a conceptual framework that recognizes the distinction between intentions (policy) and implementation (practice) was employed to investigate the project in the Eastern Cape, Pietermaritzburg, North West and Gauteng regions. The notion of levels of use of innovation was also used.

The purpose of the investigation during the period covered was to analyse and evaluate the extent to which SEP's vision, intention and policies were translated into practice as they were originally intended.

The investigation took the form of analysing intentions, aspirations and policy on the one hand, and 'action', i.e. what was actually happening during the implementation of intentions on the other. Furthermore, the distinction between intended and unintended consequences of SEP's intervention were utilized as organizing foci in order to present a balanced picture of the project.

Of equal interest was the examination and understanding of innovation and change in terms of how it reflected the perspectives and perceptions of individual stakeholders or participants. Consequently, variations, trends and patterns which emerged formed an integral part of the analysis.

The case study comprised evaluative-research into the implementation and institutionalization of innovation and change in science introduced by SEP from 1980 to 1995.

The theory-driven approach and revised grounded theory methodology were employed as theoretical frameworks. The multi method approach undertaken within the constructivist paradigm was followed. The rationale for adopting the multi method approach was that there were many stakeholders who had different and sometimes divergent interests in the innovation and change introduced by SEP. Stakeholders included sponsors, donors, the education authorities, SEP National, SEP Regional and the project teachers and pupils. Different types of triangulations were used throughout the study.

The investigator became involved with the project in 1988 when negotiations were first started with senior staff members of SEP on the possibility and desirability of undertaking this kind of analysis. Since then, the investigator has conducted numerous interviews with former and current senior administrators, regional managers and implementers of the project.

The data were collected from the documents and records of SEP, from both former and current staff members, from the schools and teachers using SEP materials, from both the former and current members of the Board of Trustees, from SEP teachers, education officials responsible for science education and from a number of policy-

makers inside SEP, in the business and the public sectors. Interviews, classroom observations, content analysis of SEP's documents and records, questionnaires and photographs were used to collect data. Data were collected from 1988 to 1995 and were not limited to one specific time period. This allowed the investigator to modify interpretations of data which emerged because of the changing conditions over time.

Four research questions were developed after a prolonged period of interaction with the project. These emerged as a result of the analysis of the project's documents in general, attending Consultative Committee meetings in the various regions, attending the project's Implementers' Conference (IMPCO), and by conducting group and individual interviews. Research questions that guided the investigation revolved around the following issues:

- Vision, intention and policy relating to curriculum development, innovation and change in science education.
- Conceptualization of the learning and teaching of science.
- The nature and quality of relationships between the Science Education Project and other stakeholders and how these affected implementation.
- Issues relating to sustained implementation of innovation and change by SEP.

Content analysis was employed to reduce the data that emerged from the project's documents, records and interviews. Through content analysis, recurring themes, issues and trends were recorded across the different data sources relating to the four research questions.

Reliability and validity issues were handled by extensive use of triangulation. Triangulation aided the investigator to validate views from stakeholders who gave interviews on the project.

Insights that emerged from the analysis were illuminated in respect of each research question. The investigator arrived at the following conclusions for each of the research questions and methodologies followed. First, the investigator found that SEP played a major role in the improvement of science teaching and learning in disadvantaged communities of the 1970s, 1980s and early 1990s. However, its success needs to be seen against the background of the reluctance of the government of the time to provide even basic educational resources to these communities. The conclusion drawn therefore, was that SEP assumed a role that is normally taken by the government in a democratic environment. Furthermore, the investigator came to the conclusion that SEP's strategy of intervention was unique and relevant to the conditions of the 1980s. It was also found that the project staff shared the culture and ethos of the organization, cooperated and supported each other both in terms of the vision and the implementation levels of curriculum innovation and change.

In view of the inadequate training that science teachers have, the investigator concluded that the RD and D and 'pre-package' approaches for the development of the science curriculum and the introduction of innovation and change adopted by SEP were reasonable and indeed justifiable. However, the investigator also came to the conclusion that in some instances, there had been a tendency to overinflate the project's achievements. The inability of the SEP staff to stand back and reflect on the weaknesses of the project could be attributed to evaluation reports that were conducted almost exclusively by people who were part of the project. As far as curriculum and teacher development are concerned, insights were explored in respect of SEP's idea of school-based INSET where implementers were required to work closely with a small number of schools within a cluster.

It was found that SEP's model of school-based INSET and the unique support SEP implementers gave to the teachers were two outstanding innovations. The British government was one of the few donors that continued to fund SEP directly and not through IDT and TNDT after the 1994 elections. Through its funding that increased in 1994/1995, 150 teachers, implementers, RDU and National office staff and Regional managers undertook training at Leeds University. However, results also

suggest that intervention through a nucleus of implementers was too expensive because a large percentage of resources which should have benefited the schools and pupils were used to maintain the organization which became large and bureaucratic. Consequently, SEP stopped operations in the regions because of financial constraints but it continues to operate as a consultancy. Further, the researcher found that the INSET dimension of SEP was part of a shift from individuals as change agents to a view that SEP as organization was to become a change agent. It has also been concluded that the lack of coordination between the various structures and units tended to affect the implementation negatively.

The investigator also concluded that approaches adopted by the Science Education Project made a significant positive impact on teachers' and pupils' attitudes towards science. Results of the investigation further demonstrated that SEP teachers assumed the roles of facilitators of learning while the pupils occupied a central role in the learning process. However, inherent contradictions emerged between some epistemological nuances underlying the process and constructivist approaches and their implementation.

The conclusion was drawn that SEP's portable science kit is a viable innovation and change that should be explored further even in the new dispensation. These portable kits appear relevant to many situations in schools because they are cost-effective. The investigator recommended that these kits be used in education in South Africa.

The analysis of data suggests that the advocacy of SEP by the different stakeholders was a major determinant of whether the project would be successful or not. However, it became evident from the analysis that the nature of advocacy has to be located within a particular socio-political context.

