The perceived roles and functions of school science subject advisors

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The science subject advisor can play an important role in upgrading the quality of science teaching in South African schools. This study deals with the perceived roles and functions of science subject advisors. Interviews with senior executives of the North West Province's directorate responsible for subject advisory services and questionnaires completed by science subject advisors revealed problems they experienced and their views on how to improve the service. Another questionnaire administered to science teachers revealed their problems, perceptions and expectations of the science subject advisors. A literature study highlighted practices in the UK and the US that are of relevance to South Africa. Recommendations are made as to how to optimise the services rendered by science subject advisors.

Introduction

Various studies (Smit, Selvaratnum, Nel, Taole, Du Toit, Selvaratnum, Vreken, 1996, Arnott & Chabane, 1995:29, Howie, 1997:53-54) indicate that there is a serious shortage of properly qualified science teachers at secondary schools in South Africa. The resultantly poor performance of science learners in Grade 12 and the extremely low rating South Africa received in the Third International Mathematics and Science Study (Howie, 1997) can be linked directly to this fact.

The National Department of Education is taking various measures to improve the situation. In-service development of the existing teacher's corps is generally accepted as one of the obvious options. The science subject advisor can play a key role in this strategy. The study reported on had as its aim outlining the role and functions of the science subject advisor in the new dispensation in South Africa.

One of the six key priorities for quality education singled out by the World Bank in a study of teaching in Sub-Saharan Africa was **Outcomes** (Oxtoby 1996:104). South Africa has recently adopted a strategy of outcomes-based education (DOE, 1997).

Although the outcomes-based Curriculum 2005 has recently been revisited (Chisholm, 2000) the principles of outcomes-based education still serve as cornerstones for the Revised Version of Curriculum 2005: A South African Curriculum for the 21st Century (Chisholm, 2000:76). A further motivation for this study was the call from the Centre for Education Policy Development (CEPD), dating back to 1994. CEPD stated that a programme of INSET (in-service training of teachers) "Requires immediate development" (CEPD, 1994:19). It is expected that subject advisors may play an important role in INSET programmes.

In this article the present situation with regard to science subject advisors is analysed and recommendations on how to optimise the service are made.

As circumstances with respect to science teaching do not differ much from province to province in South Africa, it is expected that the results of this study done in the North West Province may also serve a useful purpose in other provinces.

Empirical survey

The survey was conducted in 1997–1999 and was carried out in two sections. The first was a literature study of the situation with regard to subject advisors/inspectors in South Africa, and their counterparts in the UK and the US. It was apparent that little attention had been given in formal studies as reported in literature to supervision in science education, even though the science supervisor is perceived to be a very important person in the science education enterprise (Voss, 1983; Madrazo & Hounshell, 1987:9).

The second part of the survey was conducted in 1998 in the North West Province. Information was obtained by means of structured interviews with the Deputy Director Subject Advisory Services and two senior subject advisors and two questionnaires, one administered to the seven subject advisors and the other to 69 science teachers.

Literature survey

South Africa

The inspectors of education (academic) in the dispensation before the first democratic elections in 1994 had clearly spelt-out functions stipulated in the manual for inspectors of education as, for example, in the former Transvaal province (TED, 1979). Inspectors' roles and functions were specified and differentiated under common functions of inspectors of education (academic) (TED, 1979:5) and specific function of inspectors of education (academic) (TED,1979:7). The assumption can be made that their role specifications optimised their functions. The inspectors of education (academic) were also responsible for determining the grading and promotability of teachers in their subject to the level of a senior teacher (TED, 1979:14). According to Prinsloo (1988:304) the majority of teachers in the TED were in favour of the involvement of the academic inspector (later referred to as academic superintendents) in their professional development, particularly in INSET programmes.

Brighouse and Moon (1995:vii) indicated that changes in the political mood and educational aspirations inevitably influenced attitudes towards inspection. Teachers, particularly in the DET, criticized the subject advisory services and the appraisal system. Subject advisors in the DET had no powers but only rendered an advisory service to teachers. Incompetence, one-off visits, irregular criteria, secrecy, absence of contextual factors and arbitrariness in appraisal processes were among the criticisms levelled against inspectors and subject advisors of the DET (ANC, 1994:53-54).

