

A century through GIS: Diocesan School 1904 – 2004

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Abstract

May 1904, Auckland, New Zealand: Diocesan High School for Girls opens. One hundred years later Diocesan celebrated its centennial. How have the school site, the wider school community and the area adjacent to the school changed in 100 years? This paper looks at how answering these questions offered a way of introducing students (aged between 12 and 17) to local history and geography in an interesting and meaningful context – within existing units of work - and at the same time introduced staff and girls to GIS. It discusses how the GIS project shows these changes by using census data, historic and modern photographs and maps and written records. Incorporating physical, socio-economic, transport and urban development information it was built for use by different year levels and in different subjects. The teaching methods used and the impact on student and staff learning are also considered.

Setting the scene

Diocesan School for Girls is an independent (private) school located in Auckland, New Zealand catering for 1560 girls aged five to eighteen. It opened in May 1904 and in 2004 celebrated its centennial.

The School is well resourced with regard to IT. Girls in Years 8 to 11 (aged 12 – 16) have their own laptop computers, there are several computer rooms with desktop computers, the school site is wireless enabled and there are nine professional IT staff.

The School has a laptop computer initiative that aims to integrate IT in a meaningful way into the teaching and learning programme.

Diocesan purchased ArcView 3.2 in 1999 and while seeing its potential as a teaching tool, lack of time meant little progress was made in learning how to use it, so we dabbled rather unsuccessfully for several years. In 2004 I was fortunate to spend a year away from Diocesan on a Ministry of Science, Research and Technology Teacher Fellowship. This allowed me to work with and learn about GIS and as a result gain the necessary skills to start integrating GIS more effectively into our teaching programmes. GIS is now used by girls in Years 8 to 13 (12 to 18 years) in Geography, Social Studies and to a lesser degree in History.

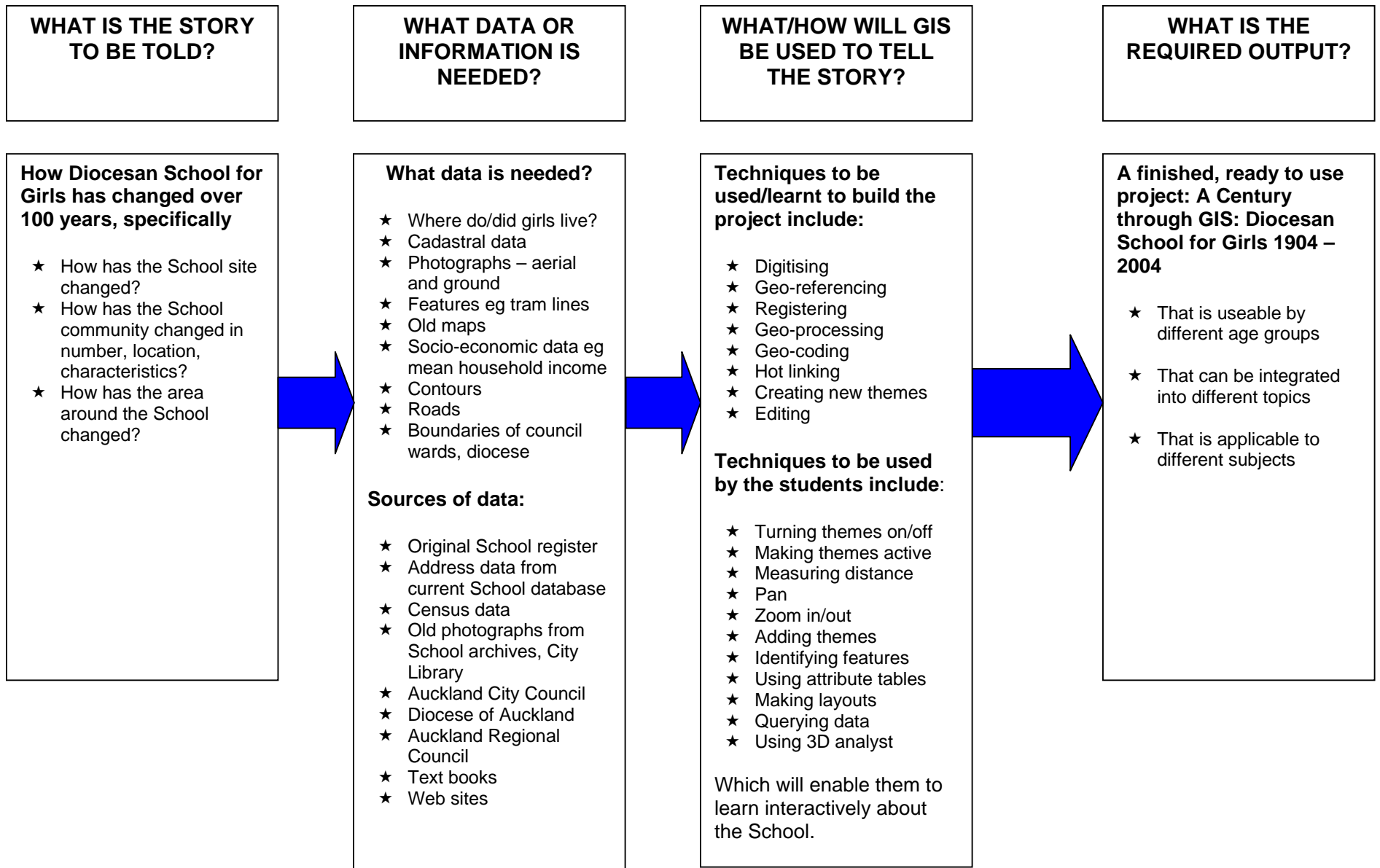
At the time that I applied for the Teacher Fellowship, the School's Centennial celebrations were being planned. Thinking about the history of the School and ways in which GIS could be applied, it seemed that a history of the School through GIS would be a valuable teaching tool and a vehicle through which we could (re) introduce the software to students and staff.