The analysis suggests that NGOs such as SEP need to review their autonomy and accountability in the present political climate in South Africa in the 1990s. As far as these issues are concerned, the investigator highlighted the complexities of the debate surrounding autonomy and accountability. The researcher found that SEP expanded

significantly in terms of the number of staff, implementers and the teachers it was serving. Accordingly, the project's expenditure doubled while efficiency and accountability were sometimes compromised during the phases of the project's expansion and consolidation of 1989/1994. The consensus reached through the analysis of the data was that accountability was not a major concern in the 1980s but became a major preoccupation in the 1990s. Further, it was found that SEP was accountable to its clients in the 1980s but became accountable to funders in the 1990s. It was found that the nature of the autonomy and accountability of SEP needed to be located within the context of the Not-for-Profit-Making Organizations Act of 1997 (Republic of South Africa 1997) intended to govern the new relationships between the NGO/CBO sector and the government in this post-election era. The investigator concluded that the Not-for-Profit-Making Organizations Act of 1997 (Republic of South Africa 1997) affected the flow of funds to the needy clients and constituted a subtle control of NGOs such as SEP by the government. Scepticism about the intention of the Act was confirmed by the closure of SEP's operations in the regions which resulted in many staff members leaving the organization.

The study indicated the need to modify perceptions, values, aims and goals of the project's developers who were involved with the implementation of its use during the post-election education system. The overall picture that emerged was that the NGO/CBO sector needs to begin to work closely with the government, in contrast to the oppositional role they played in the 1970s and 1980s. However, it was found that SEP was unable to respond quickly enough to the changing conditions of the 1990s, that the expenditure expanded and that efficiency and empowerment of individuals became of secondary importance.

Regarding sustained-implementation of innovation and change, a separate study has demonstrated that the so-called phases of innovation and change exist only in theory. The investigator concluded that sustained-implementation of innovation and change

in education depends mainly on the administrative support it receives and the warding off of threats against it. However, it was further concluded that evaluators of a particular project and its innovation need to take into account patterns of sustained-implementation that are often neglected.

It was found further that:

- Institutionalization and accountability during 1980 to 1989 were internal matters with SEP as an organization, these became external concerns as from 1989 to 1995. For example, while the policy was to lodge the project in the education system and SEP accountable to its clients during the 1980 to 1990, perceptions about institutionalization changed and the project became accountable to the funders and other outsiders from 1991 to 1995.
- Institutionalization and autonomy of SEP were paramount during the apartheid era because the project did not want to be associated with the discredited education system of the 1970s and 1980s.
- Institutionalization of SEP's work varied from school to school and depended largely on teacher mastery, commitment and other factors in the education system and in the environment.
- Implementation is likely to be sustained when its clients become advocates of its work and implementation is likely to be sustained when teachers become advocates for its methodology.
- SEP's methodology was used even in cases where the project was not explicitly supported by the education administrators at higher levels
- Sustained implementation at classroom level depends primarily on the interest and commitment of teachers, often regardless of support from role-players at other levels in the education system.

The study has contributed to knowledge relating to theories, models of curriculum development and approaches to innovation and change. Theories and models relate to curriculum development, innovation and change, the teaching and learning of

science, approaches relating to the relationship between NGOs and the state in the emerging democracy and well as the importance of institutionalizing innovation and change. The revised grounded theory methodology which provided the theoretical framework of this study had contributed to procedural knowledge for collecting, analysing and interpreting data from the field.

In addition to insights revealed through the analysis, some limitations of the study and the need for further study were identified and discussed. The limitations discussed related to various aspects of the research methodology, models for inferences and the period covered. One of these limitations relates to the unavailability of some informants to verify results because they had left the organization. Furthermore, the investigator concluded that a separate study is needed into the role of NGOs as service providers of innovation in education in the new political climate in South Africa. An in-depth study of these roles as well as investigation into the accountability of NGOs did not fall within the ambit of this study and therefore require further investigation.

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APPENDIX 1: ELITE POLICY-MAKERS INTERVIEWED

EDUCATION SECTOR			
DATE OF INTERVIEW	**NAME**	**POSITION**	**ORGANISATIONS' NAMES**
18/11/1993	Mr Derek Gray	National Chairman	Council for Exposition for Young Scientists (EXPO)
16/09/1993	Mr Motselenyane	Vice-President	National In-service Education College (BOP)
13/09/1993	Mr Dick Nel	National Subject Advisor	Erstwhile Department of Education and Training
20/2/1993	Dr Redelinghuys	Chief Educational Officer	Erstwhile Department of National Education
27/11/1994	Mr Padayachee	Superintendent (TVL)	Erstwhile Department of Education and Culture (HOD)

PARASTATAL ORGANISATIONS			
DATE OF INTERVIEW	**NAME**	**POSITION**	**ORGANISATIONS' NAMES**
15/08/1993	Mrs C. Cohen	Coordinator - Education Portfolio	Eskom
12/12/1993	Dr Prins Nebhutalu	Director	Science Schools (FRD)

PRIVATE SECTOR			
DATE OF INTERVIEW	**NAME**	**POSITION**	**ORGANISATIONS' NAMES**
01/10/1993	Mr Michael O'Dowd	Director	Chairman's Fund (Anglo American Cooperation)
10/11/1993 and 8/9/1997	Professor R Lee	a) SEP fund raiser b) Dean (Management Science)	a) Anglo American Corperation b) Wits Business School
22/10/1993	Mr Clive McMillan	a) Consultant Engineer b) President	a) OVE ARUP (SA) b) AS and TS
19/12/1993	Mr S. Anderson	a) Chairman of Council b) Chairman of the Board of Trustees c) Consulting Engineer	a) University of the Witwatersrand b) Science Education Project c) Private Company

POLITICAL ORGANISATIONS			
DATE OF INTERVIEW	**NAME**	**POSITION**	**ORGANISATIONS' NAMES**
24/09/1993	Dr Michael Kahn	Policy Analyst	Centre for Policy Development (ANC)
11/11/1993	Dr Khotso Mokhele	a) Education Secretariat b) Vice-President	a) Azanian Peoples' Organisation b) Foundation for Research and Development

NON-GOVERNMENTAL ORGANISATIONS (NGOs)