In some areas there had been, prior to the 1994 elections, a total breakdown of trust between teachers and subject advisors (FRD, 1993: 29). Despite the negative attitude portrayed towards subject advisors, the physical science teachers at Ipelegeng school in Schweizer-Reneke (North West Province) felt that a solution to their teaching problems lay in the formation of study groups to share expertise and to call on subject advisors and university specialists for guidance (FRD, 1994: 88). This is an indication that subject advisors were not completely rejected, but that a clarification of their role and function could change the attitudes of teachers.

Despite numerous criticisms levelled at subject advisors generally, the DET physical science subject advisors conceptualised their roles in 1992 (DET, 1993:1-2). The main emphasis was that the subject advisor was not to be seen as an inspector. His/her role was to advise and not to criticise. The following main areas were identified: Knowledge of the subject(s), innovation, community involvement on science issues, writing skills, confidence, upgrading of unqualified teachers, field and administrative work, identification of good teachers, communicating and establishing good relations with teachers and curriculum development.

This positive development occurred at the end of the apartheid era in South Africa. It can be concluded that in the old dispensation

subject advisors had been concerned with bureaucratic efficiency and social control, rather than effective management and professional development at school level. According to the ANC (1994:53-54) teacher management and support were conceived as two separate processes.

Supervision was oriented towards the narrow objective of improving Grade 12 examination results. Inspection was focused on assessing teachers with a view to monetary rewards and promotion. It was overwhelmingly about compliance with departmental regulations rather than engaging with educators about their work. Loyalty to officials and their departments outweighed the interest and needs of teachers.

In the TED a different scenario presented itself where the inspectors of education (academic) were responsible for subjects in secondary education. Their main role was to take the lead in the subject for whom they were responsible as set out in the common functions (TED, 1979:8).

The United Kingdom

According to Brighouse and Moon (1995:1), inspection in Britain dates back to the Industrial Revolution. The first inspectors of schools were not appointed under educational legislation but under the Factories Act. Around 1839 and thirty years thereafter the inspectorates were developed along denominational lines with separate inspectors for the Church of England, Non-conformists and Catholic schools. Initially it was not a requirement that inspectors should have taught or had experience of schools they were to inspect. The 1870 Act discontinued the denominational split of the inspectorate and by 1980 parliament debated the need for some kind of training for inspectors (Brighouse & Moon, 1995:5).

By 1911 counties tended to have organisers who increasingly advised and organised for schools about matters of health, safety and the latest advances in available equipment.

Advisors in mathematics, science, humanities and modern languages followed the concept of organiser in 1911. This structure compares fairly well with the present advisory service in South Africa where each subject/phase has an advisor (Brighouse & Moon, 1995:8).

The Local Education Authority (LEA) inspectorate/advisory activity expanded in 1986. Grants were made available for mathematics and science teachers and LEAs were also involved in curriculum development. Some of the counties were beginning to refer to their advisors as inspectors.

The period 1980–1992 witnessed the most remarkable growth of advisory and inspectorial activity on the part of LEAs. Particular inspection/advisory posts were created for INSET training for teachers who were non-existent before 1985. In September 1992 the Office of Standards in Education (OFSTED) gave direction to the new inspection system through training and accreditation of inspectors, lay inspectors and team members (Kennedy, 1995:121).

According to Brighouse and Moon (1995:1) the LEAs in the UK employed a group of professional staff in 1992 with a concern for quality in education and it was referred to as "The Advisory Service, the Inspectorate or the Inspection and Advisory Service". In general they were called upon to provide professional educational advice over the deployment of those education resources which did not belong to any one school. Their advice was also sought on matters where individual schools were not judged fully competent. It is clear from what is stated above that the inspectors and advisors functions are closely related in the UK.

