Fairhall School

Science Curriculum Delivery:
A Profile for Staff Discussion and School Development

Compiled by Dr. Brian Lewthwaite

School of Education
James Cook University
Townsville, Queensland

January 28, 2014

Steve Crockett
Fairhall School
Marlborough

Dear Steve

As requested, I have processed the information collected from the completion of the *Science Curriculum Implementation Questionnaire* (SCIQ) completed by eight of your staff. You mentioned that the information would be used as part of your Science Curriculum Review. Based on the number of responses, I think that this is an excellent starting point for your review process. The sample size for this analysis includes I believe most, if not all, of your teaching staff, and, thus, the information presented should be considered to be a very good reflection of the overall staff perceptions of factors influencing science program delivery.

I wish to emphasize that the results from the questionnaires showed many consistent perceptions amongst staff and therefore the results are likely to be quite representative of identifying school environmental and teacher professional aspects influencing science curriculum delivery, both positively and negatively.

The information provided by the SCIQ is likely to be of professional interest to you and your staff in furthering the improvement of science curriculum delivery at Fairhall. I believe the information provides a valuable platform for staff discussion and ongoing school development. You may wish to consider the value of discussing some of the information presented in this document, in particular the information gathered from the SCIQ, with your staff collectively at a staff meeting and use it as a foundation for systematic inquiry. I suggest to principals that the graph of page 7 be distributed and discussed, because the 'gaps' are the issue areas for improvement. The coinciding lines are areas of congratulations! Also, look at the standard deviations as these provide indication of the level of agreement amongst staff.

In brief, the data will prompt discussion and, I trust, action. There have been several academic papers written on school development processes using the SCIQ and I could send them along if you wish. Usually I like to be present for these meetings, but, because of my current location I am not available.

Yours faithfully

Dr. Brian Lewthwaite
Associate Professor
Science Education
James Cook University
Townsville, Queensland

Contents

Science Curriculum Implementation Questionnaire

The *Science Curriculum Implementation Questionnaire* (SCIQ) is a 7-scale, 49-item questionnaire that provides accurate information concerning the factors influencing science program delivery. Four of the scales pertain to the **school environment**. These include Professional Support, Time, Professional Ethos and Resource Adequacy. The remaining three scales pertain to **teacher personal attributes**. These include Professional Interest and Motivation, Professional Adequacy and, finally, Professional Knowledge. A description of each of these scales is provided in the Table 1 below.

Table 1: Scales and Sample Items From the Science Curriculum Implementation Questionnaire

Scale	Description of Scale	Sample Item
Resource Adequacy	Teacher perceptions of the adequacy of equipment, facilities and general resources required for teaching of science.	The school has adequate science equipment necessary for the teaching of science
Time	Teacher perceptions of time availability for preparing and delivering the requirements of science curriculum.	Teachers have enough time to develop their own understanding of the science they are required to teach.
School Ethos	Overall school beliefs towards science as a curriculum area. Status of science as acknowledged by staff, school administration and community.	The school administration recognises the importance of science as a subject in the overall school curriculum.
Professional Support	Teacher perceptions of the support available for teachers from both in school and external sources.	Teachers at this school have the opportunity to receive ongoing science curriculum professional support.
Professional Adequacy	Teacher perceptions of their own ability and competence to teach science.	Teachers at this school are confident science teachers.
Professional Science Knowledge	Teacher perceptions of the knowledge and understandings teachers possess towards science as a curriculum area.	Teachers have a sound understanding of alternative ways of teaching scientific ideas to foster student learning.
Professional Attitude and Interest	Teacher perceptions of the attitudes and interest held towards science and the teaching of science.	Science is a subject at this school that teachers want to teach.

Summary of Analysis

The following section gives a brief summary of the analysis. Although there may be variation in the views held by the staff at Faihall, the summary is a general 'trend' gathered from the data. A more thorough analysis is given in the pages to follow:

- Staff perceptions in all but Resource Adequacy are in the neutral to highly positive range. This suggests that teachers, by and large, see all other scales of the science curriculum as moderately to highly supportive of a science program delivery.

- While these perceptions indicate staff satisfaction and no 'great cause for concern', some improvement in selected areas is also preferred by staff.

- Resource Adequacy is seen as a concern by most staff members. This is a multidimensional aspect (organisation of equipment, facilities, availability of equipment) that will be discussed later.

