CHAPTER FIVE

PROFESSIONAL CONNECTEDNESS AND ISOLATION

5.1 INTRODUCTION

This chapter reports teachers' responses to questions about the nature and scope of their professional development opportunities, and the degree to which they felt professionally connected or isolated. The surveys presented teachers with a set of items relating to potential opportunities and support mechanisms for undertaking professional development related to science, ICT or mathematics teaching, as well as more general opportunities such as staff mentoring, ICT skill development and programs to help address student diversity in their classrooms (Table 5.1). Teachers were asked to rate each item on two scales: the importance of the opportunity for their current teaching situation, and the availability of the opportunity at their school. The two ratings for each item were combined to produce a single 'need' rating (see Chapter Three). Teachers were also given the opportunity to comment about their professional development situation or associated issues not included in the question. This chapter presents the results of analysis of need ratings across a range of variables for each of the teacher respondent groups. Where appropriate, representative comments are used to illustrate or expand on the findings.

5.2 PROFESSIONAL DEVELOPMENT NEEDS OF PRIMARY TEACHERS

Overall needs

Table 5.1 summarises, at the level of the entire primary sample, the average scores on the 'need' items dealing with opportunities for professional interaction and development. The areas of greatest overall 'need' included workshops to develop ICT skills, professional development opportunities to help teach science and mathematics to gifted and talented and special needs students, effective communication between education authorities and teachers and release from face-to-face teaching for in-school collaborative activities. Areas of least 'need' overall included collaboration between teachers in their school, opportunities to attend external in-services or conferences related to teaching and learning mathematics and professional development opportunities to help teach science and mathematics to NESB students.

The high need for professional development in using ICT was reflected in primary respondents' comments. For example:

> The lack of given time to upgrade personal skills and knowledge in the area (ICT) is also serious. Teachers having to do it in their own time and often with own equipment. (Primary Teacher, Provincial Area, WA).

> As I have been 'around' so long I have needed to familiarise myself with 3 or 4 different types of computers as they evolved. There is never any time allocated for the amount of PD or contact with an expert that I need to keep my skills up to scratch. (Primary Teacher, Provincial Area, Tas.)

Table 5.1 Overall average 'need' scores, standard deviations and valid N for primary respondents' ratings of the Professional Interaction and Development items (items are listed in descending order of mean 'need' score) [Scores can range from 1 to 20[36]]

PROFESSIONAL DEVELOPMENT ITEMS	Mean	s.d.	Valid N
Workshops to develop your ICT skills	**9.92**	3.73	1460
Professional development opportunities to help you teach science & maths to gifted & talented students	**9.70**	3.74	1446
Professional development opportunities to help you teach science & maths to special needs students	**9.62**	3.79	1440
Effective communication between education authorities and teachers	**9.57**	3.59	1454
Release from face-to-face teaching for in-school collaborative activities	**9.40**	3.80	1477
Involvement in region or state-wide syllabus development, or research projects in science	**9.35**	3.76	1442
Involvement in region or state-wide syllabus development, or research projects in mathematics	**9.26**	3.73	1427
Opportunities for mentoring new staff	**9.24**	3.77	1468
Financial support for attendance at external in-services or conferences	**9.15**	3.91	1461
Opportunities to attend external in-services or conferences related to teaching & learning science	**9.11**	3.53	1469
Professional development opportunities to help you teach science & maths to Indigenous students	**9.07**	4.25	1396
Professional development opportunities to help you teach science & maths to NESB students	**8.95**	4.25	1355
Opportunities to attend external in-services or conferences related to teaching & learning mathematics	**8.71**	3.27	1454
Collaboration with teachers in your school	**7.62**	2.85	1487

A principal components analysis of the 'need' items (Appendix 5.1) produced four substantive components: Development for Teaching to Targeted Groups, In-Service Development, General Personal Professional Development, and Professional Relationships Development. Scores on these four components were analysed using a series of MANCOVAs in order to make specific group comparisons. Two MANCOVAs were conducted comparing mean component 'need' scores by MSGLC category and percentage of students with Indigenous backgrounds. Table 5.2 shows the mean ratings and their associated standard errors on the three components across the categories of the comparison variables.

Variation with geographic region

The multivariate test for MSGLC category differences across the four professional interaction and development components was significant[37]. Follow-up tests revealed that the reasons for this significant multivariate difference were suggestive univariate differences on the In-Service Development and the Professional Relationships Development components. For both of these components, the highest level of 'need' was indicated by respondents from Remote Areas and the lowest 'need' by respondents from Metropolitan Areas. Figure 5.1 displays the profile plot of the original professional interaction and development 'need' transformed items by MSGLC category. The clear trend in Figure 5.1 is that respondents from Remote Areas indicated a higher level of 'need' across most of the original professional interaction and development items. This disparity was most notable in the areas of release from face-to-face teaching for collaborative activities, opportunities for mentoring new staff, and attending in-services and conferences for both science and mathematics teaching (respondents from Metropolitan Areas perceived the lowest 'needs' on these latter two items whereas respondents from Provincial Cities and Areas were intermediate).

[36] The 'needs' scores constitute ordinal rather than interval measures, since they were transformed from ordinal rating scales. While the possible scores range from 1 to 20, an average 'need' score on an item (that is, an item rated midway on both the importance and availability scales) would be about 7.5, rather than 10.

[37] Wilks' lambda = .975, $F(12, 3751.967) = 3.58$, p = .001, partial $\eta^2 = .01$.