DATE OF INTERVIEW	NAME	POSITION	ORGANISATIONS' NAMES
13/08/1993	Dr Peter Glover	Director	Primary Science Project
25/09/1993	Mr Peter Buckland	Senior Policy Analyst	Urban Foundation
13/10/1993	Dr John Volmick	Director	Centre for the advancement of Science and Mathematics (CASME)
30/10/1993	Mr David Kramer	National Director	Programme for technological careers (PROTEC)
16/12/1993	Mr Brian Gray	a) Project Coordinator b) Member of Board of Trustees	a) Kwangwanase Science Teachers Dev. Project b) Science Education Project
24/02/1994	Prof. T. Morphet	a) Member of the Board of Trustees b) Policy Analyst	a) Science Education Project b) University of Cape Town
24/02/1994	Prof. P. Spargo	a) Member of the Board of Trustees b) Science Educator	a) Science Education Project b) University of Cape Town
15/12/1993	Prof. C. Millar	b) Member of the Board of Trustees b) Deputy Dean and Policy Analyst	a) Science Education Project b) School of Education University of Cape Town

DONORS

DATE OF INTERVIEW	NAME	POSITION	ORGANISATIONS' NAMES
12/12/1993	Mr B. Evans	Head of Education Section	United States Aid

UNIVERSITIES AND RESEARCH INSTITUTES			
DATE OF INTERVIEW	**NAME**	**POSITION**	**ORGANISATIONS' NAMES**
17/12/1993	Mr Dave Finemore	Director, Science Course Development	Goldfields Science and Mathematics Resource Centre (GFRC)
22/07/1993	Prof. M. Rutherford	a) Co-Director b) Director	a) RADMASTE b) Science school (Wits)
15/09/1993	Prof. J. Bradley	Co-Director	RADMASTE
19/01/1993	Mrs M. Keogh	Project Coordinator	Science Curriculum Initiative in South Africa (SCISA)
19/10/1994	Mr P. Naidoo	Lecturer	Dept. of Education (UDW) Science Division
19/10/1994	Mr David Brookes	Project Coordinator	Science Education (University of Durban Westville)
24/05/1994	Dr K.M. Lewin	Consultant on Science Education (UNESCO)	University of Sussex (United Kingdom)

APPENDIX 2: AN INTERVIEW GUIDE DURING THE INITIAL PHASE OF THE CURRENT INVESTIGATION

Researcher: **What is your view of SEP's philosophy?**

Informant: The issues at the famous meeting held in Cape Town was whether SEP was an Education/Sociological change project or whether it was concerned with education---if SEP had its fundamental aim, to change the social structure, then it should not have been called SEP (Former Director interview).

Informant: SEP is an organization and has two main functions. These are: Developing science education material and INSET for teachers (Director interview)

Informant: SEP philosophy could be divided into broad areas: Educational in general, science education in particular and a definite kind of philosophy of teacher development... SEP had as its philosophy the creation for rather building a non-racial education system (Board of Directors interview).

Researcher: **What is SEP's blueprint?**

Informant: SEP's blueprint has been to develop its ideas in science education by working on school-based model of innovation...The idea of regional projects is central to its plan of action (Transcript NO. 7 Board of Directors interview)

Researcher: **What is your perception of SEP?**

Informant: SEP is an innovation -something that belongs to the teachers, an association of people, a change agent, it enhances new ways of developing the teachers.

Researcher: **Is the vision and policy of SEP appropriate for the future?**

Informant: SEP's philosophy and practices will be eternal because it is affected by various stances that normally characterises education systems (Transcript NO.7- User interview).

Informant: I think the NGOs like SEP have an important role to play. These NGOs need to be outside the bureaucracy because state bureaucracy is very quick to settle down on something which is comfortable and manageable. I think the dialectical tension must be maintained. (Transcript NO. 3- Researcher interview)

Informant: Even more so, I hope SEP will foster good relations with single education departments should this be created (Transcript NO. 6 - Director interview)

Researcher: **What other issues would you like to see explored in reaction to the current schooling?**

Informant: No matter what kind of government we will have, there is still a place for independent research and development projects like SEP which come from outside the system (Transcript NO. 7 Board of the Trustees interview).

Researcher: **What are some shortcomings of SEP?**

Informant: I do not think SEP has been a learning organization. SEP is one of the thoroughly evaluated curriculum projects but few people in SEP ever read these reports. Always short-term administrative needs take a priority over carefully reflection and systematic learning. September does not have a documented theory of why it, does what it does...They never stop and say what is our theory of innovation? There is usually no training of new members who join the organization, no staff development (Transcript NO. 3 Research coordinator interview).

Informant: It is difficult to influence the people within SEP to accept the fact that because the environment around us is changing, SEP will also have to change. One of the things where SEP has been tested is the creation of the science centre. Many people within SEP would like to stick to the old way of SEP and so have become more conservative. This is a major contradiction within SEP because while SEP says it is a change agent, the organization itself resisted change... it is all right to change the behaviour of teachers, sponsors and everything else, but the organization itself resists change (Transcript NO. 3- Research Coordinator).

Informant: The organization cannot institutionalize, but rather it should be the principles, philosophy and action practice that must be institutionalized. Thus it is the three Ps philosophy, principles and practices and not the Organization that has got to be institutionalised. The other images of institutionalization are through the subject advisors, as well as through recycling which involves sending a teacher leader to Leeds University and then negotiate a secondment

when s/he or he returns. This arrangement will also be applicable in the case of a single education department and it is not something peculiar to South Africa (Transcript NO. 2 Implementer interview).

Informant: Yes, I agree with the notion of lodging...it was right for SEP to remain autonomous. If you are not independent, I do not think you can be creative. There must be tension between what exists in the state structures and what might be (Transcript NO. 3 Research Coordinator interview).

Informant: SFP might lose support of dual relationships with the teachers and the community if it does not retain its autonomy (Transcript NO. 6 Executive Director interview).

Informant: I think as soon as SEP becomes wholly institutionalized, the innovation will also fall away. What we endeavour to do is to influence the education departments to accept SEP's methodology (Transcript NO. 6 Executive Director).

Informant: Every change agent/programme hopes to influence the system. It is the permeability of the system which determines whether SEP's philosophy and practices will be institutionalized... SEP will probably have to change relationship towards the education departments from oppositional to supportive (Transcript NO. 7 Board Director interviews).

