APRIL 2006

STAYING IN SCIENCE

AN INVESTIGATION OF FACTORS THAT ENCOURAGE STUDENTS TO CHOOSE SCIENCE AS A STUDY AND CAREER FOCUS

A Ministry of Research Science and Technology funded project in two parts

MINISTRY OF RESEARCH SCIENCE + TECHNOLOGY

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Measuring participation

Any trends in the numbers of students studying sciences need to be interpreted with care. Measures used in different research projects include:

- numbers enrolled in a science subject as a percentage of overall student numbers at this year level (relative popularity);
- numbers enrolled in assessment for qualifications (persistence during year of study);
- actual numbers of students enrolled in a science subject in final year (fluctuates on cohort size, predicts likely tertiary numbers);
- numbers enrolled in a final year subject as a percentage of the total cohort on entry to secondary school (curriculum retention across secondary school);
- aggregate numbers enrolled in any of the sciences compared to other learning areas (curriculum share, takes account of increased competition in expanding curriculum); and
- subject combinations chosen by individual students (e.g. mathematics and science discipline combinations that open or constrain future study pathways).

What's the project all about?

This research, undertaken by the New Zealand Council for Educational Research (NZCER), was funded by the Ministry of Research Science and Technology (MoRST) and used to inform its ongoing policy work. They wanted to know who took Year 13 science subjects and why, and to find out about the factors that influence students to keep studying sciences at tertiary level (or not). The research had two phases:

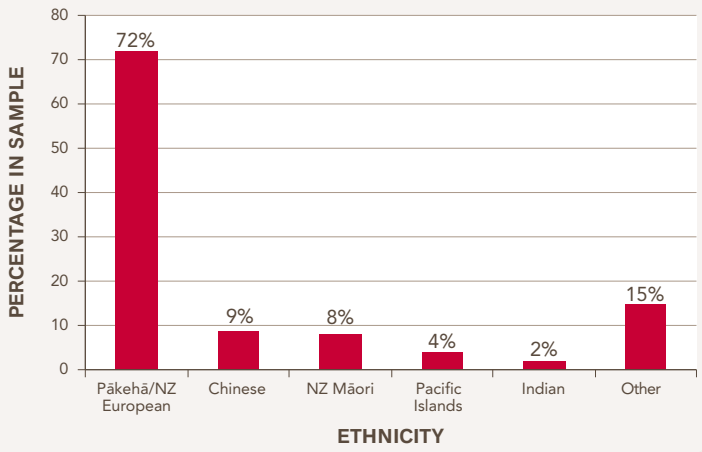
1. **A background paper that:**
   - outlined competing ways to measure patterns of participation in school science subjects; and
   - summarised other research about factors that influence students to carry on in science.
2. **A report of focus group and survey research that addressed two critical questions:**
   - Why do students choose to take sciences in Year 13?
   - Why do students plan to take up (or not take up) sciences in their tertiary level studies?

KEY FINDINGS

1. No single information and support strategy will suffice to encourage higher levels of ongoing participation in the sciences.
2. Exploring the ways students combined subjects in Year 13 helped in understanding their different attitudes to science and career interests. A cluster analysis of ways science and selected other subjects tend to be combined revealed four different groups, with associated differences in attitudes to science as a potential career area. This finding suggests that science opportunities need to be different for students with different interests.
3. Some students make the decision to continue studying sciences at tertiary much earlier than Year 13. Other students are still very undecided at the stage of leaving school. There are benefits associated with each approach, and any support needs to account for both ends of the continuum.
4. Factors that influence students to stay with science subjects can include: personal interests, broad decision-making orientation, family background, positive learning experiences (curricular and extracurricular), type of school attended, and knowledge of potential science careers.
5. Although it is sometimes said that less young people are taking science, there are a number of different ways to measure "science participation" so any claims about trends need to be interpreted carefully.

WHO TOOK PART IN THE RESEARCH?

- 50 students from five secondary schools took part in focus groups.
- 496 students from 20 randomly selected secondary schools took part in the survey. The ethnic composition of this group is shown on the graph.



Who stays in science?

Students' Year 13 subject combinations tended to fall into one of four cluster patterns. These cluster patterns were associated with interesting differences in students' attitudes to science careers and their future study plans.

"SERIOUS SCIENCE" students (33 percent of those surveyed – 57 percent of this cluster were female students) tended to:

- take more than one traditional science subject, and at least one mathematics subject in their final year of school;
- enjoy sciences and think they do well in them;
- be planning towards somewhat traditional science-related careers, for example in medicine, dentistry, or veterinary sciences; and
- intend to study science at university, often with encouragement from parents and teachers.

"SCIENCE/BUSINESS" students (23 percent of those surveyed – 86 percent of this cluster were male students) tended to:

- choose physics and calculus in combination with some form of computer science/information and communication technology (ICT) as well as the business-oriented subjects in Year 13;
- be neutral about their interest in science and science learning; and
- be less likely than the "serious science" students to see science as a worthwhile career to pursue.