Table 5.2 Mean ratings by primary respondents on Professional Interaction and Development item components, broken down by MSGLC categories and percentage of students with Indigenous backgrounds [a]

			Professional Interaction & Development Component				
			Development for Teaching to Targeted Groups	In-Service Development	General Personal Professional Development	Professional Relationships Development	Valid N
MSGLC categories	Metropolitan Area	Mean	**9.06**	**8.27**	**9.13**	**8.62**	
		s.e. (Mean)	.26	.23	.22	.21	210
	Provincial City	Mean	**9.23**	**8.90**	**9.13**	**8.47**	
		s.e. (Mean)	.21	.18	.18	.17	323
	Provincial Area	Mean	**9.30**	**9.11**	**9.68**	**8.74**	
		s.e. (Mean)	.14	.12	.12	.11	743
	Remote Area	Mean	**9.92**	**9.38**	**9.86**	**9.55**	
		s.e. (Mean)	.30	.26	.25	.24	152
Percentage of students in your school with Indigenous backgrounds	0%	Mean	**8.63**	**8.47**	**9.48**	**8.66**	
		s.e. (Mean)	.21	.19	.18	.17	298
	1 - 20%	Mean	**9.30**	**9.04**	**9.35**	**8.71**	
		s.e. (Mean)	.12	.10	.10	.10	910
	21 - 40%	Mean	**10.52**	**9.14**	**9.91**	**8.82**	
		s.e. (Mean)	.36	.32	.31	.29	95
	> 40%	Mean	**11.77**	**10.49**	**11.39**	**10.08**	
		s.e. (Mean)	.46	.41	.40	.37	60

[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.

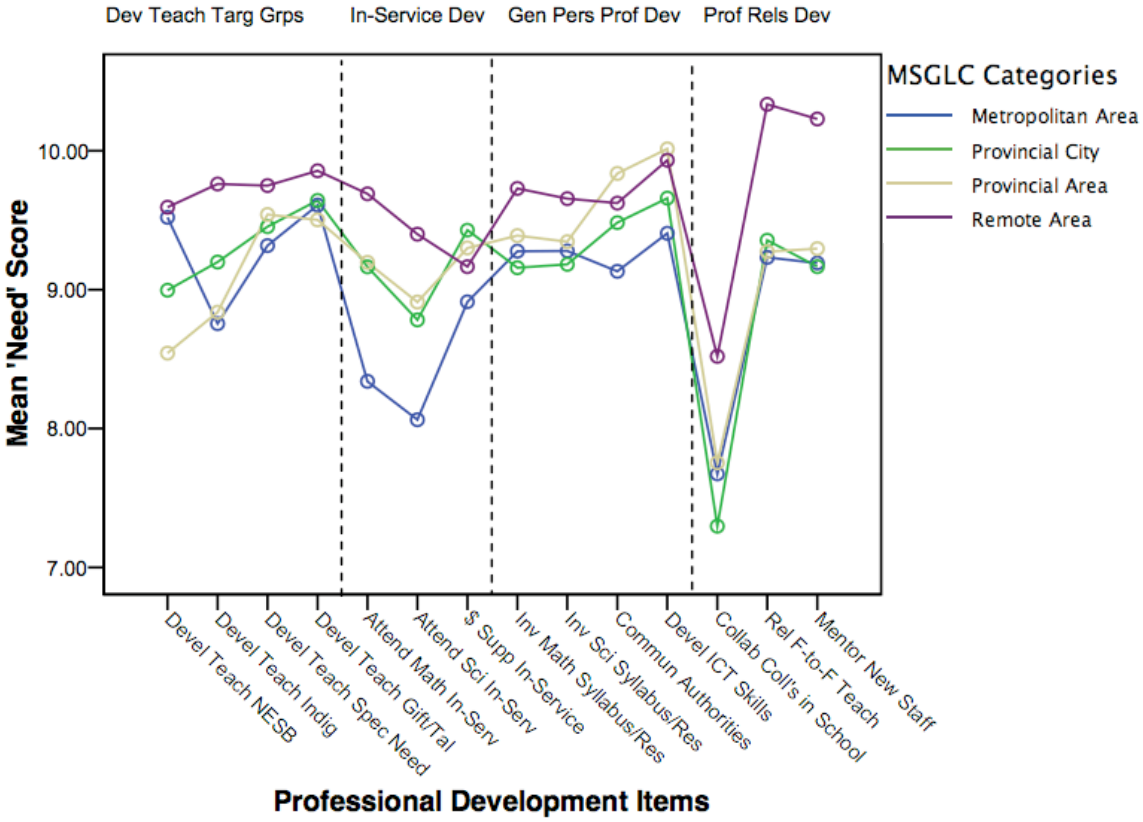

Figure 5.1 Profile plot of mean 'need' scores of primary respondents for the Professional Interaction & Development components, compared by MSGLC categories (Table 5.1 for item names in full)

The greater reported need for professional development opportunities and assistance in non-metropolitan areas was supported by primary teachers' comments. The main obstacles to professional development were identified as distance and associated cost, as most professional development opportunities are located in cities or major centres. A further impediment was the lack of relief staff to take classes while teachers were away at in-services. The contrast between the situations of city and remote area primary teachers is illustrated by the typical comments below:

> We get great PD support in accessing the available PD. We also run PD in-house. If anything, we have too many choices and not enough time to properly utilise the great learning and teaching programs available. (Primary Teacher, Provincial City, Vic.)

> Professional development is not usually available because staff cannot be replaced to allow it to happen. There is very little money available in our school for these activities – professional development priorities are always decided by the employer. (Primary Teacher, Remote Area, Qld)

Variation with Indigenous student population

The multivariate test comparing the four professional interaction and development components across primary schools with different percentages of student with Indigenous backgrounds was significant[38]. Follow-up tests revealed that the reasons for this significant multivariate difference were significant univariate differences on all components except Professional Relationships Development, where a suggestive difference was observed. In each case, respondents from schools where more than 40% of students were Indigenous indicated substantially greater levels of need in these four components compared to respondents from schools where the percentage was 40% or less. The areas of Development for Teaching to Targeted Groups and General Personal Professional Development were clearly of greatest 'need' for these respondents. Additionally, respondents from schools where the percentage of Indigenous students was between 21% and 40% showed a level of 'need' in the area of Development for Teaching to Targeted Groups greater than did respondents from schools with lower Indigenous percentages.