Informant: It is difficult to prove that SEP is successful in terms of student performance because it is currently involved with junior schools. One can only judge the success of the project by its objectives and in the case of SEP, pupil performance is not measured against SEP's

objectives but against the objectives of the authorities. Donors however, have not been satisfied that there have been qualitative changes that have taken place (Transcript NO. 7 Board of Director interview).

Informant: There must be a resounding year before one can argue that a project is successfully implemented. However, since SEP was adopted and implemented, it is almost normal that schools get good results in physical science (Transcript NO. 1 User interview).

Researcher: **What are your comments on the Consultative Committee?**

Informant: You can have any number of Consultative Committees but if the education authorities do not want to cooperate there is nothing anyone can do. Consultative Committees might be able to do something if the department is agreeable to their activities (Transcript NO 3 Research Coordinator interview).

Informant: Consultative Committee are important strategy of getting as much input from local stakeholders as possible (Transcript NO. 7 Board of Directors interview).

Researcher: **What in you opinion is SEP's vision and policy for the future?**

Informant: SEP has to remain autonomous and must not be 'magnetised' to any education departments. It must continue to send implementers to give the necessary assistance should this need arise (Transcript NO. 1 User interview)

APPENDIX 3 (i): CLUSTERED RECURRENT THEMES WITH RESPECT TO VISION AND POLICY PROPOSALS BY ELITE POLICY MAKERS

	TREND	FREQUENCY	NO.OF INTERVIEWS		TREND	FREQUENCY	NO.OF INTERVIEWS
1.	There is a need to rethink what is communicated to students in science.	2	5	9.	Innovation and change of science education need to be contextualized.	9	22
2.	Climate for change and innovation would need to be supported by all interested parties.	2	6	10.	Curriculum in science education needs to cater for the needs of students.	10	21
3.	There is going to be a need to redistribute resources in education in general and science in particular.	3	27	11.	Foreign donors are likely to channel funds through a legitimate state.	10	14
4.	Recruitment of science teachers will have to be seen in relation to affirmative action.	4	5	12.	NGOs and the private sector need to reassess their relationship with the state.	11	28
5.	Policies for the provision of science facilities will have to be reassessed.	4	20	13.	The number of students who are doing science needs to be rapidly increased.	11	26
6.	The state will have to have both the power and authority in order to be effective in its tasks.	4	28	14.	Policies on INSET will have to be reassessed.	12	28
7.	The state will need to take responsibility for the actual delivery of science education.	6	14	15.	The restructuring of science education policy needs to be inclusive.	12	22
8.	There is a need to demystify science among the Blacks.	7	11	16.	A two-tier system of curriculum policies at regional and national level is desirable.	15	18

TREND		FREQUENCY	NO.OF INTERVIEWS	TREND		FREQUENCY	NO.OF INTERVIEWS
17.	NGOs and Private Sector would have to play a pivotal role in science education in the new dispensation.	15	25	20.	Policy on science education would have to be located within the context of historical inequalities.	18	28
18.	NGOs are going tohabe to rethink thheir intervetion	16	20	21.	Policy on science education must evolve out of what actually happens in the laboratory.	19	24
19.	Teachers in general and science teachers need to be empowered.	17	28	22.	Science education curriculum needs to be relevant with respect to regions and rural needs.	20	28

APPENDIX 3 (ii): CLUSTERED RECURRENT THEMES WITH RESPECT TO VISION AND POLICY PROPOSALS BY ELITE POLICY-MAKERS

RECURRENT THEMES WITH RESPECT TO VISION	RECURRENT THEMES WITH RESPECT TO POLICY PROPOSALS
1. The urgency of promoting scientific and technological literacy.	1.1 Science should be made mandatory for all pupils. 1.2 Policies that promote scientific literacy and technology should be developed. 1.3 As many students as possible should go through matric in the short term and many children should do science at primary level.
2. The need to restructure education in South Africa.	2.1 Education should be less bureaucratic and should promote efficiency. 2.2 Education should create opportunities and not restrict them. 2.3 The state should accept the responsibility of providing science education. 2.4 There should be coordination and cooperation between colleges and universities. 2.5 The education system should channel more black students into science. 2.6 The education sector should fight to retain qualified scientists who are likely to join industries as a result of the application of affirmative action.
3. Science education curriculum and policies need to be restructured.	3.1 Science curriculum should be less academic and should be related to everyday lives of children. 3.2 Science curriculum should take into account the variations in response as suggested in the interim constitution. 3.3 Science curriculum policies should be adapted to the needs of rural areas. 3.4 Regions should shape their own science curriculum beyond Standard 7. 3.5 Science teaching should not be driven by matric results. 3.6 Curriculum development in science should be seen as a process. 3.7 There should be a link between curriculum development processes in schools and theoretical issues researched by students in science.

RECURRENT THEMES WITH RESPECT TO VISION		RECURRENT THEMES WITH RESPECT TO POLICY PROPOSALS	
4.	The need for redeployment and provision of resources.	4.1	All schools should be provided with minimum resources as opposed to creating elite science schools.
		4.2	There should be significant proportional gain in school leavers going to science and technological fields.
		4.3	There should be a significant redeployment of resources from humanities to science and technology.
5.	Images, perceptions and attitudes towards science need to be improved.	5.1	Images about science should be demystified by being taught practically rather than theoretically.
		5.2	Students' attitudes and perceptions towards science should be improved by making it less of an elitist subject.
		5.3	The possible image model by the teachers is necessary to improve the images and attitudes towards science.
		5.4	Images and attitudes towards science should be improved by having science on the immediate experiences and not on a Eurocentric model.
6.	There is an urgent need to develop and empower science teachers.	6.1	Curriculum development must involve teachers at national, regional and local level.
		6.2	INSET policies and practice should meet the needs of the teachers.
		6.3	The system should recognise the problems and frustrations faced by science teachers.
		6.4	Teachers should be made more confident about content through workshops and INSET.
		6.5	Teachers should be empowered by being paid for their performance and not qualifications.
		6.6	There should be accelerated programmes for training of science teachers.
		6.7	INSET and other diplomas acquired by science teachers should be accredited. Salary should be adjusted accordingly.
		6.8	Science teachers should be made aware of where to obtain information.
		6.9	There should be a policy change from supervision to support of teachers.

