CHAPTER THREE

DESIGN AND IMPLEMENTATION

3.1 INTRODUCTION

The National Survey was designed to collect an extensive body of base-line data and perspectives on science, ICT and mathematics education from key stakeholders across Australia. The design incorporated several data collection strategies, including paper and web-based questionnaires and focus group interviews. The quantitative and qualitative data generated through this multiple mode approach were triangulated to improve the overall trustworthiness of the findings.

The survey proceeded in two phases. Phase One, with which this volume is concerned, involved the collection of data via five survey questionnaires sent to primary teachers, secondary science teachers, secondary ICT teachers, secondary mathematics teachers, and parents/caregivers of school age children. In Phase Two, focus group interviews were conducted with teachers, parents/caregivers and students in each state and territory. Details of the design of this phase are set out in the companion volume, *Science, ICT and Mathematics Education in Rural and Regional Australia: State and Territory Case Studies*.

3.2 IDENTIFYING THE STUDY POPULATION

A unique database of schools was constructed for the National Survey by merging the MCEETYA Schools Database with a second database containing additional demographic and contact information. Schools in the resulting database were classified according to the eight categories of the MCEETYA Schools Geographical Location Classification (MSGLC).

In line with the inclusive approach of the National Survey, invitations to participate were sent to all non-metropolitan schools in Australia. In order to provide data for comparison, invitations were also extended to a representative group of metropolitan schools identified through a process of stratified random sampling. These consisted of 10% of all primary and 20% of all secondary schools in metropolitan areas (MSGLC categories 1.1 & 1.2), selected randomly in proportion to their representation within states and territories and within educational sectors. The over-sampling of metropolitan secondary schools was necessary to avoid analytical problems which might arise from a lower than expected response rate, since there are far fewer secondary than primary schools.

For logistical and analytical reasons, combined schools ($N = 565$) catering for both primary and secondary level students were represented twice on the database, coded once as a primary school and again as a secondary school. This ensured that teachers received copies of all surveys. Table 3.1 provides a general description of the 5445[4] invited schools on the National Survey database.

[4] The National Survey began with a database of 5669 schools. Seventy-two of these were removed when correspondence was returned indicating that the schools had closed or parcels were incorrectly addressed. In addition, 152 special schools for physically and intellectually challenged students originally invited to participate were later removed from the database as their very low response rate (<4%) suggested that the teachers considered the focus of the survey to be of less direct relevance to their situation than might be the case in schools with a more conventional curriculum. There is also some question about the validity of including data from special schools with that from more conventional schools, given their different needs and contexts.

Table 3.1 Characteristics of schools invited to participate in the National Survey

		Number of schools	% of all invited schools
School Type	Primary	3447	63%
	Combined [a]	1130	21%
	Secondary	868	16%
School System	Government	4031	74%
	Catholic Systemic	772	14%
	Independent	642	12%
State/Territory	ACT	26	0.05%
	NSW	1590	29%
	NT	229	4%
	QLD	1157	21%
	SA	481	9%
	TAS	230	4%
	VIC	1145	21%
	WA	587	11%
MSGLC Category [b]	Metropolitan Area	703	13%
	Provincial City	925	17%
	Provincial Area	2932	54%
	Remote Area	885	16%
	Total	5445	100%

[a] Each of the 565 combined schools was included twice. See text for explanation.
[b] Only the four categories used for analysis are shown here.

It was not possible to establish with any accuracy the total numbers of teachers involved in science, ICT or mathematics education within these schools. A large proportion of secondary school teachers teach a combination of science, mathematics or ICT, making it very difficult to obtain reliable estimations of target populations. To give some indication of the margin for error in such an estimation, independent calculations of the numbers of science teachers per school conducted by the Australian Council of Educational Research (ACER), and the Australian Council of Deans of Science (ACDS) differed by as much as 50% (Harris et al. 2005).

Even if one or other of these calculations had been used as a base population, it would have been very difficult to accurately estimate the proportion of this population represented by the study schools, due to the different selection strategies applied to metropolitan and non-metropolitan schools. Likewise, it was not possible to establish the size of the parents/caregiver population associated with these schools, given the various possible parenting combinations and the fact that many pupils are siblings.

3.3 DATA COLLECTION INSTRUMENTS

3.3.1 Questionnaire design

Five survey questionnaires were constructed to collect data from the key respondent groups: primary teachers, secondary science, ICT and mathematics teachers, and parents/caregivers. The teacher surveys had many items in common, allowing comparisons to be made within and between survey types. The majority of items invited teachers to indicate responses using a

multiple-choice format or a Likert-like rating scale. In addition, there were 13 opportunities on each survey for teachers to expand on their responses or contribute reflections (see Appendix 3.1).

Each survey consisted of four sections designed to collect demographic data on responding teachers and their schools, as well as views on a range of issues identified in the literature as possibly affecting on outcomes in science, ICT and mathematics in rural and regional schools. A brief overview of the generic survey format is shown below.

Section A. Teacher Profile

a) Biographical data
b) Professional background, qualifications and experience
c) Views on teacher education and preparedness
d) Motivation for moving to and remaining at a school in a provincial or remote area (if applicable)
e) Motivation for leaving a position at a school in a provincial or remote area (if applicable).

Section B. School Profile (completed in collaboration with school administration)

a) Perceptions of teacher turnover and difficulty of filling positions in science, ICT or mathematics
b) Range of courses in these subject areas available at the school
c) Approximate class sizes
d) Percentage of Indigenous students in the school
e) Views on the influence of school context on teaching and learning.

