MODESTUM

Research Article

Exploring the effect of the source of information on awareness of climate change in secondary students in the Gippsland Region

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ARTICLE INFO	ABSTRACT
	This study aims to ascertain the impact different sources of information have on secondary student awareness and understanding of climate change. This research presents the results obtained from surveys of secondary school students who carried out activities under the Gippsland ADAPT Program in the Gippsland Region of Victoria, Australia. The results suggest that students consider that they are well informed and that the main sources of information are social media, the Internet and television. The role of educators, family, scientists and environmental groups is also crucial in developing awareness of climate change.

INTRODUCTION

In the last decade, extreme weather events have increased, with global socio-economic impacts (World Meteorological Organization, 2023). According to the Food and Agriculture Organization (2022), the impacts of climate change and extreme weather events on poverty, nutrition and food security, have greatly heightened the need to address climate change. To mitigate the negative effects of climate change, environmental education (Henderson et al., 2017) and communication (Stevenson et al., 2017) have been identified as priority issues that must be addressed in local communities. McAfee et al. (2022) found that to achieve successful climate communication, connections and integration across several topics, and a more creative approach is key. This is particularly important for young people, as they experience diverse patterns of worry and increased climate concerns could be related to greater social engagement (Sciberras & Fernando, 2022). Efforts to educate young people about climate change can help them move past their skepticism, which is often influenced by their personal beliefs, and make them more open to understanding and caring about climate issues (Stevenson et al., 2014).

Raising awareness about climate change in young people can be addressed through a multitude of approaches (Ballard et al., 2024). For example, climate change education could go beyond cognitive and scientific approaches (Brownlee et al., 2013) and the attitudes, beliefs, and context of the students should also be considered (Mebane et al., 2023). Establishing connections between diverse experiences and information about climate change seems essential to engage students from a more affective or emotional perspective on the topic (Rousell & Cutter-Mackenzie-Knowles, 2019). Hands-on climate activities have been shown as an effective way to increase awareness about climate change issues (Croak & Walker, 2024; Monroe et al., 2017) and dissipate associated anxiety in youth (Olsen et al., 2024). Previously, Corner et al. (2015) claimed that communication or messages should be shared regarding the interests of young people, and it is crucial to understand the target group and consider the reliability of messengers. Research methods such as focus groups, interviews, and surveys allow researchers to understand audience perspectives and design strategies to frame messages (Brownlee et al., 2013). A challenge highlighted by Monroe et al. (2017) is that climate educators must create an inclusive learning space, where they can correct misconceptions about climate science and consider sociocultural influences.

Finally, educators or practitioners related to environmental science, science, geography and agriculture education should consider the impact of their own beliefs and attitudes regarding climate change. Reid (2019) notes that traditional educational and professional institutions do not yet require or support such training on how to address climate change. Nor are most educators required to participate in professional learning related to climate change education. Meanwhile, public debate about measures to address climate change is intensifying, and paradoxes about role of education and educators in addressing the climate crisis persist.

Furthermore, the effects of interventions targeting climate behavior differ among groups of people and specific behaviors (Vlasceanu et al., 2024). For instance, communications designed to make people feel geographically closer were successful in increasing climate concern and stimulating intentions to adopt mitigation behaviors, such as reducing energy consumption (Jones et al., 2017). Other possible interventions include collective actions, writing letters to future generations, reducing the psychological distance with climate change, work-together norms, among others, which have different effects on beliefs, political support or the way of sharing on social networks (Vlasceanu et al., 2024). Therefore, supporting educators through new pedagogical interventions and by offering professional development opportunities seems crucial to increasing the awareness of climate change (Olsen et al., 2024).