- Similarly, there are quite neutral perceptions about staff professional knowledge for teaching science, which is again multidimensional (knowledge of science, knowledge of science teaching strategies).

- Time is also perceived as a concern by many.

- There is little variation overall in scoring from respondents, suggesting a general agreement amongst staff over most matters.

- The highest scoring occurs in the areas of collegial support and school leadership. This implies teachers perceive they work in a collaborative and effective environment. This is tremendous and gives some indication of the school's overall positive perception amongst staff. As well, it suggests that if the staff were to enact a collaborative professional development initiative or development inquiry, the school functions as such that this would likely be very successful.

- In general, the seven areas can be categorised into three levels based on their ratings from the staff:

1. *Professional Science Knowledge, Professional Adequacy* and *Professional Attitude and Interest* were perceived as the second most positive areas by respondents. These are also the areas where staff perception is variable, especially in Professional Knowledge.

2. *School Ethos* and *Professional Support* rated slightly higher. These are the areas with the least diversity in responses from the staff.

3. *Resource Adequacy* and *Time* were notably below the other two categories suggesting a heightened awareness of the need for improvement in these areas.

- Of all their personal attributes teachers perceive their pedagogical and subject matter knowledge (strategies and knowledge of science) as lower than their overall attitude and adequacy.

- Overall, in comparison to the scores of schools that have applied the SCIQ, Fairhall is in a very positive position and it is likely its students are gaining valuable experiences in science.

Some important statements:

- **Teachers perceive they are pressed for time to prepare and deliver the requirements of the science curriculum.**

- **Teachers, overall, perceive there are concerns with adequate equipment, facilities and general resources for the effective teaching of science. This may be only an availability issue.**

- **Several teachers are interesting in improving their pedagogical capability in the teaching of some science areas.**

- **Does the school have a designated curriculum leader for science? If not, it may be wise to discuss this and consider how these issues may be remediated.**

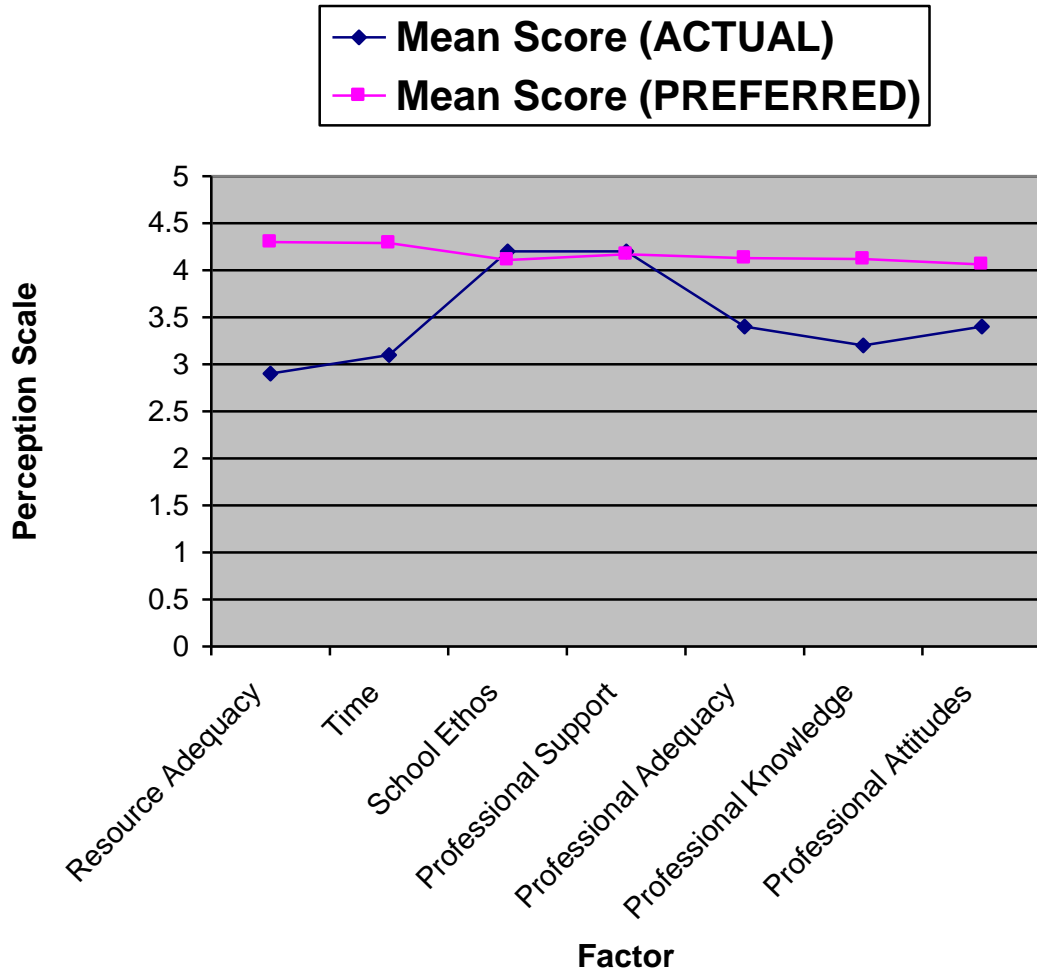# Fairhall School - Actual & Preferred SCIQ Comparison

