Improving Learning

Evaluation of the In2science Peer Mentoring Program

Final Report

Education Policy and Practice Research Program

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ACER

TABLE OF CONTENTS

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List of Tables

List of Figures

EXECUTIVE SUMMARY

Large-scale studies of 15-year-old school students show associations between students' attitudes toward science learning and their levels of achievement (Ainley, Kos, & Nicholas, 2008). One model for improving students' attitudes towards science and mathematics learning has been the provision of peer mentoring. The In2science program uses a peer mentoring approach to engage secondary school students in science and mathematics study. Working with the classroom teacher, university students serve as mentors and help students with their learning and build relationships in a small group or a whole class. Mentors talk to students about studying science (or another STEM area) at university and how science is used in everyday life and careers. In2science mentors act as role models to show school students what a future in science might look like.

The Australian Council for Educational Research (ACER) was contracted to evaluate the In2science program during Semester 2, 2016. The evaluation used a mixed methods approach to focus on student outcomes as a result of the program.

Key findings

- *In2science provides a valuable resource for science and mathematics teachers, who make use of the mentor in a wide variety of ways to suit their class needs.*
- *Students are more self-confident in their learning in science and mathematics after participating in In2science.*
- *Students have a greater understanding of the importance of science and mathematics in daily life after participating in In2science.*
- *Students have a better understanding of how many different occupations use science and mathematics after participating in In2science.*
- *Students' off-task behaviours reduced when the mentor was in the classroom, and continued to be reduced after the completion of the mentor's placement in the classroom.*

The In2science program operates in a range of diverse ways across different schools and classrooms, subject to the discretion of the individual classroom teacher. This allows each school and teacher participating in the program to benefit from the activities of the mentor, based on each teacher's professional judgement of how best to use the resource provided by the mentor. The program operates in Government schools, so it is important for schools and teachers to make use of any and all available additional assistance.

The analysis of the student surveys used in the evaluation In2science identified the following benefits:

- After the program, students reported that they were more confident in their ability to learn about science and mathematics.
- After the program, students reported that they had a better understanding of the importance of science and mathematics in daily life and in the world around them.
- After the program, students reported that they could use what they learned in science and mathematics classes in other classes at school.
- After the program, students reported that they were more determined to try to solve science and mathematics problems on their own.
- After the program, improvements in attitudes towards science and mathematics were greater for students who worked directly with a mentor compared to students who did not work with a mentor directly. However, students who did not work with a mentor directly also showed improved attitudes towards science and mathematics after having the mentor in the classroom.
- While the mentor was in the classroom, student behaviour improved. Off-task behaviour remained lower after the mentor's placement had finished.

Students also indicated that they are more confident in discussing science and mathematics with family and friends, but at a lower level than the other post-program effects.

This evaluation was not able to establish longer-term effects of In2science.

While this evaluation did not investigate mentors' experiences of the In2science program, it was noted from students' feedback on surveys that the role of mentors is not clear. Some students mentioned that the mentor worked with them to help with homework, while others wrote about the mentor teaching part of a class. It is not possible to determine from the data if this was a result of the program's implementation practices or the teacher's flexibility in how the mentor is used.

At present, there are no data available on past students who have previously been involved in the In2science program and no follow-up of students currently participating. This means that program objectives—such as increasing the uptake of science and mathematics subjects in Years 11 and 12—cannot be measured.

While the student surveys currently used by the program examine students' attitudes towards science and mathematics, which is one aspect of the program, the current items are too broad in scope and do not focus on how the program operates or on the role of the mentor in the classroom.

Key recommendations

While the key findings indicate the value and importance of In2science, there are significant improvements that can be made to enhance the effectiveness of peer mentoring in science and mathematics.

- *The placement of mentors with teachers and classes should focus on how the teacher will work with the mentor to allow the best match of mentor, teacher and class.*
- *Provide teachers and students with more information to clarify the mentor's role in the classroom.*
- *The In2science program, with agreement from participating universities, should endeavour to organise mentor placements to coincide with school terms.*
- *In2science should continue to conduct detailed evaluations, in particular to assess the different ways that mentors work in the classroom to determine which modes are more effective with which students.*
- *A new evaluation of In2science should be conducted to determine the longer-term effects of the program, to determine whether the program influences the continued study of science and mathematics.*
- *In2science should discuss with participating schools and the Victorian Department of Education and Training protocols to allow follow-up of students to allow long-term evaluation of the effects of the program on students' subject choices.*
- *The In2science surveys should be simplified to include more items on the activities of the program and the role of the mentor in the classroom.*
- *Items that do not relate to the program should be removed from the surveys.*

1 INTRODUCTION

The importance of Australian secondary school students engaging in and continuing their study of science and mathematics has been highlighted across a range of policy documents, including the Victorian Department of Education and Training's plan released in 2016, *STEM in the Education State*. The plan highlights the importance of improved education and learning outcomes for Victoria's youth in science, technology, engineering and mathematics, or STEM. The policy comes after years of declining student enrolments in STEM subjects, particularly in science and mathematics.

The number of students enrolling in mathematics and science subjects in Year 12 and in universities has been on the decline in Australia since the late 1980s (Ainley, Kos & Nicholas, 2008; Fullarton, *et al*., 2003; Kennedy, Lyons & Quinn, 2014; Office of the Chief Scientist, 2012; Weink, 2015). As one response, the Australian Government allocated $21.6 million in the 2012-13 budget to the Australian Maths and Science Partnerships Program (AMSPP) to improve learning outcomes in mathematics and science. AMSPP aims to improve student engagement in mathematics and science courses at schools and university through innovative partnerships between schools, universities and other relevant organisations.

Large-scale studies of 15-year-old school students show associations between students' attitudes toward science learning and their levels of achievement (Ainley, Kos, & Nicholas, 2008). One strategy that can be used to improve secondary students' enthusiasm for science and mathematics subjects is peer mentoring. Using a peer mentoring framework, students relatively close in age and studying in a science, technology, engineering or mathematics discipline can share their interest in and knowledge about their subject with another student. The In2science program, one of 22 projects currently funded by AMSPP, has adopted this framework since its inception in Victorian schools in 2004, before the introduction of AMSPP.

In2science uses university students acting as role models and mentors in Victorian secondary schools for a ten-week period. These mentors are volunteers who are currently studying science, technology, engineering or mathematics at one of four partner universities (La Trobe University, The University of Melbourne, RMIT University and Swinburne University of Technology). Mentors work with teachers and students in Year 7, 8 and 9 Mathematics and Science classes. Working with the classroom teacher, mentors help students with their learning, and build relationships in a small group or whole class setting. They talk to students about studying science at university and how science is used in everyday life and careers. In2science mentors also act as role models to show school students what a future in science might look like.

The In2science program is currently funded by the Australian Government Department of Education and Training through AMSPP and the four partner universities. It represents a collaborative, partnership approach – between different Victorian universities and secondary schools – towards improving secondary students' engagement in science and mathematics subjects.

2 METHODOLOGY

The Australian Council for Educational Research (ACER) conducted an independent evaluation of the In2science program. This evaluation used a mixed methods approach, combining quantitative and qualitative methodologies. The evaluation focused on students' experiences of the In2science program, as well as whether or not the program achieved its student-related objectives during Semester 2, 2016.

The quantitative component of the evaluation included two paper surveys distributed at two points in time: before the ten-week In2science program had commenced (the pre-program survey) and at the conclusion of the ten-week In2science program (the post-program survey). Both pre- and post-program surveys included 20 questions that asked students to indicate whether or not they agreed or disagreed with a statement. Students responded using a five-point scale. In addition to the 20 questions, both pre- and post-program surveys contained open-ended questions. The post-program survey also asked students to rate their experiences of having an In2science mentor in their classroom.

The qualitative component used a case study approach to ascertain the impact of the In2science program at four schools, which were chosen because they had not been involved in the In2science program in Semester 1, 2016. Classrooms participating in the In2science program at these schools were observed three times: prior to the ten-week In2science program commencing, mid-program, and two-to-three weeks following the conclusion of the In2science program.

2.1 Participants

The main participants were secondary school students in a science or mathematics class involved in the In2science program in Semester 2, 2016. In total, there were 38 Victorian Government secondary schools involved in the program at that time. Across those schools, 110 classes took part with a total student enrolment of 2262. Not all students worked with an In2science mentor: 1976 students worked with one of the 105 mentors.

Of the 110 classes that formed the In2science cohort for this evaluation, 25 classes across 11 schools had teachers that had not taken part in the program during Semester 1, 2016. Both the pre- and post-program surveys were distributed to all of students in these classes. A sub-sample of schools, classes and students was selected to take part in the qualitative components of the evaluation.

2.2 Instruments

There were seven instruments used in the evaluation: two surveys, a classroom observation schedule and four focus group schedules. In addition, a series of questions was developed for informal interviews undertaken with teachers and mentors, as well as science and mathematics co-ordinators, when they were available.

2.2.1 Surveys

Two surveys were developed by In2science staff in cooperation with ACER to ensure a focus on answering the key research questions for the evaluation. The first was a paper and pencil survey for students to complete. The survey was designed to measure students' attitudes about various aspects of mathematics or science. It included 19 multiple choice items to measure attitudes to the subject, and a twentieth item to determine if students were conscientiously responding to the items. All items used a five-point scale, using response categories of 'Strongly disagree', 'Disagree', Neither agree or disagree', 'Agree' and 'Strongly agree'. These items were followed by three open-ended questions. The survey was designed to be completed within 15 minutes. A copy of the survey is included in Appendix A.

The second survey was also a paper survey for students to complete. This survey included the same 20 multiple choice items asked of students in the pre-program survey, to determine if students' perceptions of science and mathematics had changed since participating in the In2science program. In addition to the multiple choice items, the post-program survey included two open-ended questions and five multiple choice items to ascertain their perceptions about science and mathematics after having an In2science mentor in the classroom. This survey was designed to be completed within 20 minutes. It is attached as Appendix B.

For both the pre-program survey and the post-program survey, the twentieth item, which was included to test students' ability to follow instructions, was not included in the analyses.

2.2.2 Classroom observation schedule

ACER developed the classroom observation schedule to collect information on students' engagement in their science or mathematics class. Instances of 16 behaviours were listed on the left-hand side of the schedule, with blank space on the right for the observer to record instances that occurred during each observation cycle. There were four identical schedule sheets used for each observation. See Appendix C for a copy of the Classroom Observation Schedule.

2.2.3 Focus group schedules

A series of questions was developed by ACER to guide the focus group discussions with students. There were four schedules developed: a mid-program and a post-program schedule for students in a science class, and a mid-program and a post-program schedule for students in a mathematics class. Questions focused on assessing students' attitudes and beliefs, and two questions were included to ascertain information about students' knowledge of universities. The four sets of focus group questions are attached as Appendix D.

2.2.4 Informal interviews with teachers and other school personnel

Informal interviews were conducted with teachers and other school personnel to ascertain their perceptions about the In2science program, data available in the school, and to arrange a time for the final school visit. See Appendix E for a copy of the questions posed to teachers and subject coordinators.

2.3 Procedures

2.3.1 Selection of sample

Four schools were selected to take part in the qualitative components of the evaluation. These schools were selected by In2science and ACER, based on earlier discussions the In2science coordinators had with schools. Specifically, two coordinators selected two schools each to approach about being involved in the qualitative case study components of the evaluation. Schools to be approached had to be new to the In2science program, or if the school had taken part previously, the teacher and students must not have taken part in the program in the last couple of years.

From these four schools, eight classroom teachers were invited by their In2science coordinator to take part: two teachers from two of the schools, three from one school, and one from the fourth school. Each of the schools and class teachers invited agreed to do so. From the six classes that took part in at least some of the evaluation, a further sub-sample of students was selected to take part in focus group discussions with the evaluation team. In total, 11 focus group discussions were conducted with students from six different classes. There were 29 students who took part in a focus group discussion, and the number of students in each group ranged from two to six students.

The teachers of the seven classes selected also participated in this evaluation, along with the mentors assigned to those classes. In total, seven teachers and seven mentors were invited to take part in two short, informal interviews. Six of the seven teachers were interviewed mid- and post-program, and the mentors assigned to the classes of these teachers were interviewed pre-program.

2.3.2 Data collection

2.3.2.1 Student surveys

All 2262 students were asked to complete both surveys. The relevant mentor gave the pre-program survey to the relevant class teacher prior to commencing the program. Teachers then distributed the survey to students and had them complete it prior to the mentor commencing in their class.

2.3.2.2 Classroom observations

All of the students from the selected classes in the case study schools took part in the classroom observations. Classroom observations were conducted on three separate occasions: pre-, mid- and post-program. All observations were conducted using the ACER-developed Classroom Observation Schedule (see Appendix C).

In2science coordinators were trained to undertake the first classroom observation. In addition, an information cover sheet was included on Classroom Observation Schedule 1 to ensure coordinators followed the methodology required for the observation (see Appendix F). In total, six classroom observations were conducted by the In2science coordinators. Observers made observations of the classroom during the set class for a period of 10 minutes, followed by a two-minute break. Four periods of observation were conducted. The aim of these observations was to provide a baseline measure of classroom behaviours prior to the mentor entering the classroom.

A second round of classroom observations was conducted during the program. The aim of these observations was to provide an opportunity to determine the extent to which the mentor's interactions with students influence student engagement with the subject. A third and final observation of classrooms occurred approximately four weeks following the cessation of the program for Semester 2. The aim of these observations was to assess the extent to which the program had influenced classroom behaviours.

The second and third observations were to be conducted in the same six classrooms with the same students and teachers as the first observation. However, due to timetable changes and other factors, this was not possible. Overall, four classes took part in all three observations.

2.3.2.3 Focus groups

Prior to the commencement of the second classroom observation, teachers were asked to randomly select up to six students to take part in two focus groups – one following classroom observation 2 and the other following classroom observation 3. The students in five of the classes were involved in two focus groups (one mid-program and one post-program), while the remaining discussion was undertaken with students following the mid-program classroom observation only. Each focus group discussion was completed in less than 15 minutes.

2.3.2.4 Informal interviews

Following the conclusion of the second classroom observation, teachers and mentors were invited to talk about their experience with In2science. Some interviews were short, lasting about 10 minutes, while others continued for 20 minutes. Science and mathematics coordinators were informally interviewed, if they were available at the time. Half of the discussions during the final visit to schools occurred prior to the commencement of the third classroom observation, while the other half occurred after it.

3 FINDINGS

This section provides the findings from the evaluation. The findings are detailed separately for each of the data collection methods used. The first section provides findings from the student surveys. This is followed by findings from the case study component, including classroom observations, focus groups and informal interviews with teachers and other school personnel.

3.1 Student surveys

Surveys were completed (and returned) by 1898 students across 34 Victorian secondary schools. This represents 84 per cent of the 2262 students who were in a class with an In2science mentor during Semester 2, 2016. Of the 1898 students who completed surveys, 1382 (73%) had taken part in the program through their science class; the remaining 516 students (27%) had participated through a mathematics class. Almost 60 per cent of the surveys did not note the year level of the student, so there was no analysis by year level. Details are contained in Table 1.

Where possible, pre- and post-program surveys were matched when a student had completed both surveys. These data were then analysed separately for pre-program survey findings, post-program survey findings and matched survey findings. All responses received were analysed, regardless of whether or not students had completed both the pre- and post-program surveys, or whether or not they had indicated that they worked directly with a mentor most of the time.

Table 1 Number and per cent of students who completed survey by subject, year level and survey type

Subject/year level	Both pre- and post-program	Pre-program only	Post-program only	Total (n)	Total (%)
Science					
Year 7	14	21	5	40	2.1
Year 8	184	108	52	344	18.1
Year 8 advanced	0	0	0	0	0.0
Year 9	104	96	88	288	15.2
Not recorded	181	367	162	710	37.4
Total, Science	*483*	*592*	*307*	*1382*	*72.8*
Mathematics					
Year 7	0	0	0	0	0.0
Year 8	33	8	10	51	2.7
Year 8 advanced	0	21	0	21	1.1
Year 9	0	18	0	18	1.0
Not recorded	67	187	172	426	22.4
Total, Mathematics	*100*	*234*	*182*	*516*	*27.2*
Total	***583***	***826***	***489***	***1898***	***100***

3.1.1 Pre-program survey

The pre-program survey was completed by 1409 of the 2262 eligible students, a response rate of 62 per cent. This section provides the findings from all of the pre-program surveys received, from 583 students who completed both pre- and post-program surveys and 826 students who completed only the pre-program survey.

3.1.1.1 Students' attitudes towards science and mathematics

The distributions of responses to the 19 pre-program survey items on students' attitudes are presented in Table 2 below. Graphs representing these distributions are included in Appendix K.

Table 2 Students' attitudes towards science and mathematics, pre-program survey items 1 to 19

Question	Strongly Disagree (%)	Disagree (%)	Neither Agree or Disagree (%)	Agree (%)	Strongly Agree (%)	Total (%)	Did not answer (n)	Mean response
1. Everyone can understand science/maths if they work at it	1.6	3.5	16.5	50.1	28.3	100.0	6	4.00
2. To understand science/maths I discuss it with friends and students	2.9	9.4	26.8	45.4	15.5	100.0	6	3.61
3. I enjoy learning science/maths	4.8	8.7	30.9	34.1	21.5	100.0	7	3.59
4. I try my best in science/maths classes	1.3	4.6	20.8	46.9	26.4	100.0	15	3.93
5. When I have trouble with a science/maths problem, I know how to find information to help me answer the question	1.4	8.3	31.2	43.1	16.0	100.0	7	3.64
6. I enjoy figuring out answer to science/maths questions	5.3	14.9	33.3	32.8	13.7	100.0	8	3.35
7. I'm confident I can understand science/maths concepts	2.6	12.2	34.9	37.7	12.6	100.0	11	3.45
8. I usually finish my work in science/maths classes	1.7	7.8	26.9	44.7	18.8	100.0	7	3.71
9. In my science/maths classes I learn things that I can use in my daily life	5.5	13.2	35.4	32.7	13.2	100.0	11	3.35
10. To learn science/maths, I only need to memorise facts and definitions*	7.4	25.4	40.5	20.1	6.6	100.0	15	2.93
11. I can use what I've learned in science/maths classes in other classes	3.5	13.8	33.5	36.2	12.9	100.0	4	3.41
12. I would stop studying science/maths now if I could*	28.7	30.9	26.0	8.4	5.9	100.0	6	2.32
13. Studying science/maths subjects in VCE will help me get a job in the future	3.3	6.6	25.8	37.7	26.6	100.0	11	3.78
14. Science/maths subjects in VCE are harder than other VCE subjects	2.0	6.2	57.2	25.1	9.5	100.0	20	3.34
15. I want to continue to study science/maths at school	4.7	9.5	26.2	35.1	24.5	100.0	14	3.65
16. There are many job opportunities for people who study science/maths	1.6	3.6	20.6	44.9	29.3	100.0	13	3.97
17. I'd like a job where I can use science/maths	8.6	21.9	35.8	22.3	11.4	100.0	8	3.06
18. The science/maths I learn in school will be important for my future	3.9	10.1	32.2	35.2	18.6	100.0	14	3.54
19. You only use science/maths in life if you are a scientist*	31.7	39.2	19.6	6.8	2.7	100.0	14	2.10

Notes: Based on responses from 1409 students (583 pre- and post-program surveys and 826 pre-program only surveys). Percentages and means based on valid responses only.

Students' attitudes towards science and mathematics were generally positive prior to commencing the In2science program. For example, 78 per cent of students agreed that everyone can understand maths/science if they work at it. The majority of students (60%) reported both an intention to continue studying science/maths at school and that they would not stop studying these subjects. Seventy-one per cent of students recognised that science and mathematics are not restricted to scientists and mathematicians.

3.1.1.2 Students' likes and dislikes about studying science and mathematics

The open-ended questions in the pre-program survey asked students what they enjoyed about studying science and mathematics, as well as what they found difficult about studying these subjects. Students' answers revealed positive attitudes towards the study of these subject areas, with only 118 students (8%) stating that they either did not enjoy studying science or mathematics, or did not know what they enjoyed about these subjects. Table 3 shows the range of responses students provided for the item 'What do you enjoy about studying science or mathematics?'

Table 3 What students enjoy about studying science or mathematics

Theme	Number	Per cent
Experiments / practicals	364	25.8
Learning new knowledge	227	16.1
Certain subject topics, i.e. biology, chemistry, algebra	168	11.9
Theory, knowledge or facts	159	11.3
It's fun or enjoyable	81	5.7
Solving problems / answering questions	74	5.3
Applying knowledge to the real world	33	2.3
It's challenging	33	2.3
The variety of topics you can study	28	2.0
Clear right and wrong answers	12	0.9
Good teacher	8	0.6
Helping others understand concepts or content	7	0.5
Nothing / not much / I don't know	118	8.4
No answer	97	6.9
Total	*1409*	*100.0*

Note: Based on initial responses from 1409 students (583 pre- and post-program surveys and 826 pre-program only surveys).

The most common element of studying science or mathematics that students enjoyed tended to be the practical components, such as undertaking experiments and learning new knowledge. Twelve per cent of students mentioned a specific topic that they enjoyed, such as biology, chemistry or algebra. A sample of positive responses to the question 'What do you enjoy about studying science or mathematics' is provided below.

- *'Learning about new things and things I didn't know about. I love doing experiments.' – Science student.*
- *'I enjoy that we do experiments and study cells, as I love studying the different parts in a cell.' – Science student.*
- *'Studying science enables me to broaden my knowledge of how the world is modernizing, how we came to be here, living things on earth and much more. It helps me understand things I don't know or don't understand.' – Science student.*
- *'I enjoy experiments. I mean who wouldn't' – Year 9 Science student.*
- *'It allows me to have deeper meanings in everything involved in my life. Everything involves science so I'd like to develop my understanding of the subject.' – Year 9 Science student.*
- *'I like to study science because I always learn something new and I can apply this to my life. I also get to know how everything works and I want to become an engineer. For that, science is very important and it is also my favourite subject.' – Science student.*

- *'I enjoy learning about anything in science. Everything is very interesting in the way science explains it. My most favourite subject for science is learning about genes and the body's defence science and mathematics against sicknesses and foreign "objects" in the body. It is interesting because all of the bacteria are fighting against the immune system without you even knowing.' – Science student*
- *'I enjoy everything about studying science, although I'm not as good at it, I decide to keep studying science because I know for a fact that it is important in life because almost everything include[s] science.' – Science student.*
- *'I love learning about the human body and chemical reactions (chemistry).' – Science student.*
- *'It's going to help [me] find a job in the future and I don't want to be the stupid one sitting while my siblings talk about maths. I want to be full of knowledge.' – Maths student.*
- *'Math is a subject w[h]ere you can keep learning. Math is a big part of [our] live[s]. We use it in lots of daily chall[en]ges even if we don't know.' – Maths student.*
- *'I really enjoy researching a lot in science classes and at home in my free time. My favourite part of science is biology.' – Science student.*

Table 3 shows that 118 students (8%) indicated they did not like studying science or mathematics. Responses that were coded into this category tended to be short, with students commonly writing 'I don't' or 'Nothing' in response to this open-ended question.

In addition to being asked what they enjoyed about studying science or mathematics, students were also asked what they found difficult about studying these subjects. Table 4 shows the range of responses students provided for the item 'What do you find difficult about studying science or mathematics?' with answers coded into 13 commonly occurring themes. While most students were able to name an aspect of science or mathematics that they did not enjoy studying, 67 (5%) of students stated that there was nothing that they found difficult, with some students stating that it is 'easy'.

Table 4 What students find difficult about studying science or mathematics

Theme	Number	Per cent
Memorising or remembering content	217	15.4
Certain subject topics, i.e. biology, decimals or fractions	202	14.3
It's difficult or confusing / I don't understand subject	202	14.3
Scientific words and their meanings	156	11.1
Learning new theory or content	128	9.1
Homework or class work	88	6.2
It's boring / I don't enjoy the subject	72	5.1
Answering questions	50	3.5
Complex problems or making mistakes	39	2.8
Experiments, including practical reports	30	2.1
Applying knowledge to the real world	1	0.1
Nothing / not much / science or maths is easy	67	4.8
No answer / I don't know	157	11.1
Total	*1409*	*100.0*

Note: Based on initial responses from 1409 students (583 pre- and post-program surveys and 826 pre-program only surveys).

The most frequently cited difficulty was the memorisation of content, as cited by 15 per cent of students. An additional 11 per cent of students cited scientific words and their meanings as the most difficult aspect. A specific subject area, such as biology, chemistry or algebra, was mentioned by 14 per cent of students. An additional 202 students (14%) stated that studying science or mathematics was difficult or confusing.

A sample of students' responses to the question is provided below.

- *'Most things are hard in maths.' – Maths student.*
- *'When I don't know how to answer a question or what the question means.' – Maths student.*
- *'I find everything difficult.' – Maths student.*
- *'Sometimes I don't understand things and I get frustrated and stressed and then I refuse to understand it.' – Maths student.*
- *'Hard to understand. Too much work and homework. Everything is complicated.' – Science student.*
- *'I find recording the results in an experiment difficult.' – Science student.*
- *'I find it difficult when people tell you information and they expect you to understand.' – Science student.*
- *'Having to memorise big words and some equations for tests. There is a lot of words I don't know.' – Year 9 Science student.*
- *'Not much, we're pretty much just memorising facts from our textbooks or things our teacher writes on the board.' – Science student.*
- *'I think that chemistry is the hardest thing in science.' – Science student.*
- *'What I find difficult in learning/studying about science is just understanding the concept of what I am learning.' – Science student.*
- *'The difficulty in science is that even if you have the answer to a question or a theory, that's not definite. Science is hard if you don't have the motivations to study but if you do science won't become easy but more like intriguing and fun.' – Science student.*
- *'I don't get along with my teacher.' – Year 9 science student.*
- *'I have low confidence in maths which makes it harder to learn and I struggle with learning a new concept every class.' – Maths student.*

3.1.1.3 Students' understanding of science and maths applications for various careers

The pre-program survey asked students to write a list of jobs that use science or mathematics every day. There was a large spread of answers provided, with students naming 58 different careers in total. A small number of students (18 students, or 1%) said 'Everything'. Figure 1 shows the most frequently listed jobs. Only those jobs that were listed first on a student's list and were listed by 10 or more students are shown. The full list of jobs can be found in Table 12 on page 25. The most common occupation was scientist, with other scientists—biologist, chemist, physicist, forensic scientist—listed separately. The variety of jobs listed by students was extensive, with 41 additional jobs identified by fewer than one per cent of students.

When asked to provide a list of occupations that require science or mathematics, approximately one-third of students identified four or more occupations, and one-half of students identified one, two or three occupations. Two-hundred twenty-three students (16%) did not name an occupation (see Figure 2).

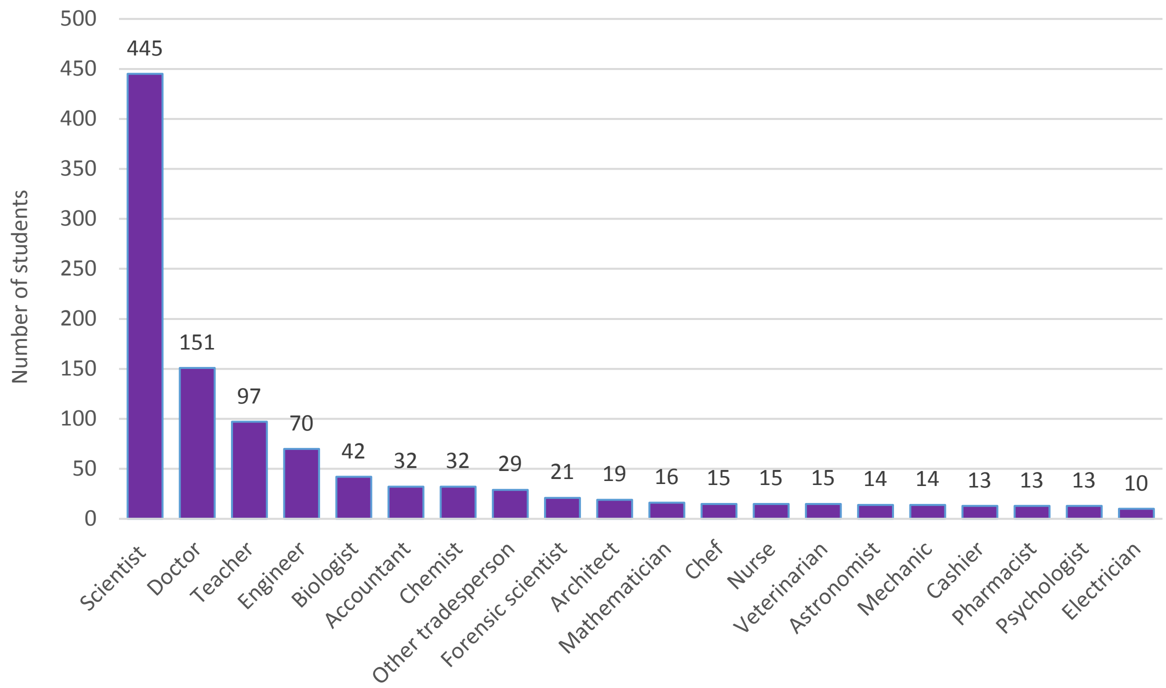


Figure 1 First job with science and mathematics applications listed by 10 or more students in pre-program surveys

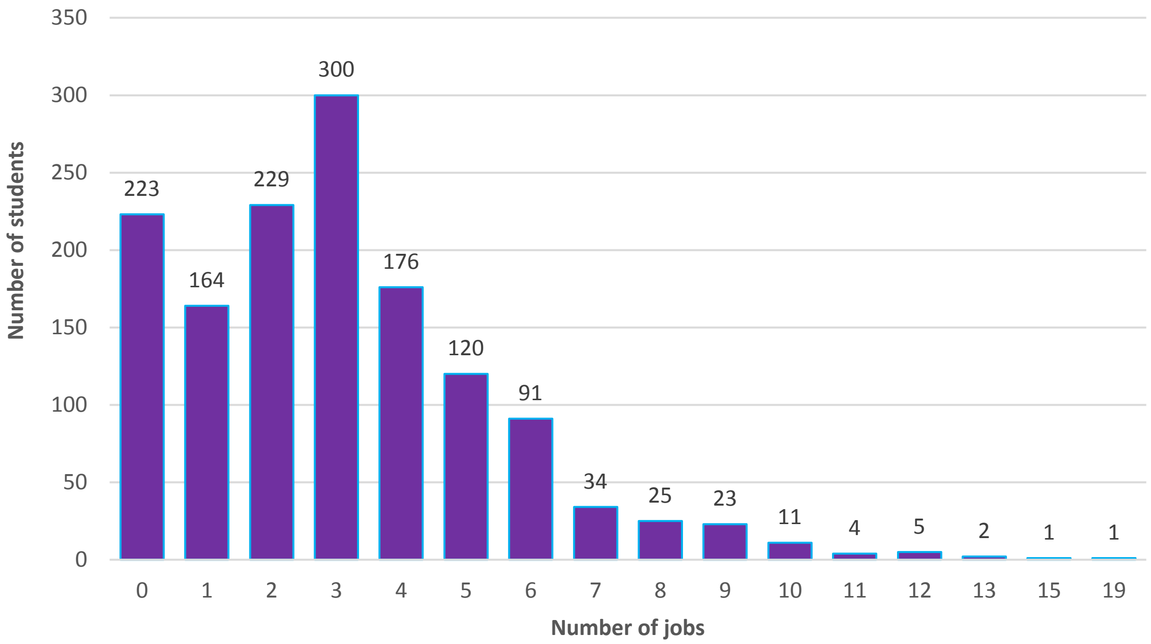


Figure 2 Number of jobs with science and mathematics applications listed by students in pre-program surveys

3.1.2 Post-program survey

The post-program survey was completed by 1072 students, or 47 per cent of the 2262 students who were involved in the In2science program during Semester 2, 2016. This section provides the findings from all of the post-program surveys received, from 583 students who completed both pre- and post-program surveys and 489 students who completed only the post-program survey.