Agriculture is a significant industry within Victoria's Gippsland Region, Australia, accounting for $7 billion of the $16 billion gross regional product (Victoria State Government, 2020). Yet, there is the perception and misconception about the contribution agriculture makes to climate change and the adaptation actions being adopted. To address this misconception, a program was designed to investigate what young people perceive and know about climate change, with a focus on adaptation and mitigation actions that the agricultural sector is implementing. The Gippsland ADAPT Program aimed to educate the region's youth to address the effects of climate change on food and fiber production (Cosby et al., 2021). This program was funded by the Victorian Government's Department of Environment, Land, Water and Planning, and was designed and facilitated by the CQUniversity Australia Agri-Tech Education and Extension team with support from Food & Fiber Gippsland (2024). The program was designed to build capacity in the region's young people to respond to the impact of climate change on food and fiber production according to the regional priorities identified by the State of Victoria (2018). The priorities considered were building awareness of local adaptation activities and translating broad climate risks into examples of local impacts and how individuals, communities, businesses and organizations can act; developing practical advice and guidance on how to embed climate adaptation into decision-making; and developing tailored communications for the community to build awareness of the concepts of adaptation and mitigation within the region (State of Victoria, 2018).

This study aims to identify the awareness and understanding of climate change among secondary school students. The research questions that guided this study are, as follows:

1. Does the source of information affect awareness and perception of climate change?
2. What is the current state of knowledge of secondary students in Gippsland, Victoria around climate change?

MATERIALS AND METHODS

This study presents the results obtained from surveys of secondary school students who carried out activities as part of the Gippsland ADAPT Program (Cosby et al., 2021) in the Gippsland Region of Victoria, Australia. This study was approved by the CQUniversity Australia Human Research Ethics Committee (approval number #22569). By involving students from the Gippsland Region, the program encourages them to develop their awareness and knowledge through their networks such as schools, family and friends that has a local and relevant impact.

Data Collection

All students participating in the Gippsland ADAPT Program (Cosby et al., 2021) were asked to complete an anonymous online survey about their perceptions and knowledge of climate change. The online survey was hosted in Qualtrics and contained 15 questions that involved demographics, sources of information, self-perceptions of how well-informed students are about climate change, and their awareness and knowledge.

Data Analysis

For the statistical analysis, data are considered from surveys where students answered all 15 questions. Descriptive statistics was used to explore the population sample (age, type of school, and year level at school) and awareness questions from the survey. Students were asked about how well they think they are informed, their sources of information, and their trust in them. They were also asked about who they think should have primary responsibility for addressing climate change and how concerned they are about the issue. Depending on whether the categorical variables analyzed were ordinal or non-ordinal, the Chi-Square test (Fisher's exact test) and Spearman's correlation were used (Field, 2018).

Knowledge based questions included whether students could identify the difference between climate and weather, and examples of climate change, climate mitigation, and climate adaptation. To evaluate the level of knowledge regarding how to mitigate climate change, a score per student was calculated. The range (min-max) score varied between zero to three (three questions about knowledge in total, each of which provides a point or intermediate values depending on the level of correct response given by the student). To analyze the medians and the distribution of the knowledge scores obtained (continuous variable with non-normal distribution; $p < 0.001$, Shapiro test) a non-paramedical Kruskal-Wallis test was used (Corder & Foreman, 2014; Field, 2018) to compare demographics, how informed students believed they are, sources of information and concern about climate change.

All data were summarized using Microsoft® Excel® (version 2311) and statistical analyses were performed using IBM SPSS statistics (version 28.0.0.0 (190)) with a significance level of $\alpha = 0.05$.