Figure 1: Actual –Preferred Comparisons for Fairhall

Fairhall School Profile - Actual

The information in Table 2 presents the results from the SCIQ *Actual* application at Fairhall. Eight staff members completed the actual form of the questionnaire. The data presented gives a picture of how staff members see the school, in the context of science program delivery, as it **is.**. The information is also represented graphically in Figure 2.

Table 2: Science Curriculum Implementation *Actual* Profiles for Fairhall

Scale	Mean Score*	Standard Deviation**
Resource Adequacy	2.9	0.72
Time	3.1	0.66
School Ethos	4.4	0.26
Professional Support	4.2	0.26
Professional Adequacy	3.3	0.41
Professional Knowledge	3.1	0.44
Professional Attitudes	3.4	0.52

*   1 (very low) to 5 (very high)
** High values indicate a wide range in responses amongst staff.

Figure 2: Science Curriculum Implementation *Actual* Profiles for Fairhall
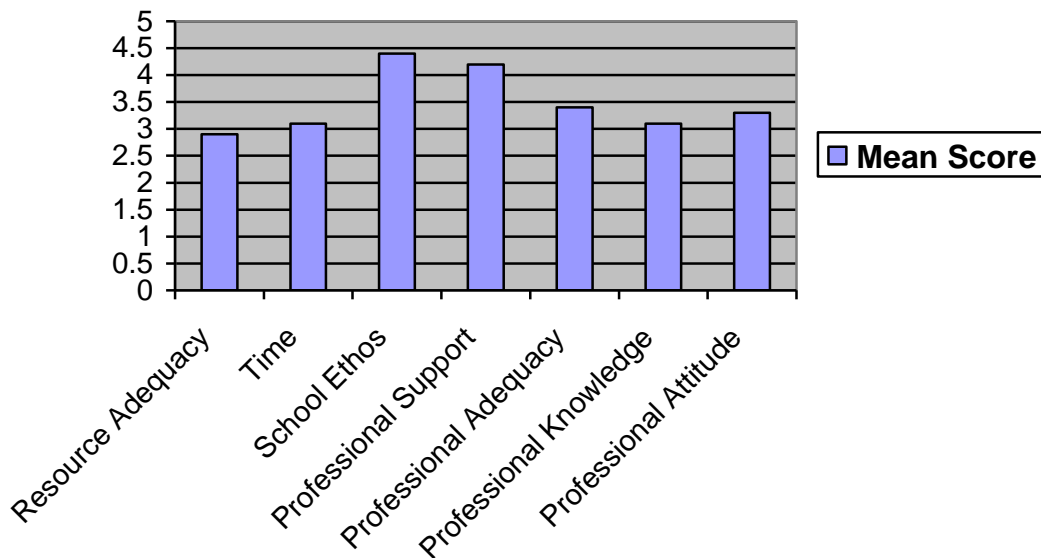
Aggregated Preference for Over 220 Schools - Preferred

The information in Table 3 presents the results from the SCIQ *preferred* application at over 200 schools. This instrument was not completed by the Fairhall staff but I would think this data would be close to what teachers at Fairhall prefer. The information is also represented graphically in Figure 3.