3.1.2.1 Students' attitudes towards science and mathematics

Students responded to the same items provided in the pre-program survey. The distributions of responses to the 19 pre-program survey items on students' attitudes are presented in Table 5 below. Graphs representing these distributions are included in Appendix K.

Between the pre-program surveys and the post-program surveys there were small increases in students' attitudes toward science and mathematics. Two of the items in the surveys did show some relatively large changes: There were increases in the percentage of students who believe they could use what they learn in science and maths classes in their daily lives, and in the percentage of students who believe they could use what they learn in science and maths classes in other classes. There were also small increases in the percentage of students who believe science and maths could be understood, who discuss the subjects with others, who enjoy learning the subjects, and who enjoy learning the subjects and try their best in class. In addition, the percentage of students who are confident they can understand science and maths concepts increased from 50 per cent on the pre-program survey to 52 per cent on the post-program survey.

3.1.2.2 Students' understanding of science and maths applications for various careers

Students listed a wide variety of careers when asked to identify jobs that would use science or mathematics every day. This finding is consistent with the range of occupations students listed in the pre-program survey. There were eight students (1%) who provided the response 'Everything' when asked to write down a list of jobs that use mathematics or science, while many others, as detailed in Figure 3, provided specialist job titles. Students named 42 different jobs in the post-program survey, fewer than in the pre-program survey. Again, the most common occupation was scientist, with other science occupations, such as biologist, chemist and physicist, identified.

Table 5 Students' attitudes towards science and mathematics, post-program survey items 1 to 19

Question	Strongly Disagree (%)	Disagree (%)	Neither Agree or Disagree (%)	Agree (%)	Strongly Agree (%)	Total (%)	Did not answer (n)	Mean response
1. Everyone can understand science/maths if they work at it	1.0	3.3	12.7	50.1	32.9	100.0	2	4.11
2. To understand science/maths I discuss it with friends and students	3.0	8.1	25.1	45.8	18.0	100.0	6	3.68
3. I enjoy learning science/maths	4.8	7.7	27.2	35.8	24.4	100.0	11	3.67
4. I try my best in science/maths classes	1.1	3.7	20.6	48.2	26.3	100.0	8	3.95
5. When I have trouble with a science/maths problem, I know how to find information to help me answer the question	1.9	6.2	27.2	46.8	17.8	100.0	8	3.72
6. I enjoy figuring out answer to science/maths questions	4.5	12.2	33.7	32.2	17.4	100.0	9	3.46
7. I'm confident I can understand science/maths concepts	3.5	9.2	35.1	37.9	14.3	100.0	8	3.50
8. I usually finish my work in science/maths classes	1.6	7.7	28.0	44.5	18.2	100.0	15	3.70
9. In my science/maths classes I learn things that I can use in my daily life	4.0	11.8	29.8	37.9	16.5	100.0	8	3.51
10. To learn science/maths, I only need to memorise facts and definitions*	7.9	25.9	37.9	20.7	7.6	100.0	4	2.94
11. I can use what I've learned in science/maths classes in other classes	3.3	10.6	31.1	39.0	16.0	100.0	6	3.54
12. I would stop studying science/maths now if I could*	29.5	29.1	23.8	10.8	6.8	100.0	8	2.36
13. Studying science/maths subjects in VCE will help me get a job in the future	3.3	7.2	26.0	34.9	28.6	100.0	12	3.78
14. Science/maths subjects in VCE are harder than other VCE subjects	2.6	6.6	56.5	24.9	9.3	100.0	24	3.32
15. I want to continue to study science/maths at school	5.9	9.7	24.6	35.3	24.5	100.0	14	3.63
16. There are many job opportunities for people who study science/maths	0.8	3.3	19.4	43.4	33.1	100.0	12	4.05
17. I'd like a job where I can use science/maths	10.5	18.2	36.5	20.7	14.0	100.0	13	3.09
18. The science/maths I learn in school will be important for my future	4.2	8.0	32.3	34.1	21.4	100.0	16	3.61
19. You only use science/maths in life if you are a scientist*	37.4	35.1	18.9	6.3	2.3	100.0	15	2.01

Notes: Based on responses from 1072 students (583 pre- and post-program surveys and 489 post-program only surveys). Percentages and means based on valid responses only.

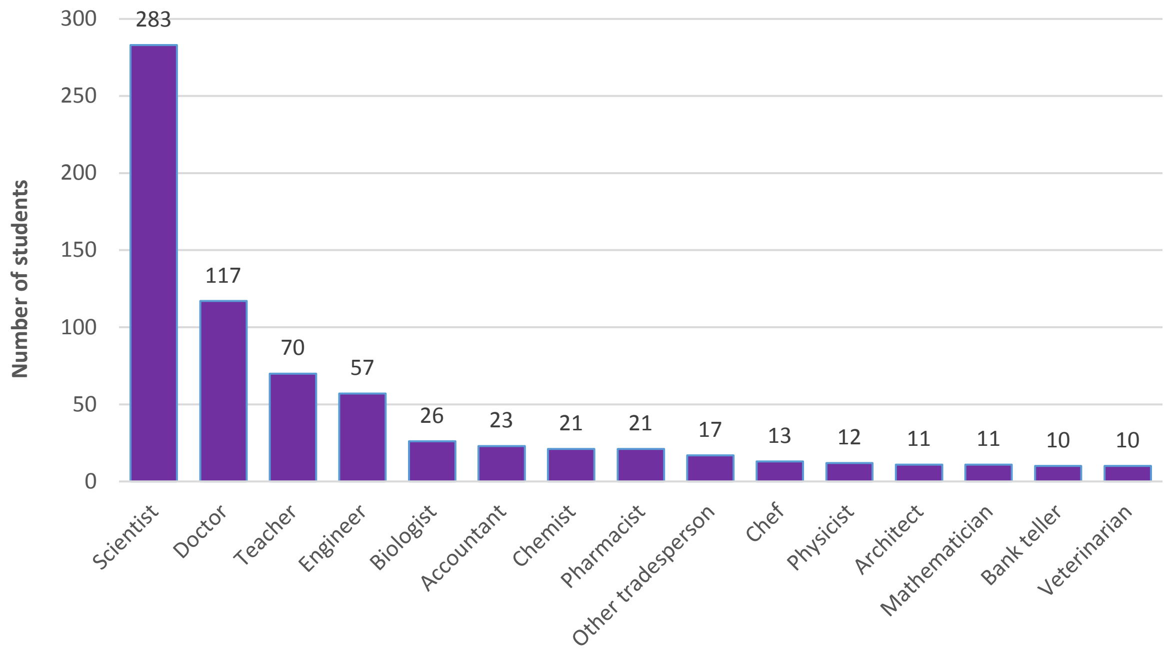


Figure 3 First job with science and mathematics applications listed by 10 or more students in post-program surveys

When asked to provide a list of occupations that require science or mathematics, the lists were more extensive than on the pre-program survey. Forty per cent of students identified four or more occupations, up from the one-third on the pre-program survey, and 35 per cent of students identified one, two or three occupations, down from 50 per cent on the pre-program survey. Two-hundred twenty-six students (21%) did not name an occupation (see Figure 4).

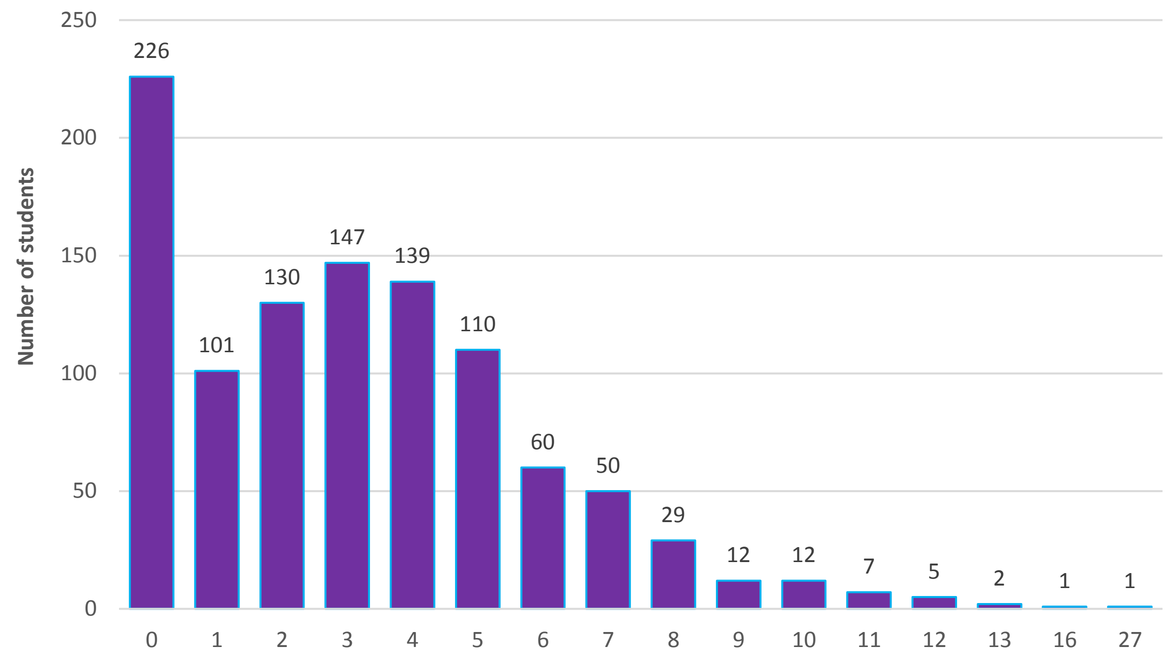


Figure 4 Number of jobs with science and mathematics applications listed by students in pre-program surveys

3.1.2.3 Students' attitudes after having completed the In2science program

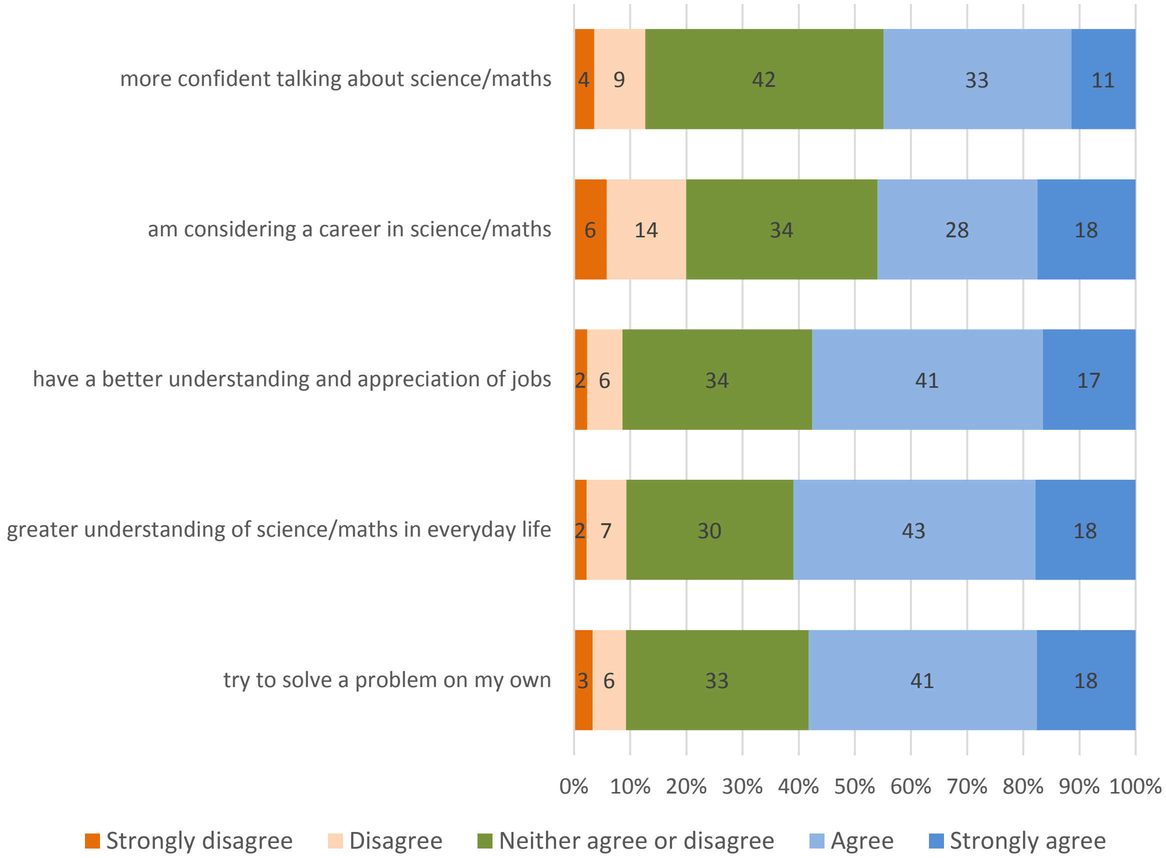
The six additional multiple choice questions included in the post-program survey relate to students' attitudes towards science and mathematics after having an In2science mentor in the classroom. As indicated in Table 6, students say they have a better understanding of how science and mathematics relate to everyday life and how many jobs rely on science and mathematics. They are also more confident about attempting to solve science and mathematics problems on their own. Forty-five per cent of students said they are more confident to talk about science and mathematics with family and friends after having a mentor in the classroom.

Table 6 Students' attitudes towards science and mathematics after having an In2science mentor in the classroom

	Strongly Disagree (%)	Disagree (%)	Neither Agree or Disagree (%)	Agree (%)	Strongly Agree (%)	Total (%)	Did not answer (n)	Mean response
I now have more confidence in talking about science/maths with family and friends	3.6	9.1	42.5	33.4	11.5	*100.0*	36	3.40
I now am considering a career that will involve science/maths	5.8	14.1	34.1	28.4	17.5	*100.0*	40	3.38
I now have a better understanding and appreciation on how many different jobs rely on science and maths	2.3	6.3	33.8	41.0	16.6	*100.0*	40	3.63
I now have a greater understanding on how science/maths relates to everyday life and my future	2.2	7.1	29.8	43.1	17.9	*100.0*	37	3.67
I now know how to try and solve a science/maths problem on my own	3.3	5.9	32.6	40.5	17.7	*100.0*	41	3.63

Notes: Based on responses from 1072 students (583 pre- and post-program surveys and 489 post-program only surveys). Percentages and means based on valid responses only.

Figure 5 highlights the students' growing understanding of the importance of science and mathematics in their lives, and their ability to attempt to solve science and mathematics problems on their own.



Notes: Based on responses from 1072 students (583 pre- and post-program surveys and 489 post-program only surveys). Percentages based on valid responses only.

Figure 5 Students' attitudes towards science and mathematics after having an In2science mentor in the classroom

3.1.2.4 Students who worked with a mentor to those who did not

In the In2science program, mentors do not always have the opportunity to work with all students on all visits. Of the 526 students who provided information on the post-program survey about whether they had worked with the mentor, 368 indicated that they had worked with the mentor and 158 students indicated that they had not. This section examines differences in the responses on the surveys between these two groups of students.

Surveys questions 1–19

There were a number of differences between students who worked with a mentor and those who did not work with a mentor on their responses to the main pre-program survey items (see Table 7). Positive attitudes among students increased during the ten-week program. Those who worked directly with the mentor in the classroom had more positive changes about understanding the science or mathematics, about their own ability to work out problems, and about the importance of science and mathematics in daily life. Students who did not work directly with a mentor had more positive changes in other areas: enjoying learning the subject, figuring out answers to problems on their own, becoming self-confident in the subject, growing interest in further study of the subject, and exploring careers in science and mathematics. Nevertheless, by the end of the ten-week program, students who had worked directly with the mentor were more positive overall than were students who had not worked with the mentor.

Table 7 Students' attitudes towards science and mathematics, pre- and post-program survey items 1 to 19, by contact with mentor

	Pre-program survey		Post-program survey	
Question	Worked with mentor	Did not work with mentor	Worked with mentor	Did not work with mentor
1. Everyone can understand science/maths if they work at it	4.02	3.92	4.19	3.97
2. To understand science/maths I discuss it with friends and students	3.62	3.57	3.72	3.59
3. I enjoy learning science/maths	3.83	3.42	3.73	3.53
4. I try my best in science/maths classes	4.04	3.89	4.01	3.87
5. When I have trouble with a science/maths problem, I know how to find information to help me answer the question	3.68	3.85	3.83	3.73
6. I enjoy figuring out answer to science/maths questions	3.45	3.23	3.49	3.38
7. I'm confident I can understand science/maths concepts	3.56	3.43	3.57	3.57
8. I usually finish my work in science/maths classes	3.92	3.64	3.83	3.70
9. In my science/maths classes I learn things that I can use in my daily life	3.38	3.35	3.56	3.49
10. To learn science/maths, I only need to memorise facts and definitions*	2.96	2.80	2.98	2.71
11. I can use what I've learned in science/maths classes in other classes	3.55	3.50	3.62	3.42
12. I would stop studying science/maths now if I could*	2.15	2.45	2.31	2.27
13. Studying science/maths subjects in VCE will help me get a job in the future	3.85	3.76	3.87	3.85
14. Science/maths subjects in VCE are harder than other VCE subjects	3.36	3.23	3.29	3.27
15. I want to continue to study science/maths at school	3.72	3.44	3.65	3.64
16. There are many job opportunities for people who study science/maths	4.08	3.96	4.14	4.03
17. I'd like a job where I can use science/maths	3.20	3.00	3.15	3.16
18. The science/maths I learn in school will be important for my future	3.60	3.51	3.65	3.52
19. You only use science/maths in life if you are a scientist*	2.05	2.00	1.96	1.88
Number of students	*368*	*158*	*368*	*158*

Notes: Based on responses from 526 students who responded to item about working with the mentor.
*Items are reverse-coded: lower scores indicate more positive responses.

Survey questions 22–26

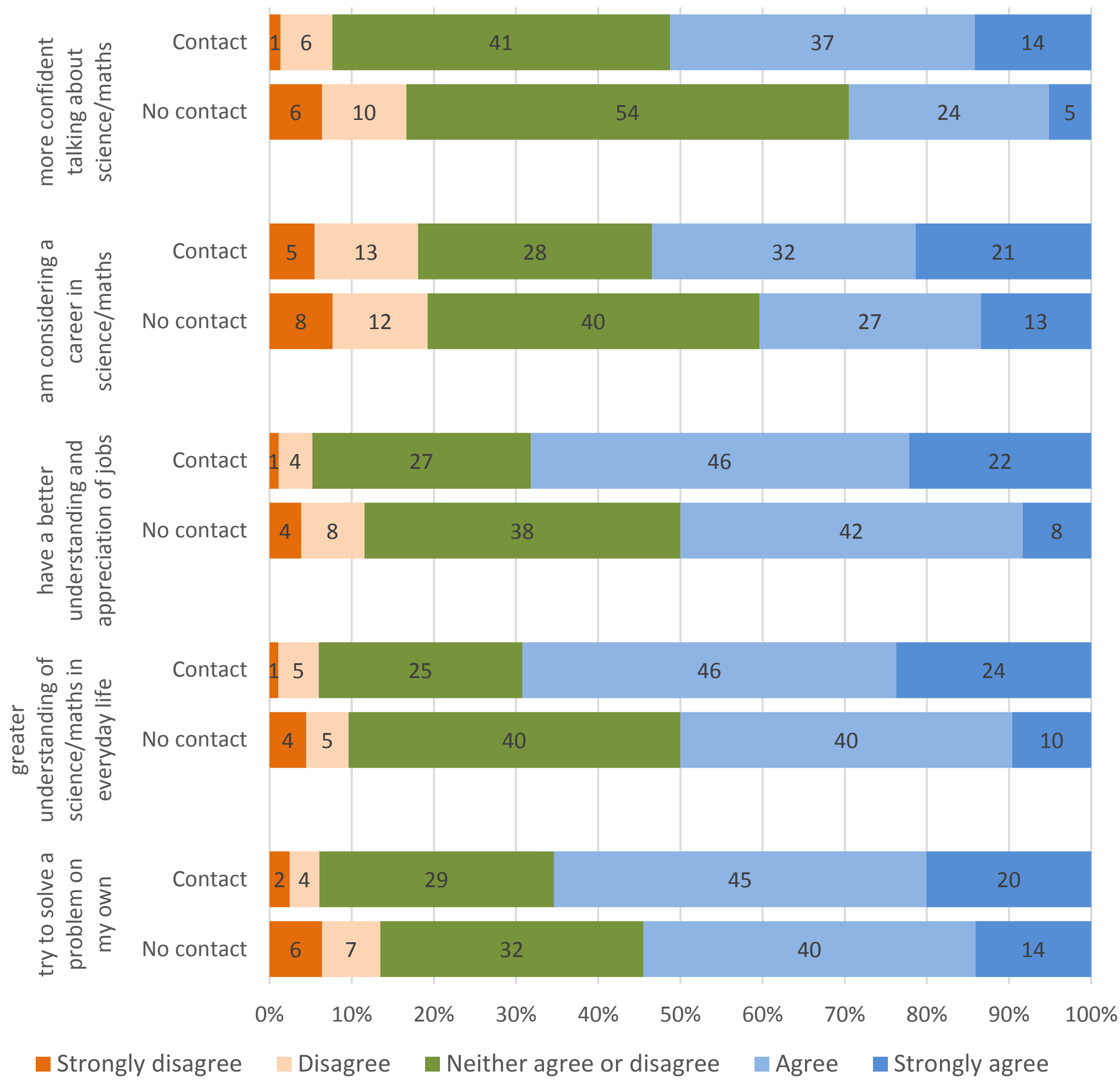
Questions 22 to 26 on the post-program survey asked about changes in students' attitudes toward the subject after having had a mentor in the science or mathematics classroom. Students' responses to these five items showed statistically significant differences according to whether the students worked directly with the mentor. For all items, the mean score for those who worked with the mentor were higher than the mean score for those who did not work with the mentor (see Table 8).

Table 8 Students' attitudes towards science and mathematics after having an In2science mentor in the classroom, post-program survey items 22 to 26, by contact with mentor

Question	Contact: Worked with a mentor	Did not work with a mentor	*t*
I now have more confidence in talking about science/maths with family and friends	3.55	3.08	5.58**
I now am considering a career that will involve science/maths	3.48	3.23	2.33*
I now have a better understanding and appreciation on how many different jobs rely on science and maths	3.81	3.39	4.78**
I now have a greater understanding on how science/maths relates to everyday life and my future	3.85	3.41	4.99**
I now know how to try and solve a science/maths problem on my own	3.73	3.44	2.97**
n	*368*	*158*	

Notes: Based on responses from 526 students who responded to item about working with the mentor.
*$P \le .05$; ** $p \le .01$.

These differences are also shown in Figure 6, which shows the distribution of responses to the survey items. Those who worked directly with a mentor more frequently agreed and strongly agreed with each of the statements, compared to those who did not work directly with a mentor. For additional information on the number and percentage of students who selected each of the response options, please refer to Appendix I.



Notes: Based on post-program survey responses from 526 students who responded to item about working with the mentor. 'Contact' represents students who worked directly with a mentor (n=368); 'No contact' represents students who did not work directly with a mentor (n=158).

Figure 6 Students' attitudes towards science and mathematics after having an In2science mentor in the classroom, by contact with mentor

3.1.2.5 Students' reactions to having an In2science mentor in their class

In addition to questions 22 to 26, the post-program survey asked students describe how the In2science mentor helped with their studies. The responses to this item were coded into 23 themes. Table 9 lists these 23 themes, along with the number and per cent of students who gave each response. Of the 1072 students who completed the post-program survey, 495 students (46%) did not answer this item.

The themes that emerged most frequently among the 577 responding students were:

- The mentor helped the student to understand questions and problems.
- The mentor helped the student with class work and homework.
- The mentor helped the student when the student had trouble or was struggling.
- The mentor clearly explained content.

Table 9 Student responses to open-ended question describing how In2science mentors helped with science and mathematics studies

Theme	Number	Per cent
Mentor helped student understand questions/problems	104	9.7
Mentor helped student with class work/homework	97	9.0
Mentor helped student when student had trouble or was struggling	86	8.0
Mentor explained content clearly	83	7.7
Mentor helped student understand concepts / improve students' understanding	61	5.7
Mentor did not help student	26	2.4
Mentor answered students' questions	22	2.1
Mentor helped to improve students' confidence (i.e. in solving science/mathematics problems)	12	1.1
Mentor shared their experiences with student about subject or content	11	1.0
Mentor gave student study tips	11	1.0
Mentor talked to student	10	0.9
Mentor helped student to think about future science/mathematics study paths	7	0.7
Mentor did not work with student	7	0.7
Mentor helped student to understand that science/mathematics can be fun/enjoyable	6	0.6
Mentor helped student understand that science/mathematics is a part of everyday life	6	0.6
Student was not in class when mentor was there	6	0.6
Mentor challenged student intellectually	5	0.5
Mentor checked in to see how student was going	5	0.5
Mentor was not judgemental about students' science/mathematics knowledge	5	0.5
Student does not know what In2science is / who mentor is	3	0.3
Mentor helped to free up teacher's time	2	0.2
Mentor helped student improve writing (e.g., answer question effectively, write lab reports)	1	0.1
Mentor and student spoke about real world applications of science/mathematics	1	0.1
No answer provided by student	495	46.2
Total	*1072*	*100.0*

A vast majority of the responses/themes were positive, and related to the help and guidance the mentor provided to students. These responses demonstrate that, overwhelmingly, students believed that having a mentor in the classroom helped in their science and mathematics studies. Students stated that mentors helped them in five key ways:

- Mentors helped students to understand the content through clear explanations and assistance with problem solving.
- Mentors assisted students in the classroom with either class work or homework.
- Mentors helped students when they appeared to be struggling, when the student asked for help or when the student had questions.
- Mentors improved students' confidence in studying science and mathematics.
- Mentors shared their knowledge and experiences about the subject or content with students.

3.1.3 Matched surveys

Of all the surveys received, 583 post-program surveys were matched with pre-program surveys. This section presents the findings from these matched surveys only.

3.1.3.1 Students' attitudes towards science and mathematics

Students' attitudes towards science and mathematics were already high on the pre-program survey, as indicated above in section 3.1.1.1. With this high starting point, it is difficult for student attitudes to change over the course of a ten-week program. The 583 matched surveys show that although there are small differences in attitudes between the pre-program survey and the post-program survey for the same students (see Table 10), two items have a statistically significant difference over time:

> *Question 1*. Everyone can understand science/maths if they work at it.
>
> *Question 9*. In my science/maths classes I learn things that I can use in my daily life.

These two items also featured in the analysis of the post-program surveys. These two items support the comments in the previous section, which indicated that mentors help students to solve problems and to understand how science and mathematics relate to everyday events.

The distributions of responses show a number of positive trends. By the end of the program, more students agreed with the following statements:

- 'Everyone can understand science/maths if they work at it' (+5.0 percentage points)
- 'To understand science/maths I discuss it with friends and students' (+3.2 percentage points)
- 'When I have trouble with a science/maths problem, I know how to find information to help me answer the question' (+4.6 percentage points)
- 'In my science/maths classes I learn things that I can use in my daily life' (+6.6 percentage points)

In addition, fewer students disagreed with the statement, 'In my science/maths classes I learn things that I can use in my daily life' (-3.6 percentage points), indicating that students were less negative about science and mathematics as well as being more positive about the subjects.