A few years before the 1992 developments Gerald Haigh (1989: 22) raised the question: "When is an inspector not an advisor?" According to Mark Lear (Haigh, 1989:27), principal advisor in Devon, "on the spectrum from advice to inspection you cannot actually separate them out". Bill Laar, chief inspector for the New London Authority of Westminster indicated that advisory services in an inspectorial role must make the criteria upon which they are basing their investigation explicit to schools (Haigh, 1989:27). What Laar was asking for was the kind of partnership in which school and inspector agreed on what the criteria of inspection were going to be. Laar (Haigh 1989:27) also mentions a process in which the school's own evaluation plan involves, periodically, an "external view" by the advisory service. This is called the "shared criteria" model of inspection/monitoring whereby the inspector/advisor is involved in the formulation of the school's development plan. According to Laar it may not be a bad rule of thumb to follow that inspection reports should not provide any awkward surprise for schools. Equally inspectors should not be overwhelmed by unexpected discoveries when they visit schools (Haigh, 1989:27).

The above statements somehow indicate the rapport that has to exist between the inspectorate/advisory service and the schools serviced by the two groups of officials. A conclusion can be drawn that the advisors in the UK, through their "shared criteria model" and their team work with inspectors, were acceptable to schools because they conduct inspection on agreed terms of reference.

The United States of America (US)

In the US science teachers were assisted by science consultants/ co-ordinators in the 70s and 80s. In 1980 the National Commission on Excellence in Education observed a steady decline in science achievement of 17-year olds, compared with the achievement measured in 1969, 1973 and 1977. This decline coincided with the steady elimination of science co-ordinators (Stronck, 1987).

In the US the results of two national surveys on the roles of the science supervisor were found to be the same. The NSTA (National Science Teachers Association) Committee on the Supervision of Science Teachers (Madrazo & Motz, 1982:42) conducted the first survey in 1978. The second was directed through the NSTA's Division of Supervision (Madrazo & Hounshell, 1987:10) The participants in the first survey were teachers, administrators and other professionals and in the second one teachers and administrators.

The participants were asked to rank the roles of the science supervisor in the order that would most closely fit their needs. The seven perceived roles in order of preference in both surveys (Madrazo & Motz, 1982:42, Madrazo & Hounshell, 1987:9) were:

- **Instruction:** assistance in the development of instructional materials; implementation of curriculum changes; encouragement of student involvement in extracurricular programme; review and refinement of methods of instruction.
- **Curriculum:** facilitation of teacher involvement in curriculum development; evaluation of new methods and materials; communication of significant new developments and of the status; accomplishments and needs of the science programme.
- **Staff development:** initiation of in-service programme; co-ordination with other school personnel; communication of opportunities for staff development; research in curriculum and long- range programme objectives.
- **Implementation:** initiation of opportunities for teacher exchange and co-operative teaching; dissemination of information on funding; co-ordination of teachers' ideas on the design or remodelling of facilities and development of proposals for new instructional projects.
- **Management:** requisition of supplies; co-ordination of information about laws, liabilities, district policies, safety regulations, financial status, and budgets.
- **Assessment:** analysis of test results; maintenance of data on student achievement, examination of teaching objectives based on test results and assistance to teachers in self-evaluation.
- **Assignment, transfer, load:** assistance in assignment; equalisation of teaching load; resolution of conflict and selection of staff.

One of the most significant conclusions from the literature study is that a lack of clear role definition seemed to limit the effectiveness of the science supervisor. Several investigators have suggested the development of a clearly-defined set of expectations for the position (Madrazo & Hounshell, 1987:10).

Madrazo and Hounshell (1987:13-14) further state: "While there is agreement on the roles of the science supervisors by different participants, it is imperative that these supervisors should examine carefully the role expectations of the various groups of individuals in their school systems. A clear definition of the requirements and role description for the position should serve as basis for the training of supervisors in general and science supervisors in particular. It is recommended that the role function of the science supervisor be continuously evaluated in surveys. Only through reassessment of the role expectancy of the various groups will science supervisors and other educational leaders keep abreast of changing attitudes and perceptions concerning their roles".

The science supervisor in the US fulfils a different role from the science co-ordinator. The supervisor's functions are focused on the academic and professional needs of the teachers as outlined in the seven points stated earlier in this section.