Section C. Department or Faculty Profile

a) Importance and availability of a range of material resources
b) Importance and availability of a range of ICT resources
c) Importance and availability of a range of support personnel
d) Opportunities for Professional Development
e) Importance and availability of a range of student learning experiences.

Section D. Your Reflections (Open response)

a) The strengths of the school in terms of helping students achieve in science, ICT and mathematics
b) The obstacles to student learning in these subject areas
c) Useful practices and programs for improving student learning in these subject areas
d) Recommendations to school systems.

The Parent/Caregiver Survey (Appendix 3.2) was only three pages and of a more general nature. Its three sections are outlined below.

Section A. About you and your child

a) Biographical details of parent/caregiver and child.

Section B. Teaching and Learning science, ICT and mathematics

a) Views on relationships between school, teachers, parents/caregivers and community
b) Perceptions of teaching quality
c) Perceptions of availability of resources and learning support.

Section C. Your Ideas and Concerns

a) The strengths of the school in terms of helping students achieving in science, ICT and mathematics
b) The obstacles to student learning in these subject areas
c) Useful practices and programs for improving student learning in these subject areas
d) Recommendations to school systems.

The extensive format of the teacher surveys was necessary in order to explore a range of factors that may affect student learning outcomes across school types, geographical regions and subject areas. However, it was also anticipated that the length of the teacher questionnaires (ten pages) and the time required to complete them could adversely affect response rates among busy teachers (Porter 2004). Nevertheless, the literature indicates that issues in rural education are complex and interconnected, and in order to produce as comprehensive a map as possible from a single survey, it was decided that data richness should take priority over response rate.

3.3.2 Trialing and refining the survey instruments

The survey instruments underwent an extensive review process, including review by the National Survey Advisory Committee, and consultation with experts in statistical analysis.
The instruments were also reviewed by members of the state and territory hubs of SiMERR Australia to ensure that terminologies, references to curricula and other contextual details in the surveys would be relevant and comprehensible to teachers and parents/caregivers in different states and territories. Both the Advisory Committee and the hub teams were also asked to comment on the format and accessibility of the Web surveys. The surveys were also piloted by groups of practising primary and secondary teachers and non-teaching parents.

3.3.3 Web survey design issues

The National Survey questionnaires were also made available on the SiMERR web site in order to reduce mailing costs and data entry time, and to enable real time monitoring of response rates (Dillman 2000). On the other hand, there was some doubt about the quality of Internet access among the target populations, and concern about whether these populations would be predisposed to completing a Web survey (Lang et al. 2000; Mertler 2003). Consequently, Phase One employed a dual mode approach, providing the surveys in electronic and paper form. This approach can improve both the representativeness of the sample (Yun & Trumbo 2000) and response rates (Schneider et al. 2005). Research shows that responses to questionnaires are not significantly affected by response mode (Mertler 2003; Smither, Walker & Yap 2004).

3.4 RESEARCH INTEGRITY

The scope and complexity of the National Survey presented substantial ethical issues with regard to gaining the consent of education authorities and participants. Permission to conduct Phase One was required from the University of New England Research Ethics Committee, and 29 educational jurisdictions. These included all state and territory departments of education, and various Catholic education authorities. Permission was also required from all school principals.

In order to inform participants about the purpose of the survey, confidentiality of responses and security of data, an Information Sheet for Participants accompanied each survey form. For the Web survey, respondents were directed to links providing this information.

Each school was allocated a unique survey code and web-logon code. The codes ensured that only the research team could identify individual schools. They also ensured security of

electronic responses, since surveys were only accessible via an authentication page requiring matching codes. Nevertheless, it was anticipated that some parents/caregivers may become aware of the National Survey through the media or organizations other than schools, and might not have access to the codes. The electronic version of the Parent/Caregiver Survey therefore allowed respondents to access the survey using the name of their child's school and the postcode of the school.

3.5 RESPONSE RATES

3.5.1 Strategies to encourage responses

Response rates to mail surveys, and to education surveys in particular, have been declining over the last decade or so (Porter 2004). Because of the importance of the National Survey, and the extensive format of the teacher surveys, strategies were put in place to maximise response rates. On the basis of recommendations from the literature (Dillman 2000; Porter 2004) the following strategies were incorporated:

- the use of multiple modes of participation (paper and web)
- multiple contacts with potential respondents
- extensive media coverage of the National Survey
- advertisement of the National Survey through professional teacher and school leadership organizations, and through parent bodies such as the Australian Parents Council, the Australian Council of State School Organisations, and the Isolated Children's Parents Association
- the provision of posters and postcards as staffroom reminders
- an emphasis on the relevance and uniqueness of the National Survey
- assurances of confidentiality
- assurances of access to project findings
- reference to sponsorship by University of New England and the Australian Government.

In particular, the use of multiple contacts was an important feature of this strategy. Table 3.2 outlines the timetable for contact. Additional correspondence was sent to principals in various states and territories regarding arrangements to accommodate the differing holiday periods or other circumstances.

3.5.2 Profile of responding schools

Survey parcels were sent to the principals in the last two weeks of May 2005. Those consenting to participate were asked to distribute the questionnaires to teachers involved in science, ICT or mathematics education, and to invite parents/caregivers through the school newsletter or parent organisation to complete a survey questionnaire.

Useable responses were received from 3868 teachers and parents/caregivers in 1408 schools. The school response rate varied considerably with MSGLC category, type and size of school. Response rates of less than 10% were found among very small independent schools (<40 students) and remote Indigenous community schools, while a response rate of 61% was achieved from large (>700 students) provincial government secondary schools. Table 3.3 illustrates the response rates among primary and secondary schools from different sectors and locations.