Figure 5.2 displays the profile plot of the original professional interaction and development 'need' transformed items by percentage of students with Indigenous backgrounds. The figure shows that 'needs' are greatest in all specific areas of all components for respondents from schools where the percentage of students with Indigenous backgrounds exceeded 40%. Peak areas of 'need' for these schools included professional development for teaching science and mathematics to gifted and talented, Indigenous, and special needs students, involvement in the regional or state-wide development of the mathematics and science syllabi, attending in-services and conferences related to teaching and learning mathematics and workshops for developing ICT skills. In schools where the percentage of students with Indigenous backgrounds was between 21% and 40%, professional development 'needs' for teaching to all four targeted groups were intermediate between respondents from the 40%+ schools and the less than 21% schools.

[38] Wilks' lambda = .948, $F(12, 3579.993) = 6.02$, $p < .001$, partial $\eta^2 = .02$

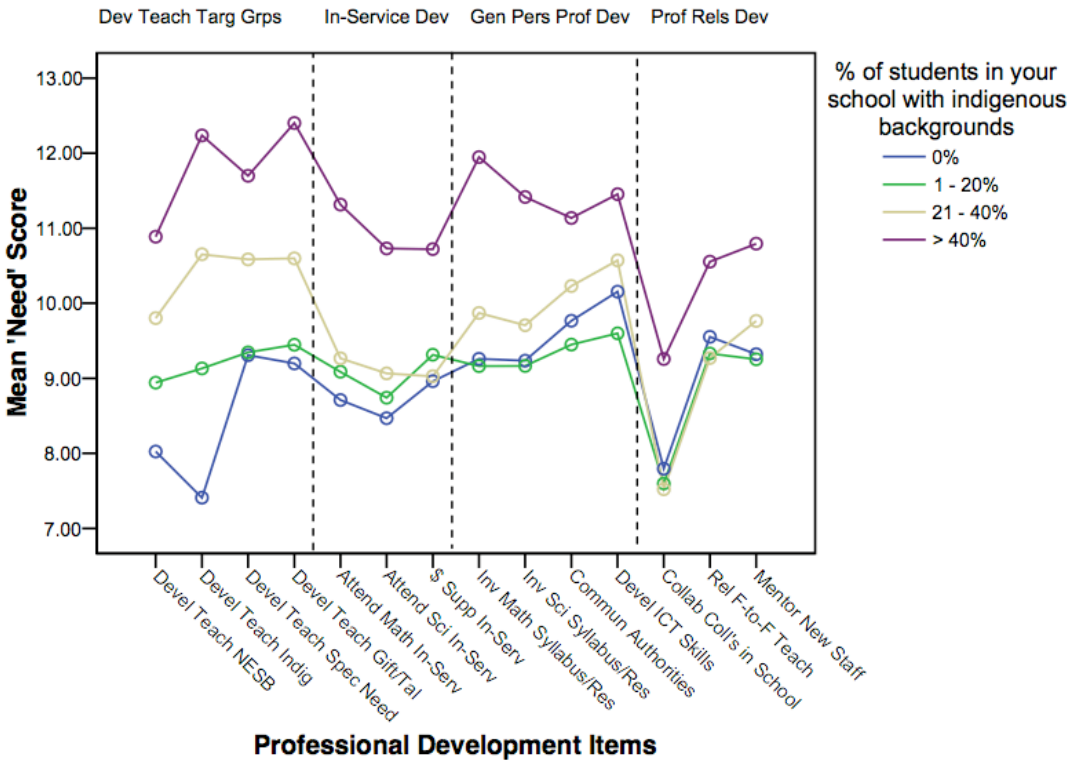

Figure 5.2 Profile plot of mean 'need' scores of primary respondents for the Professional Interaction & Development components, compared by percentage of students from Indigenous backgrounds (Table 5.1 for item names in full)

In their comments, primary teachers in schools with relatively high Indigenous populations reported feeling professionally isolated due to distance, costs and lack of relief teachers. For example:

> Remoteness of location has a huge impact. One day out of school is $300 for a relief teacher, plus a $200 flight and other transport plus registration course fees. It is impossible to attend a one or two hour 'after school' seminar (because of) flight times. (Primary Teacher, Remote Area, SA, Indigenous student population >40%)

> There are very few opportunities for PD, and a total lack of funds to cover travel and relief arrangements. There is also a total lack of relief teachers available. (Primary Teacher, Remote Area, NT, Indigenous student population >40%)

Summary of findings and implications

1. The findings indicate a strong need for professional development opportunities for primary teachers to develop their ICT skills, and to help them cater for special needs and gifted and talented students.
2. The findings provide strong evidence that primary teachers in Remote Areas are significantly disadvantaged in terms of accessing professional development opportunities such as mentoring, release time for PD and collaboration with colleagues. Teachers in Metropolitan schools appear to have a considerably lower unmet need for in-services in mathematics and science than teachers in other areas, particularly those in Remote Areas.

3. There appears to be a need to develop or improve structures to support mentoring of teachers in remote schools.
4. The findings provide evidence that primary teachers in remote schools, and in schools with high proportions of Indigenous students, feel professionally isolated. In particular, there is a need for professional development to help these teachers cater for special needs and gifted and talented students, for more financial support to cover the costs of professional development, and for strategies to ensure that classes are covered in their absence.

5.3 PROFESSIONAL DEVELOPMENT NEEDS OF SCIENCE TEACHERS

Overall needs

Table 5.3 summarises, at the level of the entire science teacher sample, the average scores on the 'need' items dealing with opportunities for professional interaction and development. The areas of greatest overall 'need' included release from face-to-face teaching for in-school collaborative activities, effective communication between education authorities and teachers and professional development opportunities to help teach science to gifted and talented students. Areas of least 'need' overall included collaboration between science teachers in their school and professional development opportunities to help teach science to NESB students.