Table 3: Science Curriculum Implementation *Preferred* Profiles for Aggregated Schools

Scale	Mean Score*	Standard Deviation**
Professional Knowledge	4.12	0.18
Professional Attitude	4.06	0.23
Resource Adequacy	4.30	0.21
Professional Adequacy	4.13	0.17
School Ethos	4.11	0.19
Time	4.29	0.20
Professional Support	4.17	0.14

* 1 (very low) to 5 (very high)
** High values indicate a wide range in responses amongst staff

Figure 3: Science Curriculum Implementation *Preferred* Profiles for Aggregated Schools
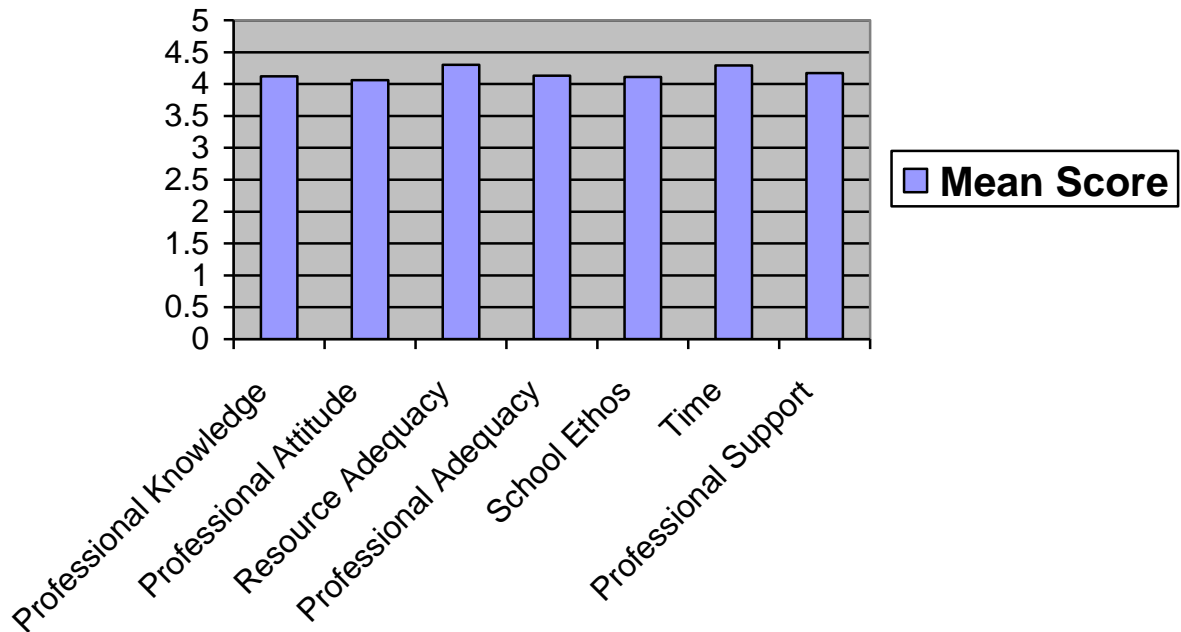
What Does This Information Mean?

1. Resource Adequacy:

Data collected from the SCIQ application confirm that the resourcing of science as a curriculum area is of some concern for teachers at Fairhall. With the lowest actual mean of 2.9, it is perceived by teachers as the most problematic of the seven categories. The high standard deviation of 0.72 shows inconsistency among the teachers' perceptions, however the clear majority rated it as the most negative item. This suggests that the availability of resources for science teaching is a key area of concern for the staff at Fairhall, and that there is much perceived room for improvement in this regard. As two other respondents had a positive perception of the resource adequacy of the science curriculum, staff discussion of this issue is recommended to identify specifically where any resource shortages may exist.

2. Time

As with Resource Adequacy, Time was rated by respondents as an area in need of consideration. It achieved the second lowest actual mean (3.1) indicating again it is an area with a perceived need for improvement. It is important to identify in what ways teaching staff are feeling pressed in this area. Time is usually perceived as the major factor inhibiting primary science program delivery. The broad curriculum requirements of the NZ Curriculum Framework contribute to this problem, but it is important to recognise that the time factor is often reflected in the low priority placed on science in many schools. **The SCIQ results emphasize that time availability is perceived to be a factor influencing science curriculum implementation.** While the high standard deviation (0.66) shows this

view is not shared by all, half the respondents indicated there is not enough time or room in the school curriculum to teach science effectively. It is important to address this issue through discussion in your school review.