RESULTS AND DISCUSSION

Secondary students (n = 151) from the Gippsland Region of Victoria in Australia, completed the survey. Of the students, 58.3% were female, 37.7% were male, and 4% preferred not to say. Regarding the type of schools, the majority of students attended catholic (64.9%), then state (30.5%) and followed by private schools (4.6%). In Australia it is compulsory to attend
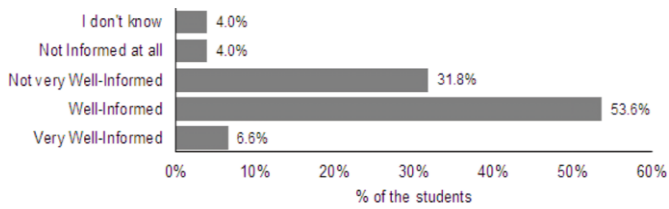
Figure 1. Student self-efficacy of knowledge about climate change (Source: Authors' own elaboration)
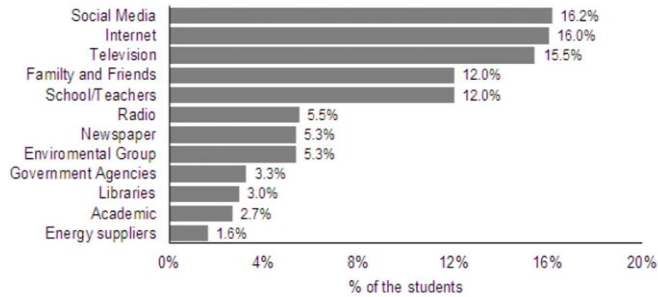

Figure 2. Frequencies of the platforms where students get information about climate change (Source: Authors' own elaboration)

secondary school from year 7 to year 10). The majority of the students were in year 10 (54.3%), then year 8 (17.9%), year 7 and year 9 (13.9% each).

Self-Efficacy of Knowledge

To understand the perception that students have about their level of knowledge about climate change, students were asked to rate how well-informed they believe they were about climate change (**Figure 1**). More than half of the students (60.2%) considered themselves well-informed and very well-informed. On the contrary, 35.8% of students believed that they were not very well-informed or not informed at all. Finally, 4.0% did not know. These differences in perceptions of information levels highlights knowledge gaps between participants. Similarly, Baldwin et al. (2022) reported a knowledge gap regarding contributors to climate change among secondary school students in Australia. For example, the authors find a gap in students' knowledge about their possible individual-level mitigation options regarding climate change. This is crucial because self-efficacy predicts positively on knowledge, engagement and exposure to climate change communication in the media concerning climate change (Loy et al., 2020).

Sources of Information

Students were asked about all of the sources where they obtained information about climate change. Most students got information from social media (e.g., Facebook, X [Twitter], Snapchat, and Instagram), the Internet and television sources (16.2%, 16.0%, and 15.5%, respectively). This was followed by personal connections from family and friends (12.0%) and their school or teachers (12.0%). Only a small proportion of students indicated traditional media sources such as radio (5.5%) or newspapers (5.3%), and environmental groups (5.3%). Finally, students got information from government agencies (3.3%), libraries (3.0%), academic journals/special publications (2.7%), energy suppliers (1.6%) (**Figure 2**) and
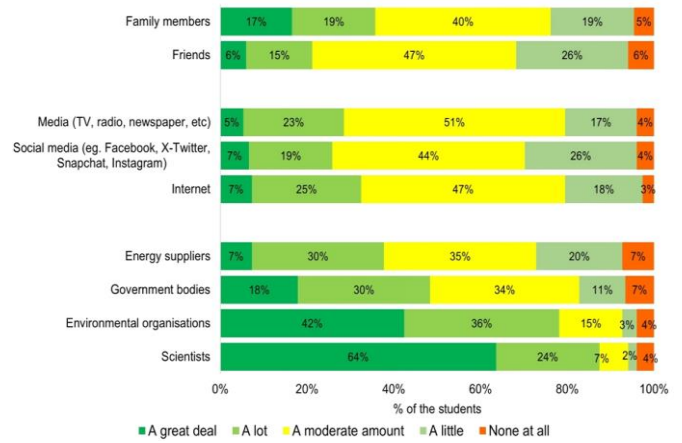