The science co-ordinator's roles compare with that of the senior subject advisor in SA and the chief advisor in the UK. The science co-ordinator, as the name implies, co-ordinates activities by participation in administrative planning with supervisors, participation in disseminating science programmes in the community and writing reports after visits to schools.

Another type of official (namely state science consultants) is reported on in a study that Dowling and Yager (1983:771-774) conducted in 50 states in the US in the period 1960–1980. This study indicates that science consultants in the state departments of education work in local schools, write proposals as members of evaluation teams and spend two-thirds of their time in science education *per se*.

Empirical survey in the North West Province

In 1998 the situation with regard to the science subject advisor was studied in the North West Province. Structured interviews were conducted with the Deputy Director, Subject Advisory Services, and two senior subject advisors physical science. Two questionnaires were completed: one by seven physical science subject advisors and a second by 69 physical science teachers distributed randomly in the province (Dilotsotlhe, 1999: Appendices 1 and 2). The teachers were from eight school districts.

Results

Deputy Director Subject Advisory Services

A structured interview consisting of 51 items was conducted with the Deputy Director, Subject Advisory Services and Professional Support. Conclusions drawn from this interview were:

- There is no legislation governing the functioning of subject advisors.
- A minimum qualification of BSc plus an education diploma is required.
- There is a shortage of experienced subject advisors as a result of the small supply of experienced science teachers.
- There is an orientation towards newly-appointed subject advisors.
- There is no formal evaluation of subject advisors by seniors or teachers. This is due to the Labour Relations Act.
- Subject Advisors do not belong to a professional body that could be used for networking.
- There is evidence that subject advisors are involved in management at the expense of other roles.
- Physical science subject advisors and subject advisors in general are involved in issues not related to their directorate/tasks.
- There is a need to clarify subject advisors' roles so that there is no role conflict, for example subject advisors doing the tasks of circuit managers, the curriculum unit and examinations directorate.

The enormous task of a subject advisor in the North West Province has become apparent from the fact that according to the Deputy Director each subject advisor has on average to attend to 425 teachers teaching at 325 schools.

Senior Subject Advisors, Physical Science

The two senior science subject advisors were interviewed. The aim with the interviews was to probe their views on their own roles and functions and those of subject advisors and the problems they experience in practice.

The following became apparent from the interviews with the two senior subject advisors:

- The mission of the sub-directorate is to render efficient support to all physical science teachers with regard to academic, professional and administrative issues efficiently and effectively.
- Senior subject advisors receive a job description on appointment and their roles are clearly spelt out.
- The roles of the senior subject advisor are mainly to co-ordinate the activities of the subject advisors, to accompany them on school visits, to ensure that standards are maintained in the subject throughout the different districts and to assist them with their professional duties to conduct workshops and to compile reports.
- It appeared that induction and training differ according to the year of appointment. One senior subject advisor was inducted and trained and the other one not. In the case of the one who was trained, the training programme entailed all duties and functions of the senior subject advisor including management and administrative issues.
- The absence of a formal system of training and induction of senior subject advisors on appointment impacts negatively on their performance. Both senior subject advisors expressed this view.
- Senior subject advisors assist subject advisors to overcome some problems they encounter by discussing them with senior management.
- Self-evaluation by the senior subject advisors indicates that both rate themselves as very good on approachability, general helpfulness to subject advisors and teachers and skills in counselling subject advisors. They rate themselves as good on knowledge of school management and in-service skills.
- Their self-evaluation highlights that there are differences between the two senior subject advisors in the level of competence regarding general educational knowledge, availability to subject advisors, skills in observing and assessing work in schools, INSET skills and knowledge of different teaching strategies.
- Senior subject advisors come across obstacles in their duties and these include: unqualified and demotivated teachers, negative attitudes of teachers and duties they are expected to perform beyond their job description. Administrative problems include budget cuts, poor communication, poor co-ordination, and lack of co-ordination and co-operation with senior management, lack of follow-up on the part of senior management and lack of either a government or subsidised car which hampered school visits and workshops at the time of the survey.
- There was no similarity in the ranking of the seven perceived roles (Madrazo & Hounshell, 1987:9) of science subject advisors by the two senior subject advisors.
- In a list of ten qualities regarded as important to consider on appointment of science subject advisors, the three qualities rated as most important by the two seniors were: knowledge of current developments, skills as a problem solver and the ability to look critically at work in the classroom.
- The Key Performance Areas (KPAs) of subject advisors according to the two seniors are: training, coaching and guidance of teachers on content problem areas, to assure quality in the teaching of the subject, management of subject groupings, conducting workshops on examination related matters and difficult topics, action research, monitoring of students' performance and extra-curricular activities.
- There is an induction and staff development programme for the newly-appointed physical science subject advisors. The programme entails administrative issues e.g. reports, cars, itinerary, appraisal, the role and importance of the senior subject and