Table 3.2 Timetable of contact with schools

Date / 2005	Details
May 18	Principals contacted by email to introduce the National Survey and advise that survey parcel will soon be sent to schools.
May 24-27	*Survey launch. All invitations and survey parcels dispatched to schools*
June 20	Follow-up letter sent to all schools by email, thanking those who had responded and reminding principals about the July 8 deadline for returns. Letters posted to schools without email addresses.
July 8	*Initial deadline*
July 12	Letters mailed to non-responding schools extending the deadline to August 19 and encouraging participation.
August 19	*Final deadline*

Table 3.3 Response rates of invited schools by Type, System, State/Territory and MSGLC category

		Invited	Responded	Response rate
School Types	Primary	3447	766	22%
	Combined [a]	1130	271	24%
	Secondary	868	371	43%
School System	Government	4031	1037	26%
	Catholic Systemic	772	202	26%
	Independent	642	169	26%
States and Territories	ACT	26	10	38%
	NSW	1590	428	27%
	NT	229	45	20%
	QLD	1157	277	24%
	SA	481	188	39%
	TAS	230	59	26%
	VIC	1145	231	20%
	WA	587	170	29%
MSGLC Categories [b]	Metropolitan Area	703	206	29%
	Provincial City	925	283	31%
	Provincial Area	2932	740	25%
	Remote Area	885	179	20%
	Total	**5445**	**1408**	**26%**

[a] Each of the 565 combined schools was counted twice. See text for explanation.
[b] Only the four categories used for analysis are shown here.

Some of the variation in response rates may be attributable to differences in the number of teachers per school. For example, Metropolitan and Provincial City schools are, in general, larger than Provincial Area or Remote Area schools and therefore have a larger number of teachers available to complete the survey. Small, rural one-teacher primary schools, for example, had very low response rates. The lower than expected representation of Victorian schools is consistent with comments from a number of Victorian government school principals that teachers were already involved in at least one large state government survey and were reluctant to commit to another. The low response rate from the Northern Territory is consistent with the low response rate among the many small Indigenous community schools.

Other variations are more difficult to explain. The higher than expected response rate from South Australian schools might be related to the higher level of media coverage generated about the National Survey in that state, though the high response rate from ACT schools is difficult to understand, considering that there are only two non-metropolitan schools in the ACT.

The response rates from different education systems and MSGLC categories have implications for the interpretation of findings. Although the overall response rates from schools in each system were similar (26%), system representation within each of the MSGLC categories is not proportional. For example, about 86% of respondents in Remote Areas were from Government schools, with less that 2% from Independent schools. Thus, there is an interaction effect in that data from Remote Area schools pertain mainly to characteristics of government schools. On the other hand, only about 50% of respondents from Metropolitan Area schools worked in government schools, so data from this MSGLC category relates to all three systems. While the system representation within MSGLC categories in the study is similar to that within the general population, the fact that these representations do vary substantially should be considered when attempting to generalise from the findings.

Similarly, interpretations of the findings need to consider that analyses ignored state and territory boundaries[5], and therefore state and territory-based educational characteristics. General findings relating to MSGLC categories therefore do not necessarily apply to all states and territories.

3.5.3 Profile of responding teachers

Table 3.4 provides an overall breakdown of responding teachers by survey type. In all 2940 useable responses were received from teachers. Overall, and perhaps not surprisingly in view of population distributions, roughly 68% of respondents came from three states: NSW, Queensland and Victoria. Respondent numbers were quite small in the ACT, chiefly from Catholic Systemic schools. Northern Territory respondents were also somewhat sparse and predominantly from Government schools.

The table shows that responses were received from 1576 primary teachers and 1364 secondary teachers. Of the latter, 580 were science teachers, 237 were ICT teachers and 547 were mathematics teachers. Overall, about 58% of respondents were from Provincial and Remote Areas, and about 69% taught in Government schools.

[5] A condition of the consent from two state government authorities was that no comparisons across states and territories be reported in the findings.

Table 3.4 Breakdown of teacher survey respondents by State/Territory, School System and MSGLC Categories of School