Figure 3. Levels of trust that students have according to the source of information (Source: Authors' own elaboration)

others such as fiction novels, books or influencers (1.6%). This is in slight contrast to what has been found in other studies in Australia. For example, Baldwin et al. (2022) reported that TV watched in schools is the main source of information related to climate change for secondary school students. However, Cosby et al. (2023) studying the perceptions and awareness of AGTech by New South Wales TechMand teachers, also reports that the main sources of information are the use of online media, followed by friends and family and traditional media. Willems (2012) highlighted the importance of using social networks, which provided connectivity, learning opportunities and a means of information for citizens. As young people's access to information through unmoderated or reviewed sources, such as social media, increases, the potential for misunderstandings about climate change to persist is high (Lee et al., 2020).

The results suggest that students consider the most used sources of information (social networks, the Internet, and television) but with a low level of trust. However, Dubovi and Tabak (2021) recently highlighted that videos on YouTube with scientific and educational content were among the top trending views, and therefore offer a potential avenue to increase student awareness of climate change. Ferreira et al. (2023) highlighted that the presence of a researcher in science videos related to ecological and environmental aspects legitimized the message. Although personal connections through family and friends were also a common source of information, the level of influence varied between them, with more trust in family than friends (Stevenson et al., 2016). However, student group activities in the classroom in schools are a valuable strategy to encourage peer discussion (Stevenson et al., 2014, 2016), but the discussion could be influenced by the knowledge and beliefs of the teachers into the classroom (Wang et al., 2019). Despite a small percentage of students indicating that academic publications and environmental groups are sources of information, these were a positively related to a high level of trust and sources of information that inspire the greatest confidence among students (**Figure 3**).

The Level of Concern About Climate Change

Climate change was an issue at the forefront and a high concern for students, with the majority indicating their level
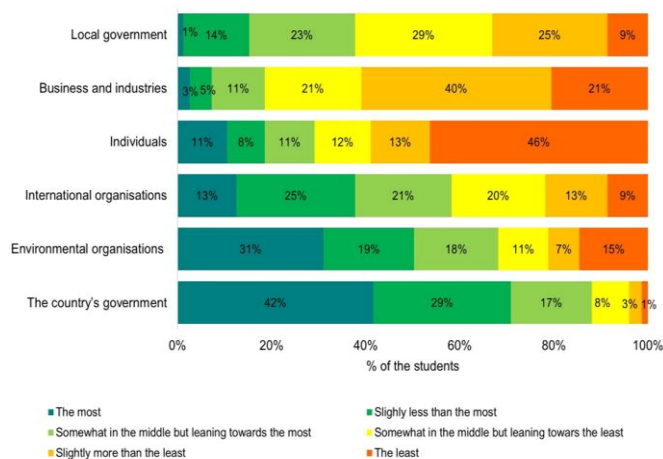
Figure 4. Frequencies of who has the main responsibility to address climate change by secondary school students (Source: Authors' own elaboration)
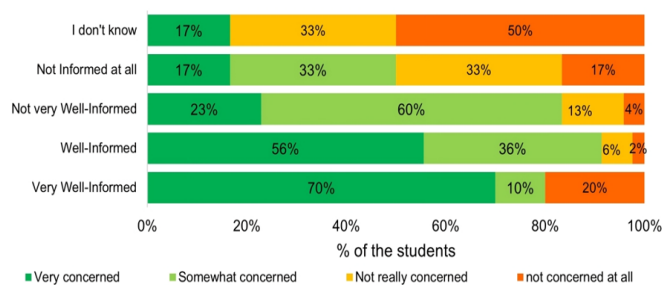

Figure 5. The proportion of students concerned with climate change depends on the level of information students consider they have (Source: Authors' own elaboration)

of concern as very concerned (43.0%) or somewhat concerned (40.4%). 9.9% of students were not really concerned and a further 6.6% not concerned at all (**Figure 4**).