Table 5.3 Overall average 'need' scores, standard deviations and valid N for science respondents' ratings of the Professional Interaction and Development items (items are listed in descending order of mean 'need' score) [Scores can range from 1 to 20]

PROFESSIONAL DEVELOPMENT ITEMS	Mean	s.d.	Valid N
Release from face-to-face teaching for in-school collaborative activities (e.g., programming)	**11.33**	4.28	539
Effective communication between education authorities and teachers	**10.16**	3.87	539
Professional development opportunities to help you teach science to gifted & talented students	**10.12**	3.88	531
Collaboration with science teachers in other schools	**9.98**	3.66	544
Professional development opportunities to help you teach science to special needs students	**9.97**	4.05	525
Workshops to develop your ICT skills	**9.80**	4.04	542
Involvement in region or state-wide syllabus development, or research projects (e.g., assessment)	**9.69**	3.89	539
Financial support for attendance at external in-services or conferences	**9.46**	3.96	542
Opportunities to attend external in-services or conferences related to teaching & learning science	**9.44**	3.74	543
Opportunities for mentoring new staff	**9.14**	3.74	539
Opportunity to mark/moderate external science assessments	**9.07**	4.12	535
Professional development opportunities to help you teach science to Indigenous students	**9.04**	4.50	522
Professional development opportunities to help you teach science to NESB students	**8.73**	4.22	501
Collaboration between science teachers in your school (e.g., sharing resources, ideas, knowledge)	**8.06**	3.48	542

A principal components analysis of the 'need' items (Appendix 5.2) yielded three substantive components: General Personal Professional Development, Development for Teaching Targeted Groups, and Professional Relationships Development. Scores on these three components were analysed using a series of MANCOVAs in order to make specific group comparisons. Two MANCOVAs were conducted comparing mean component 'need' scores by MSGLC category and percentage of students with Indigenous backgrounds. Table 5.4 shows the mean ratings and their associated standard errors on the three components across the categories of the comparison variables.

Table 5.4 Mean ratings by science respondents on Professional Interaction and Development item components, broken down by MSGLC categories and percentage of students with Indigenous backgrounds [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
Percentage of students in your school with Indigenous backgrounds	0%	Mean	9.26	8.38	8.96	
		s.e. (Mean)	.42	.52	.41	50
	1 - 20%	Mean	9.71	9.35	8.83	
		s.e. (Mean)	.15	.18	.14	395
	21 - 40%	Mean	11.68	11.97	10.49	
		s.e. (Mean)	.49	.61	.48	35
	> 40%	Mean	10.83	12.04	10.90	
		s.e. (Mean)	.73	.91	.71	16

[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.

Variation with geographic region

The multivariate test for MSGLC category differences across the three professional interaction and development components was significant[39]. Follow-up tests revealed that the reasons for this significant multivariate difference were a significant univariate difference on the Development for Teaching to Targeted Groups component and a suggestive difference on the General Personal Profession Development component. For both of these components the highest level of 'need' was indicated by respondents from Remote Areas and the lowest 'need' by respondents from Metropolitan Areas. Comparatively speaking, 'need' was highest in the area of Development for Teaching to Targeted Groups for respondents from Remote Areas. Figure 5.3 displays the profile plot of the original professional interaction and development 'need' transformed items by MSGLC category. The clear 'pattern' in Figure 5.3 is that respondents from Metropolitan Areas uniformly indicated a lower level of 'need' across all 14 original professional interaction and development items. Also particularly notable is that respondents from Remote Areas strongly indicated a higher level of 'need' for development to teach to all four targeted groups. Respondents from Remote Areas were also distinguished by indicating the highest level of 'need' for involvement in regional or state-wide syllabus development or research projects and having opportunities to mark/moderate external assessments.

[39] Wilks' lambda = .940, $F(9, 1255.96) = 3.58$, $p = .001$, partial $\eta^2 = .02$

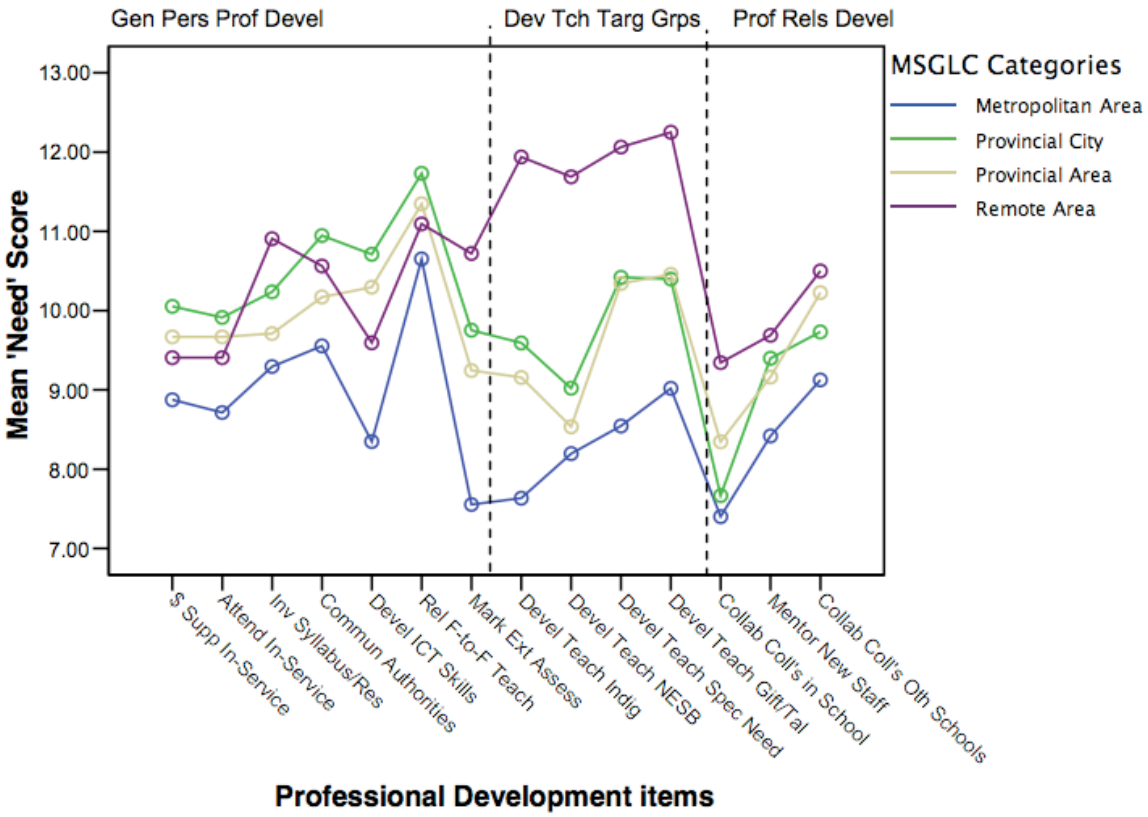

Figure 5.3 Profile plot of mean 'need' scores of science respondents for the Professional Interaction and Development components, compared by MSGLC categories (Table 5.3 for item names in full)