Building the project

From my previous attempts at using GIS, it was clear that the finished project had to be user friendly for staff and students (all themes have readily understood names), ready to use with no additional staff input (apart from learning how to use it) and of interest to the girls.

Figure 1 shows the approach taken to build the project.

Fig. 1: The approach taken to build “A century through GIS: Diocesan School 1904 – 2004”



The project took three months to build. At the end of this time the GIS data sets, instruction sheets and separate question sheets were ready for use.

It took three months because I had to learn how to use ArcView 3.2. I largely taught myself the necessary techniques from *Using ArcView GIS* (ESRI 1996). Some work was done using Arc 8.

The finished piece of work is composed of eight separate projects. Teachers can choose which ones they wish to use.

Data for 1904 and 2004 was sourced from resources that were as close to those dates as possible if data for these precise years was unavailable.

What the project contains

Figure 2 shows in detail what is contained in the project. Students download what is required onto their laptops. The five most frequently used projects will be discussed here.

“Project 1: Where is Diocesan School for Girls?” aims to provide a sense of scale, especially for Year 8 (12 year old) students whose knowledge of geography is often limited. Since we are the Diocesan School for Girls, including the Diocese of Auckland gives them a better understanding of what to them, is often an abstract term. Figure 3 shows the screen students see and the themes displaying from larger to smaller scale.

