

# Students' Views of Science: A Comparison between Tertiary and Secondary School Students

## Abstract

There is relatively little research evidence that documents current students' views of science – particularly a comparison of secondary and tertiary science. Further, little is known about how students' views of science differ according to level of study. This study provides evidence of students' view of science from both school and university students. The study uses a qualitative approach to examine how the views of secondary and tertiary students may be influenced by factors such as motivation, interest and career aspirations. Forty Australian students from a high school and a university completed an open-ended questionnaire to capture their view of science. The questionnaire results suggested that whilst the majority of students viewed science positively, with female students being more positive than males, their interest declined as they progressed to tertiary education.

## Introduction

The development of scientifically literate students remains one of the most important objectives in all domains and levels of science (Laugksch, 2000). However, a progressive decline in student enrolments in the sciences at both secondary school and university levels in industrialised nations is well-documented in Australia (Ainley, 1993; Fullerton, Walker, Ainley, & Hillman, 2003; Tytler, 2007), England and Wales (Brown, 2001), Germany (Riess, 2000), Japan (Goto, 2001), Canada (Bordt, De Broucker, Read, Harris, & Zhang,

2001) and the USA (National Science Foundation, 2002; 2004). This study will confine itself to Australia.

In Australia, the Australian Council of Educational Research (ACER) found that Australia faces significant challenges in boosting participation in science and mathematics studies at school and tertiary levels (Ainley, Kos, & Nicholas, 2008). The Australian Department of Education, Science and Training (DEST, 2003), revealed that there has been an overall decline in enrolment in undergraduate courses in the physical and natural sciences between 1997 and 2002. The decline has occurred against massive growth in higher education with student numbers doubling over the same period. The Victorian Parliament Education and Training Committee (VPETC, 2006) also expressed concerns about the declining enrolment of school graduates in mathematics - and science-based university and trade studies.

A number of Australian studies over the last two decades have shown a general decline in students' interest and enjoyment of science across the compulsory secondary school years, with a particularly sharp decline across the primary to secondary school transition (e.g. Adams, Doig, & Rosier, 1991; Goodrum, Hackling, & Rennie, 2001).

In a recent report, Masters (2009) revealed that:

“The average interest of Australian 15-year-olds in learning science is well below the OECD average and among the lowest levels of interest in the world. Queensland students' interest in science is below the Australian mean for each of the six science topics (physics, chemistry,

plant biology, human biology, astronomy and geology) and lower than in any of the 41 countries participating in PISA 2006”. (Masters, 2009, p. 27).

According to Speering and Rennie (1996), this decline in interest in science in the early years of secondary school is particularly of concern, since it is in these years that attitudes to the pursuit of science subjects and careers are formed.

At a time when Australia most needs them to carry the nation into a technologically-driven future, there are fewer students studying science. Despite the growth in the tertiary student population, the number of students studying STEM courses have decreased over the past decade (Birrell, Edwards, Dobson, & Smith, 2005; Dekkers & De Laeter, 2001) compared with the number of students studying arts and business courses.

Within the science community itself, there is increasing alarm at the declining number of students opting to undertake science studies at the tertiary level. For example, the Royal Australian Chemical Institute released a report on the supply and demand for chemists (RACI, 2005), which expresses concern at the decline in the number of students taking chemistry at university.

The Australian Council of Deans of Science (ACDS, 2003) reported that the proportion of university students taking physics subjects is now only two-thirds of what it was in 1989. The picture for chemistry is also gloomy and for mathematics it is even worse. Enrolments in mathematics fell from 7520 in 1989 to 4988 in 2005. Meanwhile, the number of secondary school students taking science in Years 11 and 12 has been falling

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steadily since 1976, and the proportion doing physics has almost halved (Wood, 2004).

The lack of interest and motivation in science among students as they move from school to university appears to be associated with a variety of factors; some are cognitive, while others are affective and attitudinal (Goodrum et al. 2001). It is possible that factors other than school preparation and negative attitudes towards science are affecting students' lack of motivation to study science. Students' negative perceptions of science and scientists, the ways in which science and technology are perceived by students and the public and taught at schools and universities, and low motivation in pursuing a career in science are but a few factors (Zeegers, 2004). Science education may have failed in its primary goal to promote science literacy and positive views of science.