The geographical differences in expressed need were supported by science teachers' comments, of which the following were typical:

> What PD? The school won't even pay for airfares and nearly all PD is in Brisbane. Drive for hours and risk fatigue and accident, or don't go. Schools in regional areas should get much bigger PD budgets as almost all of the good PD is in Brisbane. (Science Teacher, Provincial City, Qld)
>
> I have been de-skilled by working in my region. (Science Teacher, Provincial Area, SA)
>
> Being somewhat remote it is time consuming to get to PD in Melbourne and regional PD for physics is seldom available or close. It is easy to feel isolated with the demands of teaching and the difficulty of PD in physics, particularly this year with a new course. (Science Teacher, Provincial Area, Vic.)

Variation with Indigenous student population

The multivariate test comparing the three professional interaction and development components across secondary schools with different percentages of student with Indigenous backgrounds was significant[40]. Follow-up tests revealed that the reasons for this significant

[40] Wilks' lambda = .925, $F(9, 1185.38) = 4.28$, $p < .001$, partial $\eta^2 = .03$

multivariate difference were significant univariate differences on all three components. In each case, respondents from schools having more than 21% of students with Indigenous backgrounds indicated substantially greater levels of 'need' in these three components compared to respondents from schools where the percentage was 20% or less. The area of General Personal Professional Development is clearly of greatest 'need' for respondents from schools where the percentage of students with Indigenous backgrounds was between 21% and 40%. Figure 5.4 displays the profile plot of the original professional interaction and development 'need' transformed items by percentage of students with Indigenous backgrounds. The figure shows that 'needs' are greatest in all specific areas of General Personal Professional Development, except opportunities to mark/moderate external assessments, for respondents from schools where the percentage of students with Indigenous backgrounds was between 21% and 40%. In schools where the percentage of students with Indigenous backgrounds exceeded 20%, 'needs' were greatest in the specific areas of development for teaching to all targeted groups, except gifted and talented.

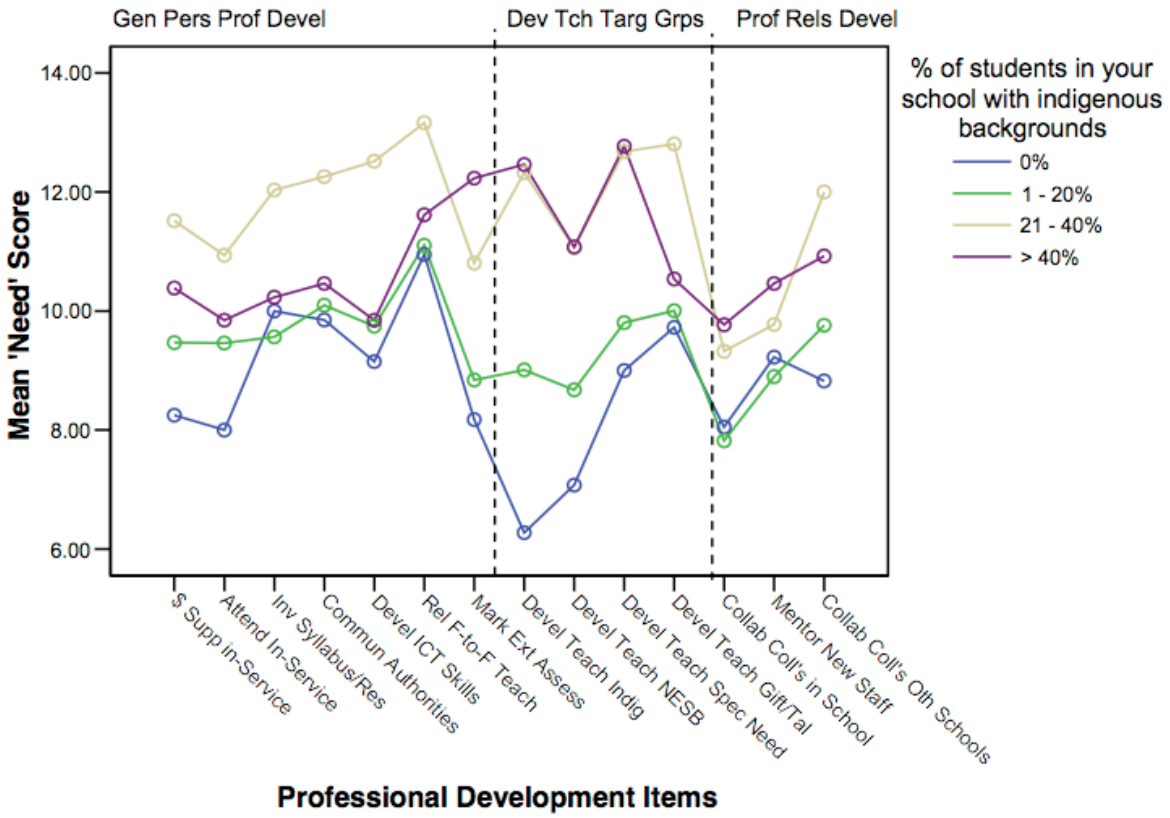

Figure 5.4 Profile plot of mean 'need' scores of science respondents for the Professional Interaction & Development components, compared by percentage of students from Indigenous backgrounds (Table 5.3 for item names in full)

Summary of findings and implications

1. The findings strongly suggest that science teachers in general see the priority areas for professional development as being release from face-to-face teaching for programming and other collaborative activities, and more effective communication with educational authorities. The high level of need may be related to developments in secondary science curriculum that have been, and still are, in progress in a number of Australian states and territories.