Fig. 3: Project 1

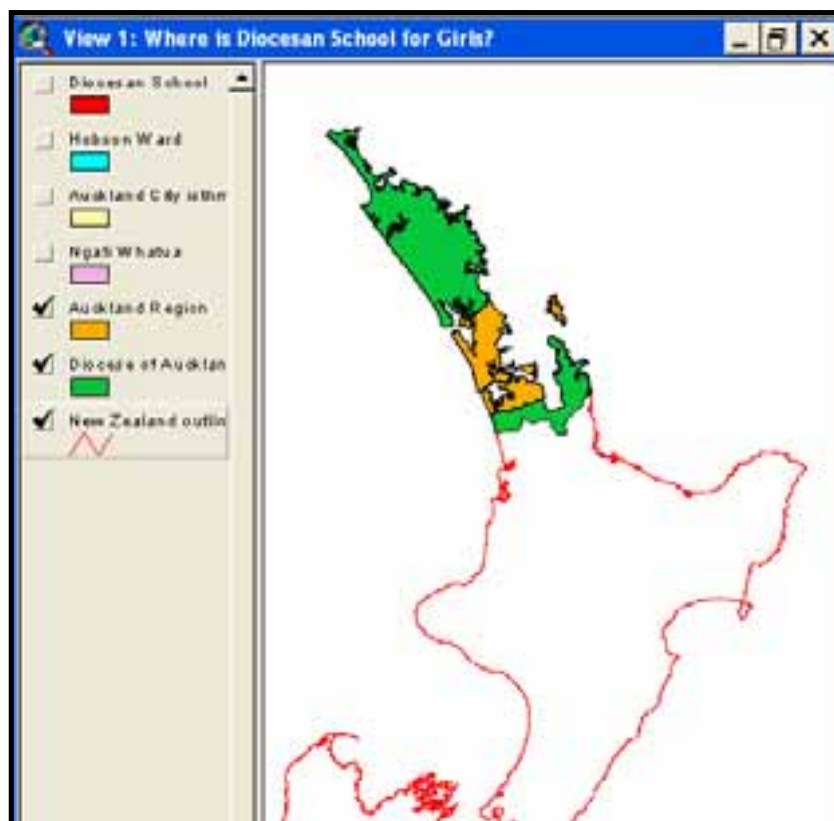


Fig. 2: What the projects contain

Project	Themes	Examples of activities/questions
Project 1 Where is Diocesan School for Girls?	<ul style="list-style-type: none"> • Outline of NZ • Diocese of Auckland • Auckland region • Ngati Whatua tribal area • Auckland isthmus • Hobson Ward • Diocesan School 	Describe the School's location in terms of different scale settings
Project 2 What is the underlying physical environment like?	<ul style="list-style-type: none"> • Contours • Cadastral • Geology (predominantly volcanic) • Diocesan School 	Interpreting contours Making 3D image from contours The School in relation to natural hazards?
Project 3 1904: What was the School site and surrounding environment like? Where did our students live?	<ul style="list-style-type: none"> • Photos of Epsom 1906 • Photos of Diocesan 1905 • Tram lines (horse drawn) • Where students lived • 1903 Auckland map • Roads (2004) • Auckland City (2004) • For sale sign and plan of School in 1899 • Cadastral 	What was the area like in 1904? Land use? Land use maps? Changes? Eg street names How might students have travelled to school? Why did the School's hours fit the tram timetable? How have the School grounds changed?
Project 4 The 1920s: what was the School site and surrounding area like?	<ul style="list-style-type: none"> • 1924 Auckland map • Tram lines (electric) • Photos of Epsom 1920 (from the ground) • Cadastral • Auckland City (2004) • Diocesan School 	Urban growth, what where? Differences in the area around Dio?
Project 5 The 1950s: Diocesan and the surrounding area	<ul style="list-style-type: none"> • Aerial photo 1958 • Impermeable surfaces for part of Epsom • 3D of extruded buildings • School buildings 	How to use aerial photos and their advantages Impermeable surfaces? How much urban growth had there been by 1958?
Project 6 2004: What does Diocesan and its surrounding area look like today?	<ul style="list-style-type: none"> • Aerial photos 2002 • School buildings • Impermeable surfaces for same area as in 1958 • 3D of extruded buildings • Cadastral • Auckland City 	Effects of intensification of urban growth – runoff? Privacy?
Project 7 The School community today: What characteristics do we have? Where do we live?	<ul style="list-style-type: none"> • Where students live • Transport routes • 500m buffers around routes • How girls travel to school • Are students' mothers old girls? • 2001 Census data for meshblocks for Auckland region eg mean household income, % dwellings owned, ethnicity, usually resident population, mean number bedrooms • Auckland City • New Zealand • Diocesan School 	Transport issues Patterns of residence? Relationships between census data sets? Eg Where do Dio girls live?
Project 8 What socio-economic characteristics does the area around the School have?	<ul style="list-style-type: none"> • Census data eg age, ethnicity, home ownership, population density, usually resident population, % population change • Diocesan School • Auckland City • Roads 	What are the characteristics of the community that lives adjacent to the School?

Project 3 is one that the girls enjoy using and find particularly interesting. This is used as part of a Year 8 Social Studies topic “Take another look at New Zealand”, that examines our local environment and how people, both Maori and European, have affected it in the past.

