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# The link between social media exposure and students' moral reasoning and environmental concern: A generational analysis in Chile

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**Abstract:** Currently, social media is a fundamental source of information for higher education students, and universities are seeking to strengthen the ethical training and environmental concern of their students enrolled in engineering and business careers since they should lead teams and make relevant decisions in private or public organizations, affecting their subordinates, clients, suppliers and the environment. There is little information about the relationship between exposure to social media platforms and the level of moral reasoning and environmental concern of students enrolled in these areas, differentiating such relationships among younger students who are part of the centennial generation and older ones. To address this knowledge gap, this research analyses the responses of 237 Chilean engineering and business students to an online self-report survey through the Mann-U Wilcoxon test and Spearman correlation coefficients. Students were selected through convenience sampling during the 2020–2021 academic year. The results suggest that there is a positive relationship between the frequency of exposure to social media and the aforementioned concepts and that this relationship is more prominent in the centennial generation. Significant differences among the social media platforms are also supported. WhatsApp is a more transversal social media platform that shows significant correlations in both the younger and older students. This research highlights that social media platforms can be a relevant tool to strengthen the moral reasoning and environmental concern of engineering students who will lead people in organizations.

**Subjects: Instructional Communication; Environmental Communication; Adult Education and Lifelong Learning; Higher Education; Sustainability Education, Training & Leadership**

**Keywords: social media; moral reasoning; environmental concern; higher education; centennial generation**

## 1. Introduction

By the end of 2022, 3.96 billion people will be users of social media; among the most used platforms, Facebook stands out in the number of users by reaching approximately 2.7 billion people in 2021 (Statista, 2022). Since their creation and massification, social media have transformed the way that people around the world receive information and communicate with each other. In last years, social media platforms have facilitated interaction between people and the viralization of content in virtual communities (O'Connor, 2013; Samghabadi et al., 2017). Recent studies have recognized the benefits of social media in higher education teaching (Chugh et al., 2021; Rahman et al., 2020) and have suggested strategies for its use as a tool to facilitate the

learning process (Mostafa, 2015; Berlin & Weavera, 2021; Mehrpouyan et al., 2021). These studies have also highlighted the potential of social media in teaching processes, pointing out that there are still ample opportunities to develop its use for the training of professionals (Ali et al., 2020; Eubanks et al., 2021).

One area with limited information available to date is the relationship between exposure to social media and the expression of moral reasoning and environmental concern in university students. Moral reasoning is especially relevant to the training of adult engineering and business students, since they will be involved in making investment decisions and marketing products, leading people and utilizing environmental resources. In this sense, it has been highlighted that company management with low ethical standards implies high psychological damage in subordinates (Ambrose, 2021) and high costs due to turnover and job abandonment (Cialdini et al., 2021). Complementarily, it has been argued that leaders with low environmental concern tend to invest in and develop products or promote regulations that generate high pollution, toxic waste and misuse of natural resources (Mnyaka, 2019; Morrison, 2005; Palazzo, 2007); therefore, several universities, including those located in Latin America, are making efforts to promote environmental concern among their students enrolled in engineering and business careers.

Moreover, for decades, it has been recognized that information sources affect attitudes, perceptions and actions of the population. In this sense, the effect of social networks has been supported by several theories associated with information processing. A referential framework is social network theory, which defines a social network as "a set of individuals, organizations or other social entities, connected by a set of socially meaningful relationships" (Lea et al., 2006, p. 121). This perspective implies that people become involved in social networks seeking a wide range of economic, social, emotional and psychological benefits from others (Granovetter, 1983). According to S. Kim et al. (2018), network theory supports that online social networks play an important role in determining individual values and actions, and therefore, the network of relationships in which individuals are embedded is very important to explain their behaviours. From this perspective, social media exposure could affect the moral reasoning and environmental concern of engineering and business students, according to the information they frequently read from these sources.

A second referential framework regarding the influence of social media is two-step flow theory and the follower context, which are related to news selectivity models (Sears & Freedman, 1967). This theory asserts that opinion leaders affect the opinions of others close to them, a process of information gathering that is sometimes referred to as "two-stage flow." Initially, opinion leaders transmitted media messages to others who were not as frequently exposed to them (Katz & Lazarsfeld, 1955); therefore, they are receivers of information who synthesize, analyze and process this information to subsequently transmit it to other people (Lazarsfeld et al., 1968). This perspective states that people tend to choose well-known and reliable information sources as trusted news programs on television; therefore, information comes from selected information sources. In similar sense, in the social media environment information is exposed from several sources suggested which are defined by social media algorithms or by influencers, friends and followers (Messing & Westwood, 2014); hence, people read content based on their past online behaviour and are also exposed to the topics of interest of these prominent individuals who can play the role of opinion leaders.

As has been pointed out, there is currently little knowledge about the relationship between the reading of massive social media, such as Twitter, Facebook, Instagram, WhatsApp and YouTube, and the expression of moral reasoning and environmental concern of university students enrolled in engineering and business careers. In Latin America, this information is relevant because environmental sustainability and professional ethics are two topics that have been highly promoted during the last decade by organizations composed of Latin American universities, such as the Latin American Network of Social Responsibility (Cladea, n.d.). Moreover, a high percentage of

higher education students in Latin America select careers associated with business administration or engineering (Avenu Learning, 2021), and universities aspire to provide them with ethical behaviour and environmental concern, as these are qualities necessary in future business and government leaders who will impact the welfare of countries through their decisions. Likewise, job recruiters look for candidates with professional ethics.

This research seeks to address the knowledge gap that has been raised; therefore, This research aim to assess the link between the frequency of exposure to social media sites highly used in Chile and the expression of moral reasoning and environmental concern, comparing the results among engineering and business students who integrate the centennial generation, called digital natives (Kleinjohann & Reinecke, 2020), and older students who tend to use more traditional media and who have learned to use social media after its creation. This comparison is valuable because higher education institutions could use social media to strengthen moral reasoning and environmental concern, according to the students´ age and the social media platforms they use most frequently. This result is also consistent with previous research that has shown significant differences across age generations regarding social media use (Kezer et al., 2016; Auxier & Anderson, 2021), moral judgment (Huang et al., 2021; McNair et al., 2019), and environmental concerns (Kim et al., 2020; Kymäläinen et al., 2021).