			Survey Respondent Type				
			Secondary Science	Secondary Mathematics	Secondary ICT	Primary	*Overall*
State/Territory	NSW	Count	161	151	62	414	788
		% of Row	20.4%	19.2%	7.9%	52.5%	100.0%
		% of Column	27.8%	27.6%	26.2%	26.3%	26.8%
	QLD	Count	123	137	65	272	597
		% of Row	20.6%	22.9%	10.9%	45.6%	100.0%
		% of Column	21.2%	25.0%	27.4%	17.3%	20.3%
	VIC	Count	99	92	35	339	565
		% of Row	17.5%	16.3%	6.2%	60.0%	100.0%
		% of Column	17.1%	16.8%	14.8%	21.5%	19.2%
	SA	Count	87	75	37	206	405
		% of Row	21.5%	18.5%	9.1%	50.9%	100.0%
		% of Column	15.0%	13.7%	15.6%	13.1%	13.8%
	WA	Count	50	46	20	214	330
		% of Row	15.2%	13.9%	6.1%	64.8%	100.0%
		% of Column	8.6%	8.4%	8.4%	13.6%	11.2%
	TAS	Count	25	16	7	83	131
		% of Row	19.1%	12.2%	5.3%	63.4%	100.0%
		% of Column	4.3%	2.9%	3.0%	5.3%	4.5%
	NT	Count	21	20	7	43	91
		% of Row	23.1%	22.0%	7.7%	47.3%	100.0%
		% of Column	3.6%	3.7%	3.0%	2.7%	3.1%
	ACT	Count	14	10	4	5	33
		% of Row	42.4%	30.3%	12.1%	15.2%	100.0%
		% of Column	2.4%	1.8%	1.7%	.3%	1.1%
School System	Government	Count	365	367	149	1138	2019
		% of Row	18.1%	18.2%	7.4%	56.4%	100.0%
		% of Column	62.9%	67.1%	62.9%	72.2%	68.7%
	Catholic Systemic	Count	107	87	45	319	558
		% of Row	19.2%	15.6%	8.1%	57.2%	100.0%
		% of Column	18.4%	15.9%	19.0%	20.2%	19.0%
	Independent	Count	108	93	43	119	363
		% of Row	29.8%	25.6%	11.8%	32.8%	100.0%
		% of Column	18.6%	17.0%	18.1%	7.6%	12.3%
MSGLC Category of School	Metropolitan Area	Count	148	142	60	230	580
		% of Row	25.5%	24.5%	10.3%	39.7%	100.0%
		% of Column	25.5%	26.0%	25.3%	14.6%	19.7%
	Provincial City	Count	120	132	47	362	661
		% of Row	18.2%	20.0%	7.1%	54.8%	100.0%
		% of Column	20.7%	24.1%	19.8%	23.0%	22.5%
	Provincial Area	Count	266	240	110	809	1425
		% of Row	18.7%	16.8%	7.7%	56.8%	100.0%
		% of Column	45.9%	43.9%	46.4%	51.3%	48.5%
	Remote Area	Count	46	33	20	175	274
		% of Row	16.8%	12.0%	7.3%	63.9%	100.0%
		% of Column	7.9%	6.0%	8.4%	11.1%	9.3%
Overall	Count		580	547	237	1576	2940
	% of Row		19.7%	18.6%	8.1%	53.6%	100.0%
	% of Column		100.0%	100.0%	100.0%	100.0%	100.0%

Table 3.5 provides a description of teacher respondents by sex, age, position, qualifications and teaching experience at their current school. About 60% of respondents were female, reflecting the high proportion of female teachers in primary schools. The majority of respondents were 41 years of age or older; only about 18% were less than 30 years of age. Approximately 64% of respondents were classroom teachers, 18% were Subject Coordinators or Heads of Department (these were secondary respondents only) and about 19% were Senior School Management

(Principals or Deputy/Assistant Principals). In the Teacher and Senior School Management categories, the greater percentages of respondents were female and vice-versa for Subject Coordinators/Heads of Department.

Over 85% of respondents held either a Bachelor degree (plus an undergraduate or postgraduate diploma) or some type of postgraduate teaching qualification, with females dominating the percentages in each case. Respondents having qualifications at a level less than a B.Ed. were most frequently older than 41 years of age. Over 80% of respondents had 12 years or less experience teaching at their current school.

Table 3.5 Breakdown of Sex and Age of Respondent, by individual teacher-related variables

			Sex of Respondent			Age of Respondent				
			Male	Female	Overall	< = 30 yrs	31 - 40 yrs	41-50 yrs	> 50 yrs	Overall
Position of Respondent	Senior school management	Count	235	305	540	39	99	214	187	539
		% within Row	43.5%	56.5%	100.0%	7.2%	18.4%	39.7%	34.7%	100.0%
		% within Col	19.9%	17.6%	18.5%	7.4%	16.3%	22.6%	22.6%	18.5%
	Subject coord/HoD	Count	306	207	513	39	115	181	179	514
		% within Row	59.6%	40.4%	100.0%	7.6%	22.4%	35.2%	34.8%	100.0%
		% within Col	25.9%	12.0%	17.6%	7.4%	18.9%	19.1%	21.6%	17.7%
	Classroom Teacher	Count	640	1220	1860	447	395	553	461	1856
		% within Row	34.4%	65.6%	100.0%	24.1%	21.3%	29.8%	24.8%	100.0%
		% within Col	54.2%	70.4%	63.9%	85.1%	64.9%	58.3%	55.7%	63.8%
Highest academic qualification	< B.Ed.	Count	112	305	417	6	48	170	192	416
		% within Row	26.9%	73.1%	100.0%	1.4%	11.5%	40.9%	46.2%	100.0%
		% within Col	9.5%	17.7%	14.4%	1.1%	7.9%	18.0%	23.3%	14.4%
	B.Ed.	Count	300	654	954	322	238	261	133	954
		% within Row	31.4%	68.6%	100.0%	33.8%	24.9%	27.4%	13.9%	100.0%
		% within Col	25.6%	37.9%	32.9%	61.6%	39.3%	27.6%	16.2%	32.9%
	Bach + UG or PG Dip	Count	499	483	982	136	222	315	308	981
		% within Row	50.8%	49.2%	100.0%	13.9%	22.6%	32.1%	31.4%	100.0%
		% within Col	42.5%	28.0%	33.9%	26.0%	36.6%	33.4%	37.4%	33.9%
	PG degree + other	Count	263	284	547	59	98	198	190	545
		% within Row	48.1%	51.9%	100.0%	10.8%	18.0%	36.3%	34.9%	100.0%
		% within Col	22.4%	16.5%	18.9%	11.3%	16.2%	21.0%	23.1%	18.8%
Years teaching at this school	0 - 3 years	Count	440	713	1153	396	268	301	188	1153
		% within Row	38.2%	61.8%	100.0%	34.3%	23.2%	26.1%	16.3%	100.0%
		% within Col	37.4%	41.3%	39.7%	76.0%	43.9%	32.0%	22.7%	39.8%
	4 - 12 years	Count	464	738	1202	124	321	428	324	1197
		% within Row	38.6%	61.4%	100.0%	10.4%	26.8%	35.8%	27.1%	100.0%
		% within Col	39.4%	42.7%	41.4%	23.8%	52.6%	45.4%	39.2%	41.3%
	13 - 25 years	Count	220	241	461		21	201	238	460
		% within Row	47.7%	52.3%	100.0%		4.6%	43.7%	51.7%	100.0%
		% within Col	18.7%	13.9%	15.9%		3.4%	21.3%	28.8%	15.9%
	> 25 years	Count	54	36	90	1[a]		12	77	90
		% within Row	60.0%	40.0%	100.0%	1.1%		13.3%	85.6%	100.0%
		% within Col	4.6%	2.1%	3.1%	.2%		1.3%	9.3%	3.1%
Overall	Count		1187	1746	2933	528	612	954	833	2927
	% within Row		40.5%	59.5%	100.0%	18.0%	20.9%	32.6%	28.5%	100.0%
	% within Col		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