Figure 4 shows some aspects of Project 3; where the girls attending the School by the end of 1904 lived, both in relation to the School and the (horse drawn) tram routes. The addresses were sourced from the original handwritten register, entered into an Excel spreadsheet converted to dbf format and geocoded.

Fig. 4: Project 3: 1904 – Where did our students live?



Year 8 students are asked to consider the relevance of the tram lines to the distribution of students.

Also as part of this project, an 1899 sale sign for the property that became the School, allows girls to discover what the land used to be used for. Figure 5 shows the whole of the sale sign while Figure 6 shows what students see when they use the zoom in tool.

Fig. 5: Project 3 – 1899 sale sign.
(Source: Auckland City Library, NZ Map 4255)

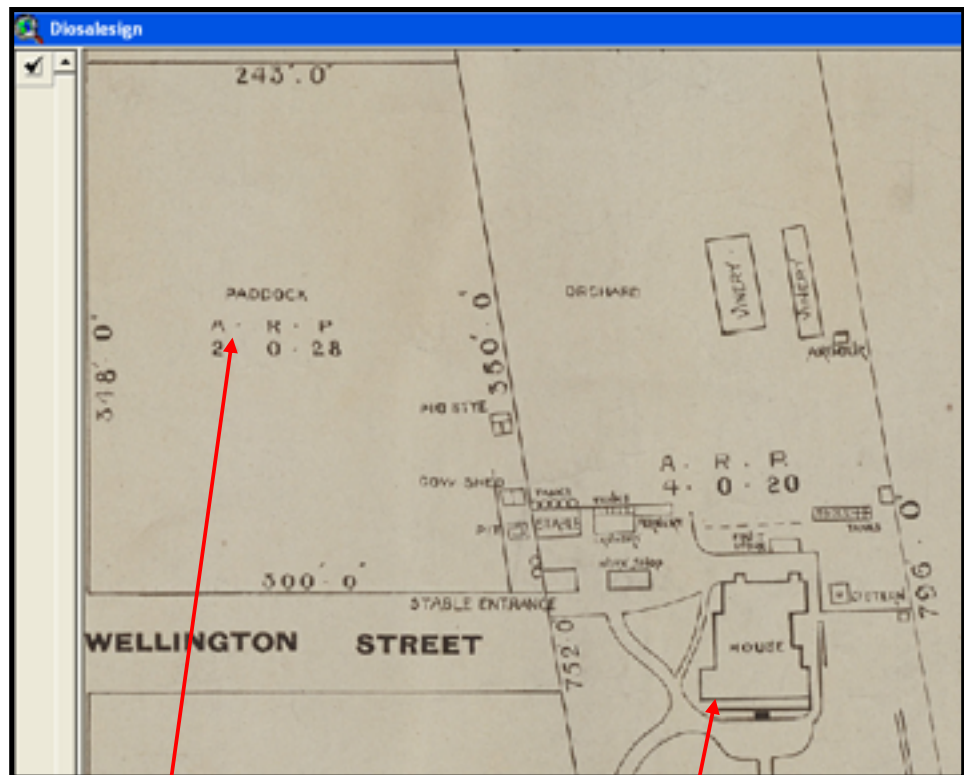


Fig. 6: A close up of the 1899 sale sign.

(Source: Auckland City Library, NZ Map 4255)

Tasks for Year 8 students include listing all the uses of the School grounds that no longer occur, and other changes, for example the street names are not the same as the modern ones.

Students are also required to reconcile the orientation of this sign with photographs provided and identify features that appear both.