2. There was a clear indication that science teachers need professional development opportunities to help them cater for the diversity of students in their classes
3. The unmet need for professional development opportunities increased substantially with distance from Metropolitan and Provincial Cities. Indeed, teachers in metropolitan schools reported a lower mean 'need' score on *every* professional development item.
4. The evidence suggests that science teachers in remote schools feel professionally isolated when it comes to opportunities to contribute to syllabus development. It is also apparent that teachers in Metropolitan Areas have far more opportunity to mark/moderate external science examinations. Such opportunities for teachers in remote schools would clearly benefit their students.
5. The findings suggest that science teachers in schools which have a relatively large proportion of Indigenous students have a substantially greater need for a range of professional development opportunities, particularly those which would help them cater for student diversity. However, the findings imply that science teachers in schools where Indigenous students make up 21 to 40% of the student population have a greater need for general in-service opportunities and support than do those in other schools

5.4 PROFESSIONAL DEVELOPMENT NEEDS OF ICT TEACHERS

Overall needs

Table 5.5 summarises, at the level of the entire ICT teacher sample, the average scores on the 'need'-transformed items dealing with opportunities for professional interaction and development. The areas of greatest overall 'need' included release from face-to-face teaching for in-school collaborative activities, professional development opportunities for teaching ICT to gifted and talented students, collaboration with ICT teachers in other schools, opportunities for mentoring new staff, professional development opportunities for teaching ICT to special needs students and having effective communication between educational authorities and teachers. Areas of least 'need' overall included opportunities to mark/moderate external ICT assessments, collaboration between ICT teachers in their school and professional development opportunities to help teach ICT to Indigenous students.

Table 5.5 Overall average 'need' scores, standard deviations and valid N for ICT teachers' ratings of the Professional Interaction and Development items (items are listed in descending order of mean 'need' score) [Scores can range from 1 to 20]

PROFESSIONAL DEVELOPMENT ITEMS	Mean	s.d.	Valid N
Release from face-to-face teaching for collaborative activities	**10.79**	4.00	225
Professional development opportunities: teach ICT to gift/talented students	**10.38**	4.34	214
Collaboration with ICT teachers in other schools	**10.34**	3.88	223
Opportunities for mentoring new staff	**10.22**	4.03	223
Professional development opportunities: teaching ICT to special needs students	**10.21**	4.40	214
Effective communication between education authorities & teachers	**10.17**	3.85	218
Involvement in region/state-wide syllabus development/research projects	**9.93**	3.88	218
Financial support to attend external in-services/conferences	**9.59**	4.01	221
Professional development opportunities teaching ICT to NESB students	**9.46**	4.38	205
Opportunities to attend external in-services/conferences related to teaching ICT	**9.43**	3.49	221
Professional development opportunities: teaching ICT to Indigenous students	**9.33**	4.58	211
Collaboration between ICT teachers in your school	**9.23**	3.79	222
Opportunities to mark/mod external ICT assessments	**9.17**	4.27	214

A principal components analysis of the 'need'-transformed professional interaction and development items (Appendix 5.3) produced three substantive components: Development for Teaching to Targeted Groups, General Personal Professional Development, and Professional Relationships Development. Scores on these three components were analysed using a series of MANCOVAs in order to make specific group comparisons. Two MANCOVAs were conducted comparing mean component 'need' scores by MSGLC category and percentage of students with Indigenous backgrounds. The multivariate tests for differences across the three professional interaction and development components were not significant.

Most of the priority areas for ICT teachers relate to the need for on-the-job training, for example, the need for collaboration both within schools and with ICT teachers in other schools, and for mentoring new staff. This is consistent with the fact that there are relatively fewer ICT teachers in a school than mathematics or science teachers. The response below illustrates this point:

> As the only ICT teacher at the school there is very limited interaction between myself and others in my teaching area. Professional Development opportunities seem to always occur in the city and it is not always possible to drive down there (2 hours) attend the course/seminar and return (ICT teacher, Provincial Area, Qld)

These professional development needs are consistent with the acknowledgement by respondents that they lacked relevant pre-service training in what is a very dynamic field.

Table 5.6 shows the mean ratings and their associated standard errors on the two components across the categories of the comparison variables. The multivariate tests for MSGLC category and percentage of students with Indigenous backgrounds differences across the three professional interaction and development components were not significant.

Table 5.6 Mean ratings by ICT respondents on Professional Interaction and Development item components, broken down by MSGLC categories and percentage of students with Indigenous backgrounds [a]

			Professional Interaction & Development Component			
			Development for teaching to targeted groups	General personal professional development	Professional relationships development	Valid N
MSGLC categories	Metropolitan Area	Mean	8.04	8.68	9.32	
		s.e. (Mean)	.65	.49	.51	56
	Provincial City	Mean	10.17	9.57	10.41	
		s.e. (Mean)	.62	.47	.48	44
	Provincial Area	Mean	10.32	10.08	10.24	
		s.e. (Mean)	.43	.33	.34	98
	Remote Area	Mean	11.88	10.37	10.94	
		s.e. (Mean)	1.04	.79	.81	17
Percentage of students in your school with Indigenous backgrounds	0%	Mean	9.23	9.10	9.55	
		s.e. (Mean)	.84	.63	.67	22
	1 - 20%	Mean	9.55	9.59	10.07	
		s.e. (Mean)	.31	.23	.25	155
	21 - 40%	Mean	11.88	10.47	11.04	
		s.e. (Mean)	.87	.66	.70	19
	> 40%	Mean	12.25	9.91	10.13	
		s.e. (Mean)	1.46	1.11	1.17	7

[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.