3. Professional Support:

The SCIQ results show an overall positive perception of the adequacy of the support available from both in-school and external sources to foster science program delivery (mean score 4.2). The low overall standard deviation (0.26) and range of individual ratings indicate this is not a matter of varying interpretation between teaching staff. While most all recognise the support they receive in developing their capabilities as science teachers as adequate, there is reference to possible need for (increased) curriculum leadership in science. The relatively high preferred mean (4.2) also indicates a desire among teachers to improve on this issue. It is possible that the support issue is more of a concern for starting teachers or particular grade levels. An effort to follow through strategically on the information provided by this analysis is likely to address this concern. If the school is embarking on a Science Review it will likely be accompanied by some coherent action. This is likely to require in-school and, possibly, external support.

4. School Ethos:

Akin to the results on Professional Support, the SCIQ responses on School Ethos exhibit an overall very positive perception on the status of science as a curriculum area (mean 4.4). There is nigh agreement over this status among staff (standard deviation 0.26). The profile of science in the school ethos was rated as highly as 4.4 and 4.3 by some respondents, however two others placed it moderately. Again, this may be a reflection of different grade levels and personal experiences. **It is apparent that**

most teachers perceive that the administration and school, in general, place a fair priority on science as a curriculum area.

5. Professional Adequacy

The SCIQ results suggest that teachers have a moderately positive perception of their own abilities and competence to effectively teach science (mean 3.3). The standard deviation of this mean is also moderate meaning some agree with this statement and some disagree. **It will be valuable for staff to discuss areas in which they perceive their adequacy is compromised.**

6. Professional Science Knowledge

The Professional Science Knowledge of teachers was also perceived moderately, though slightly less so than their Professional Adequacy (mean 3.1). Again, a relatively low standard deviation (0.44) indicates the perception is reasonably shared throughout the teaching staff. Of the three areas of personal attributes and abilities (Adequacy, Knowledge, and Attitude) Knowledge was perceived as the weakest with the most room for improvement. This scale deals with a variety of knowledge aspects, **especially varying strategies required by teachers to teach science effectively**. Further discussion will help reveal where Science Knowledge development is needed.

7. Professional Attitude and Interest

The SCIQ results show a moderately positive perception of the teachers' personal interest and motivation for the teaching of science. It achieved the highest equal actual mean for Personal Attributes (3.4). While a reasonable standard deviation (0.52) suggests some variation amongst the teachers' perceptions, its lowest individual score was neutral, not negative. These statistics indicate a consistent attitude and

willingness of teachers to 'make science work'. This is critically important for the school in light of the more negative perceptions of the school's teaching environment.

Where To From Here?

This information raises some important questions. These questions, and any others that may arise as the data is considered, are likely to be best answered by, first of all, the administration-science curriculum leader and then by the staff during a discussion after a presentation of the data provided by the SCIQ. Consideration should also be given to the information illustrated in Figure 4. Where are the discrepancies between what teachers see as the present situation and where they would prefer to be?

1. It is important to consider the accuracy of this data. Do teachers identify and agree with the data collected from the SCIQ? Do they think the data is accurate?

2. The SCIQ results indicate that staff perceive their personal professional knowledge, attitude and adequacy as more effective in the teaching of science at Fairhall than Resource Adequacy and Time. Is this an accurate comment? What has contributed to this positive perception? What can be done to nurture this positive aspect of the staff collective?

3. The availability and management of resources is seen as a significant concern for the teaching staff. Is this accurate. Is the resource problem a concern for some grade levels or science topics only? Are the issues specific to equipment and availability? What coherent strategies can be implemented to address these concerns?

4. What do teachers, collectively, see as the 'time' problem? Is the time problem more of an issue for some teachers than others? Can the time problem be addressed practically? Is there a need to address those aspects of the overall school program that interfere with curriculum requirements?

5. Where professional knowledge is of concern, what specifically is the knowledge concern for teachers? Is it: Knowledge of the science? Knowledge of ways to teach science ideas effectively? Knowledge of the curriculum?

6. Perceptions of Professional Support and School Ethos received the highest perception scores and consistency. Is this a real? If so, congratulations because this is seldom experienced in schools, especially primary schools. Well done! What is contributing to this? How can it be sustained?

.

The School Development Process: Some Valuable Information for Consideration

National and international studies testify to some of the common features of strategies that promote teacher change and science curriculum implementation. These features quite evidently address many of the factors highlighted in this report.