The responses to an online self-report survey of 237 students enrolled in engineering and business careers at University of the a Américas in Chile were analysed through the Mann-U Wilcoxon test and Spearman's correlation coefficients. The students born since 1997 (18–24 years old) were incorporated into the centenarian generation, according to the definition of this age cohort posited by McGorry and McGorry (2017). Older students range from 25 to 50 years old, including students from the millennial generation who were born between 1980 and 1996 (Van den Bergh & De Wulf, 2017) and students from generation X who were born between 1965 and 1979 (Lyons et al., 2012). This study is presented using the following structure: first, the theoretical framework is developed, and the research hypotheses are proposed; second, the methodology and methods of the study are described, including the measurement instrument, sampling information and analysis techniques; third, the results obtained through the application of statistical parameters are presented; finally, the discussion, conclusions, limitations and future research sections are explored.

## 2. Literature review

### *2.1. Moral reasoning and social media*

Moral reasoning is defined as a conscious mental activity that consists of transforming information given by people to determine a moral judgment (Haidt, 2001). It can also be defined as the sum of all conscious mental processes that enable people to reach a moral judgment (Moll et al., 2005). Complementarily, prosocial moral reasoning is defined as decision-making designed to help people who are in danger or need due to the absence of protective social customs, laws, or rules (Eisenberg et al., 2006). Jensen (2020) has argued that moral reasoning is an important intra- and interpersonal psychological phenomenon for the completion of individual and collective moral judgements and behaviours, i.e., that it influences evaluations of facts and actions in different spheres of human beings.

Research published in recent years has analysed the effects of moral reasoning on various dimensions of life. Zhao et al. (2022) supported that moral reasoning moderates the relationship between people's creative potential and their malevolent behaviours. Woodward (2021) suggested that moral reasoning positively influences repression behaviour. Verrinder and Phillips (2018) highlighted the role of moral reasoning in animal ethics issues among students of veterinary medicine. In the field of workplace management, Maroney and McDevitt (2008) demonstrated that the moral reasoning of managers affects their evaluations regarding company financial statements. Complementarily, Prasetyaningsih (2021) confirmed that moral reasoning significantly

increases the intention to report noncompliance at work, and Sari et al. (2021) observed that an auditor's moral reasoning influences the quality of his or her auditing work.

The influence of education on the development of moral reasoning has captured research attention for decades (Bebeau & Thoma, 1994; Doyle & O'Flaherty, 2013). Recently, Chen and Chan (2020) argued that students' development engagement through honors programs and a higher frequency of interaction between professors and students outside the classroom improve students' moral reasoning. Ohreen et al. (2021) demonstrated that peer-to-peer student discussions improve students' moral reasoning by giving them multiple perspectives and providing support to engage in deliberations and peer dialogue when discussing ethical issues. Khatiban et al. (2019) demonstrated that a significant enhancement in nursing students´ moral reasoning is achieved by using problem-based learning instead of lecture-based learning.

Regarding the influence of audiovisual content, most previous studies have analysed the relationships among moral reasoning, mass media and video games. Krcmar and Locke (2020) supported the effects of problematic media content on several moral domains, such as people's harm/care. Vieira and Krcmar (2011) found that violent video games are negatively related to the expression of moral reasoning. Schnell and Bilandzic (2017) demonstrated the impact of television content on moral reason; in this sense, Cingel and Krcmar (2019) suggested that children exposed to moral messages through television, alone or with a parent, improve their moral judgements and moral reasoning.

Little research has analysed the link between exposure to social media and the level of moral reasoning; in addition, the studies associated with this topic have been oriented to the evaluation of children. Krcmar (2013) stated that text messaging and Facebook are technologies with high importance for the development of moral reasoning among modern children and adolescents. O'Reilly et al. (2021) argued that adolescents aged 11 to 18 find that social media have an important role in facilitating their caring relationships and in appreciating the negative consequences of failures in other people's moral reasoning. A complementary issue analysed in recent years is the relationship between the expression of moral panic and the information disseminated in social media; publications have supported that recent technological transformations in communication associated with social media intensify collective alarm (Carlson, 2020; Walsh, 2020).

The findings described above suggest that there should be a positive link between the frequency of exposure to social media and the expression of moral reasoning; hence, this research proposes that the frequency of exposure to massive social media platforms such as Twitter, Facebook, Instagram, WhatsApp and YouTube should be related to the magnitude of moral reasoning that is expressed by engineering and business students. This perspective is also consistent with the statements of social network theory (Lea et al., 2006) and with the two-step flow theory and the follower context (Sears & Freedman, 1967) previously described. Consequently, the following research hypothesis is proposed:

H1: Social media use frequency is positively related to moral reasoning in engineering and business students.

Complementarily, studies published in the last decade have demonstrated differences in social media use and moral reasoning among age groups. Auxier and Anderson (2021) stated that young people use social media more frequently; likewise, Facebook and YouTube are social media platforms with high usage among older adults, and 19–29-year-olds show a higher usage of Instagram. Chang et al. (2015) argued that there is greater selectivity of Facebook social peers in older people, and Kezer et al. (2016) stated that privacy protection when using Facebook is more important among older people. In relation to moral reasoning, Huang et al. (2021) showed that

compared to young people, older adults are more likely to support decisions based on adherence to a moral principle or duty; in this sense, other research has also supported that older people have a higher moral judgment (McNair et al., 2019; Sakel, 2019). Considering such findings, this research proposes that the link between the use of social media and moral reasoning should be different among young students who are part of the centennial generation—also known as generation Z—and older students. This proposition is raised in the following research hypothesis:

H2: The link between social media use frequency and moral reasoning is different among centennial generation students and older students.

### *2.2. Environmental concern and social media*

From a broad perspective, environmental concern is an individual's belief about the importance of environmental problems (Borusiak et al., 2021). Kirmani and Khan (2016) stated that environmental concern is the degree of an individual's awareness of environmental problems and his or her willingness to make a personal contribution to solving them. In a similar sense, from the consumers' perspective, environmental concern is defined as the level of consumers' awareness about environmental problems and their commitment to make a personal contribution to the solution of these problems (Dunlap & Jones, 2002; Kim & Choi, 2005); it also has been described as the level of consumers´ concern regarding hazards to the environment caused by human intervention (Hassan, 2014).