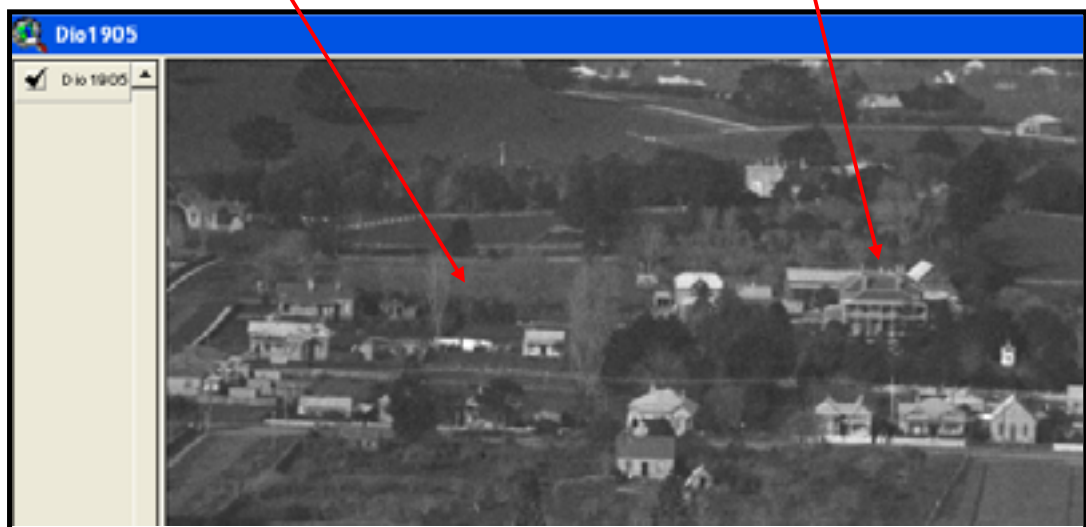


The paddock – how was this related to getting to School?

School House on

Fig. 7: Part of a 1905 photograph of the School

(Source: Auckland City Library 1-W1419)



Using this project, students are also required to complete a layout that shows the main landuses of the area in 1905, a task that challenges many girls.

Project 6 “What does Diocesan and its surrounding area look like today?” presents students with an aerial photograph of the School and its surroundings that is familiar and

yet unfamiliar. Using a vertical aerial photograph may be a new experience, particularly at Year 10, and many girls find this perspective difficult to interpret particularly when faced with an area that is unknown to them. Using a vertical photograph of the School and its environs allows them to develop the skill of interpretation for a known environment and this skill can then be applied to other settings.

Two other key themes in Project 6 show to what extent the urban area has been developed (and the resulting infill housing) since the late 1950s. Year 12 Geography students use this project as part of their investigation into the issue of “Auckland: Where are we going to live?” a topic that examines the results of population growth – should the Auckland metropolitan area be allowed to continue to spread onto productive farmland, or should it be contained? The themes provide a good starting point for discussion about the impacts of infill housing on people and the environment. The streets concerned are only a few hundred metres from the School.

Fig. 8:
Project 6 -
Showing the
significant
increase in
impermeable
surfaces
between
1958 and
2004.

The themes
were created
by digitising
impermeable
surfaces
from aerial
photographs.
The shapes
for 1958 are
less regular
than those in
2004

reflecting the
possibly haphazard development of concrete paths, yards and some driveways and my
early attempt at digitising.



This particular property results in plenty of discussion regarding the results of urban development having changed from one substantial villa in 1958 to eleven town houses by 2004.

Project 7 is used by Year 10,11 and 12 students. Of considerable interest are the “Dio dots” and girls enjoy trying to find their own dot if they were at Diocesan in 2004. It should be noted that in generating this theme, from the outset there was no data about girls’ names and once a shapefile of geocoded addresses had been generated, the address data was deleted leaving just the suburb. The data available in this theme is the year and

part of the School that the student is in, whether her mother, sister or grandmother are old girls and how the student travels to school.

As Figure 9 shows, there is a clear concentration of students' homes.

Fig. 9: Project 7 – Where do students live in 2004?

However, using other themes in this project, girls are asked to suggest reasons for the location of Diocesan students in 2004.

Turning on the theme “Mean Household Income, by meshblock”, introduces girls to choropleth maps and produces an interesting (and not unexpected) pattern as shown in Figure 10.

With students in Year 11 Geography classes, further exploration of this theme leads on to discussion about whether there are differences in living standards in New Zealand and if so, what, why and what might the consequences be ?