This is in line with findings from surveys of high school students from the Noosa Council in Queensland, Australia (Baldwin et al. (2022), who reported that 52% of students were concerned or very concerned about climate change effects. However, of the students surveyed in this study,46.4% of students identified that individuals have the least responsibility to address climate change. The majority of students (54.3%) were in year 10 (15-16 years old), and according to what was found by Busch et al. (2019), young people in higher year levels have less confidence in being able to influence climate change. Students responded that the country's government and environmental organizations have the greatest responsibility to address climate change. These results are in line with Corner et al. (2015), where young people tend to consider governments as primarily agents for addressing climate change. Although they also found that young people don't have a clear vision of what their individual contribution could be to mitigate climate change issues.

To analyze the relationship between the level of information that students consider they have and how concerned they are about climate change, Spearman's correlation was performed. The results suggest a positive correlation (0.374; p < .001) indicating that the level of concern increases as students perceive themselves as well-informed. Of

Table 1. Student agreement regarding statements related to climate change

Statements	A	M ± SD
Climate change is happening right now.	>	0.73 ±1.21
It poses a serious threat for people around the world.		0.79 ±1.16
It is caused by human activities.		0.91 ± 1.08
Global temperatures have changed compared to the previous decade.		0.95 ±1.22
Each one of us can reduce the effects of climate change.		0.98 ±1.20
I would like to learn more about climate change at school.		1.16 ±1.25
Climate change problems and its impacts are underestimated in the news.		1.25 ±1.16
It poses a serious threat to me and my family.		1.30 ±1.17
I completely understand what climate change means.	<	1.52 ±1.11

Note. A: Agreement; M: Mean; & SD: Standard deviation

the students who consider themselves very well-informed, 70.0% are concerned about climate change. At the other extreme, 50.0% of students who could not indicate or self-know the level of information they have, are not concerned at all with climate change (**Figure 5**).

Of the students who responded that they were not very well informed about climate change, 60.4% of them responded that they were somewhat concerned. These results align with Sciberras and Fernando (2022) who reported Australian adolescents who experience low levels of concern about climate change when less engaged with news and current affairs. Despite the positive correlation in this study, it is not possible to conclude about the cause-consequence of the association, that is, it cannot be stated that greater concern for the environment motivates students to be more informed or vice versa. However, Mebane et al. (2023) suggests that through an integrated approach (traditional science, ecological and affective education, and psychology), there is the potential to make students more aware of environmental problems and encourage climate actions.

Students were asked about the level of agreement regarding statements related to climate change. **Table 1** shows the average values and deviations obtained (lower values indicate higher levels of agreement). Students strongly agreed and agreed that climate change is happening right now (60.9% and 22.5%, respectively). This slightly differs to global results where a high proportion of people across a diversity of cultures and ages from 63 countries have a high level of belief in climate change (Hannah, 2024; Vlasceanu et al., 2024). Large-scale analyses demonstrate that initial beliefs regarding climate change would affect the expected outcomes of activities or behavioral interventions to mitigate climate change (Vlasceanu et al., 2024). Additionally, of the students, 29.8% strongly agreed and 33.1% agreed that climate change problems and its impacts are underestimated in the news. Guenther and Brüggemann (2023) reviewed how journalistic media present themselves concerning future climate scenarios, which could affect how the audience's daily life experiences and climate change awareness are connected. However, Sparkman et al. (2022) indicated that conservative news in the USA could be linked to increased misperceptions about the level of support for significant climate change mitigation policies and the extent of concern about climate
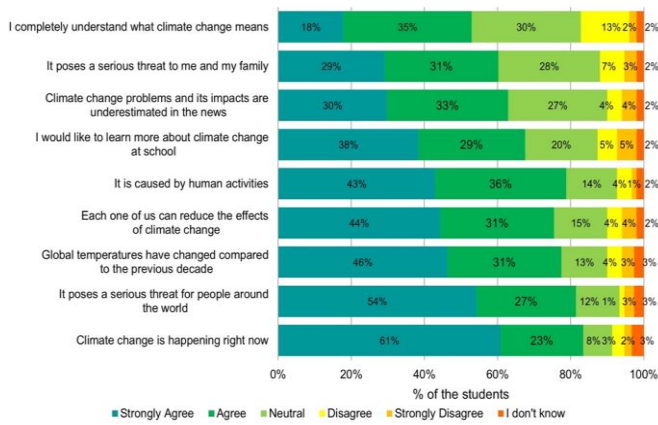
Figure 6. Frequencies of how students agree with sentences related to climate change (Source: Authors' own elaboration)