Table 10 Results of t-tests comparing responses to questions 1 to 19 for matched surveys only

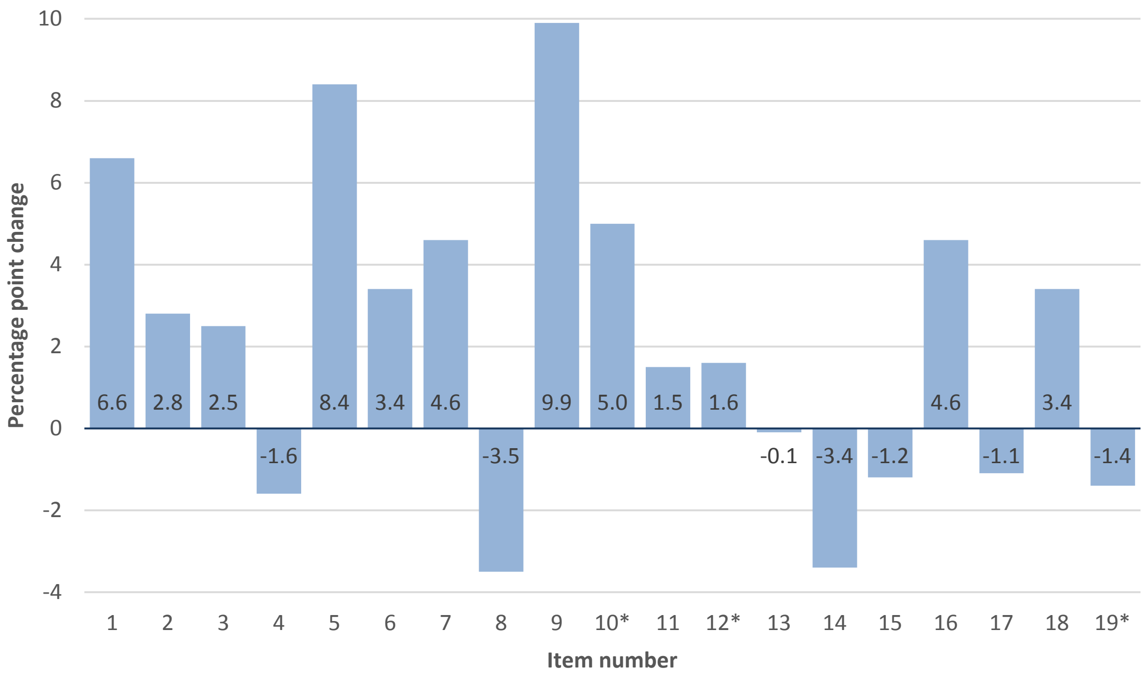
Question	Pre-program survey mean	Post-program survey mean	t
1. Everyone can understand science/maths if they work at it	4.03	4.15	-3.22**
2. To understand science/maths I discuss it with friends and students	3.68	3.73	-1.25
3. I enjoy learning science/maths	3.71	3.72	-0.29
4. I try my best in science/maths classes	3.96	3.99	-0.69
5. When I have trouble with a science/maths problem, I know how to find information to help me answer the question	3.66	3.70	-1.09
6. I enjoy figuring out answer to science/maths questions	3.41	3.46	-1.25
7. I'm confident I can understand science/maths concepts	3.46	3.49	-0.67
8. I usually finish my work in science/maths classes	3.74	3.73	0.42
9. In my science/maths classes I learn things that I can use in my daily life	3.42	3.57	-3.01**
10. To learn science/maths, I only need to memorise facts and definitions*	2.95	3.02	-1.43
11. I can use what I've learned in science/maths classes in other classes	3.54	3.55	-0.34
12. I would stop studying science/maths now if I could*	2.28	2.32	-0.66
13. Studying science/maths subjects in VCE will help me get a job in the future	3.71	3.76	-0.95
14. Science/maths subjects in VCE are harder than other VCE subjects	3.27	3.27	-0.04
15. I want to continue to study science/maths at school	3.64	3.60	0.92
16. There are many job opportunities for people who study science/maths	3.99	4.04	-1.11
17. I'd like a job where I can use science/maths	3.08	3.11	-0.63
18. The science/maths I learn in school will be important for my future	3.58	3.62	-0.90
19. You only use science/maths in life if you are a scientist*	2.09	2.00	1.77

Notes: Based on responses from 583 students who completed both the pre- and post-program surveys.
** $p \leq .01$.

3.1.3.2 Comparisons between pre- and post-program responses among students who worked with a mentor

In the In2science program, not all students who have a mentor in their classroom work directly with that mentor. This model is used to ensure that small-group mentoring can occur with a select group of students based on need, or as the classroom activity may warrant. A total of 227 students indicated that they worked with a mentor and had completed both pre- and post-program surveys.

Figure 7 shows the percentage change in attitudes among students who completed both the pre- and post-program surveys and worked with a mentor. On 12 of the 19 items in both surveys, there was a positive change. The greatest changes were in agreement on question 9, 'In my science/maths classes I learn things that I can use in my daily life' (+9.9 percentage points), and question 5, 'When I have trouble with a science/maths problem, I know how to find information to help me answer the question' (+8.4 percentage points). These two items were cited for positive change among all students, but the changes among those who worked with a mentor were greater.



Notes: Based on responses from 227 students who completed both the pre- and post-program surveys and worked directly with a mentor.
* Item was reverse coded and is reported here as the decrease in the percentage of students who disagreed with the statement.

Figure 7 Percentage change in students' attitudes toward science and mathematics on pre- and post-program survey items 1 to 19 among students who worked with a mentor

Table 11 shows the distribution of responses to questions 1-19 for students who completed both surveys and worked with a mentor. The responses have been grouped into 'Disagree' (combining 'Strongly Disagree' and 'Disagree'), 'Neutral' (recoded as 'Neither Agree or Disagree') and 'Agree' (combining 'Strongly Agree' and 'Agree'). For the majority of items, students' attitudes towards science and mathematics are generally more positive after having worked directly with an In2science mentor. Questions that show a positive improvement in attitude over time are in shaded rows.

Questions 10, 12 and 19 have reverse statements, in that the positive response is indicated by the student recording 'Strongly Disagree' or 'Disagree'. For these items, a 'disagree' response is expected for students to indicate a positive attitude towards science. These items are marked with an asterisk in Table 11.

Overall there was an increase in positive attitudes towards science and mathematics over the ten-week program for students who worked with a mentor and who completed both the pre- and post-program surveys. These changes are more pronounced among those who worked with the mentor, compared to all students who completed both the pre- and post-program surveys.

Table 11 Changes in students' attitudes towards science and mathematics on pre- and post-program survey items 1 to 19 among students who worked with a mentor

	Pre-program survey			Post-program survey		
Question	**Disagree**	**Neutral**	**Agree**	**Disagree**	**Neutral**	**Agree**
1. Everyone can understand science/maths if they work at it	4.0	13.7	82.4	1.3	9.7	89.0
2. To understand science/maths I discuss it with friends and students	11.1	27.4	61.5	7.9	27.8	64.3
3. I enjoy learning science/maths	7.9	25.6	66.5	11.5	19.5	69.0
4. I try my best in science/maths classes	4.0	16.0	80.0	3.5	18.1	78.4
5. When I have trouble with a science/ maths problem, I know how to find information to help me answer the question	7.0	32.2	60.8	6.6	24.2	69.2
6. I enjoy figuring out answer to science/maths questions	17.6	30.8	51.5	15.5	29.6	54.9
7. I'm confident I can understand science/maths concepts	11.6	36.6	51.8	9.7	33.9	56.4
8. I usually finish my work in science/maths classes	5.3	20.4	74.3	4.9	24.3	70.8
9. In my science/maths classes I learn things that I can use in my daily life	17.0	34.8	48.2	12.3	29.5	58.1
10. To learn science/maths, I only need to memorise facts and definitions*	33.8	37.3	28.9	28.8	41.2	30.1
11. I can use what I've learned in science/maths classes in other classes	15.5	28.8	55.8	15.0	27.8	57.3
12. I would stop studying science/maths now if I could*	63.3	26.5	10.2	61.7	22.9	15.4
13. Studying science/maths subjects in VCE will help me get a job in the future	8.5	26.5	65.0	9.3	25.8	64.9
14. Science/maths subjects in VCE are harder than other VCE subjects	4.4	61.3	34.2	8.9	60.3	30.8
15. I want to continue to study science/maths at school	12.9	24.0	63.1	14.2	23.9	61.9
16. There are many job opportunities for people who study science/maths	2.7	16.9	80.4	2.6	12.3	85.0
17. I'd like a job where I can use science/maths	26.5	32.7	40.7	27.3	33.0	39.6
18. The science/maths I learn in school will be important for my future	14.2	31.1	54.7	9.7	32.2	58.1
19. You only use science/maths in life if you are a scientist*	70.8	21.2	8.0	72.2	17.6	10.1

Notes: Based on responses from 227 students who completed both the pre- and post-program surveys and worked directly with a mentor.
* Item was reverse coded.

By the end of the program, students who worked with an In2science mentor were more likely to state the following:

- *Everyone could understand science/maths if they worked at it (question 1)*
- *They discuss science/maths with friends and students to understand it (question 2)*
- They enjoy science/maths (question 3)
- They know how to find solutions to questions when they are struggling in science/maths (question 5)
- They enjoy figuring out answers to science/maths questions (question 6)
- They are confident that they can understand science/maths concepts (question 7)
- *The information they learn in science/maths can be used in daily life (question 9)*
- They can use what they learn in science/maths classes in other classes (question 11)
- *Studying science/maths in VCE helps to obtain employment in the future (question 13)*
- *There are many job opportunities for people who study science/maths (question 16)*
- *The science/maths they learn in school will be important for their futures (question 18)*
- Science/maths can be used in life by people other than scientists/mathematicians (question 19)

Note: The difference between the pre-program survey and the post-program survey for items in italics was statistically significant ($p \leq .05$).

3.1.3.3 Students' understanding of science and mathematics applications for various careers

As part of the surveys, students were asked to identify as many jobs as possible that use science or mathematics. Table 12 shows the first jobs listed by students across the pre- and post-program surveys. Students were slightly less likely to record scientist, doctor or teacher as their first response in the post-program survey, compared to the pre-program survey. On both surveys, students identified specific science occupations, such as biologist, marine biologist, chemist and physicist in addition to the more general 'scientist'. By listing occupations other than scientist as the first occupation, students were showing their understanding of how science and mathematics apply in a wider range of occupations.

Table 12 First job with science or mathematics applications listed by students in matched surveys

Occupation	Pre-program survey		Post-program survey	
	Number	Percent	Number	Percent
Scientist	186	31.9	172	29.5
Doctor	72	12.3	70	12.0
Teacher	40	6.9	38	6.5
Biologist	21	3.6	12	2.1
Engineer	20	3.4	26	4.5
Chemist	15	2.6	11	1.9
Accountant	12	2.1	6	1.0
Forensic scientist	11	1.9	8	1.4
Psychologist	10	1.7	9	1.5
Astronomist	9	1.5	4	0.7
Chef	9	1.5	9	1.5
Pharmacist	7	1.2	18	3.1
Architect	5	0.9	5	0.9
Cashier	4	0.7	4	0.7
Mechanic	4	0.7	3	0.5
Nurse	4	0.7	6	1.0
Police officer / Detective	4	0.7	1	0.2
Archaeologist	3	0.5	3	0.5
Astronaut	3	0.5	-	-
Geologist	3	0.5	5	0.9
Information Technology (IT)	3	0.5	-	-
Researcher	3	0.5	2	0.3
Sales person	3	0.5	2	0.3
Zoologist	3	0.5	1	0.2
Cleaner	2	0.3	-	-
Dietician	2	0.3	-	-
Etymologist	2	0.3	-	-
Fire fighter	2	0.3	-	-
Mathematician	2	0.3	1	0.2
Meteorologist	2	0.3	2	0.3
Physicist	2	0.3	4	0.7
Physiotherapist	2	0.3	-	-
Airforce / Defence / Pilot	1	0.2	-	-
Aquarist	1	0.2	-	-
Bank teller	1	0.2	6	1.0
Business person	1	0.2	-	-
Cartographer	1	0.2	-	-
Electrician	1	0.2	1	0.2
Geographer	1	0.2	-	-
Hairdresser	1	0.2	-	-
Immunologist	1	0.2	-	-
Paramedic	1	0.2	-	-
Physiologist	1	0.2	-	-
Real estate agent	1	0.2	-	-
Sports scientist	1	0.2	-	-
Veterinarian	1	0.2	7	1.2
Botanist	-	-	1	0.2
Marine biologist	-	-	6	1.0
Neurologist	-	-	1	0.2
Optometrist	-	-	1	0.2
Other tradesperson (not already listed)	7	1.2	7	1.2
No answer	85	14.6	131	22.5
Total	*583*	*100.0*	*583*	*100.0*

Notes: Based on responses from 583 students who completed both the pre- and post-program surveys.

Figure 8 shows the number of students electing scientist, doctor or teacher, in the pre- and post-program matched surveys, as their first response when asked to list jobs that use science/maths.

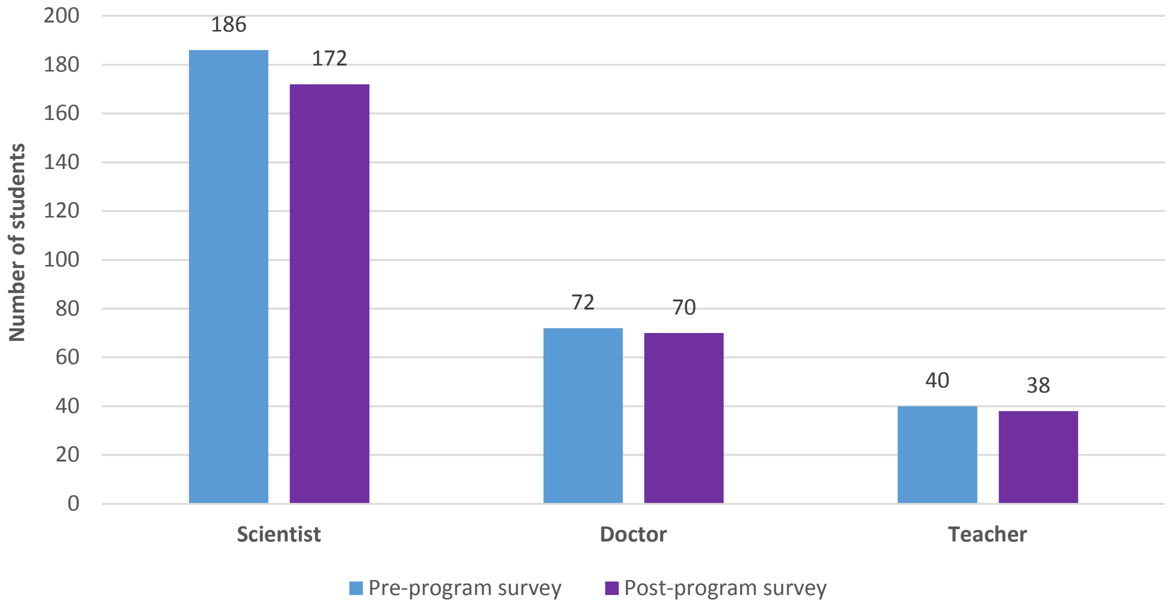


Figure 8 Number of students who listed scientist, doctor or teacher as their first response when asked to list jobs that use science/maths, for both pre- and post-program matched surveys

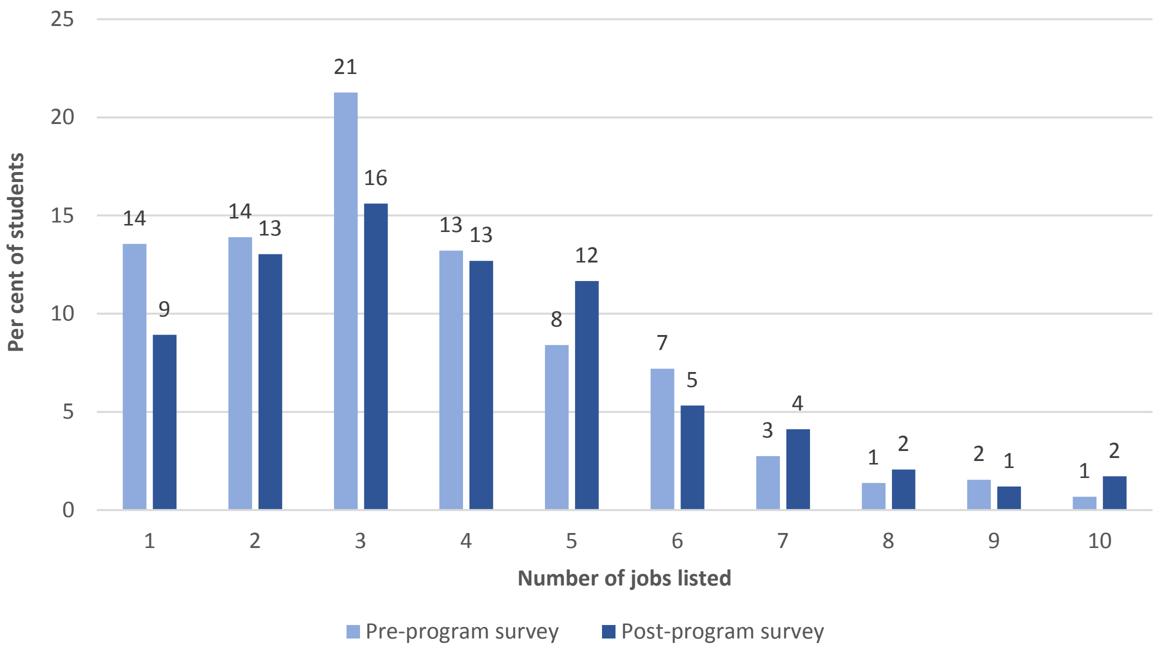
Students' understanding of the diversity of science and mathematics applications in occupations was further evidenced through the increase in the number of students who could name a variety of jobs that used science or maths, although there was also an increase in the number of students who listed no jobs (see Table 13 and Figure 9).

- Fewer students named just one job that used science and mathematics in the post-program survey compared to the pre-program survey.
- Fewer students named three jobs that used science and mathematics in the post-program survey compared to the pre-program survey.
- More students were able to name five jobs used science and mathematics in the post-program survey compared to the pre-program survey.
- One student was able to name 16 jobs that used science and mathematics in the post-program survey.

Table 13 Number of jobs with science and mathematics applications listed by students in matched surveys

Number of jobs listed	Pre-program survey		Post-program survey	
	Number	Per cent	Number	Per cent
0	92	15.8	131	22.5
1	79	13.6	52	8.9
2	81	13.9	76	13.0
3	124	21.3	91	15.6
4	77	13.2	74	12.7
5	49	8.4	68	11.7
6	42	7.2	31	5.3
7	16	2.7	24	4.1
8	8	1.4	12	2.1
9	9	1.0	7	1.2
10	4	0.7	10	1.7
11	-	-	4	0.7
12	4	0.1	1	0.2
13	1	0.2	1	0.2
16	-	-	1	0.2
Total	*583*	*100.0*	*583*	*100.0*

Note: Based on responses from 583 students who completed both the pre- and post-program surveys.



Note: Based on responses from 583 students who completed both the pre- and post-program surveys.

Figure 9 Number of jobs with science and mathematics applications listed by students in pre- and post-program matched surveys

3.2 Classroom Observation Findings

Observations of classrooms at four schools were conducted in order to obtain an understanding of student behaviours before, during and after having had an In2science mentor in their classroom. The cycle of observations was designed in order to be able to compare student behaviours and determine if having an In2science mentor in the classroom had a positive effect on student behaviour, off-task and on-task, and questioning patterns by both students and teachers.

In total, eight classes across the four schools were involved in at least one classroom observation. Observation 1 was undertaken by the In2science coordinators. Observations 2 and 3 were undertaken by ACER staff. Table 14 shows the schools and classes that were involved in each of the observation cycles. Four classes were observed three times across the observation cycle.

Table 14 Schools and classes that took part in classroom observations, by observation cycle

	Observation cycle		
School	**Observation 1**	**Observation 2**	**Observation 3**
School A	Year 8 science	Year 8 science	Year 8 science
School B	Year 8A maths Year 9B science	Year 8A maths	Year 8A maths
School C	Year 7/8 science Year 8 science	Year 7/8 science Year 8 science	Year 7/8 science Year 8 science
School D	Year 8E science	Year 9 maths Year 8B maths	Year 9 maths

The findings from the four classes (class 1, class 2, class 3 and class 4) that were observed at each observation point (pre-program, mid-program and post-program observations) are presented in figures below. There are four figures:

- **Figure 10. Student off-task behaviours** (measured by number of students not looking at teacher; number of students talking to another student; number of students distracted by something not related to task; number of students writing notes unrelated to learning; number of students teacher reprimands for not working on activity; and number of students distracted by something not related to task).
- **Figure 11. Student on-task behaviours** (measured by number of students following teacher's instructions; number of students undertaking task as instructed by teacher; number of students teacher assists one-on-one with the task; and number of times teacher explains the task).
- **Figure 12. Student questioning behaviours** (measured by number of students who asked a question; number of questions asked by students; number of questions answered by students; and number of students who offered answers to questions).
- **Figure 13. Teacher questioning behaviours** (measured by number of questions asked by teacher; and number of questions answered by teacher).

The averages have been calculated by adding the total number of measurable observations for each class (classes 1-4), for each observation (1, 2 and 3), then divided by 4. Further information about the number of observations recorded for each class are contained in Appendix J.

3.2.1 Student off-task behaviours

Across the four observed classes, the average number of instances of student off-task behaviour was 83 at pre-placement (without a mentor). When classes were observed when the mentor was present (during mid-placement), the average number of observed off-task behaviours dropped dramatically to 32 (see Figure 10). This suggests that the presence of a mentor in science and mathematics classrooms improved the ability of students to focus on tasks and, subsequently, reduced instances of student distractions and engagement in behaviours that are not related to prescribed tasks. Put another way, the presence of a mentor reduced student participation in off-task behaviours.

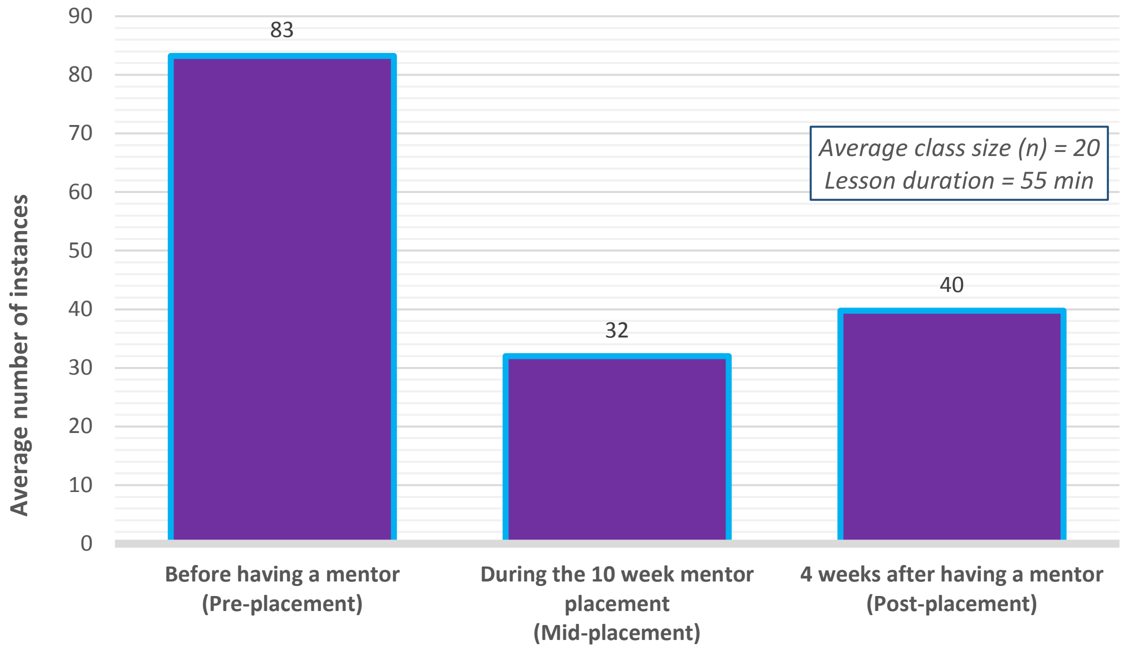


Figure 10 Student off-task behaviours observed before, during and after having an In2science mentor in a science/maths class

Figure 10 also shows that the effects on off-task behaviours remained after the mentor had left the classroom. The average number of observed instances of off-task behaviours at post-placement was 40, a slight increase of eight from that observed while the mentor was in the classroom. This is still a dramatic decline from the average number of observed off-task behaviours at pre-placement.

Consequently, the placement of a mentor in science and mathematics classrooms was shown, across the four observed classes, to decrease instances of student off-task behaviour while the mentor was present in the classroom and four weeks after the mentor had finished working with the class. It may be inferred that the placement of a mentor in science and mathematics classes assists students to concentrate on tasks that teachers have assigned.

3.2.2 Student on-task behaviours

The ability of students to focus on tasks provided by teachers were also observed and grouped as student on-task behaviours. Figure 11 below shows the average number of observed instances of student on-task behaviours at pre, mid- and post-placement.

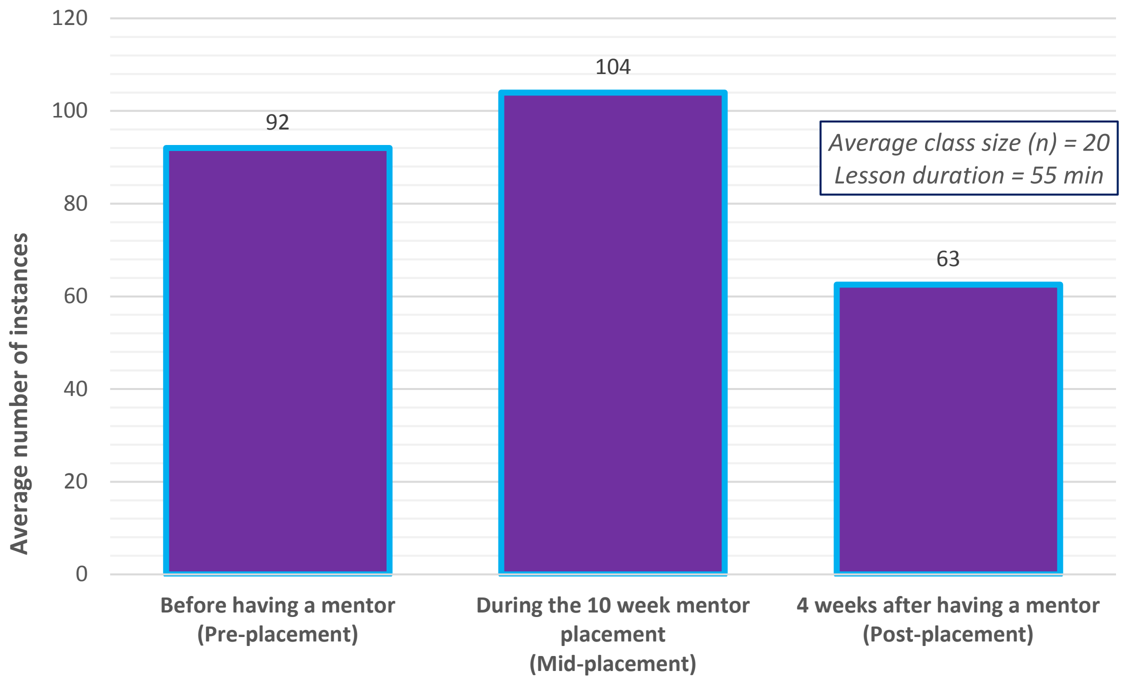


Figure 11 Student on-task behaviours observed before, during and after having an In2science mentor in a science/maths class

The average number of observed instances of student on-task behaviours was 92 prior to the placement of a mentor in the four observed classes. This average increased by 12 to 104 while the mentor was present in the classroom at mid-placement. Consequently, the presence of a mentor in a science or mathematics classroom may improve the ability of students to remain on-task, as measured by instances of students following teachers' instructions and undertaking associated tasks, teachers having to explain the task and teachers assisting students with tasks). Figure 11 shows that students are more likely to remain on-task and comprehend the task when a mentor is present.

Figure 11 also shows that the average number of observed instances of student on-task behaviours decreased to levels lower than those observed at pre-placement when the mentor had finished the placement.

3.2.3 Student questioning behaviours

Figure 12 shows the average number of observed instances of student questioning behaviours across four classes at pre-, mid- and post-placement.

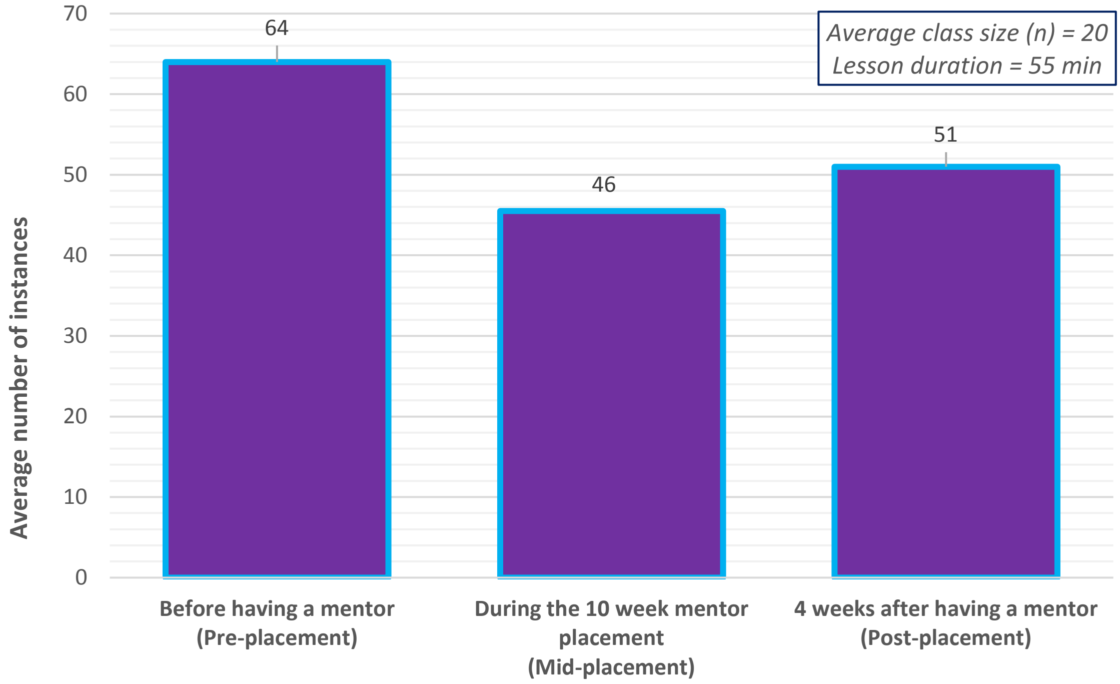


Figure 12 Student questioning behaviours observed before, during and after having an In2science mentor in a science/maths class

Student questioning behaviours, as measured by students asking and answering questions during class, were observed at higher rates at pre-placement compared to mid- and post-placement (at 64, 46 and 51, respectively). Student questioning behaviours were observed to reduce while a mentor was present in the classroom, then slightly increase once the mentor had finished the placement in the classroom.

It is possible that students were less inclined to ask questions in front of the whole class while the mentor was present. Students may have been more likely to ask private questions of mentors when they were in the class, which may not have been observed if the observer did not know a question was being asked of the mentor.

Nevertheless, the reason for the average observed reduction in student questioning behaviours from pre-placement to post-placement by 13 instances is unknown. If students were asking questions of mentors instead of the teacher while the mentor was in the class, that could explain the reduction in whole class questioning behaviours at mid-placement, but not at post-placement. Students should have reverted back to asking questions of the teacher once the mentor had finished the placement in the class, yet this does not appear to be the case.

3.2.4 Teacher questioning behaviours

Related to student questioning behaviours are teacher questioning behaviours. Figure 13 shows the average number of observed instances of teacher questioning behaviours across the four classrooms at pre-, mid- and post-placement.