RECURRENT THEMES WITH RESPECT TO VISION		RECURRENT THEMES WITH RESPECT TO POLICY PROPOSALS	
7.	The NGOs and the private sector need to rethink their roles and status in the new dispensation.	6.10	There is a need for INSET for lecturers at colleges.
		6.11	INSET for science teachers should be as teacher driven as possible.
		7.1	It is important that NGOs must coordinate in order to avoid duplication of resources.
		7.2	NGOs should be more involved in non-formal rather than in formal science education.
		7.3	The NGOs should work more cooperatively with the government.
		7.4	NGOs should retain their autonomy even in the new dispensation.
		7.5	NGOs should be financially accountable to the state, but professionally to the donors.
		7.6	NGOs should play the important role of developing the optional material.
		7.7	NGOs should institutionalise their practice.
		7.8	Independent science projects should facilitate institutionalization by secondment.
		7.9	NGOs should become public service contractors.
		7.10	NGOs should resist the temptation to be incorporated into the government and should be spokespersons for a civil security.
		7.11	NGOs should make their curriculum development model available to the system and negotiate their acceptance.
		7.12	NGOs and the private sector should complement the state in the provision of science education.
		7.13	NGOs and independent science innovation projects should not be too big and become bureaucratic.
		7.14	NGOs must concentrate on training and curriculum development.
		7.15	More accountability should be demanded from the NGOs.
		7.16	NGOs should be evaluated continuously.

RECURRENT THEMES WITH RESPECT TO VISION		RECURRENT THEMES WITH RESPECT TO POLICY PROPOSALS	
		7.17	Independent science projects should deliver clear benefits in educational terms and no longer simply deliver benefits in political terms.
8.	The changing of an education needs to be an inclusive process and rooted in practice.	8.1	The changing of the system should take the form of persuading people and not merely telling them.
		8.2	The changing process should involve the existing elites.
		8.3	The policy on changing the education system should be based on the principle of working with one's opponents.
		8.4	The policy on changing the system should not be made through force, but rather through people telling each other's stories.
		8.5	Policy makers in science should look at what happens in the lab and build up policy theory.
9.	The nature of change and innovation needs to be understood by the parties involved.	9.1	Education systems should encourage innovation and not suppress it.
		9.2	The ecological model of change and innovation should guide innovation projects.
		9.3	The project people need to modify their language to get the innovation working.
		9.4	People introducing change and innovation must integrate their expert knowledge with local knowledge.
		9.5	Both the project people and the users should understand the objectives of the project.
		9.6	Curriculum innovation should be seen in discursive terms.
10.	The examination structure and the existing points in the system need to be changed.	10.1	There should be an external examination in science but it should not be centrally controlled.
		10.2	School assessment should be built into the system.
		10.3	Optional areas of study selected by the regions in science should be examined/tested.
		10.4	Care should be taken that repetitions of previous questions in science papers be discouraged.
		10.5	The tendency of examiners to set science questions that are easy to mark and that come directly from text books should be discouraged.
		10.6	There should be a clear policy as to what should happen when assessment is done in science.
11.	Mechanisms which can select students who have potential to science at tertiary level need to be developed.	10.1	First year university programmes should take into account circumstances from which students come.
		10.2	Science departments at tertiary institutions should have certain quotas of black students.
		11.1	Bridging courses should be run parallel to science degree courses.

APPENDIX 4: INTERVIEW GUIDE USED AS A FOLLOW - UP TO QUESTIONNAIRES

	DIRECTORS and DEPUTIES	MANAGERS and IMPLEMENTORS	SPONSORS	USERS	RESEARCHERS and TRAINERS	INTERESTED PARTIES	EDUCATION AUTHORITIES
1.1 Who and what controls the rate of learning and content to be learned in SEP's classrooms?		X			X		
1.2 What is SEP's intended goal with respect to the issues in 1.1 above?	X						
1.3 What is SEP's intended goal of its 'package' approach to curriculum development in science?	X	X			X		
1.4 Does the approach work, if so, why, if not, why?	X	X			X		
1.5 Who decides the content of SEP's material? On what basis is this decided upon?	X	X			X		
1.6 How much autonomy should the various regions of SEP be given? Why?	X	X	X				
2. What do SEP students do that they did not do before being exposed to SEP?	X	X	X		X		X
2.1 What do SEP teachers do that non-SEP teachers don't do?	X	X	X		X		
2.2 Where do you get help with respect to your teaching of science?	X	X			X		
2.3 How many seminars/workshops organised by SEP implementers/ managers have you attended?				X			
2.4 How many seminars/workshops organised by the science subject advisor have you attended?				X			

	DIRECTORS and DEPUTIES	MANAGERS and IMPLEMENTORS	SPONSORS	USERS	RESEARCHERS and TRAINERS	INTERESTED PARTIES	EDUCATION AUTHORITIES
2.5 What misconceptions or alternative conceptions on science have you identified among SEP teachers/pupils in Standard 7 relating to force?	X		X	X			
2.6 What steps would you follow to reduce the level of misconceptions about force in 3.6?	X		X	X			
3.3 What factors in the environment need SEP take into account in selling its methodology and philosophy?	X	X	X	X	X	X	
3.4 Apart from the individual attitudes which other organisational structures of SEP need to change for the users and educational authorities?		X	X	X	X		
3.5 What features of SEP organisation should be targeted to change because they can be manipulated (lend themselves to change)?		X	X		X	X	
3.6 Who decides on the INSET for SEP teachers? On what basis is this being done?	X	X			X		
3.7 Who decides your research priorities? On what basis is this being done?	X				X		
4.1 What do individual regions and schools/teachers do with SEP innovation? What are the implications for its evaluation?					X		
4.2 How have the findings from the implementation of SEP been used to evaluate its model?	X	X			X		
4.3 How do the implementation findings of SEP affect the use of its evaluation results?	X	X			X		
5.1 To whom is SEP accountable?	X	X	X		X		
5.2 Why is it accountable to this/these stakeholder/s?	X	X			X		
6.1 To what extent have SEP teachers assimilated its methods and material into their regular classroom practice?	X	X			X		