[a] This respondent obviously gave an incorrect response to either age, or years of experience.

3.5.4 Response from parents/caregivers

Table 3.6 provides a description of the 928 respondents to the Parent/Caregiver survey. About 75% of respondents were female, with 66% reporting with relation to primary schools and 72% reporting on Government schools. Table 3.7 provides an overview of response rates by state/territory and School System.

Table 3.6 Overview of parent/caregiver respondent characteristics

		% respondents
Sex	Female	**75%**
	Male	**25%**
School type	Primary	**55%**
	Combined	**18%**
	Secondary	**27%**
MSGLC category	Metropolitan Area	**17%**
	Provincial City	**20%**
	Provincial Area	**53%**
	Remote Area	**10%**

Table 3.7 Breakdown for the parents/caregivers sample, by State/Territory and School System

			School System			
			Government	**Catholic Systemic**	**Independent**	*Overall*
State or territory	**NSW**	**Count**	**218**	**45**	**31**	**294**
		% within State	74.1%	15.3%	10.5%	100.0%
		% within School System	32.7%	34.9%	23.5%	31.7%
	QLD	**Count**	**152**	**27**	**24**	**203**
		% within State	74.9%	13.3%	11.8%	100.0%
		% within School System	22.8%	20.9%	18.2%	21.9%
	VIC	**Count**	**103**	**17**	**33**	**153**
		% within State	67.3%	11.1%	21.6%	100.0%
		% within School System	15.4%	13.2%	25.0%	16.5%
	SA	**Count**	**87**	**11**	**28**	**126**
		% within State	69.0%	8.7%	22.2%	100.0%
		% within School System	13.0%	8.5%	21.2%	13.6%
	WA	**Count**	**72**	**22**	**11**	**105**
		% within State	68.6%	21.0%	10.5%	100.0%
		% within School System	10.8%	17.1%	8.3%	11.3%
	TAS	**Count**	**10**	**3**	**4**	**17**
		% within State	58.8%	17.6%	23.5%	100.0%
		% within School System	1.5%	2.3%	3.0%	1.8%
	NT	**Count**	**24**	**2**	**1**	**27**
		% within State	88.9%	7.4%	3.7%	100.0%
		% within School System	3.6%	1.6%	.8%	2.9%
	ACT	**Count**	**1**	**2**		**3**
		% within State	33.3%	66.7%		100.0%
		% within School System	.1%	1.6%		.3%
Overall	**Count**		**667**	**129**	**132**	**928**
	% within State		71.9%	13.9%	14.2%	100.0%
	% within School System		100.0%	100.0%	100.0%	100.0%

3.6 VARIABLES AND DATA PREPARATION

In the design of the National Survey, decisions were made on the number of categories allocated to each variable. For example, based upon the MSGLC code, invited schools were differentiated by eight categories. However, analysis of responses revealed a number of variable categories that needed to be collapsed because they contained too few respondents, or an unnecessarily large number of categories which could unnecessarily complicate analysis and interpretation. Table 3.8 lists the various collapsed categories used for analysis and reporting. In specific databases other variables may be collapsed as required and this will be indicated at the appropriate point in the report.

Table 3.8 Variable Categories

Variable	No. Categories	Category labels
School System affiliation	3	Government school Catholic Systemic school Independent school
MSGLC Categories	4	Metropolitan Area *(also Capital city + Major Urban city)* Provincial City Provincial Area Remote Area
Type of School	3	Primary only Combined Secondary only
Age of Respondent	4	≤ 30 years 31-40 years 41-50 years > 50 years
Position of Respondent	3	Senior school management Subject coordinator/Head of Department Teacher
Employment basis of respondent	3	F/T permanent P/T permanent Temp/Contract/Casual
Highest academic qualification	4	< B.Ed. *(lower than a Bachelor of Education)* B.Ed. *(Bachelor of Education)* Bach + UG or PG *Dip (Bachelor degree of any type, + an undergraduate of Postgraduate Diploma of Education)* PG degree + other *(postgraduate degree or higher)*
Years teaching subject, and Years teaching at this school	4	0 – 3 years 4 – 12 years 13 – 25 years > 25 years
Location of school for High School study, and Location where lived during initial teacher education	4	Metropolitan centre *(pop. >100 000)* Provincial centre *(pop. 50 -99 999)* Regional centre *(pop. 25 000- 49 999)* Rural centre *(pop. < 25 000)*
Percentage of teachers who leave the school each year	3	0 – 10% 11 – 20% > 20%
Size of junior science class	3	≤ 15 students 16 – 25 students > 25 students
Percentage of Indigenous students at school	4	0% 1 – 20% 21 – 40% > 40%

Many of the variable categories listed in Table 3.8, such as 'Position of Respondent', were used only in descriptive analyses to provide profiles of responding schools, teachers and parents. This was also the case for state/territory location of school, and school system affiliation. As the National Survey was primarily concerned with geographical variations in the data, the key variable used in comparative analyses was MSGLC Category of School. A second variable, Percentage of Indigenous Students, allowed comparisons that could identify differences in the circumstances and needs of schools with different proportions of Indigenous students.