"KEEPING OPTIONS OPEN (1)" students (24 percent of those surveyed – 71 percent of this cluster were female students) tended to:

- choose a more "mixed bag" of subjects that included English along with biology or a science such as agriculture/horticulture or earth science, but not mathematics; and
- say that sciences were not among their "top choices".

"KEEPING OPTIONS OPEN (2)" students (20 percent of those surveyed – 70 percent of this cluster were male students) tended to:

- choose a more "mixed bag" of subjects that could include English for speakers of other languages (ESOL) along with science, or agriculture/horticulture or earth science, in combination with a business subject such as economics or accounting, and/or an ICT subject; and
- be less likely to see science as a worthwhile career to pursue.

The students in both "keeping options open" groups tended to be:

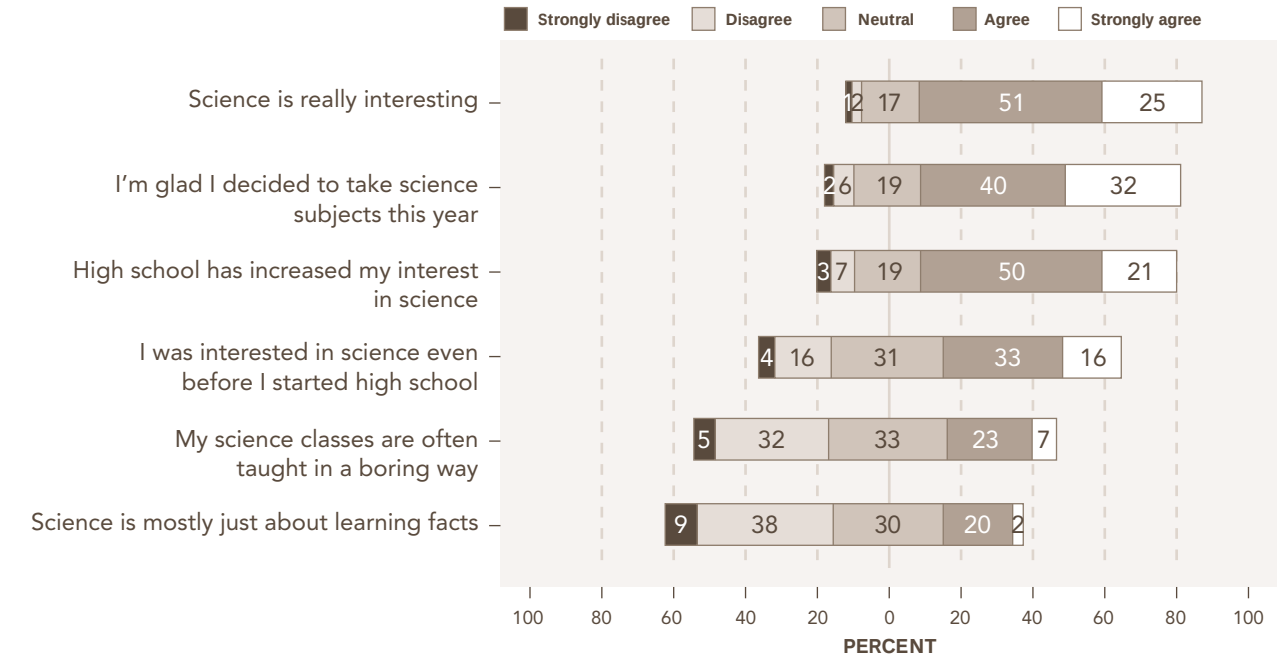
- unsure what they wanted to study, or to be planning careers in areas that did not include science;
- less confident than the other students of their academic ability in sciences;
- less likely to be enjoying their science learning;
- less often encouraged to persevere with science studies by their families; and
- poised to drop sciences on transition to tertiary, despite the fact that a number of them agreed that science may be needed for their future career plans.

These findings show that we need to take a new approach to thinking about science that does not rely on a one-size-fits-all model. There are new opportunities for combining subjects that can open up new career pathways. Students need opportunities to think about these and to be supported when they choose less traditional pathways. This has implications for how science could be taught at school, for the kinds of tertiary options that could be offered to make the most of people with cross-disciplinary interests, and for the different kinds of support and information different young people require.

Science at school

By and large, students who are still taking sciences in Year 13 are positive about their learning experiences. The picture painted by the Likert graph is encouraging.

FIGURE 1 **Students' interest in science, and views about secondary science teaching**