The characteristics of these models include a common list of features. **Teachers require concrete experience** in order to become more knowledgeable and confident in their professional science ability. The experiences provided must be based on both the practical and theoretical levels and provide opportunity for both cognitive and affective change. As well, **teachers must have the time to plan, prepare, interpret, and reflect**. Change, marked gradually rather than through leaps, is a product of time. **Teachers need to work within a sustained and well-resourced collaborative and supportive environment with colleagues and support staff**. Personal contact and social interaction is imperative. Teacher development is fostered when teachers are provided the opportunity to collaboratively develop and discuss ideas through practical experiences. **Support staff and school-based leadership are critical to teacher change**. Teachers need to operate within an environment of consensus from below and pressure from above to create a two-way relationship with top-down and bottom-up influence. **What is required is a sustained two-way relationship of pressure, support, and continuous negotiation. The supporting staff needs to be effective leaders**. Effective leadership is characterised by the commitment and competence to address the learning needs of the participants and progress towards identified targets. Finally, **teacher change is associated with a climate of readiness**. Teachers need to be more than willing; they must want to work towards change.

In summary, teacher change is best facilitated when professional development combines structural features of quality professional development within a sustained cultural environment of networking, readiness, co-operation, and support. It requires a coherent and sustained strategy to understand and influence both the classroom and overall school environment in order to foster improvement in science education practice.

Dealing with the Problems: What Other Schools Have Considered.

Resource Adequacy

- Increasing staff awareness, especially new staff, of resources available in the school and through the Ministry and other providers.
- Teacher Aide assigned to organise and replenish science equipment in the resource room.
- Whiteboard placed in resource room to identify who has borrowed equipment.
- Science curriculum leader identified and required to compile list of required equipment.
- Reallocation of funding to improve equipment availability.
- Room developed to be used for practical subjects such as technology and science.
- One central resource room for all curriculum resource materials. Materials requested and signed out through one central channel.

Time

- Clear indication by principal to staff of approximate time allocation to science eg. one strand per term, one afternoon per week, etc.
- Staff decision to reduce participation in events that impact on curriculum delivery.
- Integration of science with other curriculum areas but still retaining science as a major focus.
- Including science as a core curriculum area to promote numeracy

and literacy and problem solving skills.

- Changing of school delivery of curricula by identifying staff specialists in selected curriculum areas and rotation of senior students through a timetabled specialist area two afternoons a week.

School Ethos

- Clear indication by senior management of the compulsory inclusion of science as a regular part of the school curriculum.
- Linking science programme with key activities and people within the community.
- Participation in annual science events.
- Listing science achievement on school report cards.
- Recognising science classroom achievement in assemblies.
- Identifying school and year-long science integrating themes in overall curriculum planning.
- Profiling science activities in school newsletters.
- Recruitment of a teacher with a science strength.

Professional Support

- Identifying science support staff within the school**.**
- Identifying science professional and community support within the region and community.
- Conducting annual -biennial science curriculum reviews
- Administrative active commitment to science program delivery by supporting staff involvement in science activities, staff-wide professional development and funding allocation for facilities and

other resources.

Professional Adequacy

- Identifying through appraisals staff strengths and weaknesses in curriculum areas.
- Identifying key areas where perceptions of adequacy is of concern.
- Balancing curriculum strengths in syndicates.
- Identifying best strategy for support for individual, syndicates and school-wide needs.

Professional Knowledge

- Surveying staff to determine science concept or curriculum strand concerns.
- Coherent and sustained strategy to work with advisor for one strand per term and teach to this one strand per term.
- Full staff participation in school-based curriculum development
- Exposure to new science resources.
- Balancing curriculum strengths in syndicate.
- Team teaching – rotation of students through teachers by identified strand or topic strength.

Professional Attitude and Interest

- Full staff or syndicate participation in teacher only development in selected science areas.
- Balancing curriculum strengths in syndicates.
- Confronting attitudes and encouraging staff change, participation involvement where necessary.

Science Curriculum Implementation Questionnaire (SCIQ)

There are 49 items in this questionnaire. They are statements to be considered in the context of the school in which you work. Think about how well the statements describe the school environment in which you work.

Indicate your answer on the score sheet by circling:

SD   if you *strongly disagree* with the statement   D   if you *disagree* with the statement;
N   if you *neither agree nor disagree* with the statement or are not sure;   A   if you *agree* with the statement;
SA   if you *strongly* agree with the statement;

If you change your mind about a response, cross out the old answer and circle the new choice.