Other independent variables used in comparative analyses included Type of School, Respondent Type, Sex, Age of Respondent, and Location While Undertaking Initial Teacher Education.

3.7 DATA ANALYSIS

A range of analytical tools was used to interpret the data. Decisions about the most appropriate procedure for a particular analysis were guided by the research questions and dependent upon the characteristics of data sets.

3.7.1 Decision criteria for statistical testing

The numerous questions on the surveys and the large number of respondents, coupled with the many anticipated statistical comparisons and tests, demanded that some attention be given to the proper level of significance to be applied during analysis. To help prevent spurious claims of significance, the conventionally accepted .05 level of significance was reset to the much stricter level of *.001*. This new criterion has been employed in all statistical tests reported for all surveys. Statistical tests achieving a level of significance of .01 are identified as suggestive and worthy of further exploration. One immediate implication of this decision is that many significant associations at the .05 level may exist within the data, but have not been identified in this report.

3.7.2 Frequency tables and cross-tabulations

For many of the categorical variables of interest in the surveys, patterns and trends were summarised using either a simple frequency table or a cross-tabulation table. In all cross-tabulation tables, cell counts were reported along with both the count's percentage in the row category and the count's percentage in the column category. In some cases, the patterns in a cross-tabulation table were evaluated for statistical significance using the standard chi-square contingency table test. When a significant chi-square test was observed, the statistical test along with the Cramer' V measure of effect size was also reported as a footnote. Further, individual cell counts in the cross-tabulation table were evaluated for their contribution to the significant chi-squared relationship using adjusted standardised residuals (such contribution was always interpreted relative to what would be expected if the two categorical variables were not statistically associated).

3.7.3 Combining importance and availability ratings for items

The primary and secondary teacher questionnaires provided respondents with a large number of teaching and learning-related items, which they were asked to rate in terms of both importance (using a scale ranging from 1 – Not at all Important to 5 – Extremely Important) and availability (using a scale ranging from 1 – Never Available to 4 – Always Available). Rather than analysing importance ratings and availability ratings separately (leading to a huge number of comparisons), the analytical approach adopted was to combine the importance and availability ratings in such a way as to yield scores where higher values indicated a greater deficit or 'need' for increasing the availability of the item. This was accomplished through a simple transformation for each item: a 'need' score was computed by multiplying the Importance (I) rating for an item by the quantity of 5 minus the Availability (A) rating for the item ['Need' = I x (5 – A)]. This transformation had the net effect of reverse-scoring availability ratings so that larger numbers indicated less availability and, when multiplied by the importance rating, meant that items of high importance but low availability had the highest 'need' score. By way of justifying such a transformation, it is important to note that there is ample basis in the literature for this type of multiplicative transformation to combine sources of rating information (e.g., expectancy-valance motivation theory, see, for example, Kanfer, 1994;

and subjective expected utility theory and decision tree analysis, see, for example, Goodwin and Wright, 2004). Furthermore, by combining the two sets of ratings for each item in such a meaningful way, the number of statistical comparisons which needed to be made was cut immediately by half.

3.7.4 Principal components analysis

Each survey contained several sets of items addressing common themes. If individual items had been evaluated for group differences, the number of potential statistical comparisons and tests would have been enormous, accompanied by a virtual guarantee that at least one falsely significant finding would have been identified. Thus, in addition to employing a stricter decision criterion for evaluating each statistical test, a secondary strategy was employed to reduce the number of statistical tests conducted. For each thematically-related set of survey items (those rated using Likert-type scales), a principal components analysis was conducted to identify coherent subsets of items that measured a common sub-theme. For each principal components analysis, a scree plot, coupled with the 'eigenvalue greater than 1.0' rule, was used to determine the proper number of components to interpret. All components were rotated using the promax rotation procedure in order to produce the most interpretable component structures, while allowing for the possibility of correlated components. Each component was labelled in a way that summarised the general theme running through the items comprising it. Once the appropriate number of components had been identified in each analysis, respondents were given a score on each component by averaging their ratings on each of the items that defined the component. Subsequent statistical tests then focused on the component scores. The results of all principal components analyses for each survey instrument appear in an Appendix to the relevant Part of this report. For the principal components analyses of relevant items in the teacher surveys, the 'need' scores were analysed, yielding components whose defining items exhibited similar patterns of 'need'.

3.7.5 Multivariate analysis of covariance (MANCOVA)

Once relevant principal components had been identified for a particular domain of Likert-type items, multivariate analyses of covariance (MANCOVAs) were conducted to compare the component scores across various classifications of respondents. The covariates employed for all such multivariate group-comparison analyses were: Total FTE for the school, Median Weekly Household Income[6] and the SES Index[7]. In this way, all comparisons were made *after* controlling for the effects of school size and socioeconomic status of the school's location.
The justification for this is that these variables may in some cases have a confounding effect on the results of analyses using MSGLC categories, given that socioeconomic factors and school size may be covariates with geographic location. In order to ensure that any significant differences found in such analyses were a function of location rather than socioeconomic background or school size, these variables were controlled.