human relations. This orientation is during the first two weeks after assumption of duty. Not all subject advisors undergo induction and training on appointment.

- There is an attempt to encourage uniformity amongst the subject advisors through provincial meetings where all subject advisors are expected to report on their activities.
- Other functions related to science performed by senior subject advisors included organising the annual Expo for Young Scientists, attending and presenting workshops on Outcomes-based Education, FEST (Foundation for Education, Science and Technology) activities and other activities like assisting in the organisation of The Year of Science and Technology (1998).
- Senior subject advisors perform functions, which are not related to physical/general science which are as follows: assisting in the monitoring of examinations, involvement in teacher appraisal and collection of statistics from schools at the beginning of the year (admissions).
- Of the above-mentioned tasks, the most problematic, as a result of the time devoted to them, were admissions which take a large percentage of their time during the first quarter and monitoring of examinations which takes a lot of time in the fourth quarter. These tasks affect planning negatively during these two quarters, for example, the first weeks of the first quarter are important for the induction of new subject advisors and for reflecting on the previous year.
- Th e effectiveness of the subject advisors is not formally assessed. One of the senior subject advisors was not aware of the evaluation mentioned by the other one. The other senior subject advisor was involved in a SWOT analysis and performance audit. The study was conducted in April 1998, but the results had not yet been published about six months later.

Physical Science Subject Advisors

Seven of the eight (one was on study leave) physical science subject advisors completed a 33-item questionnaire. The aim with this questionnaire was to get a profile of the subject advisors, how they see their duties, and what problems they experience in practice. An analysis of the results revealed the following:

- Physical science subject advisors are adequately qualified both academically and professionally in terms of the minimum requirement of the Department of Education, which is a Science Bachelor's degree, plus a professional educational qualification or the equivalent of these qualifications.
- Although well qualified as physical science teachers, they are inexperienced as subject advisors, e.g. the subject advisor who had most experience as a physical science teacher according to the study had only six years experience as a subject advisor.
- Their perception is that the most important qualities looked for when a subject advisor is appointed are: specialist knowledge, expertise, enthusiasm, teaching experience, knowledge of current developments, ability to look critically at work in the classroom and the ability to form relationships with adults. Important qualities include skill in making oral and written presentations, senior management experience, and the ability to cope with pressure and stress. The least important quality was experience of working with adults.
- 67% of the science subject advisors did not receive a job description on appointment and the remaining 33% who received one indicated that their roles were not clearly spelt out.
- 83% of the science subject advisors did not undergo any training or induction on appointment.
- All the science subject advisors are confident that their own training and experience are adequate for their task and they attribute it to self-empowerment through attendance of workshops, seminars and conferences.
- Subject advisors evaluate themselves as very good on the aspects of general educational knowledge, knowledge of school management, skills in observing and assessing work in the classroom, skills in counselling teachers, knowledge of different INSET strategies and skills in facilitating discussions (INSET). However, the rating declined in responses on items on how they think teachers see them.
- Science subject advisors ranked the following duties high: implementation of suggested improvements, development of new instructional projects, curriculum development, staff development, assessment and implementation. Management was ranked low.
- Policy issues, OBE, science clubs, compilation of instructional materials and catalogues, workshops, and motivation of teachers were cited as other roles performed by subject advisors in addition to the seven perceived roles (Madrazo & Hounshell, 1987: 13-14) of the subject advisors.