Most research has studied the positive influence of environmental concern on sustainable consumer behaviour and on the sale of environmentally friendly products (C. Bulut et al., 2021; Wu et al., 2019; Yang et al., 2020). In this regard, Muralidharan and Xue (2016) pointed out that environmental concern directly influences the products that are selected by consumers, and Lee and Lim (2020) demonstrated that the effect of environmental concerns on consumer purchasing behaviour is mediated by the company's image regarding its green supply chain management. Additionally, the positive effect of environmental concern on other areas, such as green innovation (Song et al., 2020) or climate-related civic engagement (Pradhananga et al., 2021), has also been supported.

A number of studies have investigated factors affecting the level of environmental concern in people. Recently, Saari et al. (2021) showed that environmental concern is influenced by increasing levels of personal environmental knowledge and perceptions of environmental risk. Moreover, Hekmatpour (2020) stated that religiosity is positively associated with environmental concern and people´s willingness to pay taxes to care for the environment. Olivos et al. (2021) demonstrated that educational level has a positive effect on higher environmental concern in China; Hao et al. (2019) suggested that a person's connections with others, including socialization with family and friends as well as social networks in general, are positively related to several dimensions of environmental concern.

Regarding information sources, the incidence of social media has been analysed regarding the purchase of "green products". Pop et al. (2020) revealed that social media have an important role in shaping consumer motivation and purchase intention for green cosmetics, and Zafar et al. (2021) argued that social media use significantly influence sustainable purchasing attitudes. Other studies have also supported the effect or positive relationship between social media use and sustainable purchasing behaviours (Biswas, 2016; Chi, 2021). Moreover, Udalov and Welfens (2021) argued that the digital modernization of countries, including use of the internet and cell phones, significantly impacts environmental concern; therefore, the digital development of countries should have pro-environmental benefits as a side effect of the expansion of internet and cell phone services. These studies suggest that social media use frequency should positively correlate with environmental concern. Accordingly, the following research hypothesis is posed.

H3: Social media use frequency is positively related to environmental concern in engineering and business students.

Complementarily, research in the last decade support discrepancies in social media use and in environmental concern by age group (Chang et al., 2015; Kezer et al., 2016; Auxier & Anderson, 2021). Particularly, studies have highlighted a higher valuation for sustainable environmental care and a higher sustainable consumption in younger age groups (Z. A. Bulut et al., 2017; Kim et al., 2020; Kymäläinen et al., 2021). Considering this previous evidence, this research states that the link between the use of social media and environmental concern should be different between young students who belonging to the centennial generation and their older peers. Thus, the following research hypothesis is proposed:

H4: The relationship between social media use frequency and environmental concern is different among centennial generation students and older students.

## 3. Methodology and methods

### *3.1. Measurement*

This research used a self-report survey answered online by business and engineering students. The online survey included statements of the Moral and Other-Orientated Reasoning (MR) Scale and Environmental Concern Scale published by Balderjahn et al. (2013). These scales have been validated and used in studies related with fair trade (e.g., Konuk, 2019; Panico et al., 2017). The assessment used a 7-point Likert scale, from "totally agree" to "totally disagree". The 7-point scale facilitates the assessment of magnitude differences by including more options (Debets et al., 2020).

The affirmations about moral reasoning and environmental concern were translated into Spanish, revised and then distributed to twenty-five students as a test. Twitter, Facebook, Instagram, WhatsApp and YouTube were selected for their high use in Chile (Cadem, 2019). The scale of assessment for social media use including eight levels, from never to several times per day. These magnitudes were previously asked to students and academics in the instrument's testing stage and are consistent to those used in research on social media in Chile (Cadem, 2019). The questions included in the survey are shown in Table 1.

### *3.2. Sample*

A total of 237 students enrolled in the School of Engineering and Business at a university in Chile responded to the online survey. They were selected through convenience sampling during academic semesters of 2020 and 2021, and the highest possible number of completed responses were obtained in this time period. Several research studies associated with entrepreneurship have used convenience sampling and evaluated a similar number of responses (Boubker et al., 2021; Shahin et al., 2021; Soomro & Shah, 2021); moreover, the students surveyed belonged to the lower-middle, middle and upper-middle socioeconomic classes in Chile, and these socioeconomic levels represent approximately 60% of the country's population (Aim Chile, 2021). This research focuses on the study of the relationship between the use of social media, moral reasoning and environmental concern of university students enrolled in engineering and business careers in the Latin American region; therefore, the sample obtained from Chile, a Latin American country, is considered adequate. The survey administration was performed with the Survey Monkey platform; specifically, the survey was sent by email from this platform to approximately 1,000 students, so the response rate was close to 24%. Additionally, the sample consisted of 106 centennials aged 18–24 (mean = 20.89; standard deviation = 1.55) and 131 older students aged 25–50 (mean = 35.34; standard deviation = 6.63).

**Table 1. Factors and variables observed**

| Factor | Observed variable | Scale |
|---|---|---|
| Moral and Other- Orientated Reasoning (MR) | My decisions are usually based on my concern for other people. | Scale of 1 to 7, from totally disagree to totally agree. |
| | My decisions are usually based on what is the fairest and just way to act. | |
| | I choose alternatives that are intended to meet everybody's needs. | |
| | I choose a course of action that maximizes the help other people receive. | |
| | I choose a course of action that considers the rights of all people involved. | |
| | My decisions are usually based on concern for the welfare of others. | |
| Environmental Concern (EC) | I am afraid when I think about environmental conditions for future generations. | |
| | If we continue our current style of living, we are approaching an environmental catastrophe. | |
| | Watching TV or reading in the newspapers about environmental problems, I am often embarrassed and angry. | |
| | There are limits of economic growth that the industrialized world has already reached or will reach very soon. | |
| | The great majority of people in my country do not act in an environmentally responsible way. | |
| | In my opinion, environmental problems are greatly exaggerated by proponents of the environmental movement. | |
| | It is still true that politicians do much too little to protect the environment. | |
| | To protect the environment, we all should be willing to reduce our current standard of living. | |
| | Environmental protection decisions should be made, even if they reduce the number of jobs in the economy. | |
| Frequency of social media exposure | Exposure to content from Twitter, Facebook, Instagram, WhatsApp, YouTube. | 1 = Never, 2 = Every six months, 3 = Every two to four months, 4 = Once a month, 5 = Once a week, 6 = Two to three times a week, 7 = Once a day, 8 = Several times a day. |

The assessed students born since 1997 were classified as members of the centennial generation, following the definition of this age cohort proposed by McGorry and McGorry (2017). The group of older people ranged from 25 to 50 years old, representing students from the millennial generation who were born between 1980 and 1996 (Van den Bergh & De Wulf, 2017) and students from generation X who were born between 1965 and 1979 (Lyons et al., 2012). Centennial generation was compared with older adults by the great interest of the scientific community in centennials' sustainable consumption (Becerra et al., 2023; Jasrotia et al., 2022) and centennials' social media use (Aggarwal et al., 2021; Sharma, 2019). People up to 50 years of age have been asked, because they express a higher preference for the Internet as a source of information, while people over 50 years of age maintain their preference for traditional media such as television (El CIEPS, 2021; El Nacional, 2019). In similar sense, it has been recognized that people over 50 years of age are less likely to see Facebook (Sehl, 2020). All surveys included a request for informed consent defined by the Ethics Committee of Universidad de Las Américas (ID: CEC_FP_2019021), which was included in writing. Only fully complete responses—in all measurement scales-, of students who accepted this consent, were used in the statistical process. Table 2, presented below, describes the characteristics of the sample by age group.