MANCOVAs, in conjunction with the stricter level of significance criterion of .001 and the use of principal component scores as dependent variables, were employed in an attempt to maintain some control over the increased risk of making false claims of significance when simultaneous tests on many variables were conducted. It is important to appreciate that only those MANCOVAs revealing a significant multivariate test were further pursued by evaluating individual (univariate) tests on each component separately – an analytical flow consistent with the logic set out by Tabachnick and Fidell (2001). For each significant multivariate effect, the partial eta-squared (η^2) measure of effect size is reported to give a feeling for the magnitude of

[6] Median Weekly Household Income from Australian Bureau of Statistics Census 2001 figures
[7] DEST Socioeconomic Status Indicator for schools

the overall set of differences as a proportion of variance explained by the categories being compared.

Since MANCOVA analyses tended to produce voluminous sets of numbers, what is reported in ensuring chapters are tables of component mean scores (adjusted for the influence of all covariates) and standard errors (indicating the precision of the estimate of the adjusted mean) and, where a significant difference is identified, colour codes highlight which of the components showed significant differences. To further explore significant differences, a profile plot of covariate-adjusted means for the original items comprising each component (ordered by component) is presented. These profile plots make it relatively easy to identify exactly where specific differences reside, with respect to original item content. It must be emphasised that this MANCOVA approach formally tested for differences using only the component scores; the profile plots of original item scores are provided only to facilitate a post hoc understanding of what seemed to be contributing to the observed differences.

3.7.6 Qualitative analysis

Many sections of the surveys invited comments or reflections and teachers and parents made good use of these opportunities, generating thousands of items of qualitative data. Constant comparative analysis (Glaser & Strauss, 1967; Maykut & Morehouse, 1994) was used to develop numerical codes for the responses to each question. This process involved the interpretation of meaning, inductive development of response categories and allocation of subsequent responses to categories through comparisons. Frequency analysis of response codes identified the most commonly expressed opinions, and the characteristics of schools and teachers allowed comparisons across these variables. Where appropriate, representative comments are used in the report to complement or illustrate findings.

3.8 HOW TO INTERPRET TABLES AND FIGURES IN THIS REPORT

Cross-tabulation (contingency) tables

As noted above, cross-tabulations were used in some cases to look for associations between variables. Contingency tables summarise the data and use colour to identify significant patterns. For example, Table 3.9 below summarises the perceptions of respondents in different locations about the annual staff turnover in their schools. Responses to this question have been collapsed into three categories: 0-10%, 11-20%, and >20% of staff leaving the school each year. The cell count is the number of respondents from a particular location indicating a particular turnover rate. Below the count are the percentage contributions of each count to the row and column totals. For example, Table 3.9 shows that 377 respondents from Metropolitan Areas reported a low (0-10% p.a.) turnover in their schools. This represented 21.4% of all respondents who reported this turnover rate, and 73.1% of all Metropolitan Area respondents to this question.

Chi-square significance tests indicated that a significantly greater than expected number of respondents in Metropolitan Areas and Provincial Cities reported an annual staff turnover between 0-10% (pink cells). In contrast, significantly fewer than expected respondents from Remote Areas reported this situation (green cells). On the other hand, significantly fewer respondents from Metropolitan Areas and Provincial Cities reported a high turnover rate (>20% p.a.), while this rate was reported by a significantly higher number of respondents in Remote Area schools. The term ‘expected’ refers to what would be expected if there was no statistical association between staff turnover rate and location of school. The significance level is .001, indicating that there is at most one chance in a thousand that this association has been identified

incorrectly. The colour pattern in the table therefore illustrates an extremely strong likelihood of association between annual staff turnover rate and location of school.

Table 3.9 Reported rates of staff turnover in schools in different MSGLC categories [a]

			MSGLC categories				
			Metropolitan Area	Provincial City	Provincial Area	Remote Area	*Overall*
Reported percentage of teachers leaving the school each year	0 - 10%	**Count**	**377**	**424**	**886**	**76**	**1763**
		% of Row	21.4%	24.0%	50.3%	4.3%	100.0%
		% of Column	73.1%	71.6%	65.9%	30.5%	65.2%
	11 - 20%	**Count**	**103**	**126**	**298**	**67**	**594**
		% of Row	17.3%	21.2%	50.2%	11.3%	100.0%
		% of Column	20.0%	21.3%	22.2%	26.9%	22.0%
	> 20%	**Count**	**36**	**42**	**161**	**106**	**345**
		% of Row	10.4%	12.2%	46.7%	30.7%	100.0%
		% of Column	7.0%	7.1%	12.0%	42.6%	12.8%
							2702

[a] Shaded cells indicate categories making a significant ($p < .001$) contribution to the overall association between a pair of variables. Pink means *more than an expected number were observed*; green means *fewer than an expected number were observed*. 'Expected' refers to what would be expected if the pair of variables were not associated.

Principal components tables

Table 3.10 is an example of the tables used in the report to display significant associations between principal components and other variables. The three principal components (each a group of Professional Development items having a similar theme) are listed across the top of the table, and the comparison variable, in this case MSGLC category of school, on the left hand side. Each cell contains the mean 'need' score and standard error on that component for science respondents in each location. The gold colour in the cell titled 'MSGLC categories' indicates that overall, there were significant differences ($p < .001$) on the scores on these components by respondents in different locations.