A comparison of these roles with the seven perceived ones indicated that these duties still fall within the framework of the latter roles. This indicates that subject advisors agree that they are supposed to carry out the seven perceived roles.

- A major activity of the physical science subject advisors during 1997-1998 was INSET workshops initiated by the subject advisors themselves or in consultation with teachers. The number of workshops varied from 4 to 24 during the period. The workshops focused on problem topics, evaluation, examinations, science Expo, Olympiads, practical work and school policy. The main focus was on Grade 11 and 12 classes. The approach to the workshops varied from advisor to advisor and it appears that there are no guidelines for the organisation and presentation of workshops. The number of teachers who attended the workshops ranged from 50 to 212 per subject advisor and the duration ranged from 2–4 hours per workshop.
- Subject advisors indicated facilitation as their main role during INSET and follow-up visits and evaluation after INSET.
- Individual INSET was given to teachers along the sam e principles as group INSET. The topics of discussion were more or less the same. Group INSET was centralised and individual INSET took place at the individual schools or at the subject advisor's office. Contact time for individual training ranged between 20 minutes and 4 hours.
- Subject advisors also rendered other services like moderation of examination papers and memoranda, preparation of handouts to teachers, clustering of schools, practical work, cross teaching, compilation of a common year plan and encouraging schools to share ideas and resources.
- Subject advisors perform duties, which are not related to their subject. 13 such duties were identified in the questionnaires. The most frequent were: monitoring of Grade 12 examinations, Expo for Young Scientists, Olympiads, encouraging teachers to attend workshops and career guidance to learners.
- When subject advisors visited physical science teachers at their schools, they mainly expected them to present their problems relating to content and students. After the school visit they mainly expected that the teachers should implement their recommendations.
- According to subject advisors the most prominent problems experienced by physical science teachers were that the majority are under-qualified or unqualified to teach science, lack of apparatus, overcrowding of classes, inability of teachers to deliver the subject matter and a lack of text books.

The most popular suggestions for improvement of the above-mentioned problems are provision of more funds for workshops on problem topics and for individual visits to schools to follow-up on implementation.

- There is minimal or no support of physical science subject advisors by the senior subject advisors for physical science.
- The most prominent problems experienced by subject advisors were ranked from the most to least prominent: lack of transport, poor communication with schools and inadequate resources for

example lack of paper to prepare manuals for teachers.

- As far as co-operation and attitudes of teachers are concerned, there was evidence of a lack of commitment and of a culture of teaching. The extent of this on a national scale is outlined by Taylor and Vinjevold (1999:132-162).
- Financial problems (prioritised from the highest to the lowest) encountered by subject advisors resulted in the cancellation of workshops, a shortage of equipment, funds for travel and for textbooks.
- Other problems included a lack of support from senior management, lack of clear policy and direction from senior management and a lack of networking opportunities for subject advisors, e.g. attending conferences, workshops and seminars, which leads to a lack of empowerment of the subject advisors.
- The most prominent problems subject advisors identified on the side of the teachers are: a lack of understanding of methodology and assessment due to lack of training, large classes, shortage of text books, a lack of science equipment, lack of practical skills and a lack of transport to attend workshops.
- Other important problems, although not highly-rated but related to the role of the subject advisor, included the need for a clear outline of the duties of the subject advisor, lack of servicing of subject advisors by the senior subject advisors, their involvement in management problems and provisioning, lack of sufficient authority, restrictions on travelling, lack of mobile units and science kits, lack of transport, lack of resources like computers, and focus on Grades 11 and 12.

Physical Science teachers

The average teaching experience of the 69 physical science teachers who completed the questionnaire was 10.4 years. The aims with this questionnaire were to get information on teachers' expectations of subject advisors, how they experience the service rendered by subject advisors and to reveal problems they encountered — problems they expected subject advisors might be able to assist them in solving. Teachers were expected to reflect in the questionnaire their experien-ces during the period January 1997-June 1998. A summary of the main results obtained from the questionnaire indicated:

- Only 60% of the teachers received assistance in their professional development from subject advisors during the 18 months period.
- 50% of the teachers did not attend INSET courses in 1997–1998 and only 8.5% attended INSET courses initiated by subject advisors.
- The type of assistance received by teachers from subject advisors, based on the seven perceived roles (Madrazo & Hounshell, 1987: 9) was prioritised as follows: instruction, assessment, curriculum, staff development, implementation and management, assignment, transfer load. The time devoted to each varied considerably.
- The criteria to be applied when screening subject advisory candidates before appointment, according to the teachers, are listed in Table1.