		DIRECTORS and DEPUTIES	MANAGERS and IMPLEMENTORS	SPONSORS	USERS	RESEARCHERS and TRAINERS	INTERESTED PARTIES	EDUCATION AUTHORITIES
6.2	What factors within the school system hinder the sustenance of SEP's related changes?	X	X	X		X		
6.3	What changes in the education system are necessary to enable SEP to institutionalise its philosophy and practice?	X	X	X	X	X	X	
7.1	Suppose all schools had laboratories, would SEP in these circumstances continue to provide movable science kits? What is SEP's intended outcome of this policy?	X	X	X		X	X	
7.2	What policy should govern the selection of science schools for certain groups of pupils?		X			X	X	
7.3	How would the analysis of the performance of individuals and groups (rural and urban students) inform the SEP curriculum development team.		X			X		
8.1	What goals does SEP seek to achieve?	X	X	X		X		
8.2	To what extent are SEP's goals shared by its staff and users?		X			X		
8.3	What model of policy making and change is likely to be acceptable to the various stakeholders?	X	X	X		X	X	

APPENDIX 5: CLUSTERED RESPONSES OF INTERVIEWS WITH SEP MANAGERS AND IMPLEMENTERS

ITEM		RESPONSES OF MANAGERS			FREQUENCY
1.1	The rate of learning and content to be learned in SEP's classroom	1.1	(a)	The rate of learning and the content to be learned in SEP's classrooms is controlled by pupils, teachers and the programme used in schools.	4
			(b)	Work programme and the syllabus.	3
			(c)	Teachers and Implementers.	2
			(d)	Teachers, pupils and work-sheets.	1
1.2	SEP's intended goal regarding issues in 1.1 above.	1.2	(a)	SEP's intended goal is to introduce change in the classroom and a hands-on-approach.	4
			(b)	To empower teachers.	2
			(c)	To encourage pupils to learn at their own rate with the teacher facilitating the process.	1
3	SEP's intended goal with its 'package'.	1.3	(a)	To design the curriculum such that there are materials provided and used to address every facet of education.	2
			(b)	To develop curriculum which indicates the proper output of the intended goal.	2
			(c)	To develop a hands-on-and-minds-on-approach.	1
			(d)	Improvement of the learning and teaching of science.	1
			(e)	To teach the child in totality.	1
4	Who decides the content of SEP's material?	1.4	(a)	Curriculum Development Unit.	5
			(b)	The teacher and CDU through workshops nationally and regionally.	3
5	Autonomy to the regions.	1.5	(a)	SEP regions must operate in a unitary fashion and not as autonomous substructures.	5
			(b)	Regional variations that are still permissible in science - finer details within regional operations.	4
			(c)	Regions should be fully autonomous in doing their work. National Office is more likely to dictate to regions' work.	1

ITEM		RESPONSES OF MANAGERS			FREQUENCY
2.1	SEP and non-SEP teachers and Pupils		(a)	SEP pupils ask questions and SEP teachers employ the hands-on and minds-on activity.	5
			(b)	SEP teachers consult each other.	1
			©	SEP teachers and pupils work as a team.	1
2.3	Who decides the content and nature of Implementers Course.	2.3	(a)	The Training Manager and the Research and Development Team.	4
			(b)	The Training Manager, Regional Manager, R & D unit.	2
			(c)	The manager, implementer and National Office.	1
2.7	Who decides on the content of INSET for SEP teachers.	2.7	(a)	The implementers by visiting schools and observing lessons.	6
			(b)	The Implementer assisted by the Manager.	1
4.2	Implementation finding of SEP to test its model.	4.2	(a)	Nothing has been done to test the cluster system of SEP.	2
			(b)	R & D gives its feedback to Implementers and suggests solutions.	2
			(c)	Analysed and evaluated by the R & D.	1
			(d)	It is very rare to see SEP testing the validity of the findings of its implementation.	1
4.3	How do implementation findings on SEP influence the role of its evaluator.	4.3	(a)	Implementation findings and the role of evaluator are based on different or divergent perceptions from each line.	3
			(b)	SEP cannot be evaluated materially.	1
4.4	How implementation findings for SEP affects the use of its evaluation.	4.4	(a)	It can only improve the team work innate to SEP organisation.	3
			(b)	Improves the validity of the evaluation results.	2
			(c)	No concrete strategies have been implemented and monitored.	1
6.1	SEP's assimilation into regular classroom practice.	6.1	(a)	Some classrooms have and are in the process of changing into places of learning by pupils.	4
			(b)	The assimilation of SEP's philosophy into the system depends on the teacher and implementers rapport, support and other features in schools.	3

ITEM		RESPONSES OF MANAGERS		FREQUENCY
6.2	Factors that hinder the sustenance of SEP changes.	6.2 (a)	Principals do not understand the need of science teachers to meet now and then.	3
		(b)	Other teachers use different approaches for the same projects.	2
		(c)	Resistance of some principals in accepting the ideology underlying SEP.	1
		(d)	Lack of equipment hinders the sustenance of SEP changes.	1
		(e)	Attitudes and perception's authorities are not always positive.	1
		(f)	There is a general motivation of the teachers and the nature of the curriculum is generally encouraging.	1
6.3	Changes in the education system to reinforce SEP's philosophy.	6.3 (a)	The school support system needs to change.	4
		(b)	Schools should be supplied with the necessary equipment by the department.	1
		(c)	Departments should get into agreements of implementation of SEP.	1
6.4	SEP movable kits and formal laboratories.	6.4 (a)	Yes, because of large numbers of children and overcrowding necessitates the movable kit.	6
		(b)	Yes, because the government can never supply the required equipment.	2
		(c)	Yes, in order to supplement the formal equipment in formal laboratories.	3
7.1	Criteria to select SEP schooling.	7.1 (a)	Grouping such available work-related groups into zonal working schools.	1
		(b)	Availability of equipment that can be made available.	1
		(c)	Schools and pupils should be given the opportunity of deciding whether they must belong to SEP or not.	1
		(d)	The criterion should be the socioeconomic states of a school.	1
8.1	Goals which SEP wants to achieve.	8.1 (a)	Empower teachers with the best teaching materials.	4
		(b)	To improve the teaching of science.	3