A joint statement by the Australian Institute of Physics (AIP), the Royal Australian Chemical Institute (RACI), the Australian Mathematical Council (AMSC) and the Institute of Engineers Australia (IEAust) (National Initiatives in Education, 2001) defined 'the problem' facing science education in Australia in the following way:

"If the current rate of university (science) staff losses continues, there will be no chemistry, physics, mathematics and engineering (education) to support innovation (technological advance) beyond 2020"; and "If the current rate of secondary school participation in the enabling sciences continues, these sciences will disappear from the school curriculum by 2020". (Evans, 2001, p. 17).

According to Goodrum et al. (2001), almost 40% of Australian secondary school students indicated they were never excited about what they did in science, and 22% indicated that they were bored in science and will not continue with science when they leave school. Goodrum et al. (2001) argued that the science curriculum in most secondary schools falls short of expectation. They

concluded that as students move to secondary education, they feel disappointed that 'the science they are taught is neither relevant nor engaging and does not connect with their interest and experiences' (p. viii). Moreover, students' interest and lack of motivation in science drops dramatically as they moved from secondary education to tertiary education.

A recent review of the state of science in Australia by Tytler (2007) reveals that science education, as in other post-industrial countries, is in a crisis. Tytler (2007) shows that the "crisis in science education is neither confined to Australia, nor is the nature of governmental and professional concern peculiarly local" (p. 67). The UK, Germany, the USA and Japan face similar problems (Arthrop, 1998; Nature, 2002). In the UK and other Western countries there is continuing concern about the steady decline in attitudes towards science among young people and in the declining numbers of young people opting to continue science courses, particularly physics and chemistry, beyond the age of compulsory schooling or pursuing science-related careers (Osborne, Simon, & Collins 2003).

As a result of declining interest in science among secondary and tertiary students in Australia, there is a shortage of qualified scientists and science teachers, and the scientific literacy of the population is below an adequate standard (ACDS, 2003). The same can also be said about other industrialised countries such as the UK and USA.

This means that students finishing their education lack scientific knowledge. Schools and universities link the shortfall in highly-skilled science teachers in mathematics, physics and chemistry to the declining enrolment trends in science and mathematics subjects (Dobson, 2003; Thomas, 2000). In similar vein, Tytler (2007) quoted Jim Peacock, Australian Chief Scientist:

"The 'science crisis' experienced in Australia also exists in other countries, such as the United States of America and the United Kingdom. Australia can certainly lead the way

in 'reimagining' science education. We must continue to support our teachers with 'real' professional development, not just resources. We must raise the profile of our teachers and encourage young people to consider teaching as a career". (Tytler, 2007, p. vi).

Research indicates that school students perceive the traditional approach to science education as largely irrelevant to their contemporary life (Dekkers & De Laeter, 2001). For example, the Relevance of Science Education (ROSE) Project has found students across the developed world to be largely disengaged from science education (Schreiner & Sjøberg, 2004). After years of science education, misconceptions about science are common and lack of motivation and feelings of alienation show in the decreasing numbers opting to take science beyond the compulsory school years (Jenkins & Bell, 2006; Lyons, 2006). The result is a growing decline in the scientific literacy of the population and the democratic decision making process concerning scientific and technological projects (Riess, 2000). Hence, a broad scientific education for the population is more important today than ever.

While recent studies have concentrated on students' attitudes towards science (Lederman, Abd-El-Khalick, Bell, & Schwartz, 2002), students' images of scientists (Driver, Leach, Millar, & Scott, 1996; Song & Kim, 1999), students' perceptions of their science learning environments (Nolen, 2003), and changes in attitude about the relevance of science in high school science classes (Siegel & Ranney, 2003), they neglect to investigate motivational and affective factors that might be associated with students' lack of interest in studying science.

The decline in student interest in science reflects, at least in part, negative views of science and may be related to the decline in the image of science and a lack of understanding of science. It is possible that science education is not properly preparing students to function responsibly in a society that is affected

by science and technology (Aikenhead, 1980).

This study is primarily focused on gathering students' views on science, which is not commonly reflected in the literature. This study defines students' views of science as the personal attitudes students possess toward science subjects and their proclivity to respond positively or negatively towards science and careers in science.

There have been a number of studies that investigated students' attitudes towards science (Haladyna & Shaughnessy; 1982; Jenkins, & Nelson, 2005; Joyce, & Farenga, 1999; Rani, 2000; Simpson, & Oliver, 1985; Talton, & Simpson, 1985; Talton, & Simpson, 1986). With respect to attitude, there are two main categories: attitudes concerned with science education and attitudes towards science and 'scientific attitudes' (Gardner, 1975). According to Schibeci (1983), attitude towards science has a predominant affective orientation, whereas scientific attitude is predominantly cognitive. The latter involves individual's mindsets for working and thinking in scientific way, and is not considered in this study.