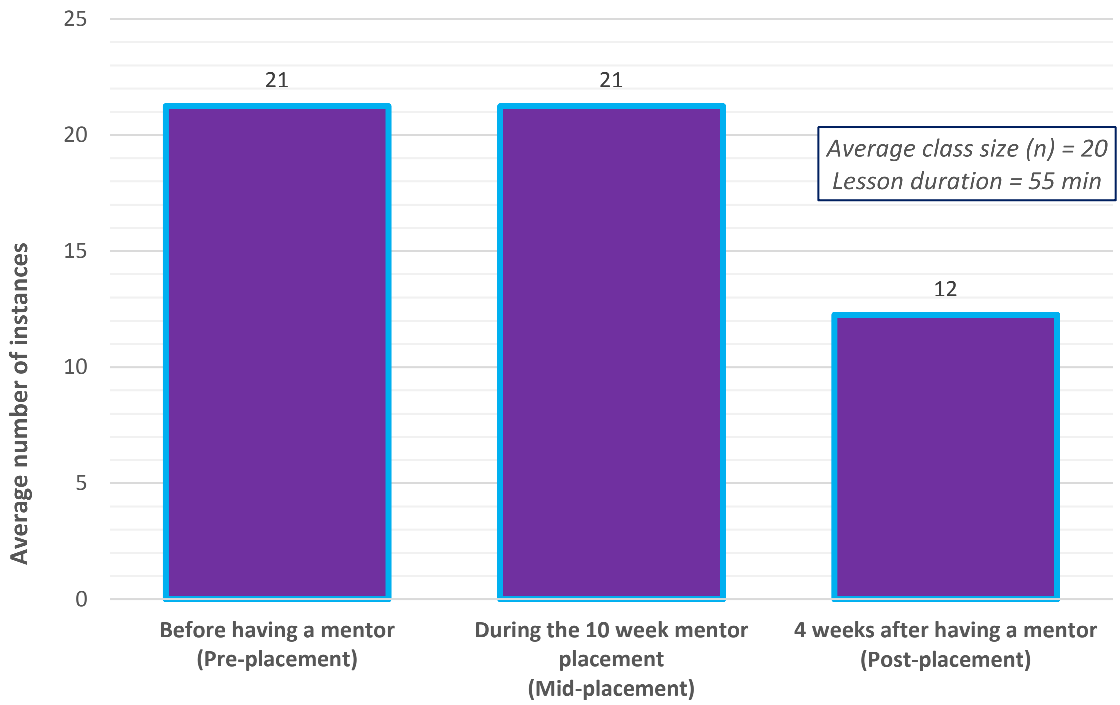


Figure 13 Teacher questioning behaviours observed before, during and after having an In2science mentor in a science/maths class

The average number of observed instances of teacher questioning behaviours remained the same while the mentor was present, yet dropped significantly after the mentor had finished the placement in the class. The average number of observed instances of teacher questioning behaviours is 21 at both pre- and mid-placement, and 12 at post-placement. This is a reduction of nine instances at post-placement.

Figure 13 thus suggests that teacher questioning behaviours, as measured by the number of questions asked by the teacher and the number of questions answered by the teacher, decreased after completion of the placement.

3.3 Focus Groups

This section provides a summary of the findings from the focus groups with students. The size of the groups ranged from two to six students. In total, 29 students took part in a focus group.

When asked about words they think of when they hear the term ‘science’ (or ‘maths’), almost all participants stated terms related to the subject area they were currently studying in class. For example, science students listed terms like ‘chemicals’, ‘oxygen’, ‘nitrogen’, ‘solids and gases’, ‘planets’, ‘periodic tables’ and ‘radiation’ Similarly, mathematics students listed terms related to the subject area they were currently studying: ‘symbols’, ‘addition’, ‘order of operations’ and ‘times tables’. Students from one mathematics class did not refer to any such terms, instead stating words like ‘challenging’, ‘fun’, ‘interesting’ and ‘boring’.

In addition, a number of students across the four schools used general terms, including ‘experiments’, ‘explosions’, ‘microscope’ and ‘research’. Other students mentioned subject areas, including physics and biology.

None of the students reported being ‘good’ at science/maths. However, when probed about the difficulty saying one is good at something, seven students agreed that they would say they were good at the subject as part of a one-on-one conversation.

About half of the students stated they intended to study for the Victorian Certificate of Education (VCE), with only a few saying they would not. Many, however, said that they were unsure at this stage about what they would study for the VCE or at university, if they were to enrol in further study.

Very few students across the four schools (six classes in total) knew at which university their mentor was currently studying. The findings from focus group 1 and 2 were similar, thus showing no change over time.

3.4 Informal interviews with teachers and other school personnel

Some teachers stated that having a mentor in their class was ‘great’ and ‘a real help’; others stated that the program was not as helpful as they had envisaged. For example, three teachers mentioned that their role and the mentor’s role was unclear, which posed a difficulty to schools about what the mentor was expected to do in the class:

- *‘I just don’t know what I am supposed to do’.*
- *‘He is so quiet, and doesn’t really know how to contribute.’*

These interviews also revealed that the length of time mentors were in classes varied. In some schools, the mentor attended each week for 10 weeks; in others, the mentor attended only five times over the course of the program; in one school, the mentor had decided to keep going for another few weeks once the ten-week program had concluded.

Four teachers noted that the additional help in their class allowed the teacher to spend more time with struggling students and the mentor was able to work directly with more able students to extend their knowledge. When asked what the best part of the program was, one teacher reported that it was the ‘one-on-one’ nature, while another said it was ‘having an extra pair of hands.’

In terms of improvements, teachers and science and mathematics coordinators said that the length of the program was a downfall: ‘it’s just not long enough to have much impact on the kids’, ‘it’s too short’ and ‘it needs to be longer’. One teacher suggested that the program would likely have more impact if it was run for a term, or at least across a whole topic. A similar sentiment was voiced by four other teachers and two school science coordinators.

Teachers also voiced opinions about the lack of *spread* of the program, saying such things as ‘It needs to be in more classes and across Year 7 to Year 9’.

Schools also asked for additional documentation to be sent to them about the program and how they were expected to include the mentor in their classroom activities.

Teachers provided anecdotal evidence about the impact having a mentor in their class had had on their students. For example, one teacher stated that his class had shown increased interest with science as a result of the program. He stated, ‘There was an improvement in asking questions … the students asked more questions.’ However, according to the teacher, this enthusiasm for science was not maintained once the mentor stopped working with the class.

All of the teachers involved in the final classroom observation said that, if approached, they would agree to be involved in the In2science program again in the future.

4 COMPARISONS WITH EARLIER EVALUATIONS

The first independent evaluation of the In2science program (Farrell & Harris, 2006) examined its overall effectiveness and its benefits for mentors and teachers. The evaluation used questionnaires completed by 31 mentors and interviews with six teachers. The evaluation found that mentors were positive about their involvement in the In2science program and that they found it valuable in their own studies to explain science to school-aged students. In relation to the benefit of the In2science program with teachers, Farrell and Harris (2006) found that teachers valued mentors as potential positive role models for their students.

There are limited comparisons that can be made between the 2006 evaluation and the current ACER evaluation because of a difference in scope. The current evaluation's focus was on the impact of the In2science program on students. The earlier evaluation did not report on the effectiveness of the In2science program at the student level.

The second independent evaluation of the In2science program used case study methodology to draw on the 'insights and experiences of school teachers and principals' to analyse the impact of the In2science program at five Victorian government schools (Harris & Calma, 2009, p. 3). It differs from the current ACER evaluation in that it included the perspectives of principals and mentors, who were out of scope in the current evaluation.

Participants in the 2009 evaluation included 15 teachers and six school principals, who completed in-depth, semi-structured interviews with researchers, and 28 students, who took part in group interviews. Six mentors completed questionnaires for the evaluation. Harris and Calma (2009) assessed the influence of the In2science program from the perspective of students and mentors, as well as teachers and principals, allowing for some similarities with the current evaluation.

The students' perceptions of In2science mentors noted by Harris and Calma (2009) generally align with the findings from the current evaluation. As noted earlier in the post-program findings, students reported that mentors helped them with their studies in five key ways:

- Mentors helped students to understand the content through clear explanations and assistance with problem solving
- Mentors assisted students in the classroom with either class or home work
- Mentors helped students when they appeared to be struggling, when the student asked for help, or when the student had questions
- Mentors improved students' confidence in studying science and mathematics
- Mentors shared their knowledge and experiences about the subject or content with students.

The similarities and differences between Harris and Calma's (2009) findings and the findings from the current evaluation are noted in Table 15.

Table 15 Student findings reported by Harris and Calma (2009) and ACER (2017)

Harris and Calma (2009)	ACER (2017)
Mentors help students to become more confident in science and mathematics *Harris and Calma identified theme: 3.1 Building confidence* (quote from p. 18).	Mentors improved students' confidence in studying science and mathematics.
Mentors provide clear explanations of the content to students *Harris and Calma identified theme: 3.2 Reducing the risk of being left behind* (quotes from p. 18).	Mentor explained content clearly
Mentors made the subject content less confusing and more interesting *Harris and Calma identified themes: 3.2 Reducing the risk of being left behind; and Young people sharing their enthusiasm with students, as fellow learners* (quotes from pp. 18, 28).	Mentor helped student understand concepts / improve students' understanding
Mentors provided students with help when needed *Harris and Calma identified theme: 3.2 Reducing the risk of being left behind* (quotes from p. 19).	Mentor helped student understand questions/problems. Mentor helped student with class work / homework Mentor helped student when student had trouble or was struggling
Mentors shared their knowledge and insights about the subject or university *Harris and Calma identified themes: 3.3 Extension for advanced students; 3.4 Role models breaking the mould; 3.5 Insights into further science study and careers; and, The voices of experience (5.3)* (quotes pp. 19, 20, 22, 36).	Mentor shared their experiences with student about subject or content
Students wanted more insight into university life (i.e., what science students do at university) *Harris and Calma identified theme: 3.5 Insights into further science study and careers* (quotes from p. 22).	N/A

5 SUMMARY AND RECOMMENDATIONS

5.1 Program Implementation

The In2science program operates in a range of diverse ways across different schools and classrooms , subject to the discretion of the individual classroom teacher. For example, a teacher may use the mentor to extend the learning of a small group of academically advanced students; another teacher may use the mentor to oversee the activities of the entire class while the teacher works with a small group of students who are having difficulties with a topic. This allows each school and teacher participating in the program to benefit from the activities of the mentor, based on each teacher's professional judgement of how best to use the resource provided by the mentor. The program operates in Government schools, so it is important for schools and teachers to make use of any and all available additional assistance. This diversity is reflected in the mix of positive findings of this evaluation.

While this evaluation did not investigate mentors' experiences of the In2science program, it was noted from students' feedback on surveys that the role of mentors is not clear. Some students mentioned that the mentor worked with them to help with homework, while others wrote about the mentor teaching part of a class while the regular class teacher worked with small groups of students. We see this as a strength of the program, in that allows flexibility in the teacher–mentor relationship, but recognise that it may not suit all teachers, mentors or students.

Mentors participate in the program by working in a classroom for 10 weeks, although it is not necessarily the same 10 weeks that coincide with a school term. Some teachers noted that this was a problem, in that the term break disrupted the mentor's program, particularly when a new topic was introduced for the new term.

- *In2science provides a valuable resource for science and mathematics teachers, who make use of the mentor in a wide variety of ways to suit their class needs.*
- *The placement of mentors with teachers and classes should focus on how the teacher will work with the mentor to allow the best match of mentor, teacher and class.*
- *Teachers should provide students with more information on the mentor's role in the classroom.*
- *The In2science program, with agreement from participating universities, should endeavour to organise mentor placements to coincide with school terms.*

5.2 Program Effectiveness

This evaluation examined data from student surveys, classroom observations, focus groups and informal discussions. These data relate to a single cycle of In2science during Semester 2 of 2016. This short timeframe did not allow for further follow-up of participating students or their mentors.

After the program, students were more confident in their ability to learn about science and mathematics, they indicated that they understood the importance of science and mathematics in the world around them, and they were more determined to try to solve science and mathematics problems on their own. Students also indicated that they are a little more likely to consider a career in science or mathematics and that they are more confident in discussing science and mathematics with family and friends, but at levels lower than the other post-program effects. These positive findings vary between those students who worked with a mentor and those who did not.

This may be a result of how the teacher uses the mentor in the classroom. The data gathered in this evaluation suggest that two general options are practised: the mentor works with the more able students in the classroom for extension and to encourage further interest in science or mathematics; or the mentor works with students who need extra assistance to understand the subject. These different modes were not examined as part of this evaluation

This evaluation was not able to establish longer-term effects of In2science. It was not possible to determine if the program influences students to continue the study of science or mathematics in the senior secondary years or at university, or enter occupations that use science and mathematics daily.

- *The use of mentors in the In2science program increases students' self-confidence in learning science and mathematics, and in understanding the importance of science and mathematics in our society.*
- *A new evaluation of In2science should focus on the different ways that mentors work in the classroom to determine which modes are more effective with which students.*
- *A new evaluation of In2science should be conducted to determine the longer-term effects of the program, to determine whether the program influences the continued study of science and mathematics in senior secondary school and tertiary programs.*

5.3 Program Management

This evaluation did not include data on students who have previously been involved in the In2science program. This means that longer-term program outcomes – such as increasing the uptake of science and mathematics subjects in Years 11 and 12 – cannot be measured. Monitoring of the program would need to be a cooperative effort between In2science program staff in the partner universities and participating schools, with the major role played by In2science.

The student surveys currently used by the program focus on students' attitudes toward science and mathematics. While one focus of the program is attitudinal change, the surveys do not focus on the activities of the program or on the role of the mentor in the classroom. Items could be answered in any science or mathematics classroom, regardless of whether an In2science mentor has been present. It may be necessary to include new items that are more program-specific and remove items that are not program-specific in order to keep the current length of the surveys.

- *In2science should discuss with participating schools and the Victorian Department of Education and Training protocols to allow follow-up of students to allow long-term evaluation of the effects of the program on students' subsequent pathways.*
- *The In2science surveys should be rewritten to include a greater focus on the role of the mentor in the classroom.*
- *Items that do not relate to the program should be removed from the surveys to allow more program-specific items to be included.*

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7 APPENDICES

7.1 Appendix A: Pre-program Survey

Student Survey – Part 1

(Science class)

Thank you for taking the time to complete this pre-placement survey. This survey will help us evaluate the In2science mentoring program. Your responses are confidential and your teacher and mentor will not have access to your responses.

School: ________________________________

First name: ______________________________ **Surname:** ______________________

Your name will be removed for all data analysis.

These questions ask you about your science classes and how you prefer to learn science. Please indicate how much you agree or disagree. There are no right or wrong answers.

	Questions	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1	Everyone can understand science if they work at it	1	2	3	4	5
2	To understand science I discuss it with friends and students	1	2	3	4	5
3	I enjoy learning science	1	2	3	4	5
4	I try my best in science classes	1	2	3	4	5
5	When I have trouble with a science problem, I know how to find information to help me answer the question.	1	2	3	4	5
6	I enjoy figuring out answers to science questions.	1	2	3	4	5
7	I'm confident I can understand science concepts	1	2	3	4	5
8	I usually finish all my work in science classes	1	2	3	4	5
9	In my science classes I learn things that I can use in my daily life	1	2	3	4	5
10	To learn science, I only need to memorise facts and definitions	1	2	3	4	5
11	I can use what I've learned in science classes in other classes	1	2	3	4	5

PLEASE TURN OVER THE PAGE

These questions ask you about what you'd like to do in the future. Please indicate how much you agree or disagree. There are no right or wrong answers.

	Questions	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
12	I would stop studying science now if I could	1	2	3	4	5
13	Studying science subjects in VCE will help me get a job in the future	1	2	3	4	5
14	Science subjects in VCE are harder than other VCE subjects	1	2	3	4	5
15	I want to continue to study science at school	1	2	3	4	5
16	There are many job opportunities for people who study science	1	2	3	4	5
17	I'd like a job where I can use science	1	2	3	4	5
18	The science I learn in school will be important for my future	1	2	3	4	5
29	You only use science in life is you a scientist	1	2	3	4	5
20	If you are reading this properly, tick disagree	1	2	3	4	5

What do you enjoy about studying science?

What do you find difficult about studying science?

Please write down a list of jobs that would use science every day.

Thank you for completing this survey

7.2 Appendix B: Post-program survey

Student Survey – Part 2

(Science class)

Thank you for taking the time to complete this pre-placement survey. This survey will help us evaluate the In2science mentoring program. Your responses are confidential and your teacher and mentor will not have access to your responses.

School: ________________________________

First name: ______________________________ **Surname:** _______________________

Your name will be removed for all data analysis.

These questions ask you about your science classes and how you prefer to learn science. Please indicate how much you agree or disagree. There are no right or wrong answers.

	Questions	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1	Everyone can understand science if they work at it	1	2	3	4	5
2	To understand science I discuss it with friends and students	1	2	3	4	5
3	I enjoy learning science	1	2	3	4	5
4	I try my best in science classes	1	2	3	4	5
5	When I have trouble with a science problem, I know how to find information to help me answer the question.	1	2	3	4	5
6	I enjoy figuring out answers to science questions.	1	2	3	4	5
7	I'm confident I can understand science concepts	1	2	3	4	5
8	I usually finish all my work in science classes	1	2	3	4	5
9	In my science classes I learn things that I can use in my daily life	1	2	3	4	5
10	To learn science, I only need to memorise facts and definitions	1	2	3	4	5
11	I can use what I've learned in science classes in other classes	1	2	3	4	5

PLEASE TURN OVER THE PAGE

These questions ask you about what you'd like to do in the future. Please indicate how much you agree or disagree. There are no right or wrong answers.

Please write down a list of jobs that would use science every day.

	Questions	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
12	I would stop studying science now if I could	1	2	3	4	5
13	Studying science subjects in VCE will help me get a job in the future	1	2	3	4	5
14	Science subjects in VCE are harder than other VCE subjects	1	2	3	4	5
15	I want to continue to study science at school	1	2	3	4	5
16	There are many job opportunities for people who study science	1	2	3	4	5
17	I'd like a job where I can use science	1	2	3	4	5
18	The science I learn in school will be important for my future	1	2	3	4	5
29	You only use science in life is you a scientist	1	2	3	4	5
20	If you are reading this properly, tick disagree	1	2	3	4	5

21	**The In2science mentor worked with me almost every time they visited**	**Y / N**

	Questions	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
	After having an In2science mentor I now…					
22	...have more confidence in talking about science/maths with family and friends	1	2	3	4	5
23	...am considering a career that will involve science/maths	1	2	3	4	5
24	...have a better understanding and appreciation on how many different jobs rely on science and maths.	1	2	3	4	5
25	have a greater understanding on how science/maths relates to everyday life and my future	1	2	3	4	5
26	..know how to try and solve a science/maths problem on my own	1	2	3	4	5

Describe how your In2science mentor helped you with your studies. Give an example if possible.

Thank you for completing this survey

7.3 Appendix C : Classroom observation schedule developed by ACER (Example from Observation 2 conducted by ACER)

CLASSROOM OBSERVATION 2

Class:
Topic being covered in session:
Observer: Julie
Number of students in class:

Need to make sure that activity to be covered is practical or theoretical. That is, not video, exams, test etc…

Questions asked – number of questions asked, number of students asking questions

10 minute intervals (if less than 50 minutes session, then only have one minute between observations)

Time commences once class has settled and teacher starts explaining the plan for the lesson.

** There were four copies of the following sheet – one for each observation interval.*

Time 1:	
ACTIVITY	***OBSERVATION***
Teacher talking to class *Number of students not listening, as measured by:*	
Not looking at teacher	
Talking to another student	
Writing	
Distracted by something not related to task	*Specify distraction*
Questioning	
Number of students who asked a question	
Number of questions asked by students	
Number of questions asked by teacher	
Number of questions answered by teacher	
Number of questions answered by students	
Number of students who offered answers to questions	*Hand up* *Called out* *Teacher requested* *Other (specify)*
*Class response to **teacher** asking a question*	*Write observations here*
*Class response to **students** asking a question*	*Write observations here*
Task/Activity *Engagement with task as measured by:*	☐ *Group activity* ☐ *Individual activity*
Number of students following teacher's instructions	
Number of students undertaking task as instructed by teacher	
Number of students teacher reprimands for not working on activity	
Number of students teacher assists one-on-one with the task	
Number of times teacher explains the task	
Number of students distracted by something not related to task	*Specify distraction*
Researcher's perception of students' interest/engagement in lesson *Any other general observations*	

NOTE: There were four copies of the following sheet – one for each observation interval.

7.4 Appendix D: Focus group schedules for students in Science and Mathematics classes

PRE-PROGRAM FOCUS GROUP SCHEDULE A –SCIENCE CLASS

1. *What words do you think of when you hear the term 'science'?*

2. *Would you say you are good at science?*
   a. *Why do you say that?*

3. *Would you like to study science in Year 11?*
   a. *Why?*
   b. *In Year 12? And why?*
   c. *What about at uni? And why?*

4. *What job would you like to be doing when you are older?*

5. *Do you think studying science at uni can lead to a 'good' job?*
   a. *What does a 'good' job mean?*

6. *What do you know about universities in Melbourne? [prompt: what courses do they offer]*

PRE-PROGRAM FOCUS GROUP SCHEDULE A – MATHS CLASS

1. *What words do you think of when you hear the term 'maths'?*

2. *Would you say you are good at maths?*
   a. *Why do you say that?*

3. *Would you like to study maths in Year 11?*
   a. *Why?*
   b. *In Year 12? And why?*
   c. *What about at uni? And why?*

4. *What job would you like to be doing when you are older?*

5. *Do you think studying maths at uni can lead to a 'good' job?*

   a. *What does a 'good' job mean?*

6. *What do you know about universities in Melbourne? [prompt: what courses do they offer]*

POST-PROGRAM FOCUS GROUP SCHEDULE A – MATHS CLASS

1. What did you learn from having a mentor in your maths class?

2. What was the best part of having a mentor in your class?

3. What didn't you like about having a mentor in your class?

4. What words do you think of when you hear the term 'maths'?

5. Would you say you are good at maths?
    a. Why do you say that?

6. How has this changed since I was here last?
    a. Why do you think that is?

7. Would you like to study maths in Year 11?
    a. Why?
    b. In Year 12? And why?
    c. What about at uni? And why?

8. What job would you like to be doing when you are older?

9. Do you think studying maths at uni can lead to a 'good' job?

10. How would you describe a 'good' job?

11. What do you know about universities in Melbourne? *[prompt: what courses do they offer]*

POST-PROGRAM FOCUS GROUP SCHEDULE B – SCIENCE CLASS

1. What did you learn from having a mentor in your science class?

2. What was the best part of having a mentor in your class?

3. What didn't you like about having a mentor in your class?

4. What words do you think of when you hear the term 'science'?

5. Would you say you are good at science?
    a. Why do you say that?

6. How has this changed since I was here last?
    a. Why do you think that is?

7. Would you like to study science in Year 11?
    a. Why?
    b. In Year 12? And why?
    c. What about at uni? And why?

8. What job would you like to be doing when you are older?
9. Do you think studying science at uni can lead to a 'good' job?
10. How would you describe a 'good' job?
11. What do you know about universities in Melbourne? *[prompt: what courses do they offer]*

7.5 Appendix E: Questions asked during the Informal interviews with teachers and other school personnel

Mid-program questions

- What are your thoughts about the In2science program?
- Comments about the program?
- What positives/benefits are there for you/your students?
- Any concerns?
- Discuss next visit, and secure date and time for it.
- Discuss data requirements with teacher (if schools has been involved in the program previously), and leave example list of data of interest with him/her.

Post-program questions

- Comments about the program?
- Experience with mentor, and program?
- What positives/benefits did the program offer *and* deliver for you/your students?
- Any concerns?
- Could the program be enhanced in any way?
- Would you take part in the In2science program again?
- Discuss data requirements with teacher (if schools has been involved in the program previously), and talk to others at school, if required.

7.6 Appendix F: Additional instructions included on front page of Classroom Observation Schedule for In2science coordinators

Prior to the observation:

1. Once the school and class teacher agree to take part in the evaluation, ACER will arrange a time to visit the school to undertake this observation.

2. The class session to be observed must be an activity that is either practical or theoretical. That is, is cannot be a session where students are shown a video, YouTube clip, or are undertaking a test/examination.

3. ACER to ask the length (in minutes) for that class.

CLASSROOM OBSERVATION 1

Class:

Topic being covered in session:

Number of students enrolled in class:

Number of students in attendance:

Observer:

Classroom observations will be undertaken in each class twice: (1) prior to the In2Science program commencing, and (2) while the mentor is in the class.

Observations will be made throughout the session. Four 10 minute observations will be made, with a 2 minute interval between each observation.

The first observation period is to commence once class has settled and the teacher starts explaining the plan for the lesson.

An example interval schedule is provided below:

Observation 1	*9:05 – 9:15*
Observation 2	*9:17 – 9:27*
Observation 3	*9:29 – 9:39*
Observation 4	*9:41 – 9:51*

Ensure time is recorded at the commencement of the observation.

7.7 Appendix G: Students' responses to questions 1–19 on the pre-program survey, displayed as percentage[1]

	Item	Strongly disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree	*Did not answer*
1	Everyone can understand science/maths if they work at it	1.6	3.5	16.4	49.8	28.2	*0.4*
2	To understand science/maths I discuss it with friends and students	2.9	9.4	26.7	45.2	15.4	*0.4*
3	I enjoy learning science/maths	4.8	8.7	30.7	33.9	21.4	*0.5*
4	I try my best in science/maths classes	1.3	4.5	20.6	46.3	26.1	*1.1*
5	When I have trouble with a science/maths problem, I know how to find information to help me answer the question	1.4	8.2	31.0	42.9	15.9	*0.5*
6	I enjoy figuring out answer to science/maths questions	5.3	14.8	33.1	32.6	13.6	*0.6*
7	I'm confident I can understand science/maths concepts	2.6	12.1	34.6	37.4	12.5	*0.8*
8	I usually finish my work in science/maths classes	1.7	7.8	26.8	44.5	18.7	*0.5*
9	In my science/maths classes I learn things that I can use in my daily life	5.5	13.1	35.1	32.4	13.1	*0.8*
10	To learn science/maths, I only need to memorise facts and definitions	7.3	25.1	40.1	19.9	6.5	*1.1*
11	I can use what I've learned in science/maths classes in other classes	3.5	13.8	33.4	36.1	12.9	*0.3*
12	I would stop studying science/maths now if I could	28.6	30.9	25.9	8.4	5.9	*0.4*
13	Studying science/maths subjects in VCE will help me get a job in the future	3.3	6.5	25.6	37.4	26.4	*0.8*
14	Science/maths subjects in VCE are harder than other VCE subjects	2.0	6.1	56.4	24.7	9.4	*1.4*
15	I want to continue to study science/maths at school	4.7	9.4	25.9	34.7	24.3	*1.0*
16	There are many job opportunities for people who study science/maths	1.6	3.6	20.4	44.6	29.0	*0.9*
17	I'd like a job where I can use science/maths	8.5	21.8	35.6	22.2	11.3	*0.6*
18	The science/maths I learn in school will be important for my future	3.9	10.0	31.9	34.8	18.4	*1.0*
19	You only use science/maths in life if you are a scientist	31.4	38.7	19.4	6.7	2.7	*1.0*

[1] Valid percentage is used so that missing data (i.e. data for students who did not complete either the pre- or post-program survey) does not distort overall distribution.

7.8 Appendix H: Students' responses to questions 1–19 on the post-program survey, displayed as percentage[2]

Item		Strongly disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree	*Did not answer*
1	Everyone can understand science/maths if they work at it	1.0	3.3	12.7	50.0	0.2	*32.8*
2	To understand science/maths I discuss it with friends and students	3.0	8.1	24.9	45.5	0.6	*17.9*
3	I enjoy learning science/maths	4.8	7.6	27.0	35.5	1.0	*24.2*
4	I try my best in science/maths classes	1.1	3.7	20.5	47.9	0.7	*26.1*
5	When I have trouble with a science/maths problem, I know how to find information to help me answer the question	1.9	6.3	27.0	46.5	0.7	*17.7*
6	I enjoy figuring out answer to science/maths questions	4.5	12.1	33.4	31.9	0.8	*17.3*
7	I'm confident I can understand science/maths concepts	3.5	9.1	34.9	37.6	0.7	*14.2*
8	I usually finish my work in science/maths classes	1.6	7.6	27.6	43.9	1.4	*17.9*
9	In my science/maths classes I learn things that I can use in my daily life	4.0	11.8	29.6	37.6	0.7	*16.4*
10	To learn science/maths, I only need to memorise facts and definitions	7.9	25.8	37.7	20.6	0.4	*7.6*
11	I can use what I've learned in science/maths classes in other classes	3.3	10.6	30.9	38.8	0.6	*15.9*
12	I would stop studying science/maths now if I could	29.3	28.9	23.6	10.7	0.7	*6.8*
13	Studying science/maths subjects in VCE will help me get a job in the future	3.3	7.1	25.7	34.5	1.1	*28.3*
14	Science/maths subjects in VCE are harder than other VCE subjects	2.5	6.5	55.3	24.3	2.2	*9.1*
15	I want to continue to study science/maths at school	5.8	9.6	24.3	34.8	1.3	*24.2*
16	There are many job opportunities for people who study science/maths	0.8	3.3	19.2	42.8	1.1	*32.7*
17	I'd like a job where I can use science/maths	10.4	18.0	36.1	20.5	1.2	*13.8*
18	The science/maths I learn in school will be important for my future	4.1	7.9	31.8	33.6	1.5	*21.1*
19	You only use science/maths in life if you are a scientist	36.9	34.6	18.6	6.2	1.4	*2.3*

[2] Valid percentage is used so that missing data (i.e. data for students who did not complete either the pre- or post-program survey) does not distort overall distribution.