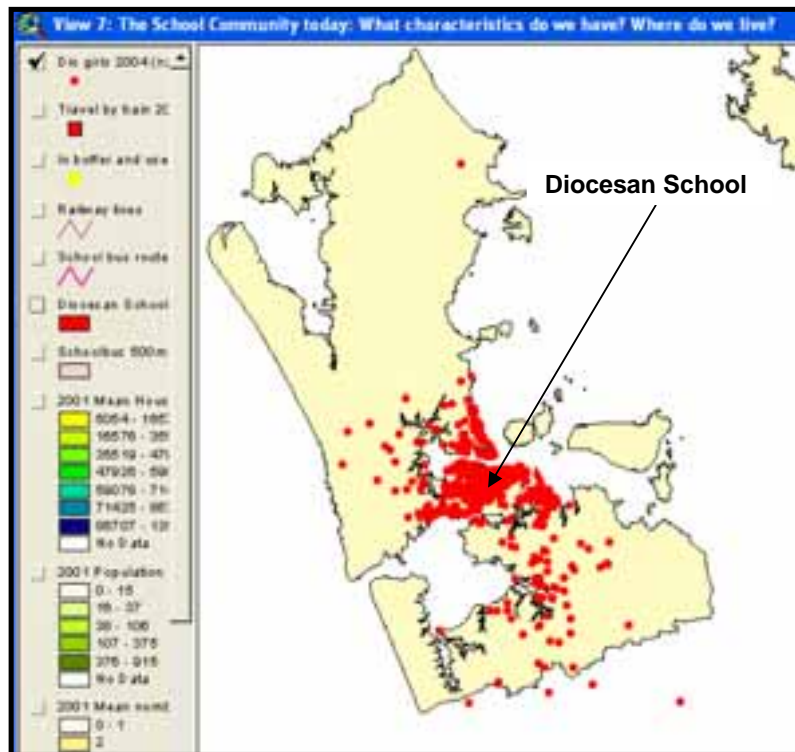
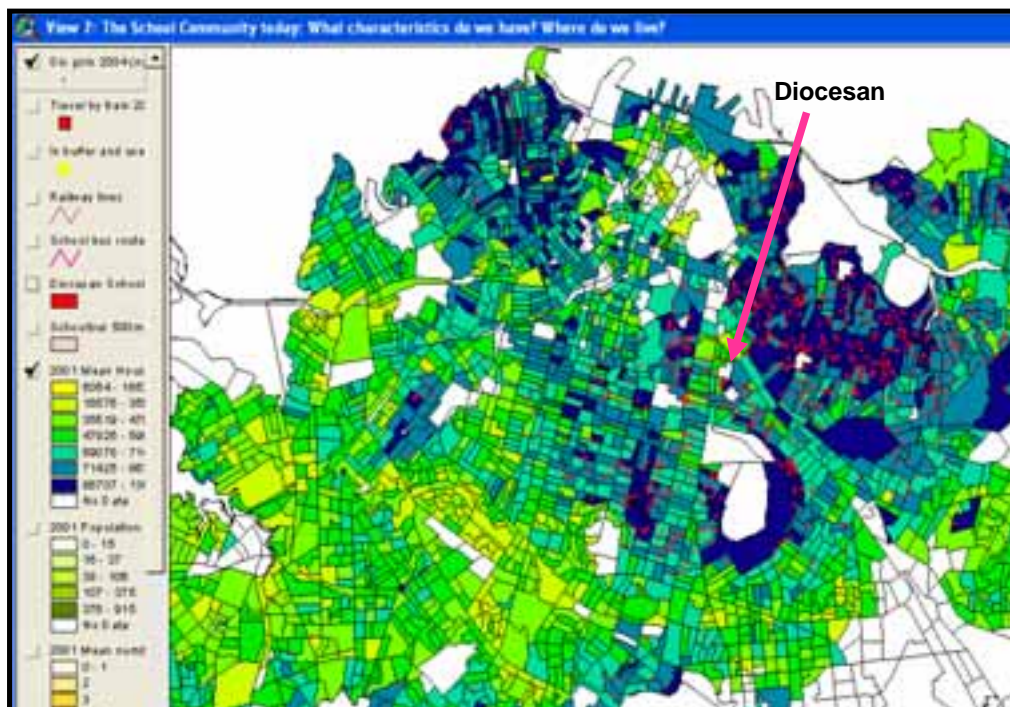


Fig. 10: A close up of central Auckland showing some of the students' home locations.

The meshblocks with the higher mean household incomes are where most students lived in 2004.