Because of its multifaceted framework, including affective, cognitive and behavioural components, it is difficult to define attitude (Nieswandt, 2005). In general, attitudes are the perceptions of students to respond positively or negatively to people, ideas or places. According to Gardner (1975), "a person's attitudes to science as a learned disposition to evaluate in certain ways objects, people, actions, situations or propositions involved in the learning of science" (p.2). Osborne et al. (2003) define attitudes towards science as "the feelings, beliefs and values held about an object that may be the enterprise of science, the impact of science on society or scientists themselves" (p. 1053).

In the absence of necessary reforms of science education at the secondary school level, there is a need to supplement scientific education with courses in history, philosophy and sociology of science with the aim of providing students with opportunities to critically examine

their views of science (Abd-El-Khalick, 2004).

The purpose of this study was to explore students' view of science to better understand the ways in which students' views influenced their academic and career choices. The present study focuses on two samples of students' views of science. The aim of the study was to explore students' views of science within two groups of students and to determine: (a) how students' views of science effect their planning to study, (b) whether students' views of science differ among the two groups of students, and (c) whether students' views of science differ according to gender.

### Theoretical Framework

The present study sought students' views of science to address the problem of declining interest in science. Students' views are assessed because students' thoughts, attitudes and judgement guide their decisions. The present study assumes that students' views of science play an important role in the behavioural choices and career decisions of students.

### Method

#### Research design.

This study is primarily focused on gathering data on students' views on science. The use of an open-ended questionnaire allowed respondents to state their views freely.

#### Participants.

The participants in the study were two groups of students from one secondary school and one university in an Australian metropolitan area. The first group was comprised of 20 Year 11 students (aged 16-17) with a mean age

of 16.4 years. The sample consisted of 12 males and 8 females taking elective senior science. The school was typical of many throughout Australia in that it included students from grade 7 to grade 12. Science was taught by qualified science teachers. Science is compulsory for all students in grades 7-10. Australia students must take science in Year 11 and 12 if they intend to continue studying science.

The second group was made up of 20 university students. The group was composed of 6 males and 14 females enrolled in undergraduate courses (Arts,  $n = 5$ ; Education  $n = 7$ ; Science  $n = 3$ ; Human Biology  $n = 2$ ; Chemistry  $n = 1$ ; Commerce  $n = 1$ ; Law  $n = 1$ ). Students' mean age in this group was 20.7 years (aged 17-32).

All participants were informed that their responses would be confidential, that their participation in the study would not affect their grades, and that participation in the study was entirely voluntary. After an introduction to the aim of the study, the participants were asked to answer 7 open-ended questions handed to them in the form of a questionnaire. No attempt was made to select a sample representative of the student population as a whole.

#### Questionnaire.

The questionnaire is composed of two distinct parts: Part I gathers demographic data about the participants background, such as their name, gender, age and the degree course they are enrolled in. Part II of the questionnaire consists of seven open-ended questions. (Table 1)

The seven questions were asked in a consistent order to provide the

Table 1. The Questionnaire

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1. Do you plan to study science at university? What motivates you to study or not to study science at university?
    1. What are your most important reasons for studying science/not studying science?
    2. What do you like/what do you not like about science?
    3. Upon completion of your study what would you like to do in your career?
    4. Do you consider there are any barriers or negative issues about studying science?
    5. Do you know students who do not like science?
    6. If you study science, are you planning to continue in science? Why?
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standardisation needed to maintain a focus. The questions were chosen after a review of relevant literature and dealt with students' motivation to study science, career goals, reason for studying science, enjoyment of science, view of science, barriers affecting students' decision, and students' inclination to continue studying science.

### Data collection and analysis

Data were drawn through the use of a questionnaire whereby students were asked to respond to questions about science. Data were coded so as to identify the emergent categories using the grounded theory approach (Strauss & Corbin 1998). In this approach, the categories emerge naturally from the data through engagement and re-engagement with the data. The researcher grouped the students' responses in categories and then studied the connections among them.

Students volunteered on an individual basis to be involved in the questionnaire after they were informed of the purpose of the study and assured of confidentiality. All participants were informed that their participation was

strictly confidential. The researcher conducted the discussion and administered the questionnaire. Each session lasted between 20 to 30 minutes.