7.9 Appendix I: Students' responses to questions 22-26, displayed by response to question 21 (worked directly with mentor or not)

Students who worked with a mentor: Student responses to Likert scale items on post-program survey regarding attitudes towards science and mathematics after having an In2science mentor, recorded by number and percentage

Item	Did not answer	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree	Total
After having an In2science mentor I now …							
22 … have more confidence in talking about science/maths with family and friends.	1 (0.3%)	5 (1.4%)	23 (6.3%)	151 (41.0%)	136 (37.0%)	52 (14.1%)	368 (100%)
23 .. am considering a career that will involve science/maths.	3 (0.8%)	20 (5.4%)	46 (12.5%)	104 (28.3%)	117 (31.8%)	78 (21.2%)	368 (100%)
24 … have a better understanding and appreciation on how many different jobs rely on science and maths.	3 (0.8%)	4 (1.1%)	15 (4.1%)	97 (26.4%)	168 (45.7%)	81 (22.0%)	368 (100%)
25 … have a greater understanding on how science/maths relates to everyday life and my future.	1 (0.3%)	4 (1.1%)	18 (4.9%)	91 (24.7%)	167 (45.4%)	87 (23.6%)	368 (100%)
26 … know how to try and solve a science/maths problem on my own.	4 (1.1%)	9 (2.4%)	13 (3.5%)	104 (28.3%)	165 (44.8%)	73 (19.8%)	368 (100%)

Students who did not work with a mentor: Student responses to Likert scale items on post-program survey regarding attitudes towards science and mathematics after having an In2science mentor, recorded by number and percentage

Item	Did not answer	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree	Total
After having an In2science mentor I now …							
22 … have more confidence in talking about science/maths with family and friends.	2 (1.3%)	10 (6.3%)	16 (10.1%)	84 (53.2%)	38 (24.1%)	8 (5.1%)	158 (100%
23 .. am considering a career that will involve science/maths.	2 (1.3%)	12 (7.6%)	18 (11.4%)	63 (39.9%)	42 (26.6%)	21 (13.3%)	158 (100%)
24 … have a better understanding and appreciation on how many different jobs rely on science and maths.	2 (1.3%)	6 (3.8%)	12 (7.6%)	60 (38.0%)	65 (41.1%)	13 (8.2%)	158 (100%)
25 … have a greater understanding on how science/maths relates to everyday life and my future.	2 (1.3%)	7 (4.4%)	8 (5.1%)	63 (39.9%)	63 (39.9%)	15 (9.5%)	158 (100%)
26 … know how to try and solve a science/maths problem on my own.	2 (1.3%)	10 (6.3%)	11 (7.0%)	50 (31.6%)	63 (39.9%)	22 (13.9%)	158 (100%)

7.10 Appendix J: Data from all observations conducted

Class 1: Year 8 Science

Activity	Observation 1 *n*=20	Observation 2 *n*=23	Observation 3 *n*=21
Topic		**Geology**	
Teacher talking to class			
Not looking at teacher	33	22	6
Talking to another student	35	3	3
Distracted by something not related to task	3	1	6
Writing	0	0	0
Questioning			
Number of students who asked a question	2	11	6
Number of questions asked by students	2	11	7
Number of questions answered by students	2	4	12
Number of students who offered answers to questions	6	4	6
Number of questions asked by teacher	4	7	14
Number of questions answered by teacher	0	10	3
Class response to **teacher** asking a question	Usual chatter A couple of students offered answered		About ½ class interested, others talking to student next to them. Students laughed when male student was shown to be not doing work
Class response to **students** asking a question			
Task/Activity			
Number of students following teacher's instructions	15	38	30
Number of students undertaking task as instructed by teacher	55	35	20
Number of students teacher reprimands for not working on activity	15	6	7
Number of students teacher assists one-on-one with the task	9	8	15
Number of times teacher explains the task	11	1	1
Number of students distracted by something not related to task	28	25	8
Researchers perception of students' interest/engagement in lesson Any other general observations	Lots of chatter, no positive response top context or questions asked by students. Teacher has used seating plan in past. Row of boys constantly distracted & calling out to one another. Low level of interest – sighing, distracted, not paying attention or attempt to respond to teacher or content of lesson. Talking is unrelated to task.	Very loud and chaotic class. A lot of noise, walking around, dancing and leaving class without permission. A lot lots of swearing from a number of students. On-task behaviour varied during the observation periods. All students had laptops, but only 5 used it.	T provided thorough explanation of task. Students initially engaged (<3 mins). A LOT of talking unrelated to task. ½ class worked on task at any one time, but all had periods of distraction during each ob interval. 4 constantly acting out, screaming & distracting others. Students seemed on-task, but walk around class showed most were not.

in total, there were 23 instances of this during the entire observation period. However, there was a lot of fluctuation, with only 2 or 3 students following instruction at some time points.

Class 2: Year 8 Science

Activity	Observation 1	Observation 2	Observation 3

	n=13**	*n*=15	*n*=15
Topic	**Animals, plants & cells**	**Space, solar system and mathematics**	**Space, solar system and mathematics**
Teacher talking to class			
Not looking at teacher	13	0	6
Talking to another student	13	2	8
Distracted by something not related to task	8	3	8
Writing	7	1	0
Questioning			
Number of students who asked a question	5	1	2
Number of questions asked by students	5	1	2
Number of questions answered by students	6	12	8
Number of students who offered answers to questions	16	8	23
Number of questions asked by teacher	7	13	15
Number of questions answered by teacher	2	1	0
Class response to **teacher** asking a question	Only a couple of students offered answers.	6 students actively participated in answering	
Class response to **students** asking a question			
Task/Activity			
Number of students following teacher's instructions*****	13	0-15	5-14
Number of students undertaking task as instructed by teacher*****	8	?	0
Number of students teacher reprimands for not working on activity*****	9	5	9
Number of students teacher assists one-on-one with the task*****	7	1	1
Number of students distracted by something not related to task*	45 Talking, sleeping, games, going to locker, walking around)	4 Looking at Facebook, watching DVD, talking, pulling paper out of book and scrunching it up	11 Pretending to be 'tigers' by growling at each other, talking, looking around room, watching a something on laptop, looking through diary, drawing in book
Number of times teacher explains the task	5	4	3 Then wrote instructions on blackboard
Researchers perception of students' interest/engagement in lesson Any other general observations	3-4 students not engaged at all throughout whole period	A lot of talking, and disinterest in class. BOREDOM! Teacher had to explain to class twice	

** Data recorded during Observation 1 was for number of students, rather than number of instances.

** Numbers relate to number of students not instances

Class 3: Year 7/8 Science

Activity	**Observation 1** *n*=18	**Observation 2** *n*=	**Observation 3** *n*=20
Topic	**Science and mathematics cell, cell biology**	**Space, solar system and mathematics**	**Space, solar system and mathematics**
Teacher talking to class			
Not looking at teacher	15	6	4
Talking to another student	11	8	17
Distracted by something not related to task	3	2	12
Writing	8	3	0
Questioning			
Number of students who asked a question	9	4	12

Number of questions asked by students	17	4	10
Number of questions answered by students	25	25	13
Number of students who offered answers to questions	41	11	31
Number of questions asked by teacher	33	23	12
Number of questions answered by teacher	14	2	4
Task/Activity			
Number of students following teacher's instructions*****	45	69	?
Number of students undertaking task as instructed by teacher*****	44	69	?
Number of students teacher reprimands for not working on activity*****	3	3	7
Number of students teacher assists one-on-one with the task*****	1	4	12
Number of students distracted by something not related to task*	45	9	16
Number of times teacher explains the task	1	4	3
Researchers perception of students' interest/engagement in lesson Any other general observations	Education support staff member talked to everyone and helped anyone who needs it Lots of noise	Mentor did not interact with students. Looked at worksheet of student next to him. Teacher worked with students so they could answer their own questions.	Took a long time for class to commence task during first Ob cycle. Students tended to 'copy' others' answers and were told a lot to 'Google' the answer by the teacher and ESS.

Class 4: Year 8 Mathematics

Activity	Observation 1 *n*=18	Observation 2 *n*=20	Observation 3 *n*=18
Topic	**Algebra**	**Intercepts**	**Angles & axis**
Teacher talking to class			
Not looking at teacher	3	0	9
Talking to another student	14	2	2
Distracted by something not related to task	0	5	1
Writing	14	0	0
Questioning			
Number of students who asked a question	1	7	3
Number of questions asked by students	1	11	3
Number of questions answered by students	0	14	0
Number of students who offered answers to questions	26	10	0
Number of questions asked by teacher	25	20	0
Number of questions answered by teacher	0	9	1
Task/Activity			
Number of students following teacher's instructions*****	72	80	72
Number of students undertaking task as instructed by teacher*****	72	80	72
Number of students teacher reprimands for not working on activity*****	8	10	14
Number of students teacher assists one-on-one with the task*****	6	4	6
Number of students distracted by something not related to task*	0	8	5
Number of times teacher explains the task	4	4	1
Researchers perception of students' interest/engagement in lesson Any other general observations	Took a while to settle class to start task. Then students generally completed task	Most students on-task & engaged activity for entire class Class became unsettled when teacher took a students to the front of the room to explain task on the blackboard	Permanent relief teacher. Of-task behaviour dealt with swiftly by teacher

Class 5: Year 8 Mathematics

Activity	Observation 2 *n*=21	Observation 3 *n*=18
Topic	**Algebra**	**Algebra, revision for test**
Teacher talking to class		
Not looking at teacher	2	4
Talking to another student	1	1
Distracted by something not related to task	1	2
Writing	0	0
Questioning		
Number of students who asked a question	10	15
Number of questions asked by students	12	20
Number of questions answered by students	37	10
Number of students who offered answers to questions	36	9
Number of questions asked by teacher	30	4
Number of questions answered by teacher	10	10
Class response to **teacher** asking a question	Enthusiasm, engaged, happy to answer, generally 'hands up' to answer	
Class response to **students** asking a question	No response	
Task/Activity		
Number of students following teacher's instructions*	80	72
Number of students undertaking task as instructed by teacher*	80	72
Number of students teacher reprimands for not working on activity*	6	8
Number of students teacher assists one-on-one with the task*	2	11
Number of students distracted by something not related to task*	16	10
Number of times teacher explains the task	3	2
Researchers perception of students' interest/engagement in lesson Any other general observations	A lot of praise provided by teacher, very 'positive' class, teacher is energetic and enthusiastic, Students quiet and on task,	On task, Teacher walked around class helping students and checking their understanding Eg, 'Is it…?' teacher says 'well you tell me.'

Class 6: Year 8 Mathematics

Activity	Observation 1 *n*=21
Topic	
Teacher talking to class	
Not looking at teacher	7
Talking to another student	13
Distracted by something not related to task	3
Writing	4
Questioning	
Number of students who asked a question	0
Number of questions asked by students	4
Number of questions answered by students	0
Number of students who offered answers to questions	17
Number of questions asked by teacher	12
Number of questions answered by teacher	0
Class response to **teacher** asking a question	Long silence, descending into low chatter; students responding individually
Class response to **students** asking a question	
Task/Activity	
Number of students following teacher's instructions	22
Number of students undertaking task as instructed by teacher	60
Number of students teacher reprimands for not working on activity	9
Number of students teacher assists one-on-one with the task	16
Number of times teacher explains the task	1
Number of students distracted by something not related to task	2
Researchers perception of students' interest/engagement in lesson Any other general observations	Some students took longer to settle than others at the start of the lesson; most students unsure what to do after being given instructions to start prac; later during prac, students engaged in activity and working well

Class 7: Year 8E Science

Activity	Observation 1 *n*=15
Topic	**Geology**
Teacher talking to class	
Not looking at teacher	4
Talking to another student	10
Distracted by something not related to task	4
Writing	0
Questioning	
Number of students who asked a question	2
Number of questions asked by students	4
Number of questions answered by students	16
Number of students who offered answers to questions	25
Number of questions asked by teacher	19
Number of questions answered by teacher	2
Class response to **teacher** asking a question	Attentive, responding well
Class response to **students** asking a question	
Task/Activity	
Number of students following teacher's instructions	40
Number of students undertaking task as instructed by teacher	40
Number of students teacher reprimands for not working on activity	2
Number of students teacher assists one-on-one with the task	1
Number of times teacher explains the task	4
Number of students distracted by something not related to task	0
Researchers perception of students' interest/engagement in lesson Any other general observations	Very well behaved; About ½ class put up their hand to answer qns; At times students chattered but stopped quickly and paid attention

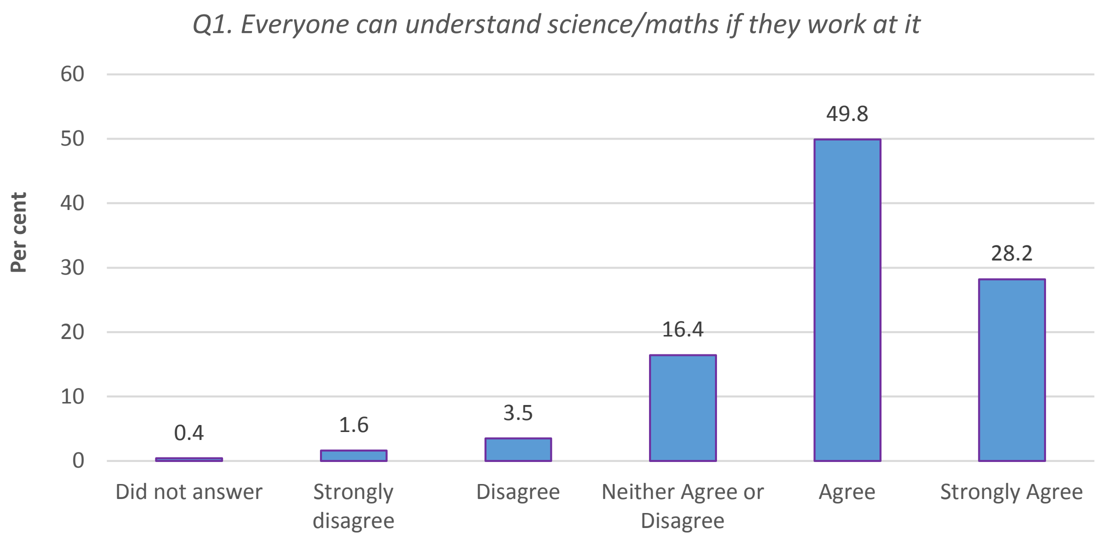
Class 8: Year 9 Mathematics

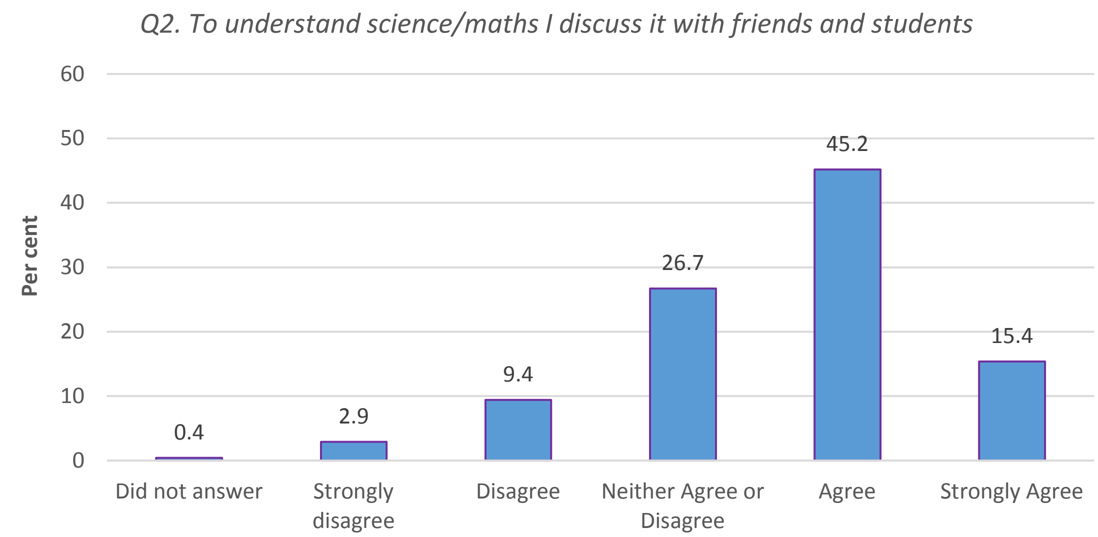
Activity	Observation 2 *n*=18
Topic	**Algebra**
Teacher talking to class	
Not looking at teacher	11
Talking to another student	2
Distracted by something not related to task	8
Writing	0
Questioning	
Number of students who asked a question	6
Number of questions asked by students	3
Number of questions asked by teacher	19
Number of questions answered by teacher	2
Number of questions answered by students	16
Number of students who offered answers to questions	9
Class response to **teacher** asking a question	Ambivalence, all questions answered by 2 female students
Class response to **students** asking a question	
Task/Activity	
Number of students following teacher's instructions	10
Number of students undertaking task as instructed by teacher	16
Number of students teacher reprimands for not working on activity	3
Number of students teacher assists one-on-one with the task	8
Number of times teacher explains the task	0
Number of students distracted by something not related to task	28
Researchers perception of students' interest/engagement in lesson Any other general observations	A lot of talking amongst students – unrelated to task, students were disinterested (confused or bored?); only 2 students appeared to understand content of the lesson.

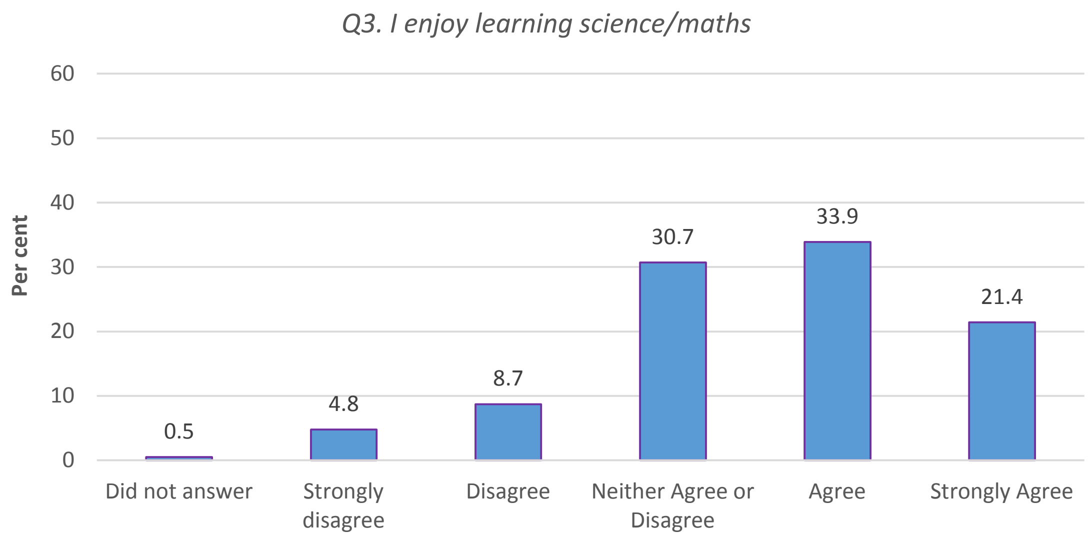
7.11 Appendix K: Figures representing student survey responses

For all figures in this appendix, percentages are based on the total number of students who completed the respective survey. This includes students who did not answer a specific item.

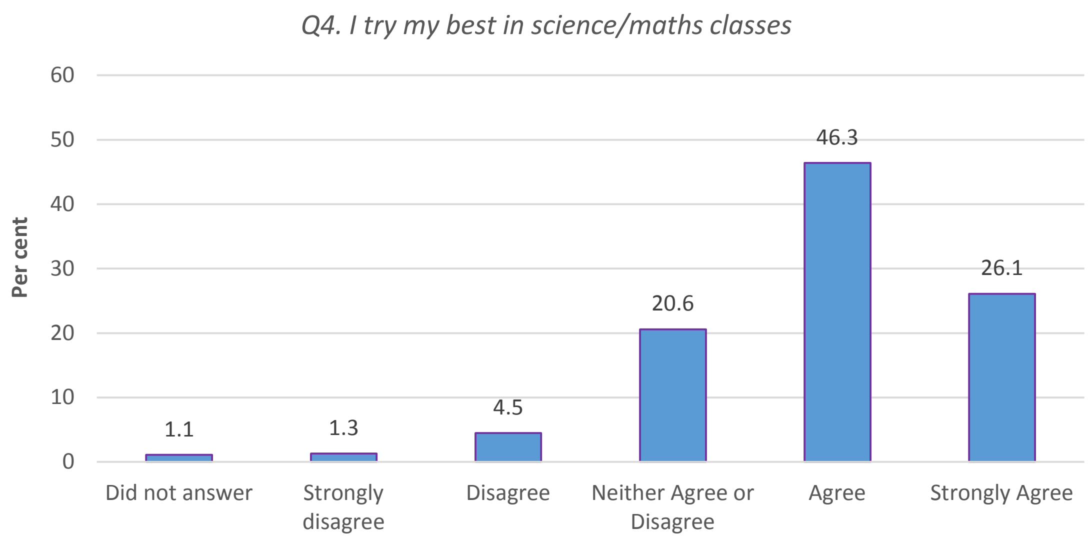
Pre-program surveys



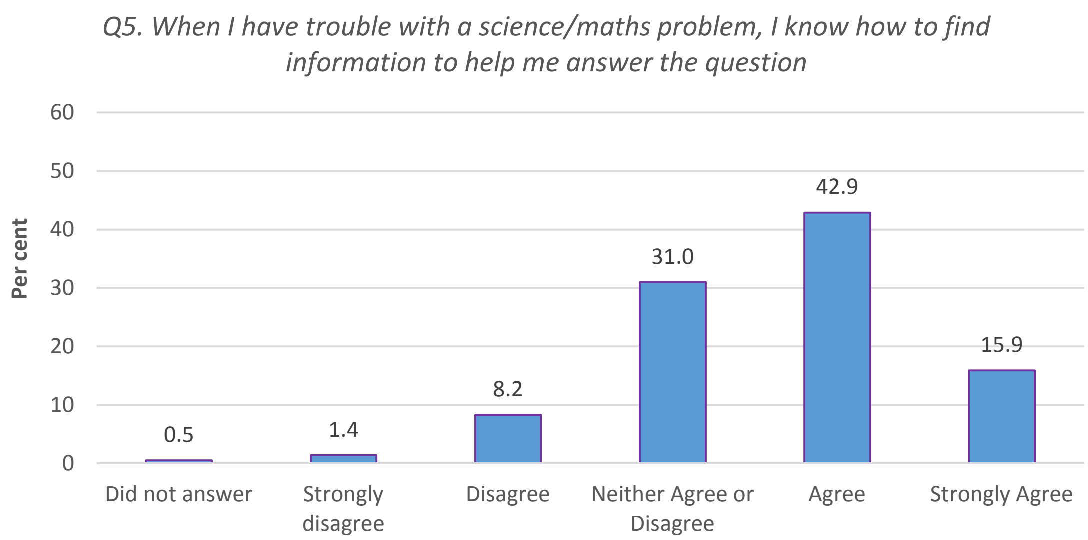




Q3. I enjoy learning science/maths
Per cent
60
50
40
30
20
10
0
0.5
4.8
8.7
30.7
33.9
21.4
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

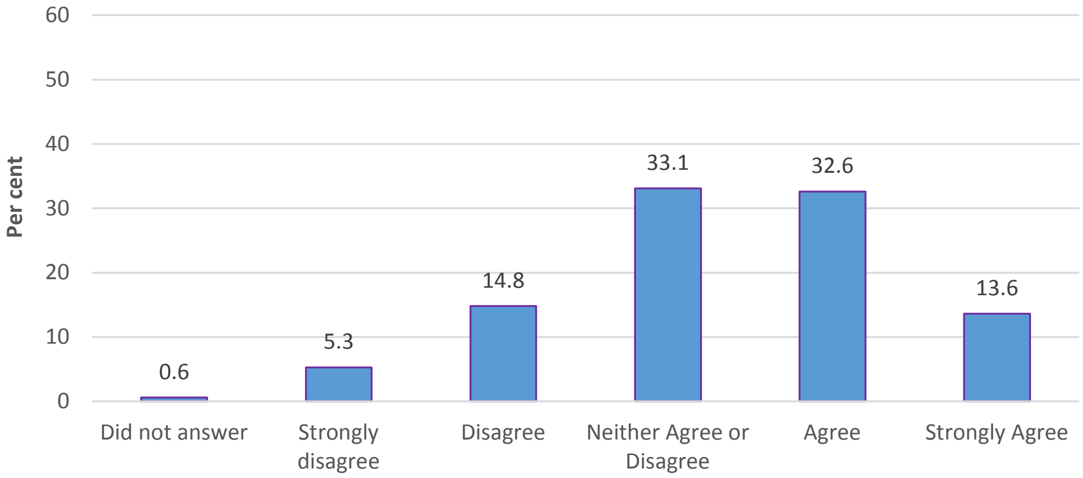


Q4. I try my best in science/maths classes
Per cent
60
50
40
30
20
10
0
1.1
1.3
4.5
20.6
46.3
26.1
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

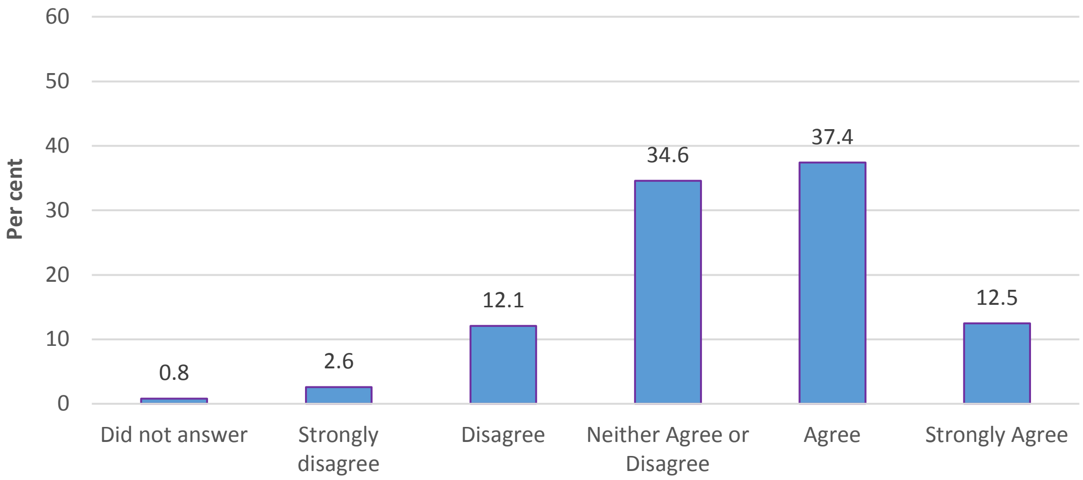


Q5. When I have trouble with a science/maths problem, I know how to find information to help me answer the question
Per cent
60
50
40
30
20
10
0
0.5
1.4
8.2
31.0
42.9
15.9
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

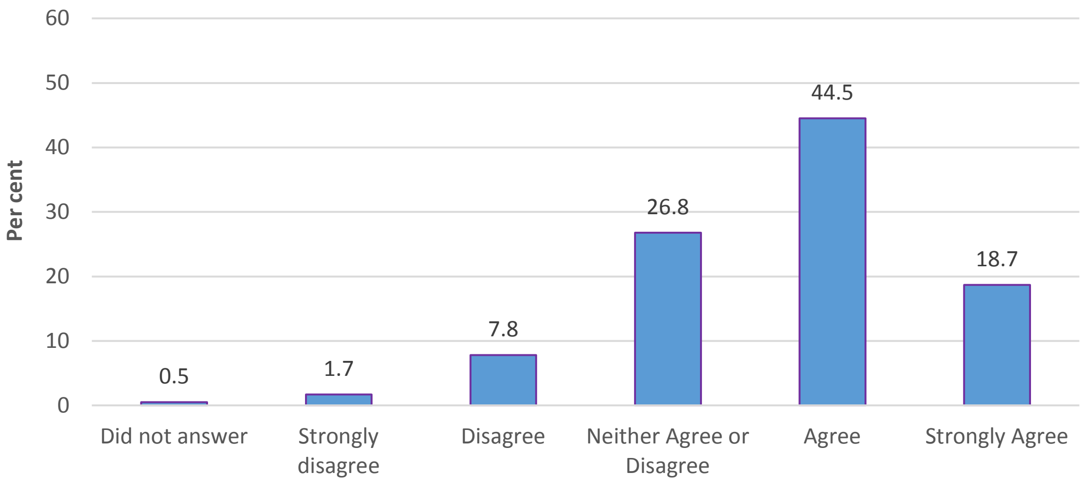
Q6. I enjoy figuring out answers to science/maths questions

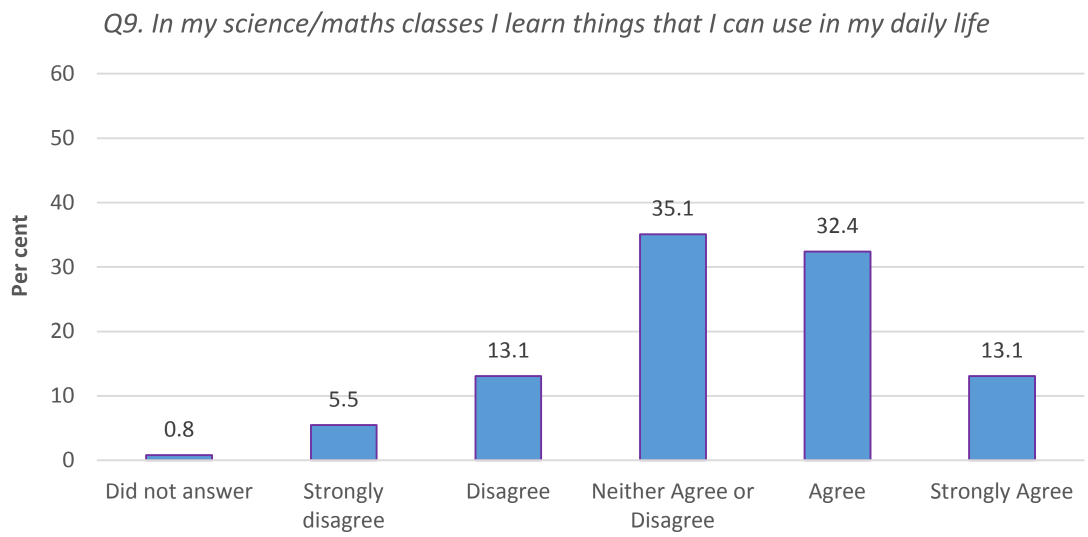


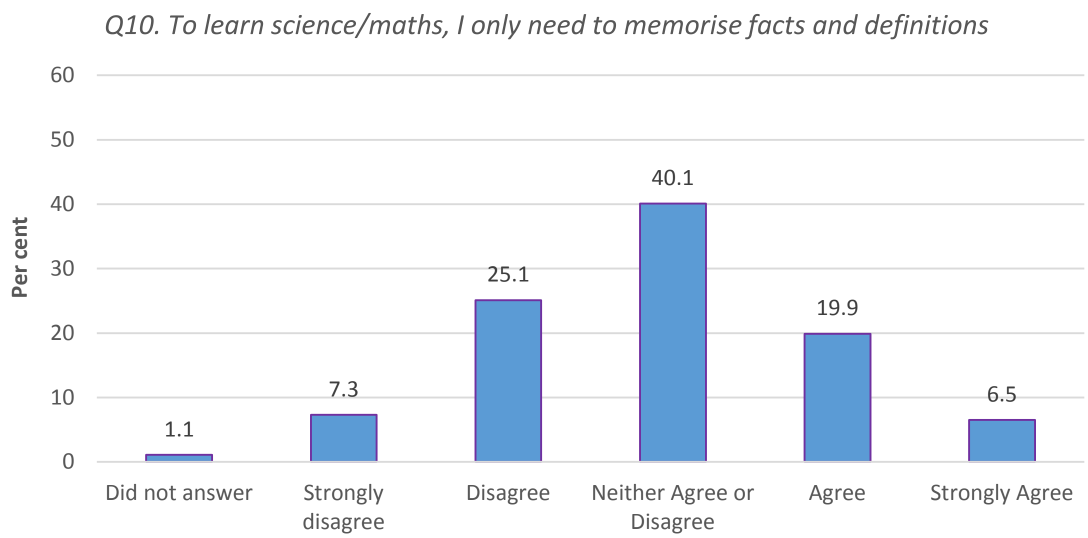
Q7. I'm confident I can understand science/maths concepts