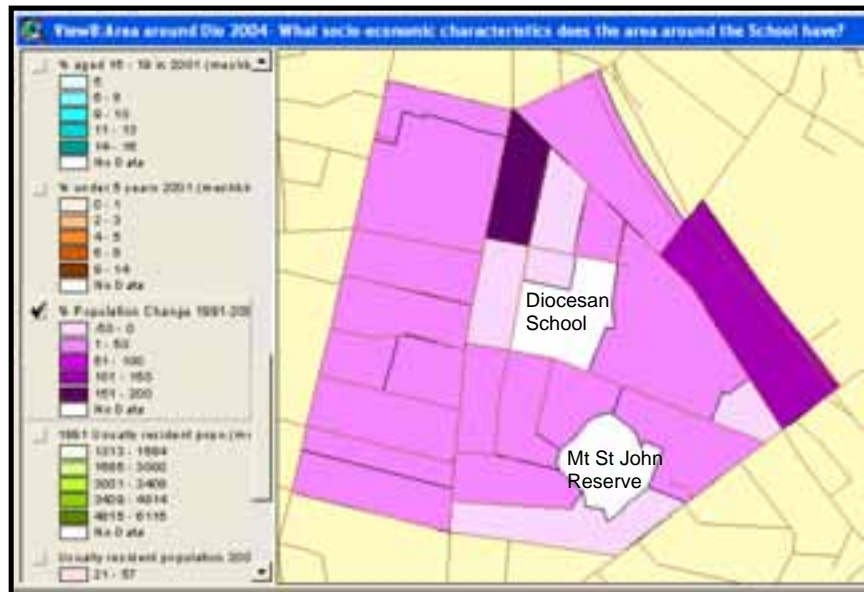


The final project allows girls to learn more about the characteristics of the area around the school. Data has been clipped ready for use. Figure 11 shows one theme from this project.

Fig. 11: Project 8

Population change 1996
– 2001

Students are required to think about what has happened in the two meshblocks that have experienced significant change.



Implementation – Using the project

2005 saw this work successfully introduced across all Year 8 and Year 10 Social Studies classes and to Year 11 and 12 Geography students.

The key factors that facilitated its implementation were:

- It was transportable so could be downloaded onto student laptops and it opened as intended. Girls did not have to build the views
- My colleagues were very supportive
- It was ready to run so staff did not have to do anything to it
- The IT staff were supportive
- It was designed to only require 2 -3 lessons at a time
- Instruction and question sheets were provided as part of the downloaded folder
- It was used as part of existing topics.

Previous attempts at using GIS showed that to gain acceptance as a teaching tool the experience of both staff and students had to be a positive one. With the constant time pressure to complete units of work, lessons spent trying to get GIS to work resulted in frustrated staff and unenthusiastic students. In 2005 to minimise the risk of this, staff were introduced to the topic as a group with a tutorial at the start of the year that showed them what was in the project and how it could be integrated into existing units of work. With the work on their laptops they were then able to go through projects in their own time using instruction sheets; an extract from one is shown in Figure 12.

Fig. 12: Part of an instruction sheet for Project 3

Icons are shown to assist students to find the correct one.

A GEOGRAPHY OF DIOCESAN SCHOOL 1904 – 2004 THROUGH GIS

Instructions:

Using the "Getting Started" sheet instructions, open up View 3: 1904. Answer the questions on the accompanying work sheet as you work through these instructions.

To speed things up when ArcView redraws, turn off themes that you are not using eg roads. Be patient. Some files are very large and take more than a few seconds to load.

1. The project should open showing a map of Auckland City. If they are not already turned on, turn on roads, trams, Dio girls homes, Diocesan School.
2. How many girls were there at Dio in 1904? Make this theme active. Open the attribute table. Left click once on the column headed Age. Go to Field - statistics. Look at count.
3. Compare the location of Dio girls homes to the tramlines.
4. Keep the Dio girls theme active. Go to Theme - properties and read what it says.
5. Make the roads theme active. Go to theme - properties and see what it says.
6. Make the Dio girls theme active, ie raised. Use the identify button to find out about the girls who lived closest and furthest away from the school.
7. Use the theme population 1906.
8. Turn on and make property boundaries active. Zoom to the active theme.
9. Adding photos. Go to File - Extensions. Scroll down to JPEG. Put a Tick in the box on the left - OK. Use the add a theme icon. Scroll down under data source types and select image data source and click. Select the images that you want to add to your view. To select several at once, hold down the shift key while you click on them. Do not select ones already in the view. In this case add Auckland1903, Dio1905, Epsom1906, Diosalesign.