During the discussions, each student was provided with a copy of the questionnaire. The questionnaire began by asking students to provide background information, such as name, school/university, age, gender and study major. Students were also asked to be clear and honest when writing their responses.

While a questionnaire was used, the researcher was present and responded to the students' description of influences in their decisions. To clarify or add any further information, each questionnaire was discussed with each participant and changes were made accordingly.

Students' responses were analysed for each question in turn. Categories of responses were identified and tabulated as either 'Negative' (e.g., "I do not plan to study science at university" and "I am not interested in science") or 'Positive' (e.g., "I do plan to study science at university") (Hogan, 1999; Strauss & Corbin, 1990). The researcher then categorized the different views of science that are present among the students. This

included the students' own views of science using individual examples. Direct students' quotes from the questionnaire were used as evidence to support the discussion. All names reported in quotes below are pseudonyms.

### Results

One of the key findings of the study was that students' views of science were positive. Using the constant comparative method (Strauss, 1987), similar characteristics of each category were grouped. Each category constitutes an umbrella category for a number of descriptive statements about science that are expressed differently among students but are directed towards the same larger view of science.

Students' personal responses show that the majority of students in both groups viewed science favourably. Generally, it was apparent that the majority of students, regardless of their grade level or gender, view science positively and see their interest in and enjoyment of science as the major motivational factors for studying science. Results are reported in Table 2 along with the number of male and female students.

Females seemed to have more positive views of science than males. Negative images of science seemed to be one of the most common factors contributing to students' avoidance of science. Some students had already made their final decisions and science was not part of their goal.

Only a small minority of the tertiary students who are studying science demonstrated lack of interest in a science career. Lea, a university Commerce student recalled her experience in school:

I studied Chemistry in year 11, but after the 1<sup>st</sup> semester I no longer enjoyed it. I really enjoyed it but the teacher didn't explain the concepts well enough. The lack of understanding frustrated me, leaving me to pull out of the subject. (Lea, Commerce).

#### Group 1: Year 11 students.

The participants in group 1 were 12 males and 8 females. After a short

Table 2. The Frequencies of the Student's Responses to the Questions

Question*	Category	Year 11 students (n=20)		University students (n= 20)	
		Male	Female	Male	Female
1. Motivation in science	Positive	8	7	3	10
	Negative	4	1	3	4
2. Motivating factor(s)	Positive	9	8	3	11
	Negative	3	0	2	4
3. Images of science	Positive	10	7	5	11
	Negative	2	1	1	3
4. Career goal	Positive	7	6	2	10
	Negative	5	2	3	5
5. Barriers to science	Positive	7	6	2	6
	Negative	5	2	4	8
6. Popularity of science	Positive	5	5	1	9
	Negative	7	3	4	6
7. Continuing in science	Positive	6	7	3	6
	Negative	6	1	3	8
Total	Positive	52	46	19	63
	Negative	32	10	20	37

\*For questions wording refer to Table 1

discussion about science, they all agreed to provide responses to the questionnaire. The following quotes are some of their responses.

When asked if they are planning to study science at university, the participants responded with confidence:

Yes, I do plan to study science at university, because I want to do sports science at uni. Motivations: probably the physical side to science where you get to do stuff. (Jenny, Year 11).

Yes, I plan to study science in university if I get there hopefully. I want to study medical imaging so I guess that's the only reason why, beside that I'm not keen to do science. (Emma, Year 11).

Yes, I plan to study science. The main reason is because I want to take courses majoring in engineering. What motivates me to study science is my aim to be an engineer. (Kenneth, Year 11).

Yes, I do plan to study science in university. Reasons are, science is much better than others such as Mathematics etc... what motivates me to study science is the constant knowledge that gets put into me, and me knowing that I am going to learn something interesting, is what motivates me. (Vincent, Year 11).

It was apparent in their comments that participants who are interested in science are planning to study science and possibly pursue a science career.

In a question about what are their most important reasons for studying science, nearly all (secondary school) male students responded positively.

More choices in university courses. Not sure what other subjects I can choose from besides science. Constant nagging from parents. (Vincent, Year 11).

Studying science is very interesting to me because really it is study of the world and matter so that is why I study science. (Anthony, Year 11).

Due to a high level of anxiety and a low level of confidence, some students find science boring and difficult subject. (Tosun, 2000; Lee & Anderson, 1993). One student, Vanessa, a Year 11 student, elaborated on some of the barriers faced by student doing science at schools.