It is apparent from Table 1 that the teachers rated all ten given qualities highly. The five most important qualities for the appointment of subject advisors were: teaching experience, specialist knowledge, expertise and enthusiasm, skills as a problem solver, knowledge of current developments and the ability to look critically at work in the classroom.

- The teachers' expectations of subject advisors when they visited schools, in order of priority, were: best advice and guidance on problems in the subject (71.4%), evaluation of the teachers (22.8%), motivation and acknowledgement of good work (15.7%), information (11.4%) and evaluation of students (7.1%).
- The teachers expect the subject advisors to do the following after their visits to schools: follow-up on problems (35.7%), draw conclusions on what needs to be implemented (22.1%), improvement in teaching and learning (25.7%) and more enthusiasm on their side (7.1%).
- Teachers expected subject advisors to play the role of facilitator (41.4%), guidance and encouragement (22%), to update the teacher (6%), be expert (5%), and evaluation (5%).
- Teachers expected subject advisors to visit (52.8%), evaluate them (25.7%) and implement programmes (10%).
- It was clear from the responses of teachers that Science, Engineering and Technology (SET) career guidance is inadequate in schools. That is attributed to the fact that subject advisors are called upon for career guidance at some schools.
- There is potential and willingness among teachers to be trained as advisory teachers or "master" teachers. These teachers can be used to train their peers as is done in the UK and the US.

Table 1 Criteria set by teachers for appointment of subject advisors (n = 69)

Criteria	Most important		Important		Less important	
	No.	%	No.	%	No.	%
Teaching experience	62	90	5	7	2	3
Specialist knowledge, expertise, enthusiasm	60	87	9	13	-	-
Skill as a problem solver	51	74	18	26	-	-
Knowledge of current developments	50	72	17	25	2	3
Ability to look critically at work in classroom	42	61	23	33	4	6
Ability to cope with pressure and stress	39	56	26	38	4	6
Skill in presentation orally and in writing	35	51	27	39	7	10
Senior management experience	30	44	31	46	7	10
Ability to form relationships with adults	28	41	32	46	9	13
Experience of working with adults	19	28	33	48	17	24

Summary of research results

The survey clearly indicated that the functioning of the North West science subject advisory service was far from optimal. Shortcomings in management, role definition and logistics were exposed. Teachers had certain expectations of the subject advisors that can serve as guidelines in restructuring the service. A literature study on similar services in the UK and the US provides valuable information that can be considered for implementation in SA.

Based on the results of the study, recommendations are made on how to improve the services rendered by subject advisors.

Recommendations

- There is a definite need for legislation/rules that governs the roles and functions of subject advisors in general and that of science advisors in particular.
- The role of the science advisor must be explicitly stated. A mission statement should underpin the role definition. A job description with critical performance areas clearly indicated is necessary. The seven perceived roles identified by Madrazo and Hounshell (1987:9) may serve as guidelines for the job description. Assignments not in line with the mission and job description must be avoided.
- Criteria for the appointment of science subject advisors must be formulated. Indicators for these criteria are given in Table 1.
- A structured programme of courses for the induction of newly-appointed subject advisors and one for the continuous professional development of advisors must be developed. Relevant international developments on this terrain must be included in the courses. Outsourcing of these in-service courses to a tertiary

institution(s) must be considered. The subject advisors of some provinces can be grouped together for such courses during times that science teachers are due to other duties not available for in-service courses. The possibility of accreditation of the INSET courses by SAQA (South African Qualifications Authority) must be investigated. It is recommended that science subject advisors form a national special interest group (SIG) to co-ordinate efforts to address their professional needs.