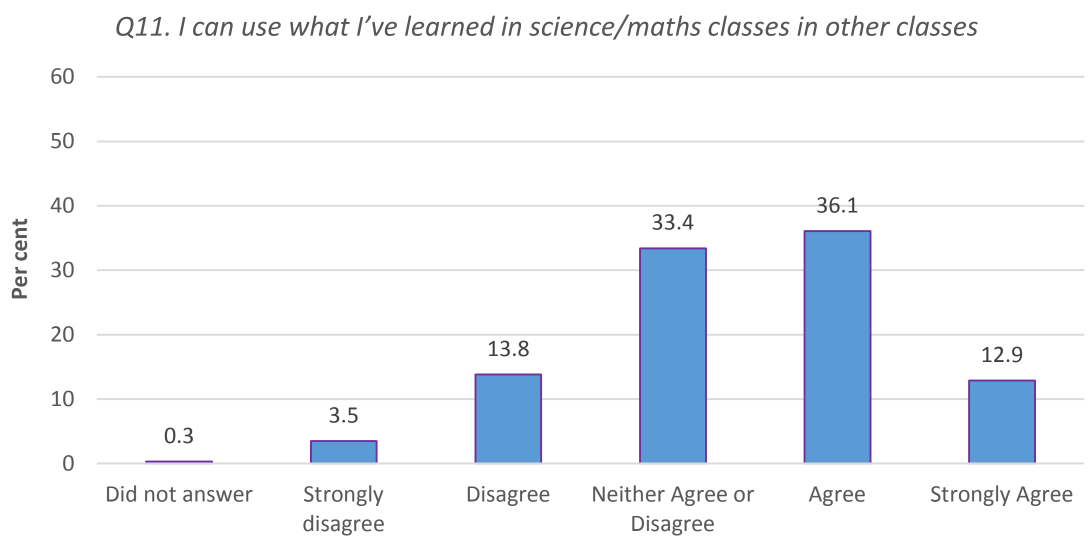


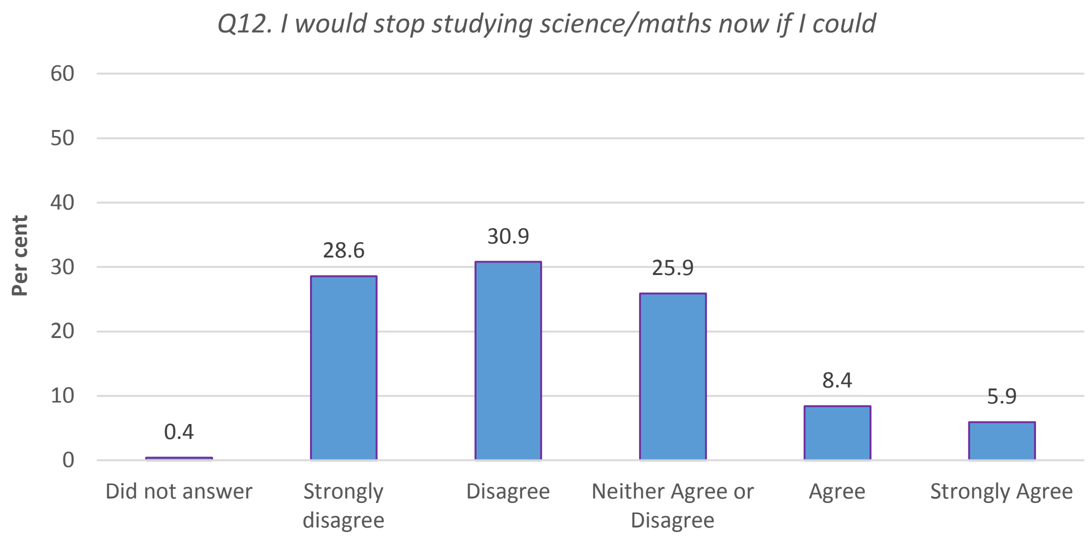
Q8. I usually finish my work in science/maths classes

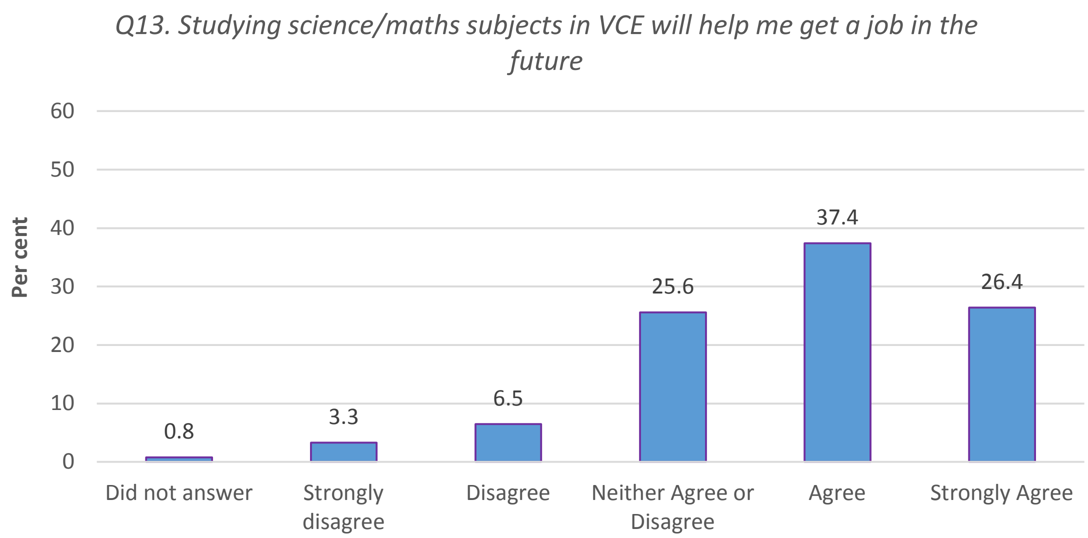


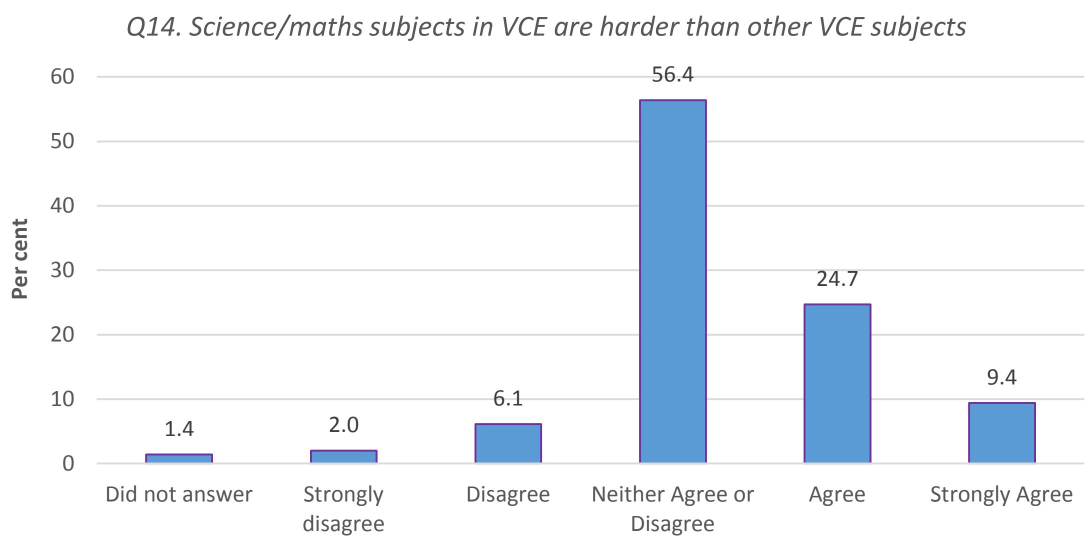

Q9. In my science/maths classes I learn things that I can use in my daily life
60
50
40
30
20
10
0
Per cent
0.8
5.5
13.1
35.1
32.4
13.1
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

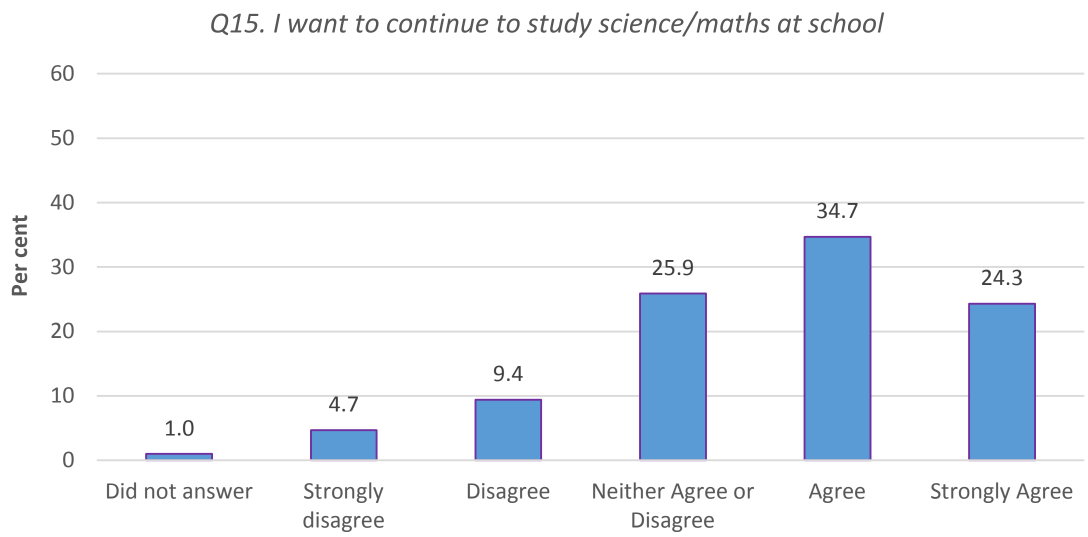

Q10. To learn science/maths, I only need to memorise facts and definitions
60
50
40
30
20
10
0
Per cent
1.1
7.3
25.1
40.1
19.9
6.5
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

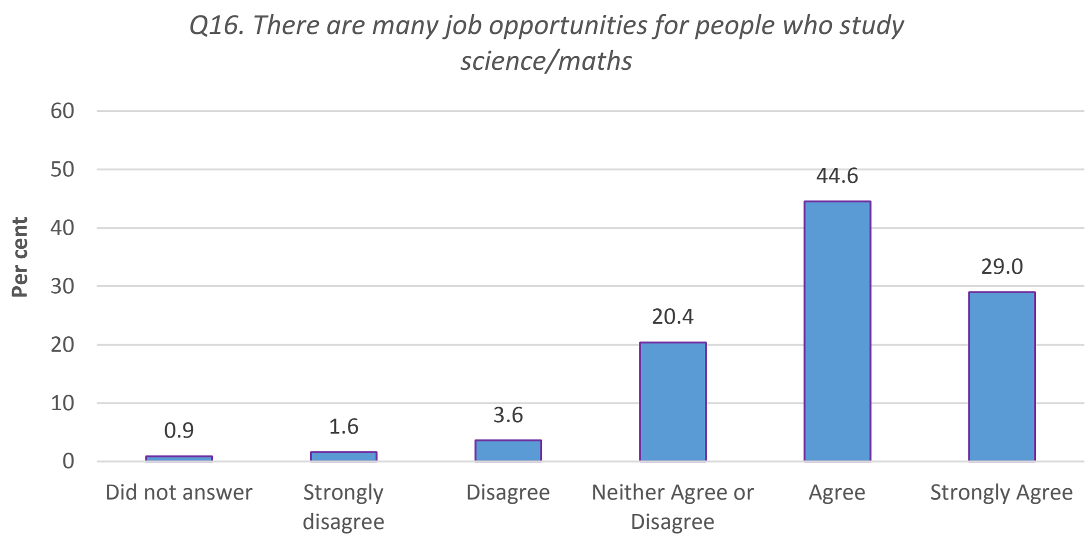

Q11. I can use what I've learned in science/maths classes in other classes
60
50
40
30
20
10
0
Per cent
0.3
3.5
13.8
33.4
36.1
12.9
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

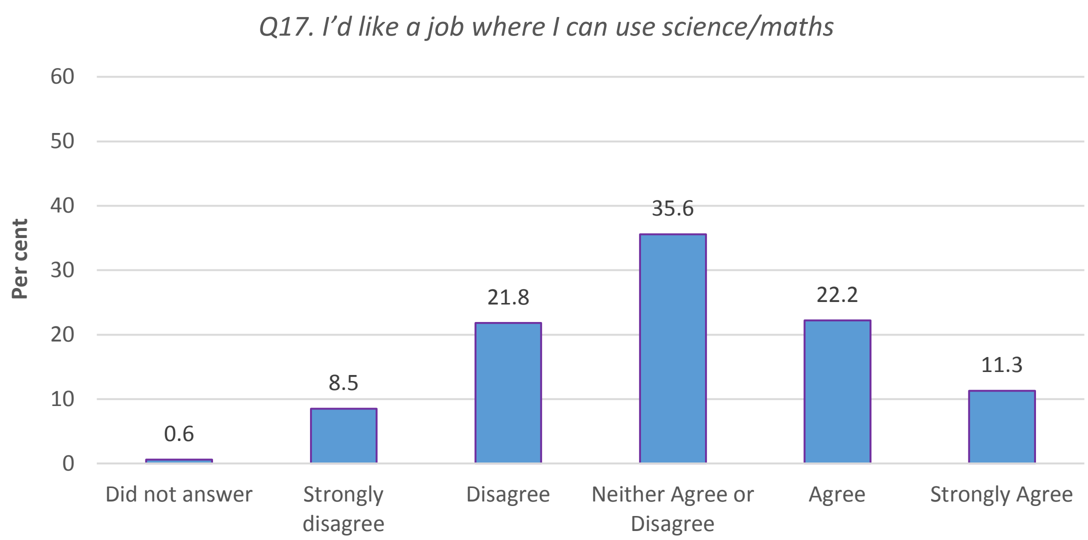

Q12. I would stop studying science/maths now if I could
Per cent
60
50
40
30
20
10
0
0.4
28.6
30.9
25.9
8.4
5.9
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

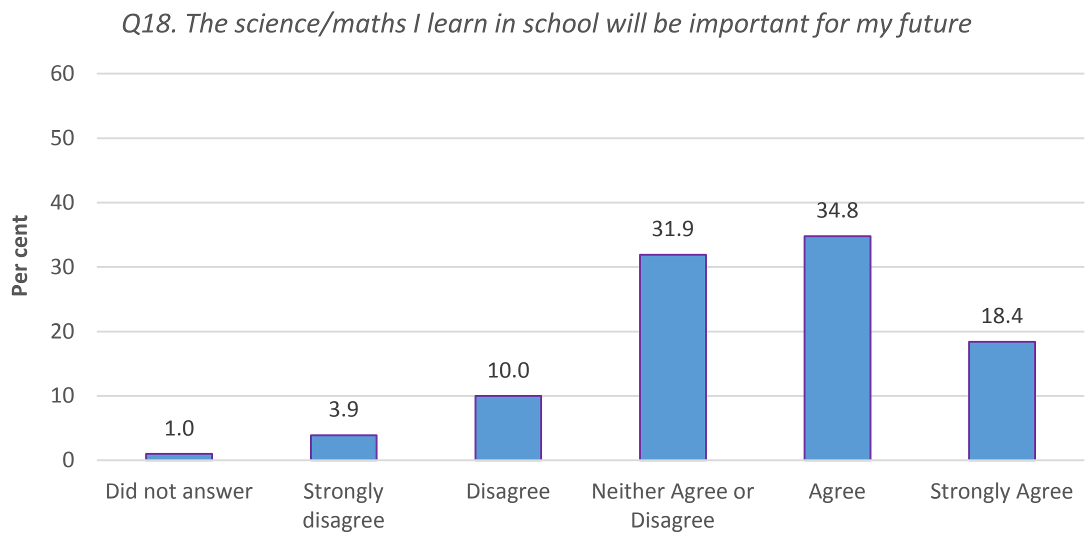

Q13. Studying science/maths subjects in VCE will help me get a job in the future
Per cent
60
50
40
30
20
10
0
0.8
3.3
6.5
25.6
37.4
26.4
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

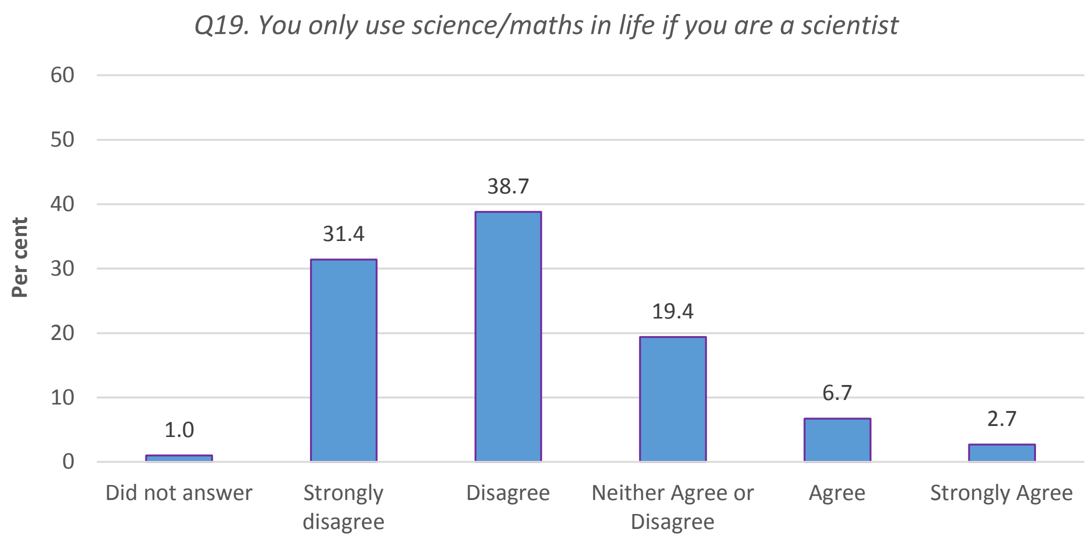

Q14. Science/maths subjects in VCE are harder than other VCE subjects
Per cent
60
50
40
30
20
10
0
1.4
2.0
6.1
56.4
24.7
9.4
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree


Q15. I want to continue to study science/maths at school
Per cent
60
50
40
30
20
10
0
1.0
4.7
9.4
25.9
34.7
24.3
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

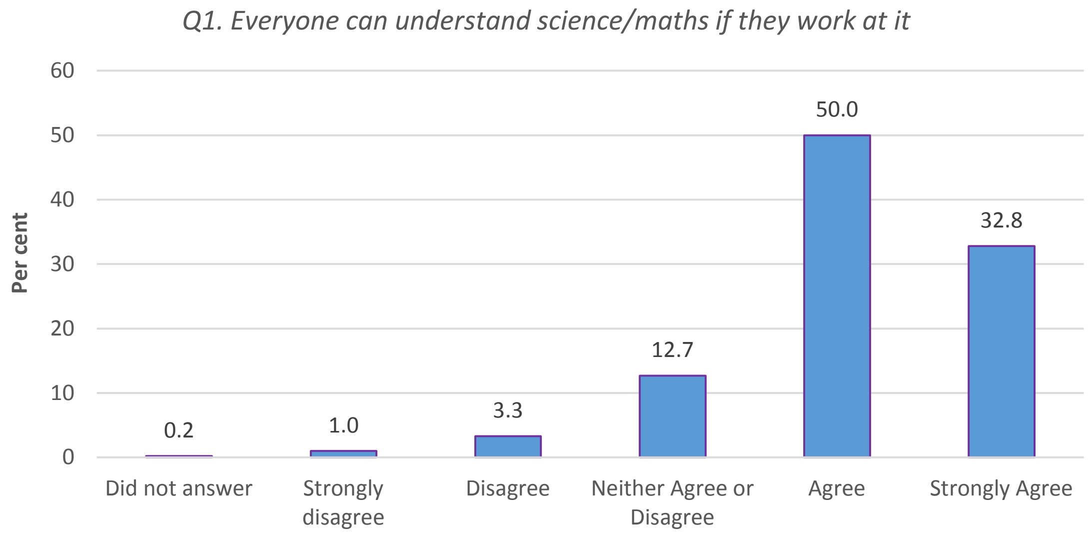

Q16. There are many job opportunities for people who study science/maths
Per cent
60
50
40
30
20
10
0
0.9
1.6
3.6
20.4
44.6
29.0
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

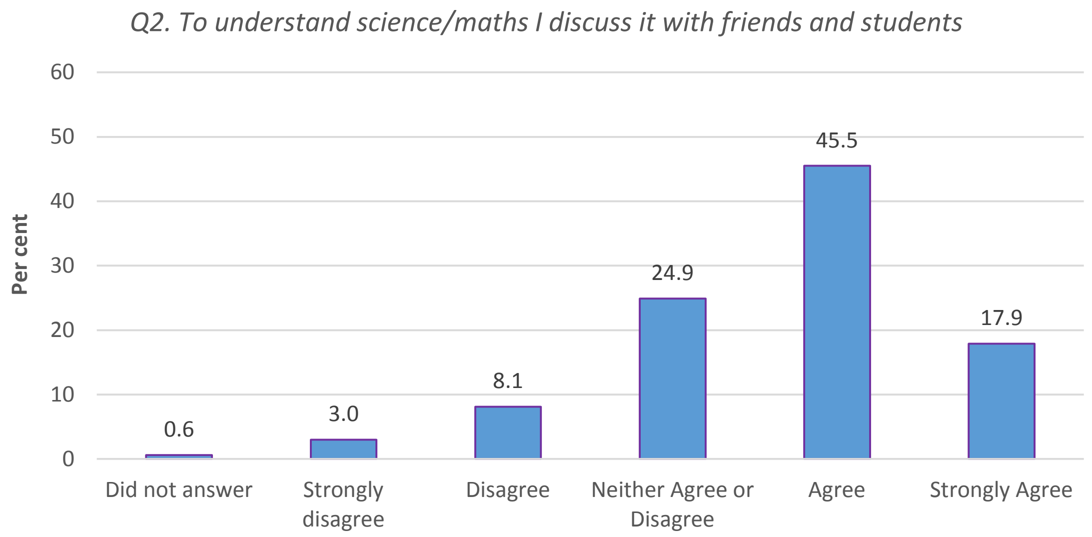

Q17. I'd like a job where I can use science/maths
Per cent
60
50
40
30
20
10
0
0.6
8.5
21.8
35.6
22.2
11.3
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

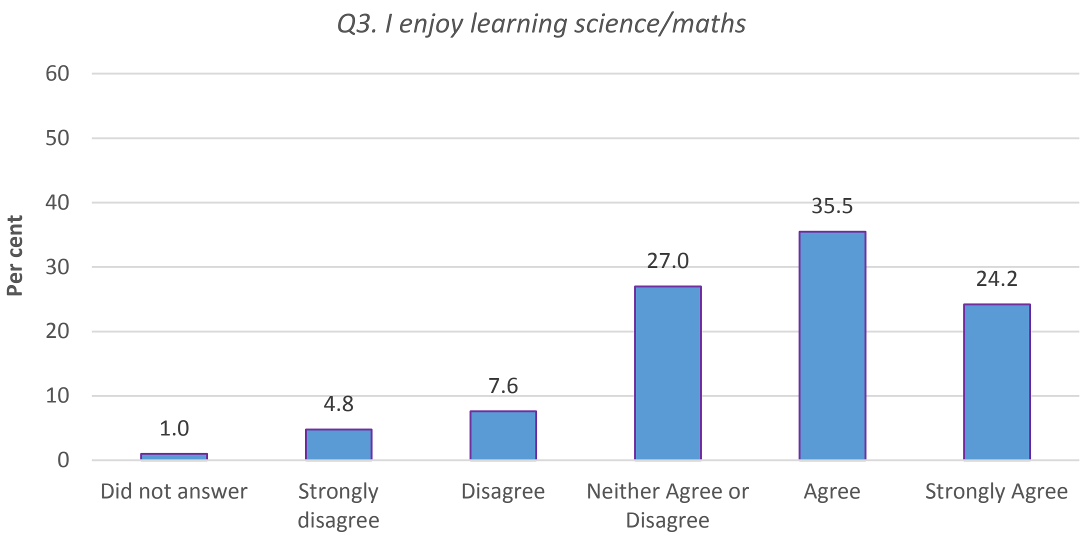

Q18. The science/maths I learn in school will be important for my future
60
50
40
30
20
10
0
Per cent
1.0
3.9
10.0
31.9
34.8
18.4
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

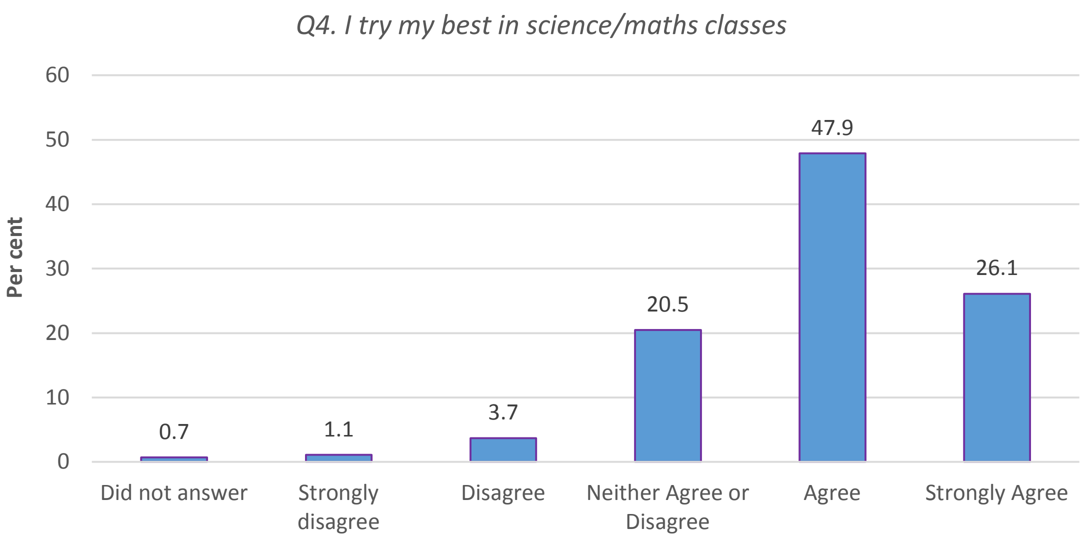

Q19. You only use science/maths in life if you are a scientist
60
50
40
30
20
10
0
Per cent
1.0
31.4
38.7
19.4
6.7
2.7
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

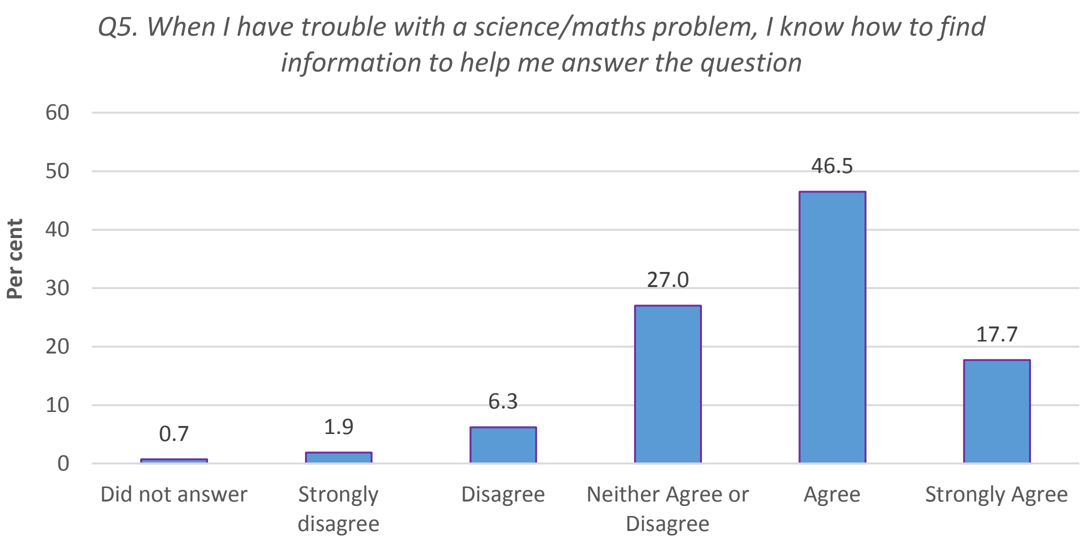
Post-program surveys



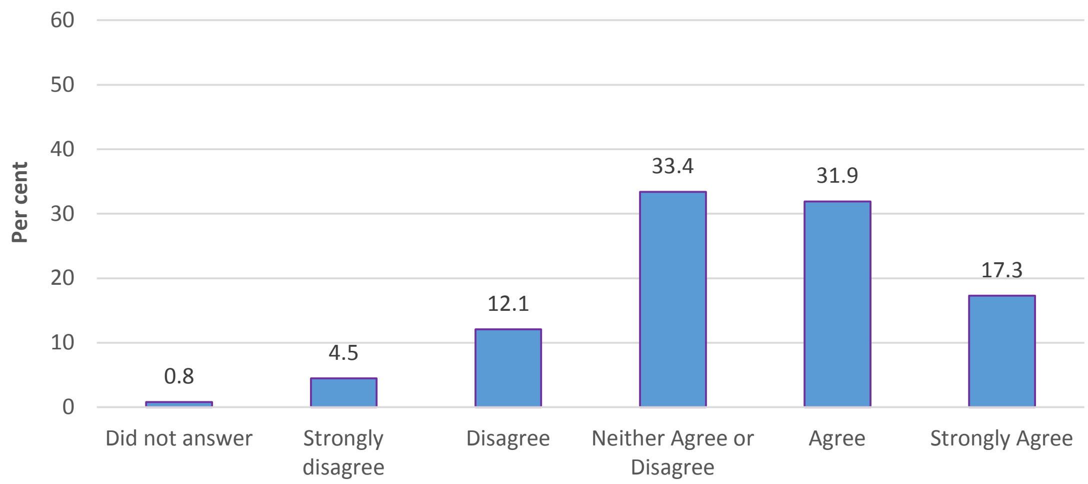



Q3. I enjoy learning science/maths
Per cent
0
10
20
30
40
50
60
1.0
4.8
7.6
27.0
35.5
24.2
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