Table 2. Student agreement regarding statements related to climate change and the actions they would like to follow

Statements	A	M ± SD
I would like to be more proactive about climate change.	>	0.99 ±0.93
I would encourage others to be more proactive about climate change.		1.09 ±0.93
I would like to participate in climate action activities outside of school.		1.88 ± 1.21
I would like to become a member of a school-based climate action group.		1.98 ±1.22
There are more important matters than climate change.		2.03 ±1.09
I would like to join a climate action group outside of school.	<	2.30 ±1.10

Note. A: Agreement; M: Mean; & SD: Standard deviation

issues, often underestimating both. This highlights the importance and impact of how environmental issues are addressed in the media. Only between 2% and 3% of the students in this study answered I don't know through all the statements, indicating that the majority of students perceived themselves to have sufficient climate change knowledge to answer the questions Furthermore, only a small proportion of students disagree and completely disagree (13.2% and 1.9%, respectively) that they completely understand what climate change means (**Figure 6**).

In regards to students wanting to learn more about climate change at school, 10.6% of students disagreed and completely disagreed (5.3% and 5.3%, respectively). The results suggest that although there is a high proportion of students who believe in climate change, there is still a need to improve their understanding. Misinformation about scientific and controversial environmental issues such as climate change and global warming are considered major concerns (Oliveira et al., 2024) and to address this problem credible information is required, but it has been acknowledged that it might have a limited effect due to prior beliefs about climate change.

To motivate attitudinal transformations concerning climate protection, it is important to focus on positive emotions such as pride, optimism or courage (Harth, 2021). To analyze motivational attitudes, students were asked about the level of agreement regarding the actions they would like to follow. **Table 2** shows the average values and deviations obtained (lower values indicate higher levels of agreement). Knowing motivational attitudes will allow the design of effective strategies to encourage climate change mitigation actions. The survey results suggest that students would not be willing to join after-school programs, even though they would like to be more proactive regarding climate change. An example of successful programs is 4-H agriculture in the USA (Nation's Cooperative Extension System and USDA, 2024) that provide young people with knowledge about environmental sciences and ag-sciences, through local clubs, educational institutions and grant-funded initiatives. Eilam (2022) emphasized that for climate change education to be effective, it must be considered in educational curricula with a disciplinary approach and not just included transversally in other disciplines. Successful examples of interventions can be found such as the Future Generation Project in Italy (Mebane

et al., 2023), the CO_2 League Program in Czech (Kolenatý et al., 2022) and also in other agricultural domains, such as the GPS Cows Program aligning with numerous outcomes outlined in the new South Wales (Australia) stage 4 technology mandatory syllabus (Manning et al., 2022).

State of Knowledge About Climate Change

The overall results of the assessment of knowledge about climate change were obtained from 151 students. The overall mean was 1.85 ± 0.52, the median was 1.94 and the mode was 1.75. Across all students, the range was from 0.0 to 2.75. The students answered the following questions:

1. Climate and weather are the same thing?
2. Match the correct term climate change, climate mitigation and climate adaptation) to an example (6 provided)
3. Which of the following adaptation strategies are being used in the agricultural industry? (8 provided).

Only the correct options were considered and the maximum final score for each question was one, therefore the maximum score to achieve was 3. According to Kolenatý et al. (2022), knowledge is a crucial initial driver for young people to adopt actions related to climate change. The results suggest that the level of knowledge obtained by the students was adequate, but it was also analyzed based on demographic and attitudinal factors.