- The needs and expectations of science teachers must be surveyed regularly and taken into account at courses offered to teachers.
- Logistic matters must carefully be attended to. The success of the subject advisory services depends critically on logistic factors like schedules, number of teachers per subject advisor, resources and budget.

Conclusion

The role and functions of the science subject advisor in the North West Province of South Africa were surveyed in the empirical study reported on in this article. Problems that impact negatively on the performance of subject advisors were identified. Teachers' perceptions and expectations of the service were probed. A literature study on the situation in similar services in the UK, the US, and the pre-democratic South Africa brought into focus the perspectives that the recommendations are based on. The outcome of this study could be expected to be of importance to other provinces in South Africa too.

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References

African National Congress (ANC) 1994. *A Policy Framework for Education and Training*. Braamfontein.

Arnott T & Chabane S 1995. Teacher demand, supply, utilisation and costs. *Report for the National Teacher Education Audit*. Graighall: Edusource.

Brighouse T & Moon B 1995. *School inspection*. Great Britain: Redwood Books.

Centre for Education Policy Development (CEPD) 1994. *Curriculum Frameworks for Science, Technology and Mathematics*. Johannesburg: Macmillan.

Chisholm L (Chairperson) 2000. A South African Curriculum for the Twenty-first Century. *Report of the Review Committee on Curriculum 2005*. Pretoria: Government Printer.

Department of Education and Training (DET) 1993. *Science Advisors' Conference Proceedings*. Pretoria: Government Printer.

Dilotsotlhe KE 1999. The role and function of the physical science subject advisor in the North West Province. Unpublished Masters' dissertation. Potchefstroom: PU for CHE

Department of Education (DoE) 1997. *Curriculum 2005. Learning for the 21st Century*. Pretoria: Government Printer.

Dowling KW & Yager RE1983. Status of science education in state departments of education: an initial report. *Journal of Research in Science Teaching*, 20:771-780.

Foundation for Research Development (FRD) 1993. The capability and capacity of South Africa to produce school science equipment. A feasibility study. *Programme Series No. 15*. Pretoria: FRD.

Foundation for Research Development (FRD) 1994. Cluster studies of the laboratory situation in South African schools. *Programme Series No. 16*. Pretoria: FRD.

Haigh G 1989. When is an inspector not an advisor? Gerald Haigh looks for the answers. *The Times Educational Supplement*, 27.

Howie SJ 1997. Mathematics and Science Performance in the Middle School Years in South Africa. *TIMSS South Africa*. Pretoria: HSRC.

Kennedy J 1995. In: Brighouse T & Moon B. *School inspection*. Great Britain: Redwood Books.

Madrazo GM & Hounshell PB 1987. The role expectancy of the science supervisor: Results of research in science supervision. *Science Education Journal*, 71:9-14.

Madrazo GM & Motz L 1982. Science supervisors — An endangered species? *The Science Teacher*.

Oxtoby R 1996. Priorities and strategies for education, a World Bank Review. *Education with Production Journal*,12::103-106.

Prinsloo ML 1988. Die professionele ontwikkeling van die natuur- en skeikundeonderwyser: 'n bestuursimperatief. Ongepubliseerde PhD-tesis, Johannesburg: Rand Afrikaans University.

Smit JJA, Selvaratnam M, Nel SJ, Taole SH, Du Toit CJ, Selvaratnam H & Vreken NJ 1996. The training of physical science teachers in the North West Province. Report of a study undertaken by the Universities of Potchefstroom and the North West, in co-operation with the North West Education Department, for the Foundation for Research Development. Potchefstroom: PU for CHE.

Transvaal Education Department (TED) 1979. *Manual for inspectors of education*. Pretoria: Government Printer.

Stronck DR 1987. Teachers' attitudes toward science co-ordination in British Columbia School Districts. *Journal of Science Education*, 17:21-27.

Taylor N & Vinjevold P (eds) 1999. *Getting Learning Right. Report of the President's Education Initiative Research Project*. Johannesburg. Joint Education Trust.

Voss BA 1983. Science supervision. In: Madrazo G M & Hounshell PB. The role expectancy of the science supervisor: Results of research in science supervision. *Science Education Journal*, 71:9-14.