1. Teachers at this school have a good understanding of the science knowledge, skills and attitudes they are to promote in their teaching.   SD D N A SA
2. Teachers have a positive attitude to the teaching of science.   SD D N A SA
3. The school is well resourced for the teaching of science.   SD D N A SA
4. Teachers at this school are adequately prepared to teach science.   SD D N A SA
5. The school administration recognises the importance of science as a subject in the overall school curriculum.   SD D N A SA
6. There is not enough time in the school program to fit science in properly.   SD D N A SA
7. Teachers at this school have the opportunity to receive ongoing science curriculum professional support.   SD D N A SA
8. Teachers at this school have a sound knowledge of strategies known to be effective for the teaching of science.   SD D N A SA
9. Teachers at this school are reluctant to teach science   SD D N A SA
10. The school-based system of managing science resources is well maintained.   SD D N A SA
11. Teachers at this school are confident science teachers.   SD D N A SA
12. The school's ethos positively influences the teaching of science.   SD D N A SA
13. There is enough time in the school week to do an adequate job of teaching the requirements of the national science curriculum.   SD D N A SA
14. Collegial support is a positive factor in fostering the implementation of science programs in this school.   SD D N A SA
15. Teachers have a sound understanding of alternative ways of teaching scientific ideas to foster student learning.   SD D N A SA
16. Teachers have a strong motivation to ensure science is taught at this school.   SD D N A SA
17. Teachers at this school have ready access to science materials and resources.   SD D N A SA
18. Teachers at this school are competent teachers of science.   SD D N A SA
19. The school places a strong emphasis on science as a curriculum area.   SD D N A SA
20. The school curriculum is crowded. Science suffers because of this.   SD D N A SA
21. The collegial support evident in this school is important in fostering capabilities in teachers who find science difficult to teach.   SD D N A SA
22. Teachers at this school are secure in their knowledge of science concepts pertinent to the primary science curriculum.   SD D N A SA
23. Teachers at this school have a positive attitude to science as a subject in the primary school program.   SD D N A SA
24. The facilities at this school promote the teaching of science.   SD D N A SA
25. Teachers possess the personal confidence, and skills necessary to teach science competently.   SD D N A SA
26. Science has a high profile as a curriculum area at this school.   SD D N A SA
27. There is enough time in the school program to teach science.   SD D N A SA
28. Teachers have the opportunity to undertake professional development in science.   SD D N A SA
29. Teachers at this school possess the necessary science subject knowledge to be a good primary science educator.   SD D N A SA
30. Science is a subject at this school that teachers want to teach.   SD D N A SA
31. The science resources at the school are well organised.   SD D N A SA   SD D N A SA
32. Teachers at this school have positive perceptions of their competence as primary science educators.   SD D N A SA
33. Science has a high status as a curriculum area at this school.   SD D N A SA
34. Teachers believe that there is adequate time in the overall school program to teach science.   SD D N A SA
35. Teachers at this school are supported in their efforts to teach science.   SD D N A SA
36. Teachers at this school have a good background knowledge for teaching science.   SD D N A SA
37. Teachers at this school have a positive attitude to science as an essential learning area.   SD D N A SA
38. The equipment that is necessary to teach science is readily available.   SD D N A SA
39. Teachers at this school are adequately prepared to teach to the requirements of the national science curriculum.   SD D N A SA
40. Science as a curriculum area is valued at this school.   SD D N A SA
41. Teachers have the time to effectively deliver the requirements of the national science curriculum.   SD D N A SA
42. The senior administration actively supports science as a curriculum area.   SD D N A SA
43. Teachers possess the necessary knowledge required to effectively teach science.   SD D N A SA
44. Teachers at this school are motivated to make science work as a curriculum area.   SD D N A SA
45. The school has adequate science equipment necessary for the teaching of science.   SD D N A SA
46. Teachers at this school have a positive self-image of themselves as regards their ability to teach science.   SD D N A SA
47. Science is regarded as an important subject in the school's overall curriculum.   SD D N A SA
48. Time is a major factor inhibiting science program delivery at this school.   SD D N A SA
49. The curriculum leadership in science fosters capabilities in those who require support in teaching sciences.   SD D N A SA