### *3.3. Analysis*

The arithmetic means of social media exposure, moral and other-orientated reasoning and environmental concern were compared by age group, incorporating the Wilcoxon–Mann–Whitney test to compare the central tendency of distributions. Subsequently, Spearman's correlation coefficient and Spearman's rank order correlation test based on the Prob>| t | parameter were performed, conducting the analysis by age group. The Wilcoxon–Mann–Whitney and Spearman's tests were selected because the observations did not have a normal distribution and had an ordinal scale; therefore, it was not appropriate to perform ANOVA and Pearson's correlation coefficient. According to McCrum-Gardner (2008), the Wilcoxon–Mann–Whitney and Spearman's correlation tests are adjusted to such conditions. The Shapiro–Wilk test was performed to evaluate the normality of the observed variables; the results showed *p value*s < 0.05, which indicates the absence of a normal distribution.

Wilcoxon–Mann–Whitney and Spearman's correlations were also conducted because they are appropriate for showing differences in distribution between groups and demonstrating positive or negative relationships between variables, which is consistent with the aim of this research. Several studies have performed these tests for similar purposes (Z. A. Bulut et al., 2017; Bilgiç, 2022; Brizga et al., 2014; Van Wyk & Mason, 2021). Complementary statistical analysis was conducted through analysis and Cronbach's alpha to recognize the internal consistency in the perceptual factors evaluated; Cronbach's alpha coefficient reported good consistency values for the Moral and Other-Orientated Reasoning Scale (0.87) and for the Environmental Concern Scale (0.81). The Cronbach's alpha coefficient can have values from 1 to 0; a value greater than 0.8 represents good internal consistency, and a value of less than 0.5 is unacceptable (Nunnally, 1978). Internal consistency implies greater reliability in measurement, and the reliability of an instrument is strongly associated with its validity (Tavakol & Dennick, 2011).

## 4. Results

### *4.1. Frequency of social media use by age group*

Table 3 presents the arithmetic means related to social media use frequency. The Wilcoxon–Mann–Whitney test supports significant frequency differences by age, showing higher results among centennials with respect to Instagram ($p < 0.01$) and YouTube ($p < 0.10$) and higher results among older students with respect to Facebook ($p < 0.05$) and WhatsApp ($p < 0.05$). Only the frequency of Twitter reading did not show significant age-related differences.

**Table 2. Description of sample by age group**

| | Men | Women | Other/no response | Commercial Engineering | Engineering Administration | Industrial Engineering | Business Technician | Other careers | Total |
|---|---|---|---|---|---|---|---|---|---|
| Centennial | 44 | 61 | 1 | 65 | 14 | 7 | 2 | 18 | 106 |
| Older | 60 | 70 | 1 | 55 | 43 | 24 | 8 | 1 | 131 |
| Total | 104 | 131 | 2 | 120 | 57 | 31 | 10 | 19 | 237 |

Note: The group of other careers includes careers such as accountancy and public administration.

### *4.2. Moral and other-orientated reasoning by age group*

The results in Table 4 show that the arithmetic means of all statements incorporated in the measurement of moral reasoning are lower in the centennial generation than among the older students. Likewise, the Mann-U test recognizes differences in the distribution of responses between these two age groups with 95% ($p < 0.05$) or 90% ($p < 0.10$) confidence in the statements: "My decisions are usually based on my concern for other people", "My decisions are usually based on what is the most fair and just way to act" and "I choose a course of action that considers the rights of all people involved".

### *4.3. Environmental concern by age group*

Table 5 presents the findings obtained regarding environmental concern by age group. The results show no significant differences between generations, since some statements show a higher arithmetic mean in the centennial generation and other statements show a higher arithmetic mean in the older group. Moreover, the Mann-U test does not recognize differences between the response distributions of the two groups evaluated, with 99%, 95% or 90% confidence, since the *p values* are higher than 0.09.

### *4.4. Correlations between moral reasoning and frequency of social media use*

Table 6 presents the correlations obtained between moral reasoning and frequency of social media use in the centennial group. Significant correlation coefficients with 90% ($p < 0.10$), 95% ($p < 0.05$) or 99% ($p < 0.01$) confidence are obtained. In this age group, the frequency of use of Twitter, Instagram, WhatsApp and YouTube is positively associated with several phrases of moral reasoning. Only the results associated with the social media platform Facebook do not support significant correlations. In this sense, the results of WhatsApp and YouTube stand out, since all the statements of moral reasoning are significant; besides, the sentence "I choose alternatives that are intended to meet everybody's needs" linked with the frequency of use of Instagram, WhatsApp and YouTube, shows higher correlations coefficients, close to 0.30 or 0.35 (significant with 99% confidence, $p < 0.01$). These results are shown in Table 6.

Table 7 presents the correlations obtained between moral reasoning and frequency of social media use in the older adult group. A lower number of significant correlation coefficients are appreciated with 90% ($p < 0.10$), 95% ($p < 0.05$) or 99% ($p < 0.01$) confidence, linking moral

**Table 3. Generational comparison of social media use**

| | Centennial | | Older | | *P Value* |
|---|---|---|---|---|---|
| | **Mean** | **S.D.** | **Mean** | **S.D.** | |
| Reading information on Twitter | 3.81 | 2.83 | 3.82 | 2.90 | 0.98 |
| Reading information on Facebook | **5.83** | **2.43** | **6.46** | **2.21** | **0.03** |
| Reading information on Instagram | **7.32** | **1.51** | **6.31** | **2.40** | **0.00** |
| Reading information on WhatsApp | **7.15** | **1.69** | **7.66** | **1.02** | **0.01** |
| Reading or reviewing information on YouTube | **6.57** | **1.73** | **6.15** | **1.99** | **0.09** |

Note: The *p value* was obtained by performing the Wilcoxon–Mann–Whitney test. S.D. represents the standard deviation. Significant differences are highlighted in bold.

reasoning and frequency of social media use. Unlike with the group of young centennials, only the use of WhatsApp shows positive correlations with most of the statements that evaluate moral reasoning, and only the sentence "I choose alternatives that are intended to meet everybody's needs" does not show a significant correlation with 90%, 95% or 99% confidence with WhatsApp frequent use. The results associated with Instagram and YouTube did not support any significant correlations. The details of the results are presented in Table 7 below.