Science can get boring at times. Too much study or rather you must study your texts to actually understand all concepts. (Vanessa, Year 11).

Most of the students show a good understanding of the usefulness of science to society, and a majority of the students find science interesting and seem to enjoy all aspects of it. However, this attitude does not always translate into a long term commitment as a career in science, particularly among university students.

Students' images of science were apparent in the students' responses. One of the students said during the discussion session, that Mahatma Gandhi once said;

He who invented the atom bomb has committed the gravest sin in the world of science.

However, the student admitted that he likes science and will pursue science for a good cause, such as medicine.

Be a doctor or physio – definitely a health professional. (Elyse, Human Biology).

As required in many university courses, students have to do science in order to enrol in courses that are not necessarily in the sciences.

Yes, because the career which I want to follow requires it, medical imaging, but overall if medical imaging didn't require science subjects then I would definitely not do any science subjects, besides human biology, because it is fun. (Emma, Year 11).

There was one student in this group who wants to be a pilot, although piloting involved some science about flying and navigating a plane. Hence, Anthony is aware of the need for a science course for his career as a pilot.

The patterns in the students' responses are somewhat similar. Because science is compulsory (until Year 10), students need to do science to further pursue their science study. However, to many, science is an interesting subject. As shown, students indicated that science provided further opportunities, and added to their knowledge. From the responses, it became apparent that most students in the study are motivated and are eager to study science. Hence, what a student experienced in school will impact his/her decisions and society in general.

### **Group 2: University students.**

The same questionnaire and procedure were used to collect data from university students, with slight modification to the questions to accommodate to the study science at university.

The following extracts are typical of this group of students answers to the question "What motivates you to study or not to study science at university?"

I am enjoying the course. I want to go on to study medicine and so that motivates me to study (I need good grades). I have recently discovered that I have a passion for science especially human science – i.e. Applying science to people. I want to help people and make a difference. (Elise, Human Biology).

I've always had a passion for science. I love learning about the way we've evolved, the human body and all facts to live. (Andrea, Human Biology).

What motivates me is the challenge to find things out. I enjoy the research (although at times can long and repetitive) side of science. I have found the course that I am studying very rewarding. (Rob, Chemistry).

In this group, female students viewed science more favourably than males. Answers indicated that early enjoyment of science or a lack of motivation in science can shape a student's experience. Students also indicated that loss of self-confidence and negative attitudes con-

tribute to negative view of science and lack of motivation to study science.

When asked what their most important reasons for studying science were, university students showed some differences in their responses from the high school students:

I like that it is relevant to day-to-day life/events. But this relationship was never drawn-out for us at school. (Christine, Diploma of Education).

I didn't have as much exposure to science based subjects in school, so I didn't really develop an interest. When I finally studied earnestly in Year 11, I didn't have a good enough understanding or concepts. (Lea, Commerce).

Little opportunity for creativity. Early work involves absorbing information, whereas study of humanities allows freethinking. (Simon, Media & Information).

Science is interesting and essential information for me. I think it's important to know what we are and where we're from. I also dislike science because of the big workload. (Elise, Human Biology).

I like science because it is interesting and factual, applies to everyday life. I dislike too much information to learn. (Andrea, Human Biology).

It is fascinating as it encourages the mind to leave more about its physical surroundings. Individuals who learn science begin to have a more profound knowledge about their existence. (Simon, Media & Information).

The majority of students show interest and enjoyment in science, however some students dislike science because they perceive science to be difficult, and thus students lack self-efficacy beliefs. It is clear to students why they are interested in science, and why they are not pursuing a science career.

[I like to] be a doctor or physio – definitely a health professional. (Elise, Human Biology).

I want to be a physiotherapist or sports trainer. (Andrea, Human Biology).

At the completion of my course I would like to become a chemical engineer. If this is not attainable then a career in research and/or development. (Rob, Chemistry).

Enjoyment of science and career goal are two of the most conspicuous factors motivating students to study science. The students are more interested in what they see as their future career. These comments suggest that students were motivated to pursue a particular career goal.

At the completion of my course, I would like to become a chemical engineer. If this is not attainable than a career in research and/or development. (Rob, Chemistry).

Despite all their enthusiasm in science, students indicated that science is a difficult subject and provided few opportunities for creative work. To some students, science appears to be 'cut and dried'. A few students commented on the fact that they felt unable to handle all the work required. Some of the students indicated during the discussion that they needed to work to 'earn some money,' and felt tired at the end of the day.