Previous experience has also shown that students can become too concerned about "button pressing" and do not gain the information or interpretive skills intended when instructions and content/interpretive questions are on the same sheet. As a result separate question sheets are provided. Figure 13 is an extract from the question sheet for Project 3. Putting the content onto separate sheets also helps students to revise for tests and exams.

Fig. 13: An extract from a question sheet

A GEOGRAPHY OF DIOCESAN SCHOOL 1904 – 2004 THROUGH GIS

Student Worksheet: _____ Student Name: _____

View 3: 1904

1. How many girls were there at Dio in 1904?
2. a) Describe the location of the Dio girls homes compared to the pattern of tramlines.

b) Suggest a reason for what you notice.
3. What was a problem in locating where some girls lived?
4. What information is there about the roads shown on the map?

The most effective way of introducing the project to students was with an interactive whiteboard. Staff showed the key actions of turning themes on and off and making them active. Girls were then asked to come up to the board (Figure 14) and try this or other actions for themselves, such as using the legend editor. Student feedback showed that they felt "safe" and in a "supportive" environment learning to use GIS this way.

Subsequent lessons working on their own computers were more productive because they had grasped the basics effectively.

Fig. 14: A Year 12 student using an interactive whiteboard and Project 6.



What were the results of using the project?

The immediate result was that many girls were introduced to GIS in a way that was positive, interesting and fun. There have been some glitches but as our competence improves these have been solved.

Year 8 girls, in particular, have said that it is a fun way to learn. Project 3 “1904: What was the School site and surrounding environment like?” intrigues them and they enjoy finding out what the School looked like when it opened.

Using GIS enables different girls to shine, as some quickly grasp what is needed and then help others who are not so fast. This has also occurred due to the different teaching style required: where girls ask two other students for help before adding their name to a list on the board if their problem has not been solved. The teacher only deals with girls whose names are on the list. This reduces the chance of a student sitting with their hand up waiting for help for a while and as a result doing very little for part of the lesson. Other students usually solve the problem so the list is short. Students work collegially as they share ideas and problem solve. Teachers work more directly with individual students and there is less whole class teaching. In our experience, students and teachers learn together as they problem solve. As girls quickly learn how to use the software, the teacher takes a step back; there is a change in pedagogy from teacher centred to student centred learning.

The project appeals to girls who are more visual learners and students enjoy customising the maps that they create.

The wealth of data available within the project allows us to teach students elements of the research process; to find information, then process and present their findings.

Staff are positive about the project. It enables them to learn the basics of a new software package but without spending hours constructing lessons. As a result we are contributing something different to the School’s information technology programme; it is a point of difference for the Humanities subjects.

This project acts as a springboard. Teachers are prepared to use GIS elsewhere in their teaching programme, using other projects and data because they have gained some confidence from using this work. The shapefiles built for it are being used in a variety of other work, for example with Year 8 girls working on “One, two, tree” (English and Feaster 2003) and Year 12 students investigating where in Auckland to locate a new fast food outlet.

Building this project improved my GIS skills significantly. A wide range of techniques were needed to construct the different projects and my copy of “*Using ArcView GIS*” is now well thumbed. My competence and confidence in using a computer also increased.

At present we are still beginners in the use of GIS and the project was designed to be an introduction to this software. However as our skills increase there is scope for a wider range of applications. For example making more use of 3D to show differences in socio-economic data, spatial analyst and network analyst to investigate patterns and accessibility.

Conclusion

This project has enabled girls to learn something of the history and geography of the School community, site and adjacent area between 1904 and 2004.

It has provided a range of data that students can use and through which they learn new skills of data interpretation.

Girls in different year levels and subjects are using and applying different aspects of this project to their studies.

Teaching has become more student centred as girls share ideas and their understanding of GIS techniques.

“A century through GIS: Diocesan School 1904 – 2004” has served the purpose that it was intended to. It has been well received by staff and students and enabled GIS to be incorporated into existing courses and topics in a meaningful way.

Acknowledgements

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