Summary of findings and implications

1. The findings strongly suggest that ICT teachers see the need for release from face-to-face teaching for collaborative activities as the highest PD priority.
2. This finding is indicative of what appears to be a need for intensive on-the-job training. This conclusion is supported by ICT respondents' emphasis on the need for collaboration with ICT teachers in other schools, and for mentoring new staff. These priority areas are also consistent with what many respondents regarded as a relative lack of pre-service training in teaching ICT courses (see Chapter Four).
3. The tendency for professional development needs to increase with distance from a metropolitan city was not significant for ICT teachers, indicating that distance may be less of an issue for these teachers than is the case with primary and science teachers. Likewise, differences in the proportions of Indigenous students did not significantly affect levels of need. However, given the pattern across variables, the lack of significant associations may also be due to insufficient cell values.

5.5 PROFESSIONAL DEVELOPMENT NEEDS OF MATHEMATICS TEACHERS

Overall needs

Table 5.7 summarises, at the level of the entire secondary mathematics sample, the average scores on the 'need'-transformed items dealing with opportunities for professional interaction and development. The areas of greatest overall 'need' included professional development opportunities for teaching higher-order thinking skills, classroom management[41] and organisation and alternative teaching methods as well as release from face-to-face teaching for in-school collaborative activities.

Table 5.7 Overall average 'need' scores, standard deviations and valid N for mathematics respondents' ratings of the Professional Interaction and Development items (items are listed in descending order of mean 'need' score) [Scores can range from 1 to 20]

PROFESSIONAL DEVELOPMENT ITEMS	Mean	s.d.	Valid N
Professional development opportunities: teaching of higher-order skills	**10.70**	3.91	492
Professional development opportunities: classroom management & organisation	**10.47**	4.04	496
Professional development opportunities: alternative teaching methods	**10.34**	3.98	494
Release from face-to-face teaching for collaborative activities	**10.33**	4.25	499
Effective communication between education authorities & teachers	**9.92**	3.72	492
Professional development opportunities: teach mathematics to gift/talented students	**9.89**	3.72	490
Professional development opportunities: integrating technology into math lessons	**9.89**	3.85	497
Professional development opportunities: teaching math to special needs students	**9.77**	3.96	493
Collaboration with mathematics teachers in other schools	**9.65**	3.61	501
Professional development opportunities: methods for using group teaching strategies	**9.60**	3.80	489
Opportunities for observing teaching techniques of colleagues	**9.49**	3.97	499
Workshops to develop your ICT skills	**9.47**	3.82	492
Involvement in region/state-wide syllabus development/research projects	**9.29**	3.90	493
Financial support to attend external in-services/conferences	**9.04**	4.00	498
Opportunities for mentoring new staff	**8.90**	3.68	501
Opportunities to attend external in-services/conferences related to T&L math	**8.76**	3.57	502
Professional development opportunities: use of graphics calculators	**8.75**	3.82	495
Professional development opportunities: outcomes/standards-based teaching	**8.72**	3.87	495
Opportunities to mark/mod external mathematics assessments	**8.62**	3.99	488
Professional development opportunities: teaching mathematics to Indigenous students	**8.40**	4.31	480
Professional development opportunities teaching mathematics to NESB students	**8.29**	3.99	459
Collaboration between mathematics teachers in your school	**7.86**	3.44	500

[41] Note that these two items were not included on the other teacher surveys

Areas of least 'need' overall included collaboration between mathematics teachers in their school and professional development opportunities to help teach mathematics to NESB and Indigenous students.

A principal components analysis of the 'need'-transformed professional interaction and development items (Appendix 5.4) produced four substantive components: Mathematics Teaching Professional Development, General Professional Development, Development for Teaching to Targeted Groups, and Professional Relationships Development. Scores on these four components were analysed using a series of MANCOVAs in order to make specific group comparisons. Two MANCOVAs were conducted comparing mean component 'need' scores by MSGLC categories and percentage of students with Indigenous backgrounds. Table 5.8 shows the mean ratings and their associated standard errors on the four components across the categories of the comparison variables. The multivariate test for MSGLC category differences across the four professional interaction and development components was not significant.

Table 5.8 Mean ratings by mathematics respondents on Professional Interaction and Development item components, broken down by MSGLC categories and percentage of students with Indigenous backgrounds [a]

			Professional Interaction & Development Component				
			Mathematics Teaching Professional Development	General Personal Professional Development	Development for Teaching to Targeted Groups	Professional Relationships Development	Valid N
MSGLC categories	Metropolitan Area	Mean	**8.86**	**8.79**	**7.95**	**8.46**	
		s.e. (Mean)	.33	.31	.36	.31	119
	Provincial City	Mean	**10.00**	**9.36**	**9.17**	**8.54**	
		s.e. (Mean)	.32	.30	.35	.30	102
	Provincial Area	Mean	**10.19**	**9.57**	**9.54**	**9.38**	
		s.e. (Mean)	.23	.21	.25	.21	229
	Remote Area	Mean	**10.35**	**10.12**	**10.52**	**10.06**	
		s.e. (Mean)	.61	.57	.67	.57	28
Percentage of students in your school with Indigenous backgrounds	0%	Mean	**9.24**	**8.86**	**7.39**	**8.68**	
		s.e. (Mean)	.42	.39	.45	.39	55
	1 - 20%	Mean	**9.73**	**9.29**	**9.05**	**8.92**	
		s.e. (Mean)	.16	.15	.17	.15	347
	21 - 40%	Mean	**10.66**	**10.08**	**10.80**	**9.70**	
		s.e. (Mean)	.50	.46	.53	.47	37
	> 40%	Mean	**12.10**	**11.13**	**12.41**	**10.68**	
		s.e. (Mean)	.82	.76	.86	.76	14

[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.