When comparing the correlations between the centennial group and the older students shown in Tables 6 and 7, it is recognized that the number of significant correlations according to Spearman's rank order correlation test is higher among centennial students. Moreover, the results show that the centennial generation demonstrates higher correlation coefficients. Additionally, it is shown that among centennials, the Instagram and YouTube platforms show positive and significant correlations with all moral reasoning statements, while in the case of older people, only the most frequent reading of WhatsApp shows positive and significant correlations. These findings allow to validate Hypothesis 1 of this research, which states that the frequency of use of social media is positively related to moral reasoning, and Hypothesis 2, which states that the relationship between the frequency of use of social media and moral reasoning is different

**Table 4. Generational comparison of moral and other-orientated reasoning**

| | Centennial | | Older | | *P Value* |
|---|---|---|---|---|---|
| | **Mean** | **S.D.** | **Mean** | **S.D.** | |
| My decisions are usually based on my concern for other people. | **4.54** | **1.75** | **5.15** | **1.57** | **0.01** |
| My decisions are usually based on what is the fairest and just way to act. | **5.54** | **1.26** | **5.80** | **1.26** | **0.05** |
| I choose alternatives that are intended to meet everybody's needs. | 4.44 | 1.59 | 4.70 | 1.60 | 0.18 |
| I choose a course of action that maximizes the help other people receive. | 5.16 | 1.42 | 5.27 | 1.51 | 0.46 |
| I choose a course of action that considers the rights of all people involved. | **5.03** | **1.38** | **5.39** | **1.38** | **0.03** |
| My decisions are usually based on concern for the welfare of others. | 4.89 | 1.56 | 5.11 | 1.48 | 0.32 |

Note: The *p value* was obtained by performing the Wilcoxon–Mann–Whitney test. S.D. represents the standard deviation. Significant differences are highlighted in bold.

**Table 5. Generational comparison of environmental concern**

| | Centennial | | Older | | *P Value* |
|---|---|---|---|---|---|
| | **Mean** | **S.D.** | **Mean** | **S.D.** | |
| I am afraid when I think about environmental conditions for future generations. | 5.53 | 1.63 | 5.73 | 1.36 | 0.68 |
| If we continue our current style of living, we are approaching an environmental catastrophe. | 6.17 | 1.21 | 6.07 | 1.17 | 0.33 |
| Watching TV or reading in the newspapers about environmental problems, I am often embarrassed and angry. | 5.56 | 1.56 | 5.65 | 1.56 | 0.61 |
| There are limits of economic growth that the industrialized world has already reached or will reach very soon. | 5.58 | 1.41 | 5.40 | 1.59 | 0.56 |
| The great majority of people in my country do not act in an environmentally responsible way. | 6.08 | 1.19 | 6.13 | 1.14 | 0.82 |
| In my opinion, environmental problems are greatly exaggerated by proponents of the environmental movement. | 3.34 | 2.03 | 3.53 | 2.19 | 0.51 |
| It is still true that politicians do much too little to protect the environment. | 5.50 | 1.78 | 5.76 | 1.83 | 0.11 |
| To protect the environment, we all should be willing to reduce our current standard of living. | 5.77 | 1.33 | 5.60 | 1.65 | 0.72 |
| Environmental protection decisions should be made, even if they reduce the number of jobs in the economy. | 5.46 | 1.57 | 5.24 | 1.75 | 0.42 |

Note: The *p value* was obtained by performing the Wilcoxon–Mann–Whitney test. S.D. represents the standard deviation.

between the centennial generation and older students. The comparisons of the correlations by age group are presented in Figures 1 and 2.

### *4.5. Correlations between environment concern and frequency of social media use*

Table 8 presents the correlations obtained between environment concern and frequency of social media use in the centennial group. Significant correlation coefficients, with 90% ($p < 0.10$), 95% ($p < 0.05$) or 99% ($p < 0.01$) confidence, were found between statements of environmental concern and a higher frequency of exposure to content on Twitter, Facebook and WhatsApp. Instagram stands out by evidencing significant correlations in all statements associated with environmental concern, with some of them being higher than 0.4. Likewise, WhatsApp frequency use shows significant correlations in all the environmental concern statements, except in the statement "It is still true that politicians do much too little to protect the environment" ($p = 0.35$). In contrast, the frequency of exposure to YouTube does not show significant correlations with the environmental concern statements. Table 8 below describes these results.

Table 9 presents the correlations obtained between environment concern and frequency of social media use in the older group. A smaller number of significant correlation coefficients, with 90% ($p < 0.10$), 95% ($p < 0.05$) or 99% ($p < 0.01$) confidence, were found. Only significant correlation coefficients between WhatsApp reading frequency and concern for the environment were recognized. In addition, the sentence "To protect the environment, we all should be willing to reduce our current standard of living" shows a negative and significant correlation ($p < 0.05$) with

**Table 6. Spearman correlation coefficients of moral reasoning in Centennial group**

| | Reading Twitter | | Reading Facebook | | Reading Instagram | | Reading WhatsApp | | Reading YouTube | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Coeff.** | **P Value** | **Coeff.** | **P Value** | **Coeff.** | **P Value** | **Coeff.** | **P Value** | **Coeff.** | **P Value** |
| My decisions are usually based on my concern for other people. | **0.17** | **0.08** | 0.03 | 0.79 | **0.17** | **0.09** | **0.19** | **0.05** | **0.29** | **0.00** |
| My decisions are usually based on what is the fairest and just way to act. | 0.13 | 0.17 | 0.07 | 0.49 | **0.26** | **0.01** | **0.17** | **0.07** | **0.25** | **0.01** |
| I choose alternatives that are intended to meet everybody's needs. | 0.08 | 0.43 | 0.12 | 0.22 | **0.35** | **0.00** | **0.37** | **0.00** | **0.29** | **0.00** |
| I choose a course of action that maximizes the help other people receive. | **0.17** | **0.08** | 0.05 | 0.60 | 0.11 | 0.26 | **0.20** | **0.04** | **0.33** | **0.00** |
| I choose a course of action that considers the rights of all people involved. | **0.21** | **0.03** | 0.03 | 0.78 | 0.14 | 0.16 | **0.21** | **0.03** | **0.25** | **0.01** |

Note: Significance of correlation coefficients is evaluated using Spearman's rank order correlation test. Significant correlations are highlighted in bold.