ITEM	RESPONSES OF MANAGERS	FREQUENCY
8.2 The extent to which SEP's goal is shared by stakeholders.	8.2 (a) Users see themselves as distant from the National Office hence the lack of accountability.	1
	(b) To a greater extent.	1
	(c) Everybody is aware of the SEP goals.	1

APPENDIX 6: CLUSTERED RESPONSES FROM THE PROJECT TEACHERS

ITEM	RESPONSES OF MANAGERS	FREQUENCY
Research Question 1:		
1.1 What do SEP teachers do?	1.1 a) SEP teachers get their support from the project's implementers.	6
	b) SEP teachers get their support from their fellow project teachers.	3
	c) SEP teachers get their support from the workshops and seminars organized by SEP implementers.	2
	d) SEP has changed the evaluation in science especially in rural areas.	1
Research Question 1:		
1.2 Assistance for SEP teachers.	1.2 a) Courses arranged for the teachers should revolve around the use of SEP kit.	5
	b) Implementers should add more on the content to raise the level of competence above those of the pupils.	3
	c) Courses for teachers should be on the use of equipment in schools	2
Research Question 2:		
2.1 SEP teachers and SEP kit vis-a-vis non SEP teachers.	2.1 a) SEP teachers do more experiments than non-SEP teachers.	5
	b) SEP kits still being used even if there are formal laboratories.	3
	c) There are not enough SEP kits so teachers do demonstrations only.	3
	d) SEP approaches are changing from quality to quantity.	2
	e) SEP has changed the attitude of teachers and pupils towards science.	1
	f) SEP teachers do not do materials but simply give pupils worksheets and ensure that they follow instructions on them.	1

ITEM	RESPONSES OF MANAGERS	FREQUENCY
Research Question 2:		
2.3 Support of SEP teachers.	2.2 a) Between 1 - 8 seminars and workshops are organised by SEP Implementers each year.	8
	b) No visits were ever made by the subject advisors.	3
	c) One visit was made by the subject advisor per Std. 9 and 10.	1
	d) Many visits were made by the subject advisor.	1
	e) In some schools the support by the principal is not visible.	1
Research Question 3:		
3.1 Relationships within SEP and with Education Authorities.	3.1 a) I think SEP ought to change the material developed during its developmental phase.	5
	b) Department of Education should support teachers by supplying them with basic science apparatus.	3
	c) Schools and principals need to take into account the burden that faces science teachers when making allocation.	2
	d) Ideally SEP kits are intended to be used by the pupils themselves and not by the teachers.	1
	e) Newsletters for SEP teachers can help in better communication.	1
Research Question 4:		
4.1 Institutionalization of SEP philosophy and practice.	4.1 a) SEP's philosophy and practice have become part of school routine in most schools.	4
	b) Inadequate equipment and work-sheets make it difficult for SEP practice to become part of the system.	2
	c) Despite the fact that it is compulsory for schools to use SEP kit, it is difficult for it to be completely part of the system.	3
	d) Vandalism and unavailability of materials make it difficult to implement SEP and for it to become part of the system.	1
	e) Because most schools do not have science kit, SEP kit has become part of the system.	1

APPENDIX 7: LEWIN'S ORIGINAL OBSERVATION SCHEDULE.

1. Settling class, preparation / administration

   Activities not related to the substantive content of the lesson observed, e.g. marking of registers, disciplinary statements, announcements.

2. General Discussions

   Context: Teacher/pupil(s) addressing class as a whole on matters relating to the substantive content of the lesson.

   (i) Introduce facts/principle: facts or principles enunciated for the first time as new pieces of information or as an original synthesis of information available to the class, e.g. stating that the earth has an iron core; establishing that energy can exist in many forms and be changed from one form to another.

   (ii) Recall facts/principles: reiteration of facts or principals previously presented to the class., e.g. recalling how sound is produced; recalling the principle of the water-cycle.

   (iii) Apply facts/principles: applications of facts or principals to explain phenomenons encountered during lessons, e.g. applying knowledge of the circulatory system to a dissected specimen; applying simple kinetic theory to explain why diffusion occurs.

   (iv) Hypothesise: the use of hypothesises is to predict outcomes which can be compared to observed outcomes, e.g. hypothesising the result of connecting 1 6-volt bulb to a 12-volt battery; hypothesising the path of a ray of light through a prism.

   (v) Observe: making direct observations of phenomena in the classroom, e.g. observing the action of dilute hydrochloric acid on magnesium; observing the one way conduction of electrons in a vacuum tube.

   (vi) Interpret data: clarifying the significance of data collected; using data for explication, e.g. using systematic observations of forces applied to levers to explain how levers work; using observations of plant growth to explain the differences between the growth of similar plants in different environments.

   (vii) Infer from data: concluding from evidence that a fact or principle is scientifically established from observations on some metals; concluding what ph. range in soil is most suitable for good plant growth from experimental data derived from soil samples.

3. Group-Teacher Discussion

Context: Teacher and pupil(s) interact within a group which excludes most the class on a matter of substantive importance.

Categories (i) to (vii) have the same meanings in relation to group interactions.

4. Individual-Teacher Discussion

Context: Teacher and pupil interact on an individual basis excluding other pupils from the interaction.
Categories (i) and (vii) have the same meanings but relate to individual interactions.

5. Teacher draws/writes/reads

Context: Teacher and pupils involved as a whole.
Teacher draws diagrams, lists on blackboard, experimental procedure, reads source material to class.

6. Pupils' draw/write

Context: Pupils involved as a whole.
Pupils draw or write in response to stimuli other than worksheets, e.g. noting additional information provided by the teacher; drawing additional diagrams at the teacher's suggestion.

7. Pupils use text/reference books

Context: Pupils involved as a whole.
Pupils use written material other than worksheets as a source of information, e.g. pupils read material in textbooks, pupils use reference books in search of additional information.

8. Pupils use worksheets

(i) Reading
(ii) Writing
Context: pupils involved as a whole

9. Teacher explains experimental procedure

Context: teacher addresses class as a whole.
e.g. introductory discussion explaining techniques to be used; discussion of the design of appropriate experiments.

10. Teacher demonstrates experiments

Context: teacher demonstrates to class as a whole.

11. Class experiments

(i) Group

(ii) Individual

Context: pupils involved within groups or as individuals.