Table 3.10 Mean ratings by science respondents on Professional Interaction and Development item components, broken down by MSGLC categories [a]

			Professional Development Component			
			General Personal Professional Development	Development for Teaching to Targeted Groups	Professional Relationships Development	Valid N
MSGLC categories	Metropolitan Area	**Mean**	**8.88**	**8.32**	**8.41**	
		s.e. (Mean)	.29	.36	.29	131
	Provincial City	**Mean**	**10.65**	**9.85**	**9.08**	
		s.e. (Mean)	.30	.38	.30	110
	Provincial Area	**Mean**	**10.12**	**9.68**	**9.23**	
		s.e. (Mean)	.20	.25	.20	248
	Remote Area	**Mean**	**10.35**	**11.69**	**10.10**	
		s.e. (Mean)	.51	.63	.51	36

[a] Shading denotes components where significant or suggestive mean differences exist between the groups being compared. Gold shading indicates significant differences ($p < .001$) on a component; light blue shading indicates suggestive differences ($p < .01$) on a component.

Closer analysis reveals that this significant overall difference was due to suggestive differences at the .01 level (blue) in the need for General Personal Professional Development of respondents from different locations, and significant differences (gold) in the need for development for Teaching to Targeted Groups. Looking at the mean scores under this heading, it is clear that science respondents in Metropolitan Areas reported a lower need (mean need

score 8.32) for this type of professional development than did those in other locations. Science respondents from Remote Areas reported the highest score (11.69) and therefore the greatest unmet need for this type of professional development.

Profile plot figures

The principal components tables do not provide detailed information about ratings on particular questionnaire items. In order to identify which items within the components contributed most to significant or suggestive differences, colour coded profile plots accompany each table. These figures have a number of dimensions, worth introducing here. The example below, Figure 3.1, shows the profile plot that accompanies Table 3.10.

Shortened names for the individual items are found on the 'x' axis, and the 'mean need' rating scale on the 'y' axis. The higher the rating, the greater the unmet need for that professional development opportunity (the scale is ordinal). It is clear from Figure 3.1 that the highest unmet need for science respondents in Remote Areas (purple) was for professional development opportunities to help them teach gifted and talented students. The highest unmet need among Provincial City science respondents (green) was for relief from face-to-face teaching for programming. The coloured lines do not suggest a trend, as these are discrete items. The lines are simply a visual aid to minimise confusion when differentiating between variables.

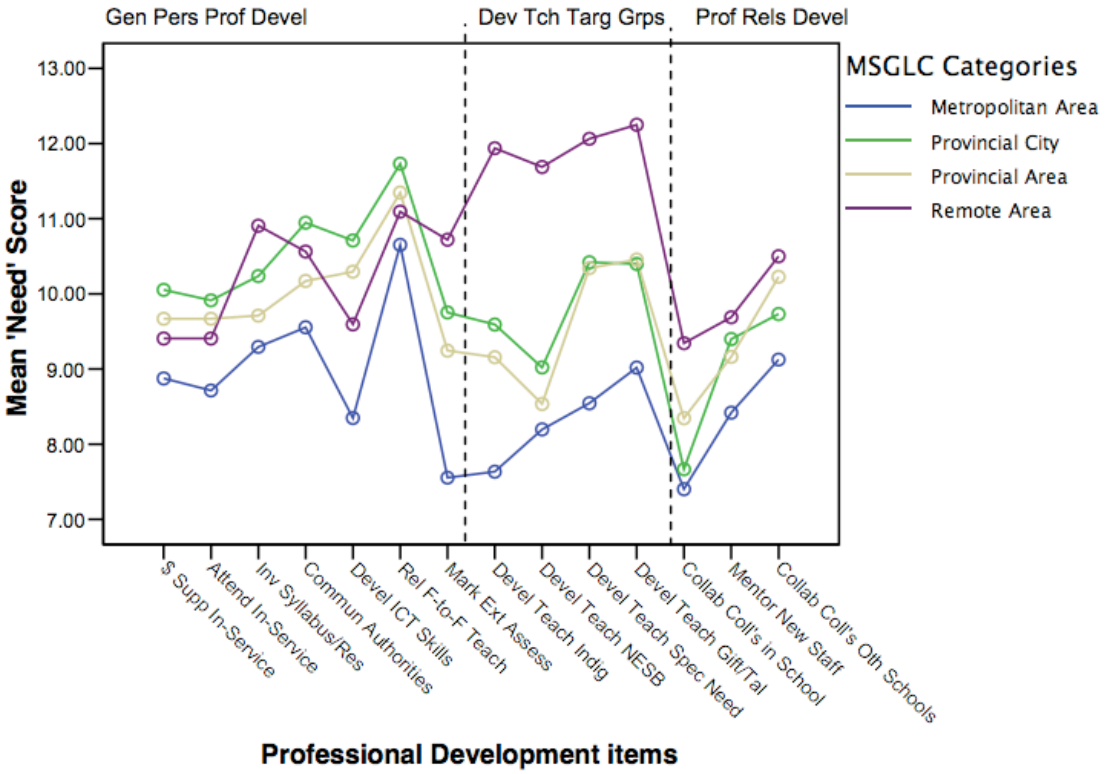

Figure 3.1 Profile plot of mean 'need' scores of science respondents for the Professional Interaction and Development components, compared by MSGLC categories (Table 5.3 for item names in full)

The items in Figure 3.1 are divided into three sets, separated by dotted lines. The sets contain items identified by the principal components analysis as relating to a common sub-theme. It is possible, therefore, to see from the tables and profile plots which components were significantly associated with particular variables, which items within these components contributed most to this association, and how mean ratings on these items differed across a variable.