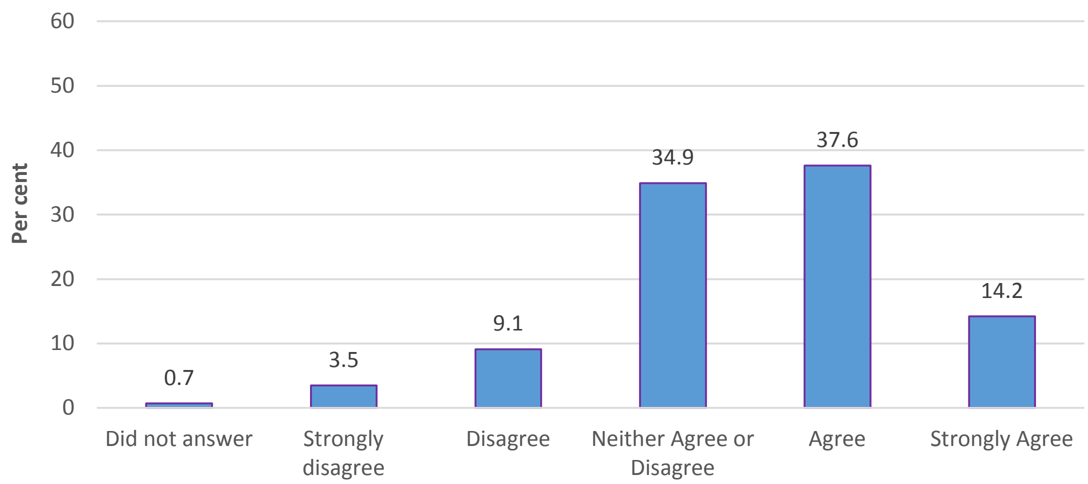

Q4. I try my best in science/maths classes
Per cent
0
10
20
30
40
50
60
0.7
1.1
3.7
20.5
47.9
26.1
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree


Q5. When I have trouble with a science/maths problem, I know how to find information to help me answer the question
Per cent
0
10
20
30
40
50
60
0.7
1.9
6.3
27.0
46.5
17.7
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

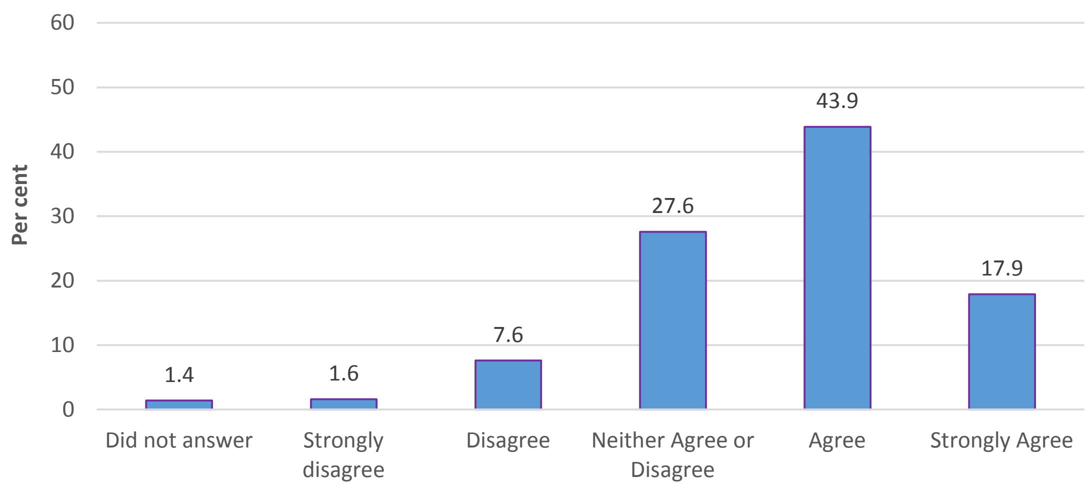
Q6. I enjoy figuring out answers to science/maths questions



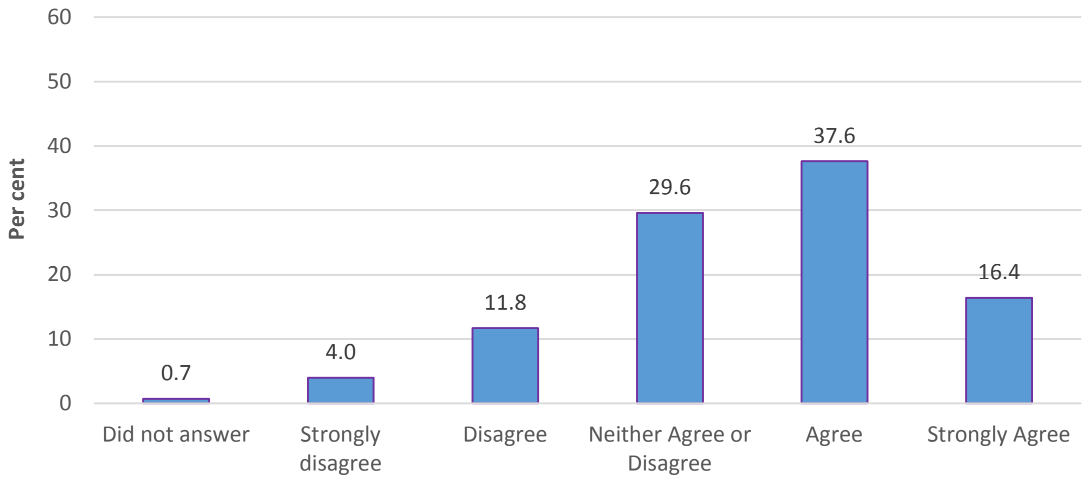
Q7. I'm confident I can understand science/maths concepts



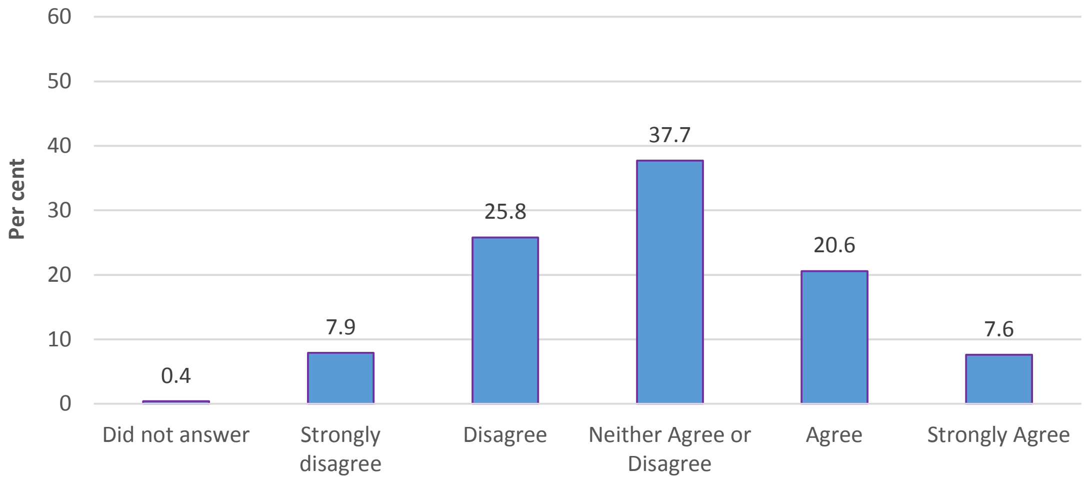
Q8. I usually finish my work in science/maths classes



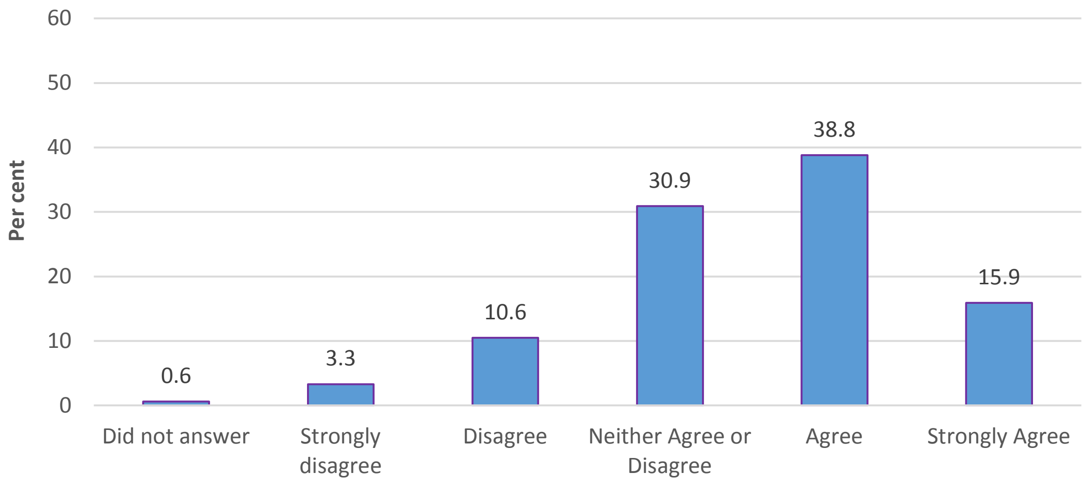
Q9. In my science/maths classes I learn things that I can use in my daily life

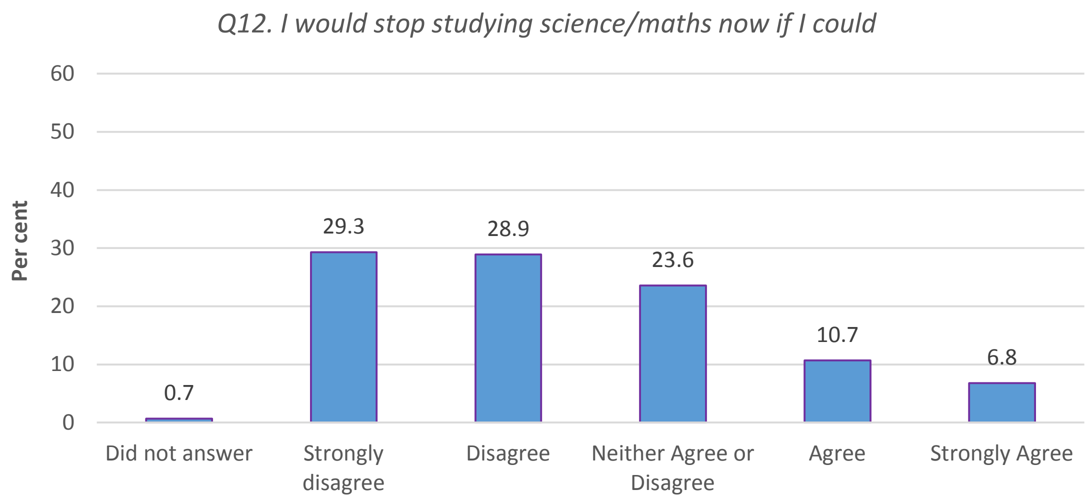


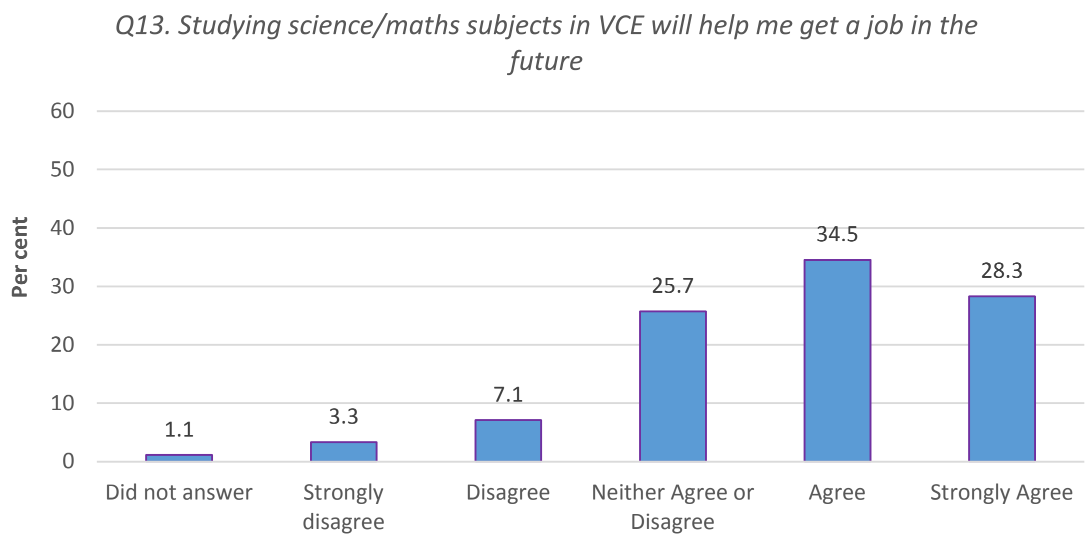
Q10. To learn science/maths, I only need to memorise facts and definitions

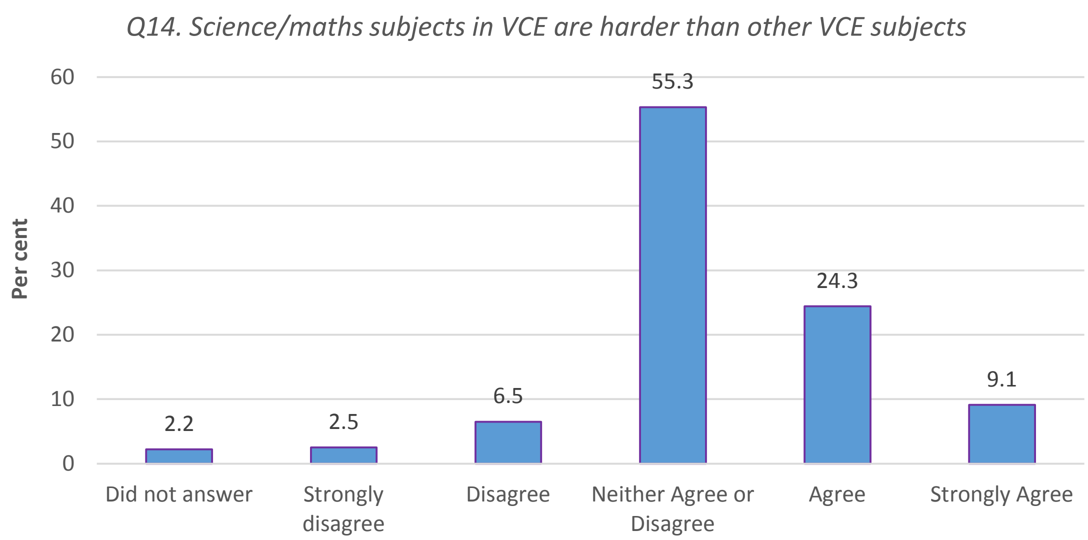


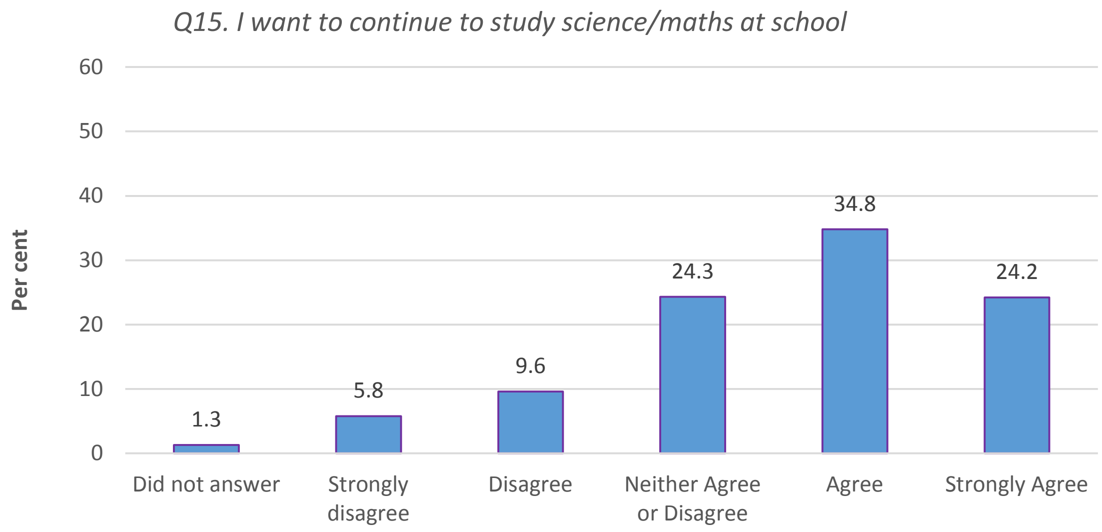
Q11. I can use what I've learned in science/maths classes in other classes

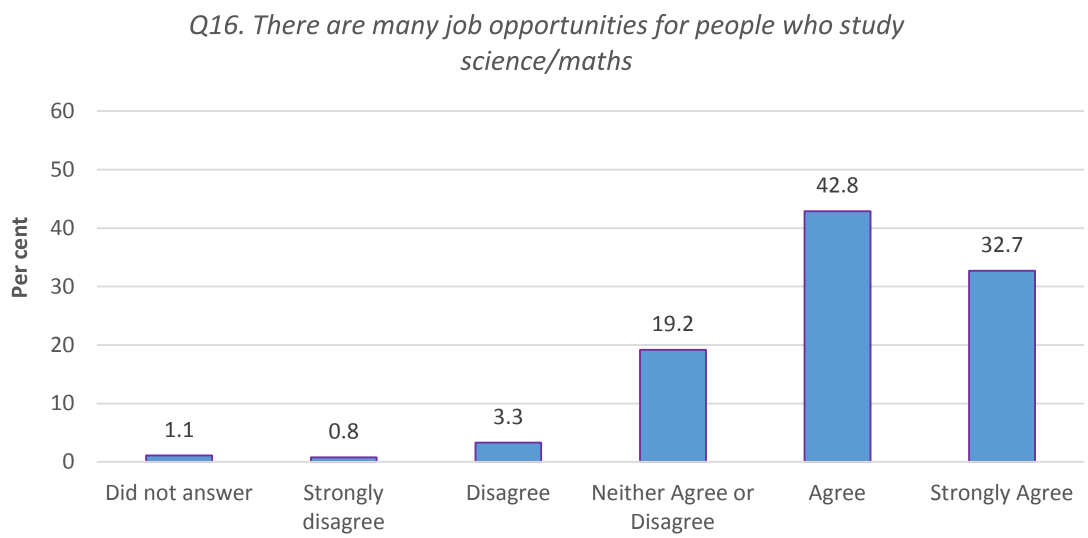


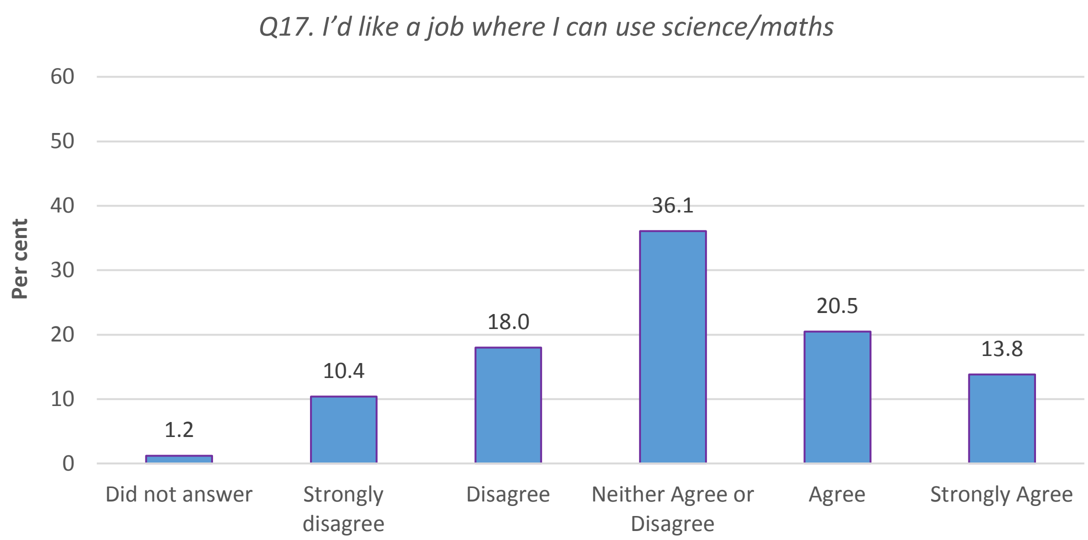

Q12. I would stop studying science/maths now if I could
Per cent
60
50
40
30
20
10
0
0.7
29.3
28.9
23.6
10.7
6.8
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

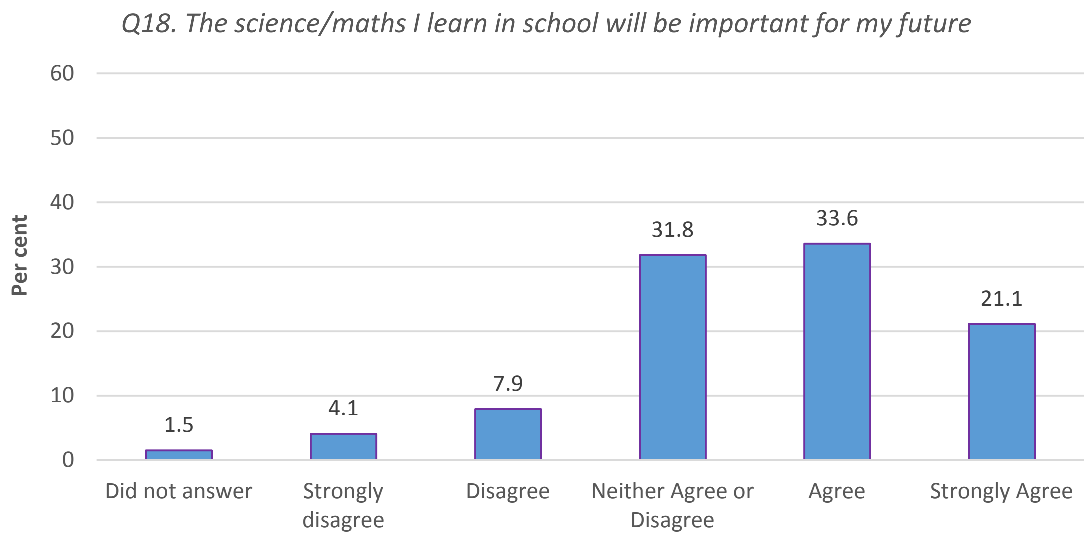

Q13. Studying science/maths subjects in VCE will help me get a job in the future
Per cent
60
50
40
30
20
10
0
1.1
3.3
7.1
25.7
34.5
28.3
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

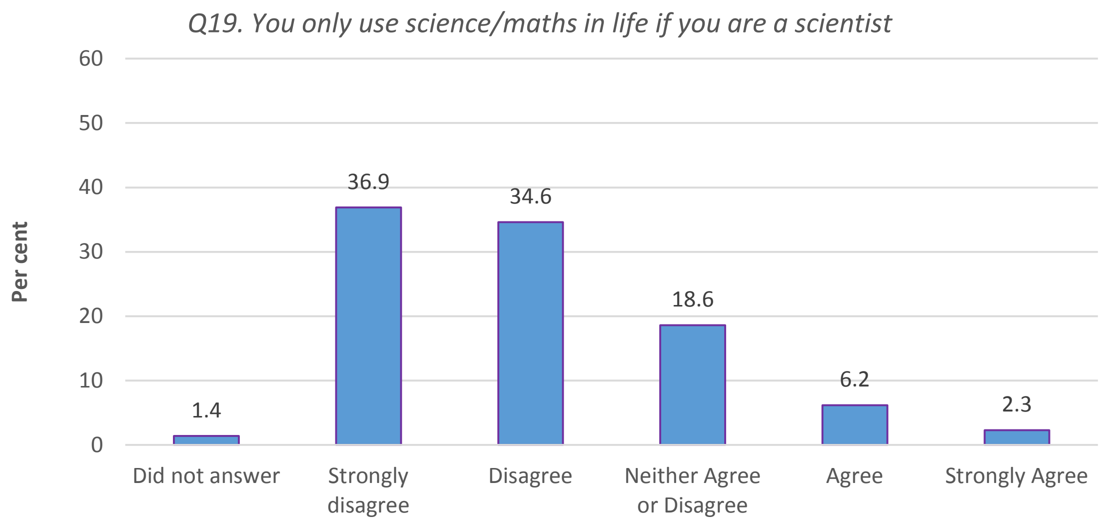

Q14. Science/maths subjects in VCE are harder than other VCE subjects
Per cent
60
50
40
30
20
10
0
2.2
2.5
6.5
55.3
24.3
9.1
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree


Q15. I want to continue to study science/maths at school
60
50
40
30
20
10
0
Per cent
1.3
5.8
9.6
24.3
34.8
24.2
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

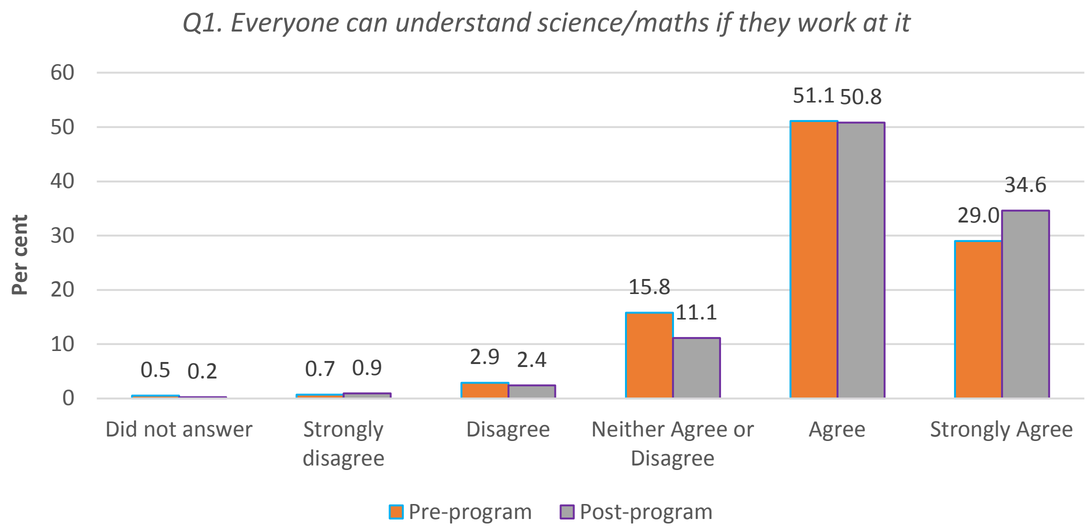

Q16. There are many job opportunities for people who study science/maths
60
50
40
30
20
10
0
Per cent
1.1
0.8
3.3
19.2
42.8
32.7
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

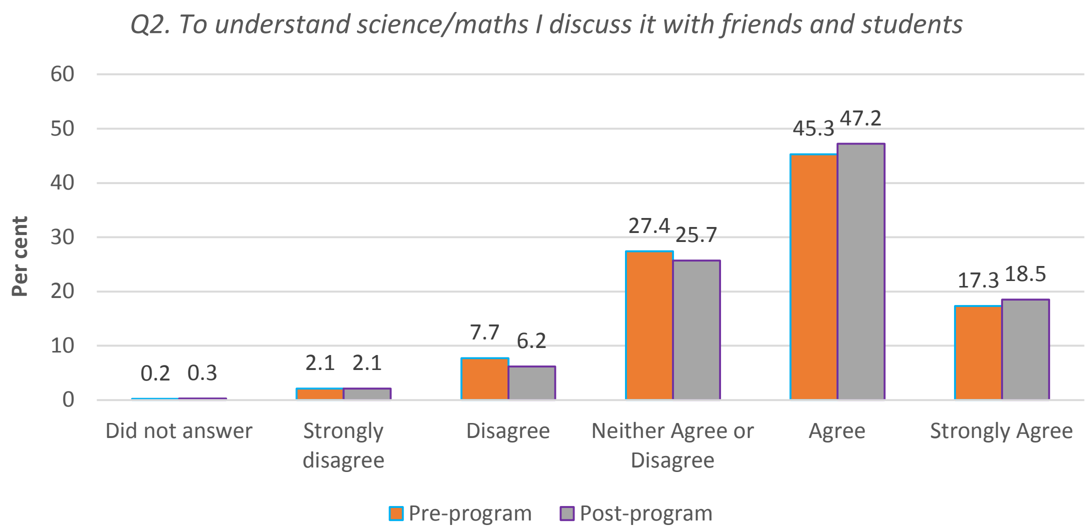

Q17. I'd like a job where I can use science/maths
60
50
40
30
20
10
0
Per cent
1.2
10.4
18.0
36.1
20.5
13.8
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree


Q18. The science/maths I learn in school will be important for my future
Per cent
60
50
40
30
20
10
0
1.5
4.1
7.9
31.8
33.6
21.1
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

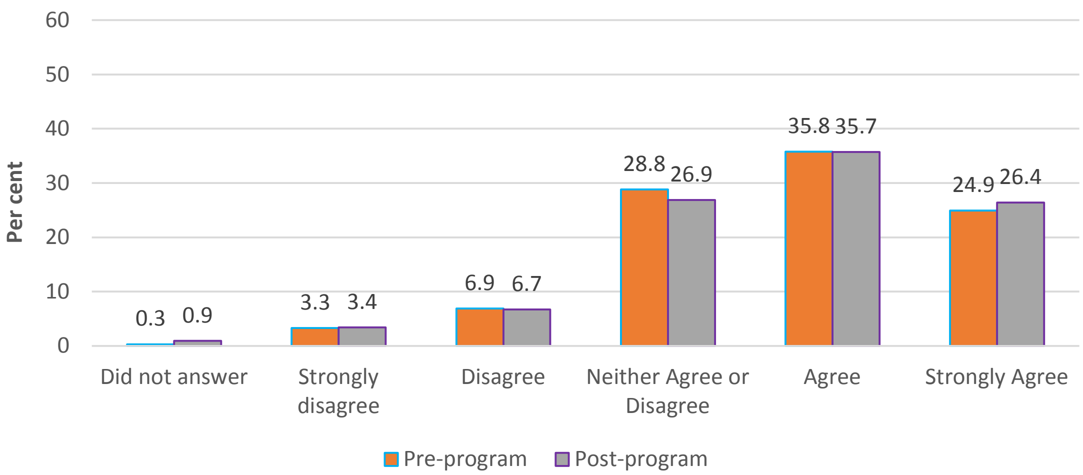

Q19. You only use science/maths in life if you are a scientist
Per cent
60
50
40
30
20
10
0
1.4
36.9
34.6
18.6
6.2
2.3
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree

Matched pre- and post-program surveys

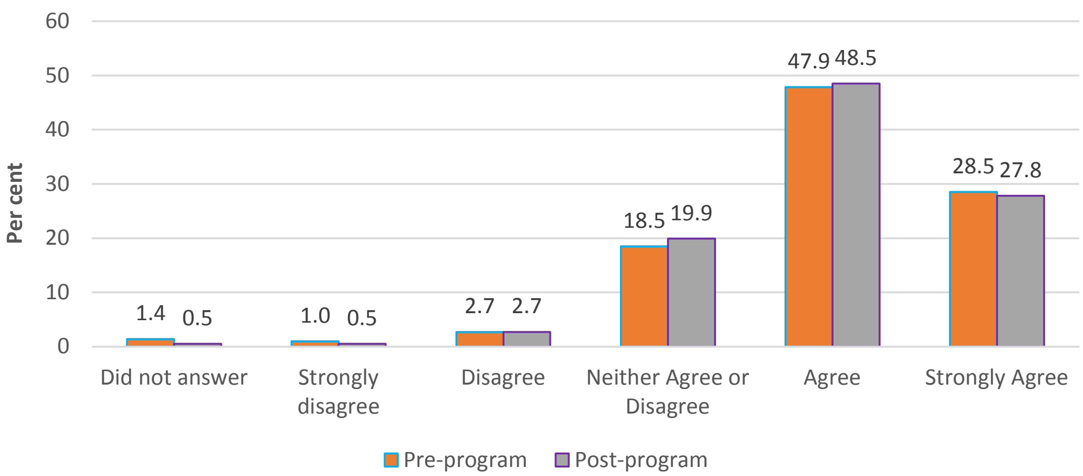




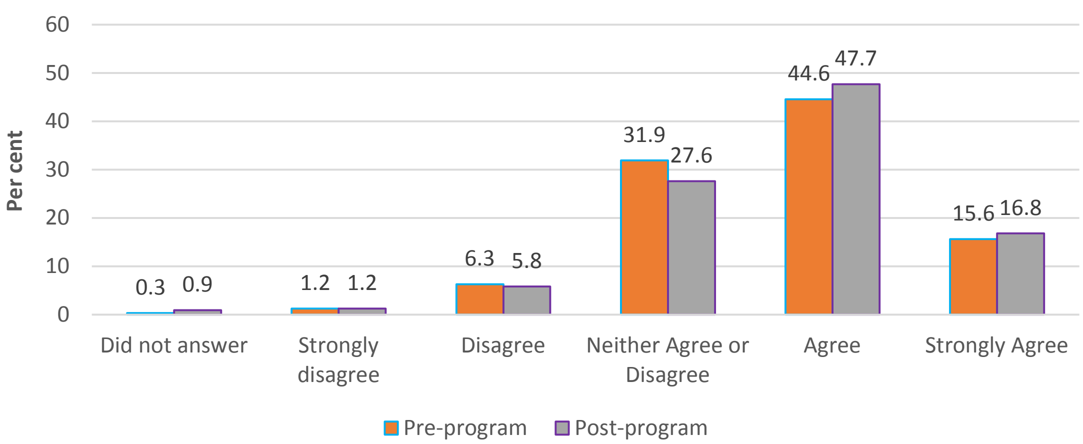
Q3. I enjoy learning science/maths

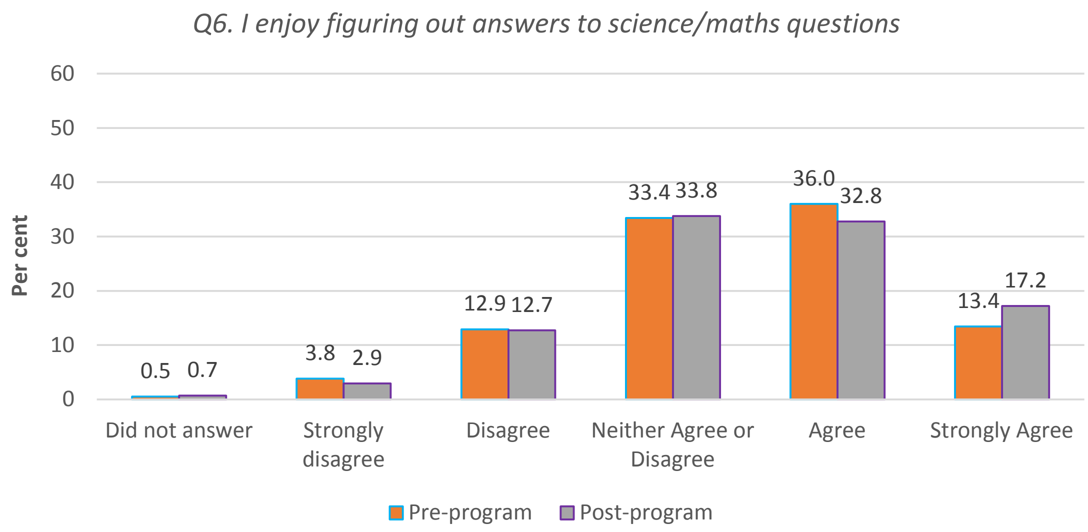


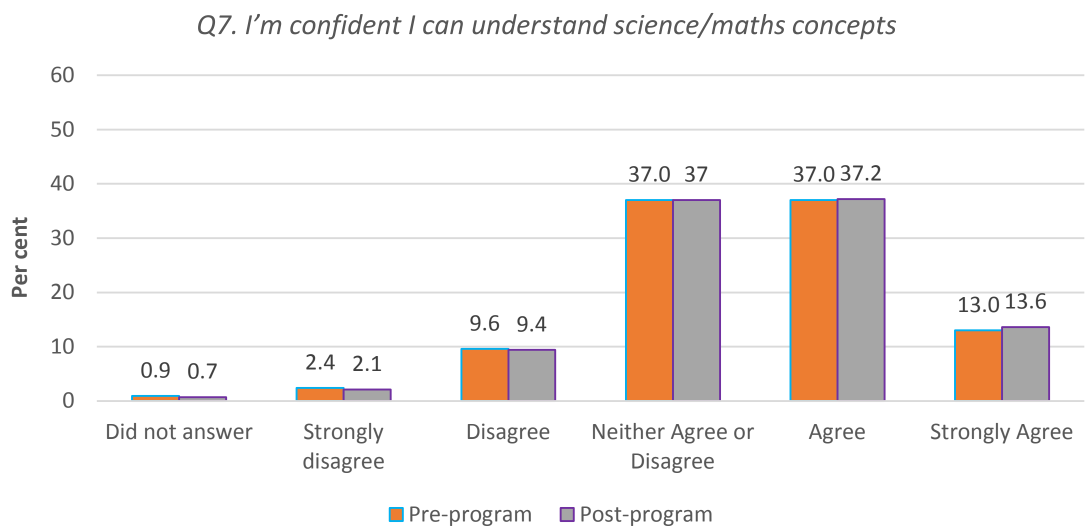
Q4. I try my best in science/maths classes

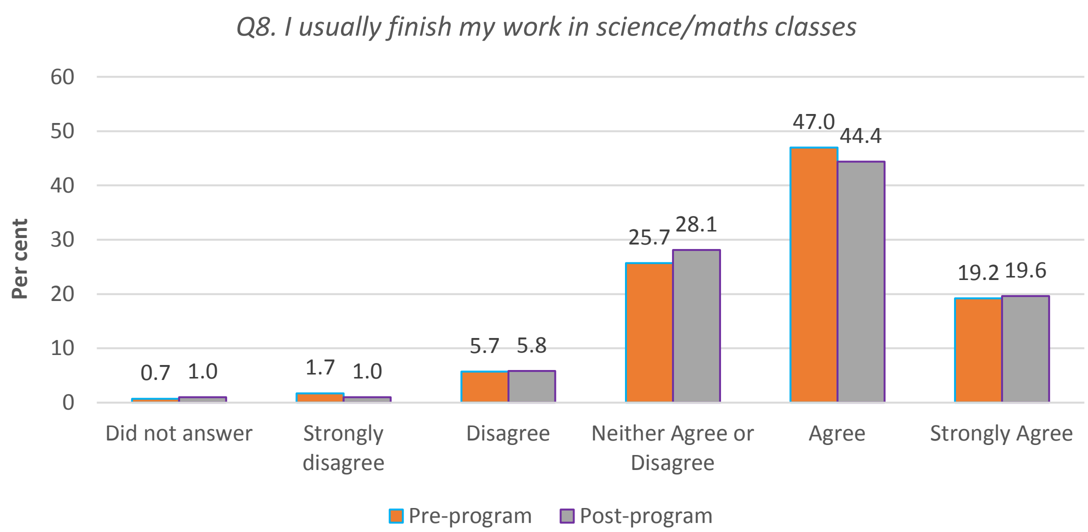


Q5. When I have trouble with a science/maths problem, I know how to find information to help me answer the question

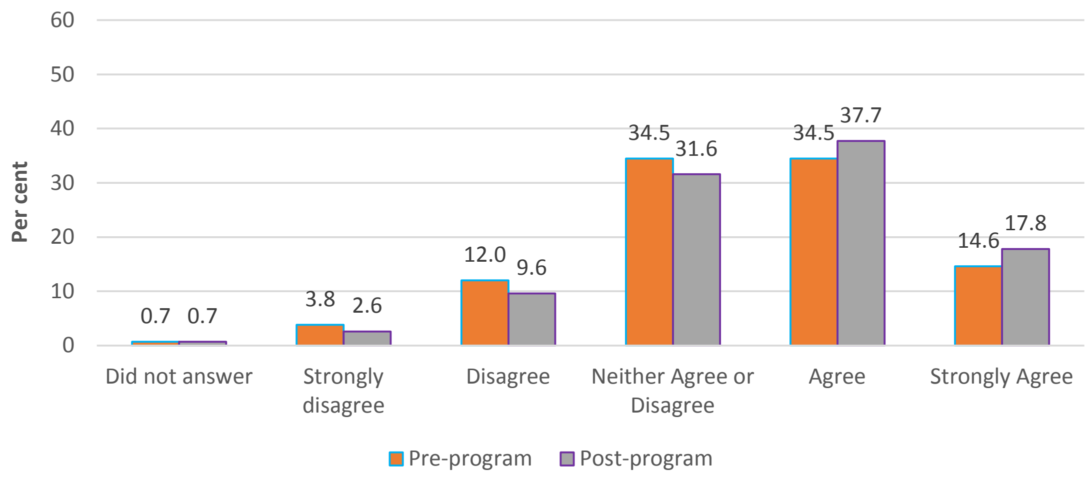



Q6. I enjoy figuring out answers to science/maths questions
Per cent
60
50
40
30
20
10
0
0.5 0.7
3.8 2.9
12.9 12.7
33.4 33.8
36.0 32.8
13.4 17.2
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree
Pre-program
Post-program

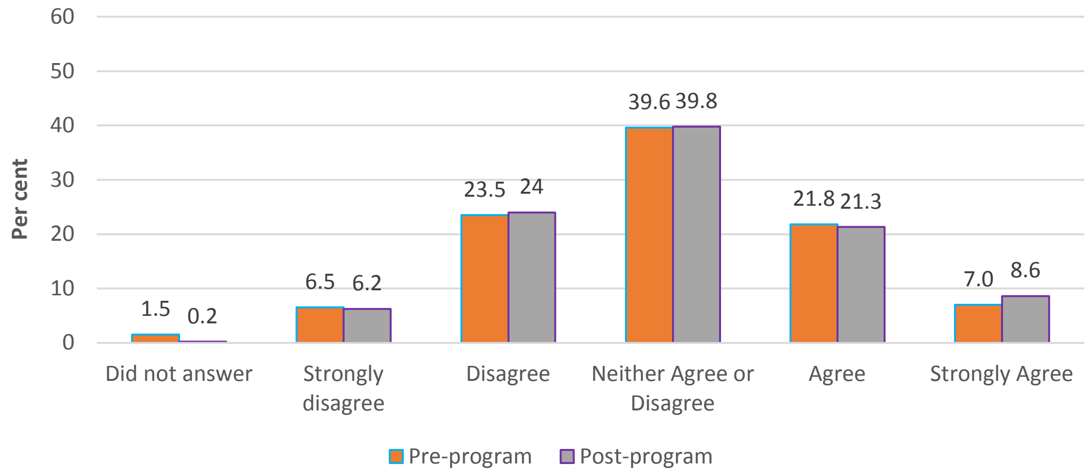

Q7. I'm confident I can understand science/maths concepts
Per cent
60
50
40
30
20
10
0
0.9 0.7
2.4 2.1
9.6 9.4
37.0 37
37.0 37.2
13.0 13.6
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree
Pre-program
Post-program


Q8. I usually finish my work in science/maths classes
Per cent
60
50
40
30
20
10
0
0.7 1.0
1.7 1.0
5.7 5.8
25.7 28.1
47.0 44.4
19.2 19.6
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree
Pre-program
Post-program

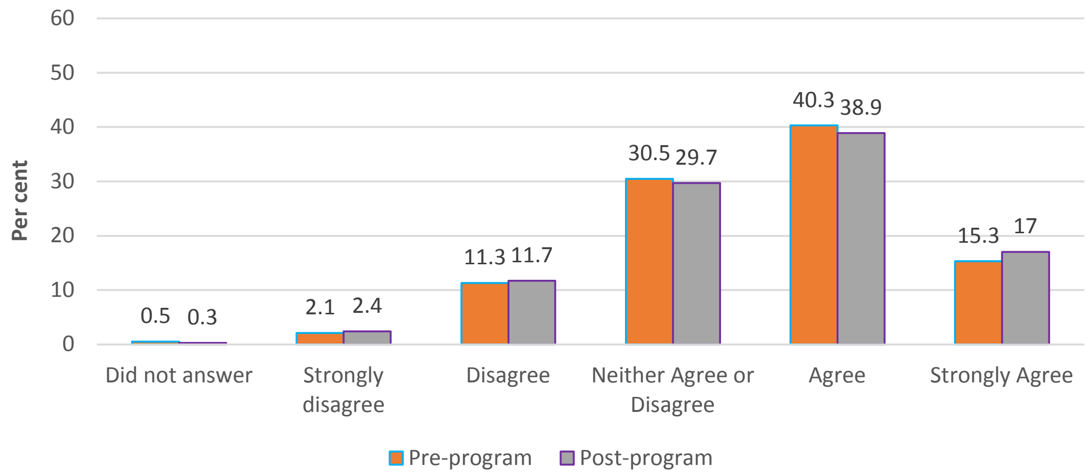
Q9. In my science/maths classes I learn things that I can use in my daily life



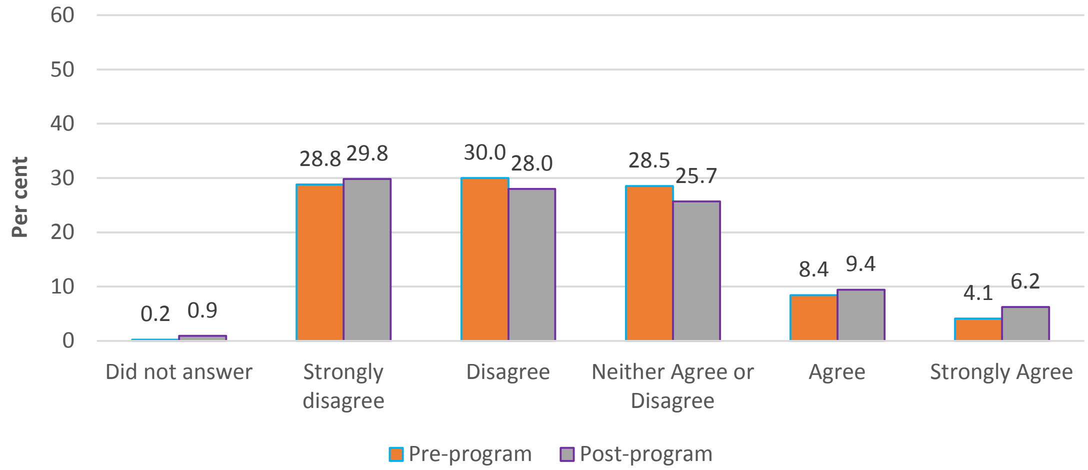
Q10. To learn science/maths, I only need to memorise facts and definitions



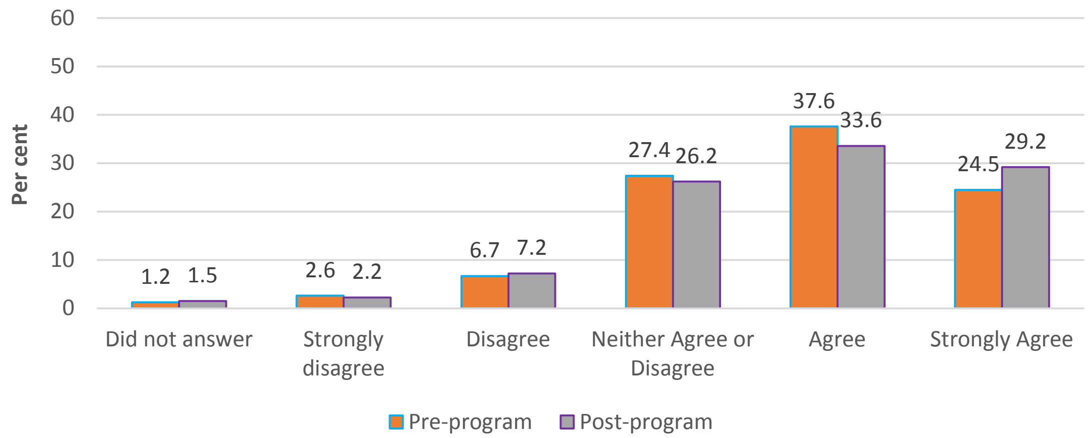
Q11. I can use what I've learned in science/maths classes in other classes



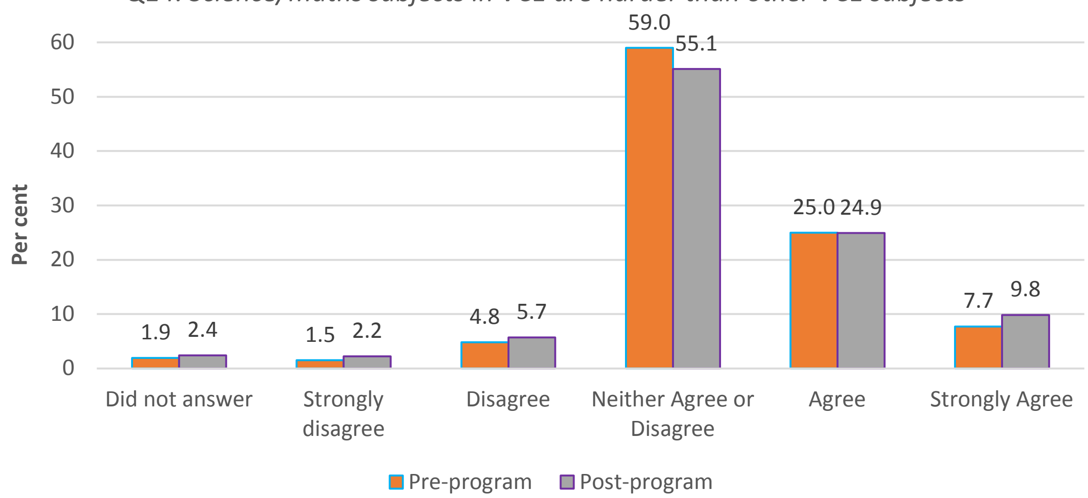
Q12. I would stop studying science/maths now if I could

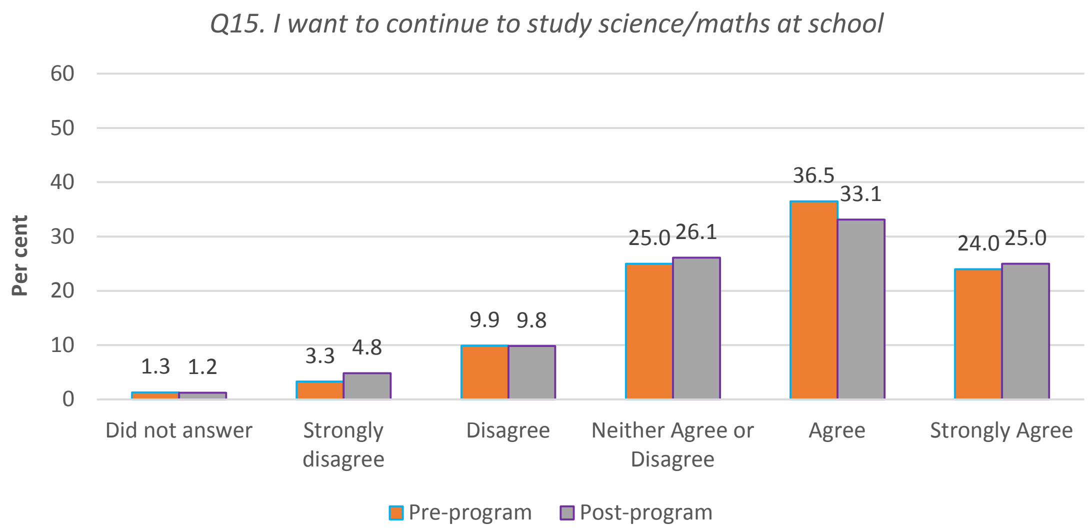


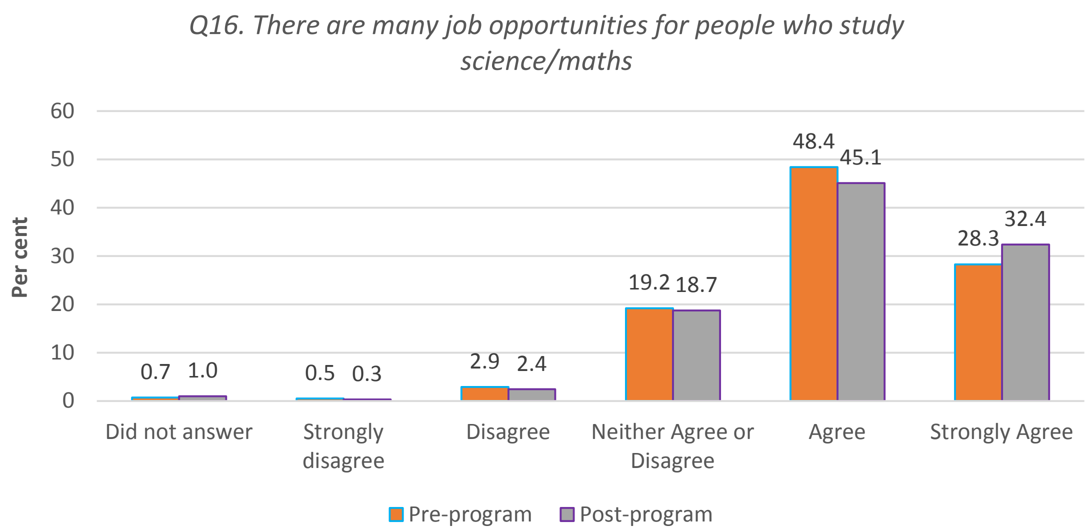
Q13. Studying science/maths subjects in VCE will help me get a job in the future

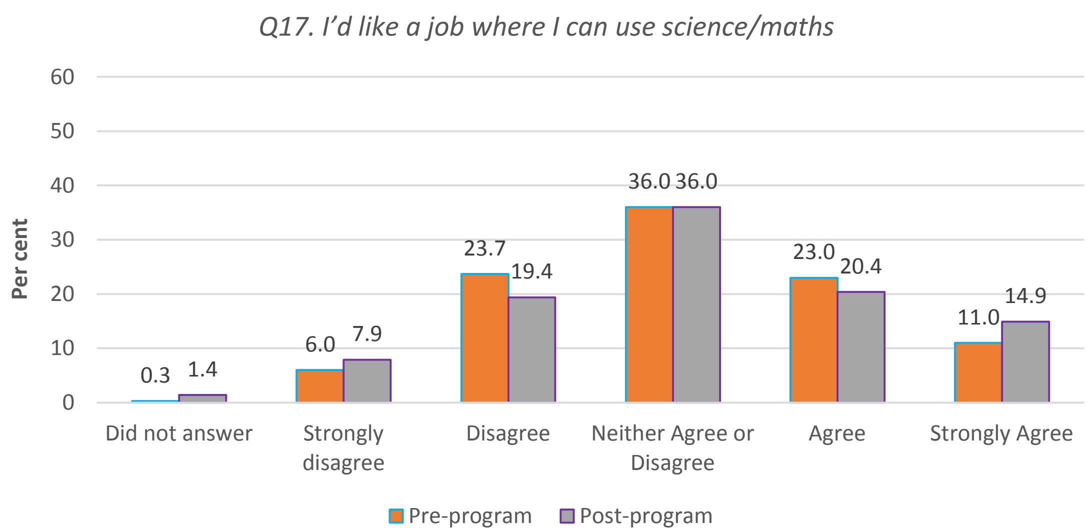


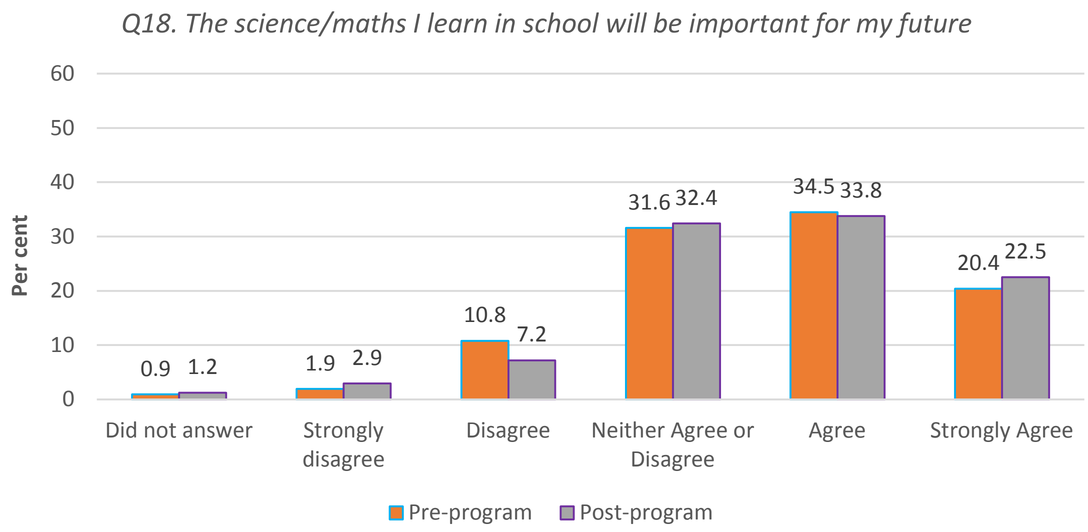
Q14. Science/maths subjects in VCE are harder than other VCE subjects

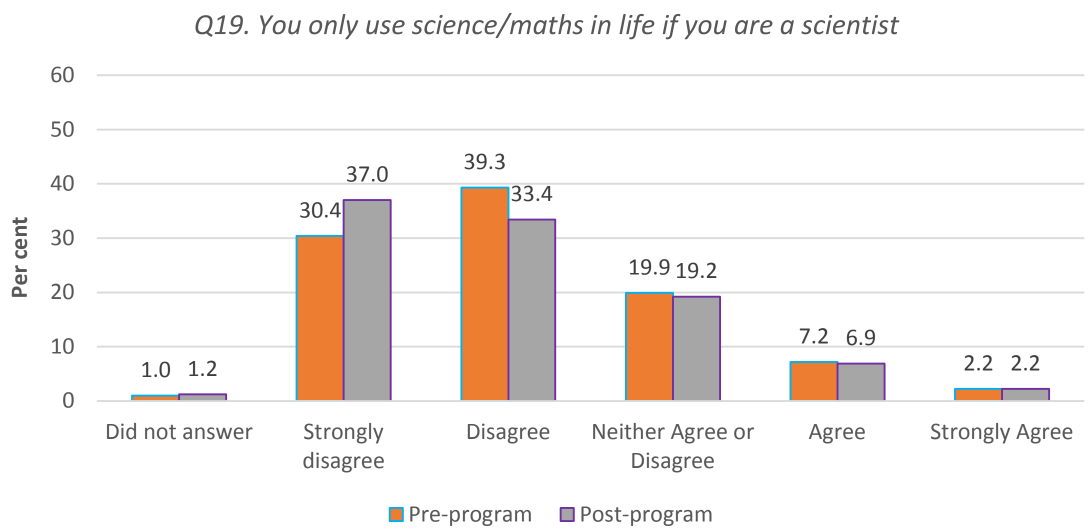



Q15. I want to continue to study science/maths at school
Per cent
60
50
40
30
20
10
0
1.3 1.2
3.3 4.8
9.9 9.8
25.0 26.1
36.5 33.1
24.0 25.0
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree
Pre-program
Post-program


Q16. There are many job opportunities for people who study science/maths
Per cent
60
50
40
30
20
10
0
0.7 1.0
0.5 0.3
2.9 2.4
19.2 18.7
48.4 45.1
28.3 32.4
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree
Pre-program
Post-program


Q17. I'd like a job where I can use science/maths
Per cent
60
50
40
30
20
10
0
0.3 1.4
6.0 7.9
23.7 19.4
36.0 36.0
23.0 20.4
11.0 14.9
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree
Pre-program
Post-program


Q18. The science/maths I learn in school will be important for my future
Per cent
60
50
40
30
20
10
0
0.9
1.2
1.9
2.9
10.8
7.2
31.6
32.4
34.5
33.8
20.4
22.5
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree
Pre-program
Post-program


Q19. You only use science/maths in life if you are a scientist
Per cent
60
50
40
30
20
10
0
1.0
1.2
30.4
37.0
39.3
33.4
19.9
19.2
7.2
6.9
2.2
2.2
Did not answer
Strongly disagree
Disagree
Neither Agree or Disagree
Agree
Strongly Agree
Pre-program
Post-program