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**Table 7. *Spearman correlation coefficients of moral reasoning in older group***

| | Reading Twitter | | Reading Facebook | | Reading Instagram | | Reading WhatsApp | | Reading YouTube | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Coeff.** | **P Value** | **Coeff.** | **P Value** | **Coeff.** | **P Value** | **Coeff.** | **P Value** | **Coeff.** | **P Value** |
| My decisions are usually based on my concern for other people. | **0.20** | **0.02** | **0.22** | **0.01** | 0.14 | 0.12 | **0.25** | **0.00** | 0.07 | 0.43 |
| My decisions are usually based on what is the fairest and just way to act. | 0.08 | 0.37 | 0.09 | 0.29 | −0.02 | 0.84 | **0.25** | **0.00** | 0.07 | 0.42 |
| I choose alternatives that are intended to meet everybody's needs. | **0.15** | **0.08** | 0.07 | 0.43 | 0.14 | 0.10 | 0.10 | 0.26 | 0.12 | 0.19 |
| I choose a course of action that maximizes the help other people receive. | 0.08 | 0.34 | 0.10 | 0.28 | 0.04 | 0.65 | **0.19** | **0.03** | 0.05 | 0.54 |
| I choose a course of action that considers the rights of all people involved. | 0.09 | 0.32 | 0.04 | 0.61 | −0.01 | 0.93 | **0.15** | **0.08** | 0.02 | 0.81 |

Note: Significance of correlation coefficients is evaluated using Spearman's rank order correlation test. Significant correlations are highlighted in bold.



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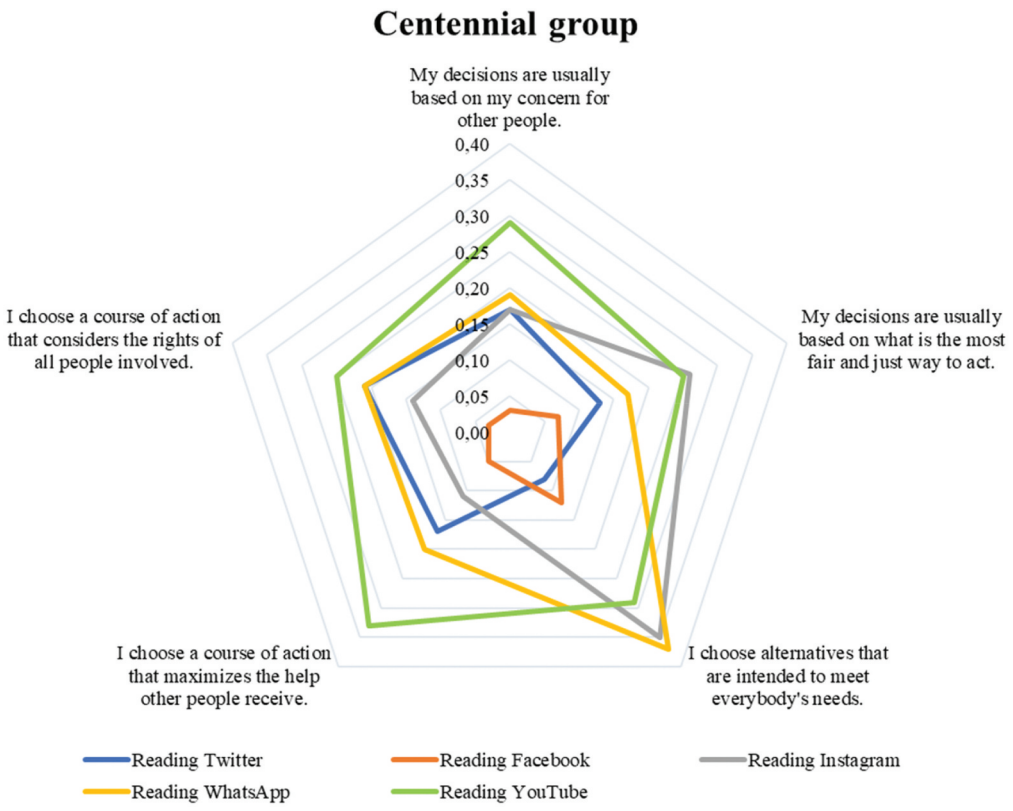
**Figure 1. Correlations between moral reasoning and social media use frequency in Centennial group.**