The normal distribution of the final scores was analyzed with Shapiro-Wilk test and presented a non-normal distribution ($p < 0.001$). To analyze the relationship between the demographic categorical variables (gender, type of school, and level year), the perception of being well-informed with the results of scores by students and how concerned about climate change were students, the Kruskal-Wallis tests were carried out. No differences were found between the medians and the distributions of the score obtained according to gender, type of school, level year or the perception of being well-informed about climate change. However, the median ($p < 0.001$) and distribution ($p = 0.003$) of students' scores showed statistically significant differences depending on their concern about climate change (**Table 3**). This is in line with what was found by Busch et al. (2019), who found that knowledge and social norms are significantly correlated. An effect of gender on knowledge was not found in this study and is in contrast to

Table 3. Effect of demographics and perceptions on the score result

Independent variables	Tests (p-value)	
	Median	Kruskal-Wallis
Gender	0.668	0.972
Type of school	0.176	0.241
Year level	0.619	0.267
Perception of being well-informed	0.359	0.292
Concerned about climate change	< 0.001*	0.003*

Note. *Level of significance p < 0.05

Table 4. Effect of demographics and perceptions on the score result

Sources	Tests (p-value)	
	Median	Kruskal-Wallis
Television	0.870	0.845
Radio	0.370	0.358
Newspaper	0.063	0.149
The Internet	0.353	0.149
Social media	0.976	0.988
Academia	0.178	0.226
Environmental group	0.009*	0.028*
School/teachers	0.011*	0.016*
Government agencies	0.740	0.500
Libraries	0.195	0.120
Family and friends	0.011*	0.022*
Energy suppliers	0.487	0.656

Note. *Level of significance p < 0.05

Stevenson et al. (2016), who found females to be more concerned about the effects of climate change. Some possible reasons are greater sensitivity of women related to climate change (Carrier, 2009), or thinking more oriented towards the future with environmental values (Joireman & Liu, 2014) and higher level of worry than men (Clayton et al., 2023). However, Clayton et al. (2023) maintain the need to continue researching demographic variables given the contrasting results in various studies.

To analyze whether the source of information has an effect on the score obtained by the students, the Kruskal-Wallis tests were carried out. The sources of information that have a significant effect on the level of knowledge are the environmental group (p = 0.028), school/teachers (p = 0.016) and family and friends (p = 0.022) (**Table 4**).

Figure 7 shows the frequencies of the scores obtained for the three sources of information that had an effect (**Table 4**). In all cases, the selection of the information source increased the frequencies of high values of the final score obtained on the level of knowledge. An observation very similar to that found in this study was also recently raised by Stevenson et al. (2016), where personal acceptance or belief was a predictor of concern about climate change, but this interest can be further developed through encouraging communication among family and friends. This is important considering the levels of trust that students have in environmental groups and families, and that 67.5% of students would like to learn more about climate change at school.

Ramadani et al. (2023) reviewed the effectiveness of several school programs with heterogenous interventions (e.g., classroom instruction, online conferences, or education program in school) and concluded that the programs that were effective in increasing the knowledge, attitudes, and perceptions related to climate change issues. According to the author, diverse aspects should be considered to achieve the effectiveness of schooling programs, such as teacher knowledge or methods of teaching. Also, Wang et al. (2019) found in the USA that teachers are struggle with to understand whether climate change is natural or anthropogenic, how model-based data work, and identify relevant topics to align with school curriculum. As a result, the time and effort spent in the classroom related to climate change varies among teachers.