Variation with Indigenous student population

The multivariate test comparing the four professional interaction and development components across schools with different percentages of students with Indigenous backgrounds was significant[42]. Follow-up tests revealed that the reasons for this significant multivariate difference was a significant univariate difference on the Development for Teaching to Targeted Groups component and a suggestive difference on the Mathematics Teaching Professional Development component. In each case, respondents from schools with more than 40% Indigenous students, and to a lesser extent from schools where the percentage was between 21% and 40%, indicated substantially greater levels of 'need' in these two components compared to respondents from schools where the percentage was 20% or less.

[42] Wilks' lambda = .912, $F(12, 1172.359) = 3.45$, $p < .001$, partial $\eta^2 = .03$

Figure 5.5 displays the profile plot of the original professional interaction and development 'need' transformed items (ordered by component and labelled across the top of the graph) by percentage of students with Indigenous backgrounds. The figure shows that 'needs' were greatest in all specific areas of Mathematics Teaching Professional Development, but especially development in the areas of classroom management and organisation and alternative teaching methods, for respondents from schools where the percentage of students with Indigenous backgrounds was greater than 20% (but particularly marked for respondents from schools where the percentage exceeded 40%). A similar pattern emerged across the items comprising the Development for Teaching to Targeted Groups component: 'needs' were particularly high in the areas of development for teaching to Indigenous and special needs students for respondents from schools where the percentage of Indigenous students exceeded 40%, even when compared with respondents from schools where the percentage was between 21% and 40%.

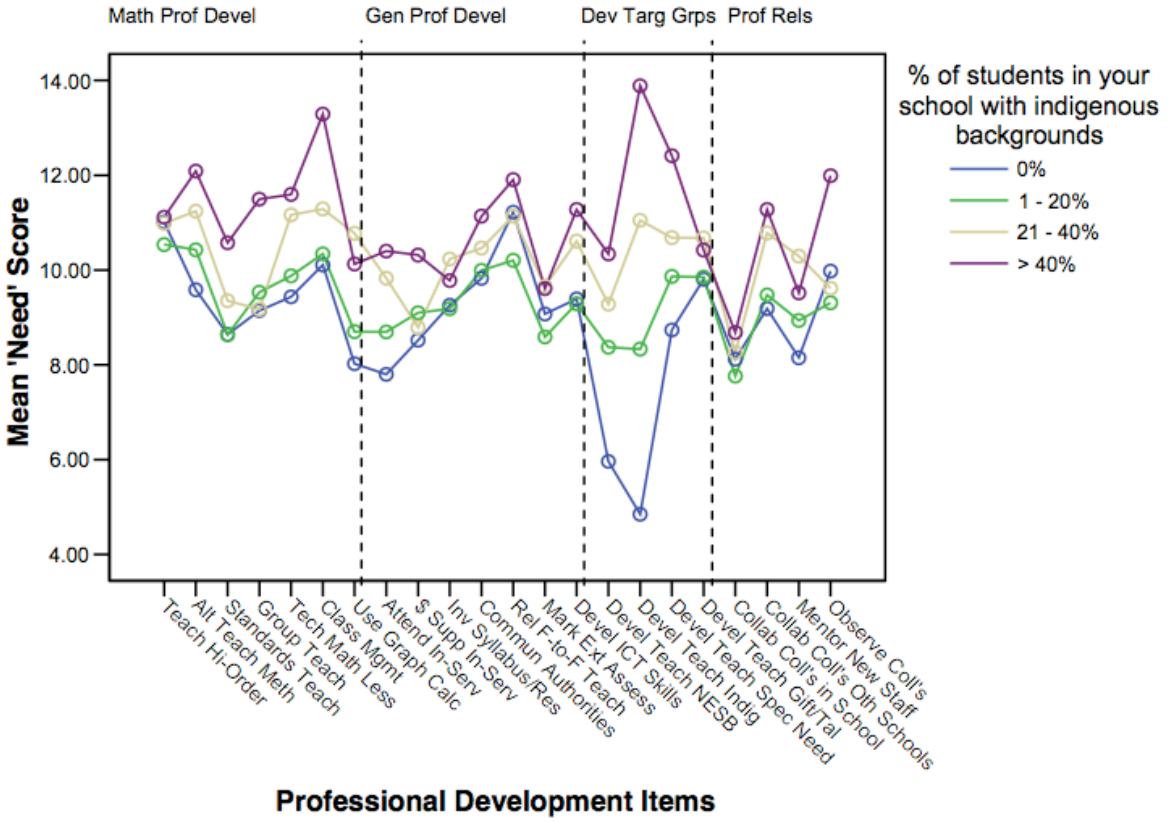

Figure 5.5 Profile plot of mean 'need' scores of mathematics respondents for the Professional Interaction and Development components, compared by percentage of students from Indigenous backgrounds (Table 5.7 for full item names)

Because schools with high Indigenous populations tend to be in Provincial or Remote Areas, it is difficult for teachers to access the professional development opportunities they would find helpful. For example:

> A lot of professional development is available, but at great expense due to distance. It may involve large travel and accommodation cost, and/or extended time away from family. It is very hard to find any help with classroom management and organization. (Mathematics Teacher, Provincial Area, NSW, Indigenous student population 21-40%)

Summary of findings and implications

1. The findings strongly suggest that secondary mathematics teachers throughout Australia see a high need for professional development to help teach higher-order thinking skills, to improve classroom management and to develop alternative teaching methods.
2. There also appears to be a strong need for release from face-to-face teaching for unit programming, and for more effective communication with education authorities.
3. The evidence suggests that mathematics teachers see a substantial need for professional development opportunities to help them cater for student diversity in their classrooms.
4. While there was a pattern in 'need' ratings across MSGLC categories, the differences were not significant, suggesting that the professional development needs of mathematics teachers do not vary as much with location as do those of science and primary teachers.
5. The findings strongly suggest that mathematics teachers in schools with substantial proportions of Indigenous students require more professional development in student management, alternative teaching methods and strategies to cater for student diversity than do those in schools with fewer Indigenous students.

The findings reported in this chapter are discussed in more detail in Chapter Nine, where they are linked to recommendations.