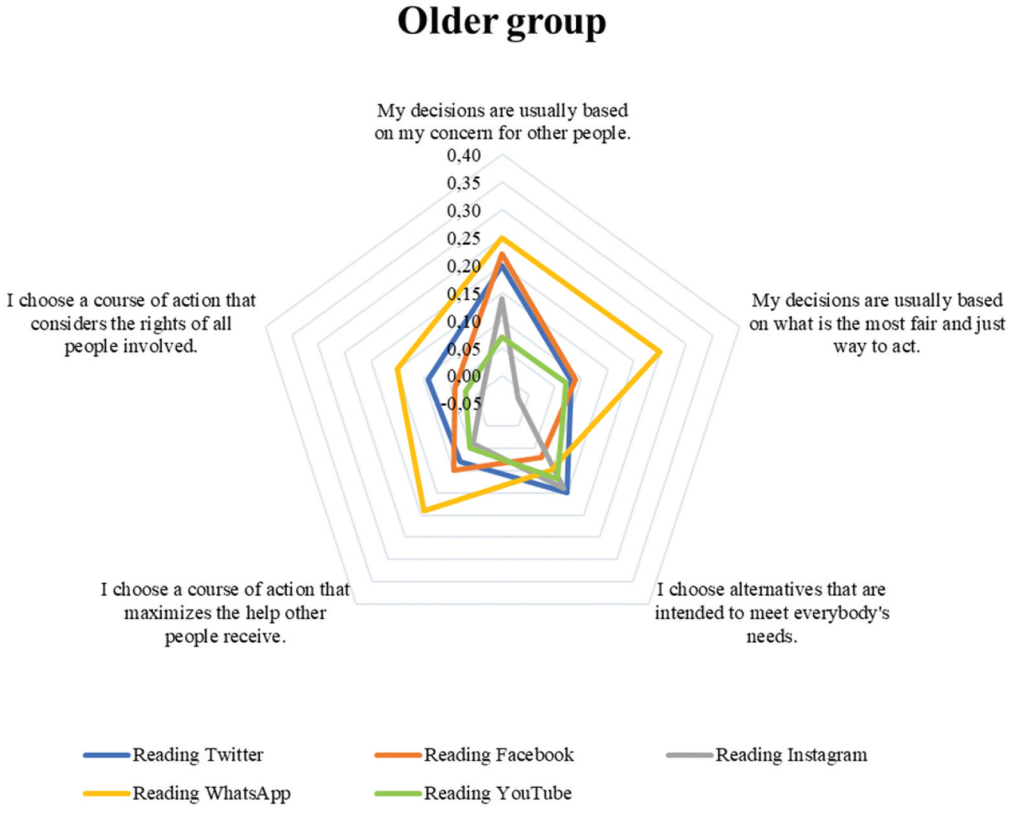



the reading frequency of Twitter and a positive and significant correlation ($p < 0.10$) with the reading frequency of Instagram.

Comparing the results of Tables 8 and 9, it is possible to conclude that a higher frequency of exposure to social media tends to be positively related to environmental concern and that the relationship between environmental concern and frequency of exposure on social media is different among the centennial generation and older people, since centennials demonstrate higher correlation coefficients and a higher number of significant correlation coefficients according to Spearman's rank order correlation test. Moreover, the results suggest that in older students, only the frequency of reading WhatsApp correlates, in an important way, with higher environmental concern. These findings allow to validate Hypothesis 3 of this research, which states that the frequency of social media use is positively related to environmental concern, and Hypothesis 4, which states that the relationship between the frequency of social media use and environmental concern is different between the centennial generation and older students.

Moreover, summarizing the highest Spearman correlation coefficients, which are positive and significant with 99% confidence ($p < 0.01$) according to Spearman's rank order correlation test, it is recognized that both in the analysis of moral reasoning and environmental concern, the highest magnitudes were obtained in the group of students from the centennial generation who were related to the social media platforms WhatsApp and Instagram. These results show an important generational difference regarding the relationship between exposure to social media and the expression of moral reasoning and environmental concern in students enrolled in careers of engineering and business. The differences in the correlations between the age groups are presented in Figures 3 and 4.

**Figure 2. Correlations between moral reasoning and social media use frequency in older group.**




## 5. Discussion

This study aims to analyze whether the frequency of social media exposure is linked to differences in the levels of moral reasoning and environmental concern in engineering and business students, differentiating this relationship by their age generation. The overall results show that there is indeed a positive correlation between the frequency of reading or exposure to social media platforms and moral reasoning, with this relationship being more significant in the centennial generation. A positive and significant association is also recognized between environmental concern and the frequency of exposure to social media; likewise, this link is higher in younger students categorized as the centennial generation. The results presented in Tables 6 and 8 support that the social media platforms YouTube, WhatsApp and Instagram show the highest number of positive and significant correlation coefficients in the centennial generation, demonstrating correlation magnitudes for environmental concern at a medium level, between 0.30 and 0.45, in accordance with the criteria proposed by Dancey and Reidy (2007). The results support the Hypothesis 1 which states that frequency of use of social media is positively related to moral reasoning, the Hypothesis 2 which states that the link between social media exposure and moral reasoning is different between the centennial generation and older students, the Hypothesis 3 which states that social media exposure is positively related to environmental concern, and Hypothesis 4 which states that the link between the social media exposure and environmental concern is different between the centennial generation and older one.

As previously stated, this research analyses students enrolled in Latin American engineering and business careers, since their decisions can have a relevant impact on social and environmental well-being. As has been recognized, ethical behaviour is a fundamental condition in 21st century leadership, since empathy and commitment to achieve the development of subordinates, associated with transformational leadership, imply a series of organizational benefits, such as an increase in work engagement (Buil et al., 2019), the development of a better work climate

**Table 8. Spearman correlation coefficients of environmental concern in Centennial group**

| | Reading Twitter | | Reading Facebook | | Reading Instagram | | Reading WhatsApp | | Reading YouTube | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coeff. | P Value | Coeff. | P Value | Coeff. | P Value | Coeff. | P Value | Coeff. | P Value |
| I am afraid when I think about environmental conditions for future generations. | **0.21** | **0.03** | **0.19** | **0.05** | **0.33** | **0.00** | **0.30** | **0.00** | −0.02 | 0.82 |
| If we continue our current style of living, we are approaching an environmental catastrophe. | 0.02 | 0.86 | **0.24** | **0.01** | **0.44** | **0.00** | **0.38** | **0.00** | 0.13 | 0.17 |
| Watching TV or reading in the newspapers about environmental problems, I am often embarrassed and angry. | 0.12 | 0.23 | **0.31** | **0.00** | **0.40** | **0.00** | **0.35** | **0.00** | 0.11 | 0.24 |
| There are limits of economic growth that the industrialized world has already reached or will reach very soon. | 0.07 | 0.46 | 0,02 | 0,86 | **0.32** | **0,00** | **0,38** | **0,00** | 0,04 | 0,71 |
| The great majority of people in my country do not act in an environmentally responsible way. | 0.05 | 0.62 | **0.16** | **0.09** | **0.34** | **0.00** | **0.30** | **0.00** | −0.02 | 0.80 |
| In my opinion, environmental problems are greatly exaggerated by proponents of the environmental movement. | 0.08 | 0.42 | −0.12 | 0.23 | **−0.23** | **0.02** | **−0.20** | **0.04** | 0.13 | 0.20 |
| It is still true that politicians do much too little to protect the environment. | 0.16 | 0.11 | 0.06 | 0.55 | **0.16** | **0.09** | 0.09 | 0.35 | −0.05 | 0.63 |
| To protect the environment, we all should be willing to reduce our current standard of living. | 0.08 | 0.42 | **0.30** | **0.00** | **0.41** | **0.00** | **0.41** | **0.00** | 0.11 | 0.26 |
| Environmental protection decisions should be made, even if they reduce the number of jobs in the economy. | 0.06 | 0.57 | 0.15 | 0.13 | **0.36** | **0.00** | **0.27** | **0.00** | 0.07 | 0.50 |

Note: Significance of correlation coefficients is evaluated using Spearman's rank order correlation test. Significant correlations are highlighted in bold.