APPENDIX 8: GUIDE TO PUPIL INVOLVEMENT (LEWIN'S ORIGINAL SCHEDULE)

Activity	Pupil Involvement Level		
	1.	2.	3.
1. Preparation Administration		No classifications	
2. General Discussions	Teacher tells. Only class attention required. No discussions. Few, if any, questions	Teacher directs discussion actively involving up to half the class. Periodically asks questions	Teacher leads discussion actively involving most of group. Frequently asks questions. Pupils contribute clearly to the progress of the discussion.
3. Group-Teacher Discussion	Teacher tells. Only group attention required. No discussion. Few, if any, questions	Teacher directs discussion actively involving up to half the group. Periodically asks questions.	Teacher leads discussion actively involving most of group. Frequently asks questions. Pupils contribute clearly to the progress of the discussion.
4. Individual-Teacher Discussion	Teacher tells. Only attention required. No discussion. Few, if any, questions.	Teacher directs discussion. Periodic questioning. Limited contributions to discussions from pupils.	Teacher and pupil discuss with teacher encouraging and responding to pupils contributions. Frequent questioning.
5. Teacher draws/writes/ reads	Controlled fully by teacher. Only attention required.	Controlled by teacher. Class involvement through questioning and some discussion.	Teacher uses dialogue to construct what he writes or draws.
6. Pupils write/draw	Controlled fully by teacher; pupils follow directions (dictation, copying, etc.)	Outlined by teacher and discussed in detail; explicit suggestions given; pupils expected to contribute clearly to end product	Outlined and discussed fully by teacher. Content and organisation left to pupils.
7. Pupils use text / reference books	Teacher directs pupils to read particular text	Teacher suggests pupils read text/ reference books.	Pupils spontaneously use text/reference books

Activity	Pupil Involvement Level		
	1.	2.	3.
8. Pupils use worksheets (i) *Reading* (ii) Writing	Pupils use worksheets on specific instructions from teacher to refer to particular part. Teacher reads or dictates	Pupils use worksheet during lessons without specific instructions to refer to particular parts. Guidance provided to reading or writing	Pupils use worksheets independently. No guidance provided by teacher unless requested.
9. Teacher explains experimental procedure	Teacher outlines procedure to be followed.	Teacher discusses experimental procedure, giving reasons and encourages questions	Teacher and pupils discuss the design of an appropriate experiment.
10. Teacher demonstrates experiments	Teacher demonstrates with commentary; results determined by teacher	Teacher demonstrates involving pupils through questioning. Some observations made by class members. Results largely determined by teacher.	Teacher demonstrates involving pupils in design and experimentation. Class members contribute directly to results.
11. Class experiments (i) Group (ii) Individual		No classification	
12. Circus Experiments		No classification.	

APPENDIX 9: GLOSSARY AND ACRONYMS

CODES USED IN EMPIRICAL CHAPTERS IN THE THESIS

SEP NATIONAL STAFF

SEPN=a
SEPN=b
SEPN=c
SEPN=d
SEPN=e
SEPN=f
SEPN=g
SEPN=h

POLICY MAKERS IN AND OUTSIDE SEP

NGO=a
NGO=b
NGO=c
NGO=d
NGO=e
NGO=f
NGO=g
NGO=h

PUBLIC SECTOR

Pub Sec=a
Pub Sec=b
Pub Sec=c
Pub Sec=d

PARASTATAL ORGANIZATIONS

Par Org=a
Par Org=b
Par Org=c
Par Org=d

PRIVATE SECTOR

Priv Sec=a
Priv Sec=b
Priv Sec=c

DONORS OF SEP

DON=a
DON=b
DON=c
DON=d
DON=e
DON =f

SCIENCE EDUCATOR IN AND OUTSIDE SEP

Sci Ed=a
Sci Ed=b
Sci Ed=c
Sci Ed=d
Sci Ed=e
Sci Ed=f
Sci Ed=g
Sci Ed=h
Sci Ed=i
Sci Ed=I
Sci Ed=k
Sci Ed=l

SEP IMPLEMENTERS

SEPIM =a

SEPIM =b

SEPIM =c

SEPIM =d

SEPIM =e

SEPIM =f

SEPIM =g

SEPIM =h

SEPIM =i

SEPIM =j

SEP MEMBERS OF THE BOARD OF TRUSTEES

SEPB=a

SEPB=b

SEPB=c

SEPB=d

SEPB=e

SEPB=f

SEP IMPLEMENTERS IN THE GAUTENG REGION

GSEP=a

GSEP=b

GSEP=c

GSEP=d

GSEP=e

SEPU= SEP USERS

SEP USERS IN THE GAUTENG REGION

GSEPU=aa

GSEPU=bb

GSEPU=cc

GSEPU=dd

GSEPU=ee

SEP IMPLEMENTERS IN THE NORTH WEST REGION

SEPNW=a

SEPNW=b

SEPNW=c

SEPNW=d

SEPNW=e

SEPNW=F

SEPNW=g

SEP USERS IN THE NORTH WEST REGION

SEPNWU=aa

SEPNWU=bb

SEPNWU=cc

SEPNWU=dd

SEPNWU=ee

SEPNWU=ff

SEPNWU=gg

SEPNWU=hh

SEP IMPLEMENTERS IN THE EASTERN CAPE REGION

SEPEC=a

SEPEC=b

SEPEC=c

SEP USERS IN THE EASTERN CAPE REGION

SEPECU=aa

SEPECU=bb

SEPECU=cc

SEPECU=dd

SEPECU=ee

SEPECU=ff

SEP IMPLEMENTERS IN THE PIETEMARITZBURG REGION

SEPPIETU=a

SEPPIETU=b

SEPPIETU=c

SEPPIETU=d

SEPPIETU=e

SEPPIETU=f

SEP USERS IN THE PIETERMARITZBURG REGION

SEPPIETU=(aa)

SEPPIETU=(bb)

SEPPIETU=(cc)

SEPPIETU=(dd)

SEPPIETU=(ec)

SEPPIETU=(ff)

SEPPIETU=(gg)

Author Ntshoe I M
Name of thesis Implementation And Institutionalization Of Innovation And Change In Science Education: The Case Of Sep Ntshoe I M 1999

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