Longitudinal research to analyze the long-term impact of educational programs in schools that integrate knowledge and community psychology related to climate change is recommended (Mebane et al., 2023) similarly to Sciberras and Fernando (2022), who reported schools and families are important sources of information to increase knowledge about climate change. Additional training for parents and teachers to support children and adolescents with concerns related to climate change is required to provide constructive responses to environmental problems.
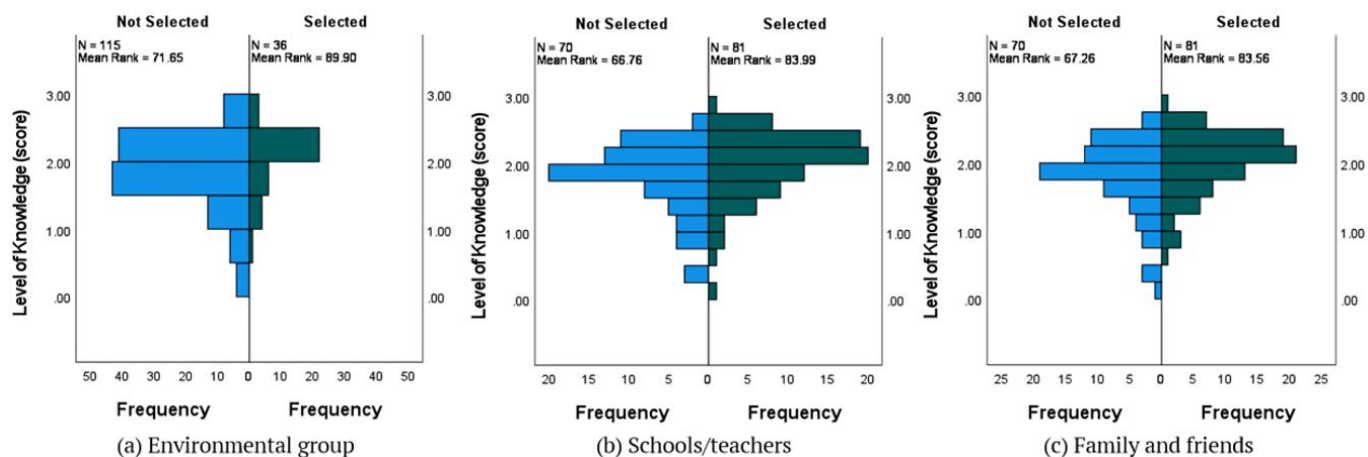

Figure 7. Frequencies of scores obtained depending on the selection of or as a source of information (Source: Authors' own elaboration)

Limitations

The limitations of this research are related to the population sample. The data analyzed in this research only correspond to a specific geographic area of Australia, so it is only possible to conclude about the population area under study. There could be a bias in the students who participated, since the teachers decided to bring the students to participate in the project, so they probably had an interest in climate change, and as we discussed above, it could probably affect their teaching. Another limitation is that at the time this study was conducted, we did not have information about what students were learning in class at that time and whether this affected their responses.

Implications

The practical application of this research is to gain a better understanding of where students learn about climate change and what are their reliable sources of information. This will help guide communication aimed at young people to increase their knowledge about climate change and strategies to mitigate it.

CONCLUSION AND FURTHER RESEARCH

Effective communication regarding climate change is an area that has gained relevance in recent years. This is particularly important considering young people and their attitudes and beliefs. This study highlighted the awareness and understanding of climate change of high school students in the Gippsland Region of Australia. More than half of the students (60.26%) considered that they were well-informed and very well-informed about climate change. Although social media was the main source of information, the levels of distrust towards that source were high. Students had higher trust for scientists, government and environmental organizations as sources of information about climate change. Yet, despite high levels of concern about the effects of climate change, students consider that individuals have less responsibility than organizations when taking action to mitigate climate change. Climate change literacy in schools appears to be crucial to increasing knowledge and concern among young people and transforming it into positive action measures through greater social engagement. Future research should consider interviews with students to get greater in-depth knowledge of the reasons behind their answers and find out how students would like to learn about climate change. Also, research to understand knowledge and perceptions of teachers and the impact this has on their teaching.

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