Throughout the discussion, the common trait is that students who are not interested in science do not want to have a career in science. When students asked about career choice and if they are planning to study science, the responses are varied:

Yes, for at least the next few years. To complete my course and get a degree. (Andrea, Human Biology).

Yes, the main reason I plan to continue is the pleasure I get out of learning and science to me is what everything is about. (Rob, Chemistry).

Yes, because I like the course and hope to become a teacher one day. (Jess, Early Childhood Education).

The university students showed little difference from the school students.

University students feel more independent and settled into their courses whereas school students are still searching for the right path. However, this study showed that both groups strive to achieve a particular goal.

The discussion ended by asking participants: "If you study science, are you planning to continue in science? Why?" About half of the students expressed lack of desire to continue in science. The following are quotes of recurring themes expressed by some students.

My interest in science ceased since high school. Science is destructive when not used ethically (Christine, Diploma of Education).

No, I am not. Not interested and you don't get much money from it. Also it seems too hard doing experiments and research. (Adrian, Year 11).

I don't plan to study science at university. I don't plan to be in a scientific career. I need it as prerequisite for university. (David, Year 11).

I do not like studying science because my interest in the subject ceased since high school when classes were boring and detached from reality. (Christine, Diploma of Education).

Science does not offer a sufficient creative outlet as Arts do. It is based on logic and static information rather than objective creations. (Simon, Media & Information).

I have done a science unit as part of my 1<sup>st</sup> year studies, and I didn't enjoy the course. (Shelley, Bachelor of Education).

I'm not studying science at university because there are no professions that I'm interested in that require me to study science. (Simone, Bachelor of Arts).

These comments reflect the students' general view of science by non-science students. Their approach to science is less favourable. The experience of these students raises issues about the nature of student motivation in science. Their reasons for not studying science are

typical of today's students (Goodrum et al., 2001; Tytler, 2007). While this study concerns Australian students, other industrialised countries such as the UK and the USA experiencing similar declining students' interest in science could benefit from the study.

### Discussion

The dominant view of science among the participants in the samples was that science is useful because science is inextricably linked to the well-being of humanity. However, students who are not studying science are not interested in science and believe that despite its usefulness to society, science is a difficult subject to master.

Some students show similar patterns in their responses, such as lack of self-confidence and concern for hard work. Other students express interest in science, but attribute their avoidance of science to the lack of opportunity and availability of career in science. However, according to Gogolin and Swartz (1992), if there is little interest in science, it is because students failed to develop and interest in science from early age.

The results of this study show that secondary school students view science less positively than the university students, particularly among male students. This difference may be due to students' individual experience in science. School students are still in the process of experiencing science, while university students have learned and experienced science and have better understanding of science and career aspirations.

The findings are consistent with the findings of a recent study (Hassan, 2008) using a larger and more representative sample of students and quantitative methods that found that university students' motivation and interests in science increase with the transfer from school to university. Further, a minority of secondary school students related their science experience to feelings of tedium as a result of rote learning and unenthusiastic teacher.

The findings underscored the difference in views among the undergraduate group. Female undergraduates showed

more positive views of science than male undergraduates. Indeed, female students showed more positive views of science in both the secondary and tertiary groups. The results demonstrate that the female students in the study hold favourable views towards science, and maintain strong career aspirations in science. Female students generally aiming at a career in science were more interested in biological science subjects, whereas male students were more interested in applied science subjects.

Finally, students' exposure to science and innovative programs such as cooperative learning and science-based projects may induce students' interest in science and enhance their views of science. Also, it is vital for science educators to contextualise science and makes it more relevant to students' everyday life.

While the study samples are small, the study showed that these students' views of science developed based on their experience in science. University students, particularly female students, showed more positive views of science than male students.

### Limitations

One of the limitations of the present study is that the samples of participants (total n = 40) were drawn from one university and one school and are not representative of the Australian student population as a whole. The study also focused on a specific number of questions without considering other variables that are likely to influence the outcome. Hence, the finding must be viewed in this context.

As for the method employed, the open-ended questionnaire has its limitation in examining students' views of science. The findings of this study indicated the need for further study into students' view of science. There is also a need to examine how student-teacher relations shape students' views of science, and identify specific teacher behaviours associated with students' views of science. The study leads to the conclusion that a similar study with a larger, more representative sample of students is needed to more

accurately identify factors associated with students' views of science.

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