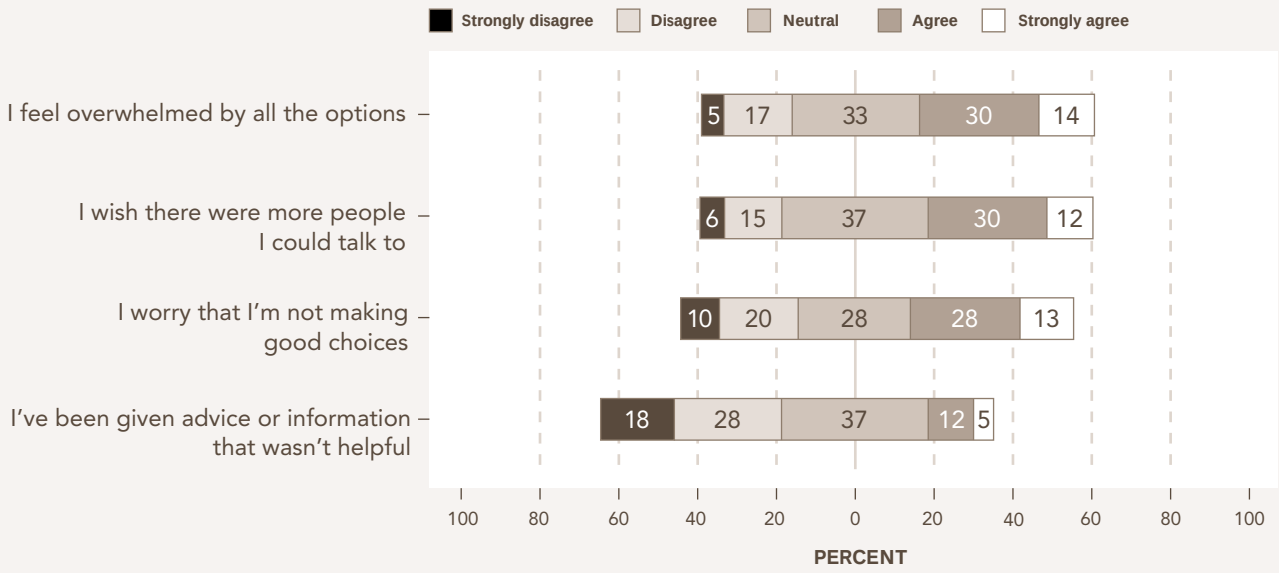
Some students did seem to be taking sciences "under sufferance", doubtless for strategic reasons:

- 10 percent of students taking biology disliked it;
- 16 percent of students taking chemistry disliked it; and
- 22 percent of students taking physics disliked it.

Decision making is complex

The next graph shows how the survey students felt about the tertiary study decisions they were facing. The need for greater levels of support is clear.

FIGURE 2 **Students' feelings about making tertiary study decisions**



The patterns in both graphs suggest that choosing science, and the decision making that goes with that choice, can be an emotional journey. This is a useful reminder that support does not just come by providing students with more and more stand-alone information. Other sorts of support are also needed.

Students make career choices in different ways – other research

From the research literature, we found one longitudinal study from England that tracked students' choices through their secondary school years (Cleaves, 2005). The students made their study choices in different ways according to their type of "choice trajectory".

DIRECTED students had already chosen by Year 9, and were headed for "high visibility" occupations such as teachers and lawyers.

PARTIALLY RESOLVED students kept their options open and thought about a wide range of potential career choices. If they kept up their science and maths they did so for strategic reasons.

FUNNELLING IDENTIFIERS began with broad choices but narrowed these down across the years of secondary school. Most of them eliminated science because they found it boring or irrelevant.

PRECIPITATING students were aware they had many choices and considered these in a mature way before finally deciding. They often chose thoughtful combinations of sciences and other subjects for strategic reasons.

MULTIPLE PROJECTION students juggled images of themselves in many careers, before making positive choices in directions that did not typically include sciences.

This English research reinforces our New Zealand finding that science decision making is a complex and dynamic process, in which the influences, timing, and pathways differ between students.

Cleaves, A. (2005). The formation of science choices at secondary school. *International Journal of Science Education, 27*(4), 471–486.

What could we do to advise and support students?

If we want to encourage more young people into science then students need rich opportunities to find out about the many ways sciences can be used in interesting careers.

But who is best placed to help them find out? While most students in our survey had accessed careers advice at school, they did not necessarily find this advice useful. Not all of them had been helped by their parents when making their study choices. But when parents could help, students generally did listen to them! The report recommends that ways are found to work with parents, so more of them are better informed about potential careers in the sciences.

At the same time, the role that schools can play is very important, and this needs more attention. From the focus group students' perspectives, there was considerable variation in the ways schools supported subject and careers decision making. The survey showed that students in smaller schools, mostly outside main urban areas, were more likely to find support from their careers advisors helpful. The relationship between teachers and students was important, as was the relationship between science teachers and careers advisors. The findings also raised a number of curriculum-related questions concerning students' enjoyment and motivation to continue studying sciences.

- *In what ways could school science become more relevant to students' lives and concerns?*
- *In what ways could it help them learn more about the wide range of science-related research and careers?*
- *How might sciences be integrated with other learning areas, so students who want to keep their options open see richer links between the various subjects that interest them?*

WHAT WILL HAPPEN NEXT?

MoRST has published the full report, and met the research team from NZCER to discuss the implications of the findings. The research has inspired MoRST to develop a workshop for key agencies in the area to come together and discuss the implications of the findings. From this it is likely that new ways of supporting students will emerge.

To find out more about the project, please contact: Project leader Rosemary Hipkins, ph (04) 802 1465, rose.hipkins@nzcer.org.nz.

Copies of the report can be downloaded from the MoRST website www.morst.govt.nz, or via the NZCER website www.nzcer.org.nz.

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