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**Table 9. Spearman correlation coefficients of environmental concern in older group**

| | Reading Twitter | | Reading Facebook | | Reading Instagram | | Reading WhatsApp | | Reading YouTube | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Coeff.** | **P Value** | **Coeff.** | **P Value** | **Coeff.** | **P Value** | **Coeff.** | **P Value** | **Coeff.** | **P Value** |
| I am afraid when I think about environmental conditions for future generations. | **−0.16** | **0.07** | 0.09 | 0.31 | 0.07 | 0.40 | 0.14 | 0.11 | 0.12 | 0.16 |
| If we continue our current style of living, we are approaching an environmental catastrophe. | −0.07 | 0.45 | 0.01 | 0.87 | −0.03 | 0.72 | 0.12 | 0.16 | 0.01 | 0.92 |
| Watching TV or reading in the newspapers about environmental problems, I am often embarrassed and angry. | −0.10 | 0.24 | 0.14 | 0.10 | 0.06 | 0.46 | **0.20** | **0.02** | 0.10 | 0.26 |
| There are limits of economic growth that the industrialized world has already reached or will reach very soon. | −0.08 | 0.39 | 0.12 | 0.17 | 0.10 | 0.24 | **0.15** | **0.08** | 0.02 | 0.81 |
| The great majority of people in my country do not act in an environmentally responsible way. | 0.00 | 0.99 | 0.05 | 0.60 | −0.05 | 0.54 | **0.15** | **0.08** | **0.16** | **0.07** |
| In my opinion, environmental problems are greatly exaggerated by proponents of the environmental movement. | 0.10 | 0.26 | 0.08 | 0.35 | 0.13 | 0.15 | −0.10 | 0.28 | −0.01 | 0.89 |
| It is still true that politicians do much too little to protect the environment. | 0.00 | 1.00 | −0.07 | 0.41 | 0.06 | 0.53 | **0.18** | **0.04** | 0.12 | 0.17 |
| To protect the environment, we all should be willing to reduce our current standard of living. | **−0.19** | **0.03** | 0.08 | 0.37 | **0.18** | **0.04** | 0.08 | 0.38 | 0.06 | 0.53 |
| Environmental protection decisions should be made, even if they reduce the number of jobs in the economy. | −0.08 | 0.37 | **0.15** | **0.09** | 0.14 | 0.12 | 0.07 | 0.42 | 0.01 | 0.91 |

Note: Significance of correlation coefficients is evaluated using Spearman's rank order correlation test. Significant correlations are highlighted in bold.



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(Balwant et al., 2019), and the achievement of higher performance of subordinates (Eliyana & Ma'arif, 2019).

From a theoretical perspective, this research provides new evidence that is consistent with social network theory (Lea et al., 2006), which suggests that social networks play an important role in determining individual values and actions, and with two-step flow theory and the follower context (Sears & Freedman, 1967), which states that people are mostly influenced by trusted opinion leaders. The influence of opinion leaders in the social media context has been recognized (Bergström & Jervelycke Belfrage, 2018; Oueslati et al., 2021); in this sense, Choi (2015) argued that on Twitter, a few individuals who are easily trusted and consulted for guidance and information significantly influence the news consumption of others. This idea has also been endorsed by several authors, who have supported that friends and followers on social media influence the news that people read because the information is highlighted with actions on social media platforms such as "liking", "sharing" or "recommending" (Firth et al., 2019; Joseph et al., 2021; Jost et al., 2018; Yu et al., 2019).

Moreover, the findings of this research are consistent with the differences in social media use and moral reasoning across generations supported in previous studies (McNair et al., 2019; Sakel, 2019; Auxier & Anderson, 2021; Huang et al., 2021). The higher correlation between the use of social media, moral reasoning and environmental concern in the centennial generation, evidenced in Tables 6 and 8 of this study, may be explained by their status as true digital natives; that is, they have been exposed to the internet, social media and mobile systems since their childhood, and therefore, they are a hypercognitive generation that feels comfortable collecting and cross-referencing many sources of information (Francis and Hoefel, 2018). This younger generation prioritizes digital channels, such as social media platforms, and these could have a major influence in shaping their opinions. On the other hand, older respondents, who are part of the millennial and X generations, may be more influenced by information from traditional media such as newspapers and television because they learned to use social media later.

From the perspective of teaching students in higher education, this research provides general guidelines on the use of social media for the development of moral reasoning and environmental concern in engineering and business students who should exercise leadership roles in private or governmental organizations. The findings reveal that social media should be considered a source of information for the strengthening of professional ethics and environmental commitment, mainly for the students of the centennial generation. Previous studies have highlighted the educational potential of social media. In this regard, Sleeman et al. (2020) stated that educators can use social media sites in the classroom to support students´ connections with other students and institutions, and Moghavvemi et al. (2018) showed that social media is an effective learning tool to enhance students' motivation and learner results. In a similar sense, recent studies have shown the benefits of social media on learning performance, students' motivation and students' skills development (Noori et al., 2022; Oh et al., 2020). Regarding methodologies for using social media in higher education teaching, Hamadi et al. (2022) proposed collaborative activities, particularly the formation of teams to perform task completion and group members' roles and problems to be solved. According to the results of this research, such collaborative activities, developed in student teams, can be incorporated into courses associated with business ethics, entrepreneurship or sustainable business, among other subjects, prioritizing the participation of centennial generation students.

The Mann-U test results in Table 4 demonstrate that the students belonging to the centennial generation show a lower moral reasoning than older ones, which is indeed consistent with previous findings (McNair et al., 2019; Sakel, 2019). This intergenerational difference in moral reasoning may be explained by a greater maturity or spirituality obtained by learning across time. In this regard, Culliford (2011) suggests that spirituality is related to changes in personal motivation and the search for a deep source of meaning and purpose in life in a path that continues in stages of increasing maturity throughout life. In addition, this difference could be related to intergenerational value discrepancies that have been supported in recent research (Abu Aleon et al., 2019; Inglehart, 2018; Tausch, 2021).

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**Figure 3. Correlations between environmental concern and social media use frequency in Centennial group.**

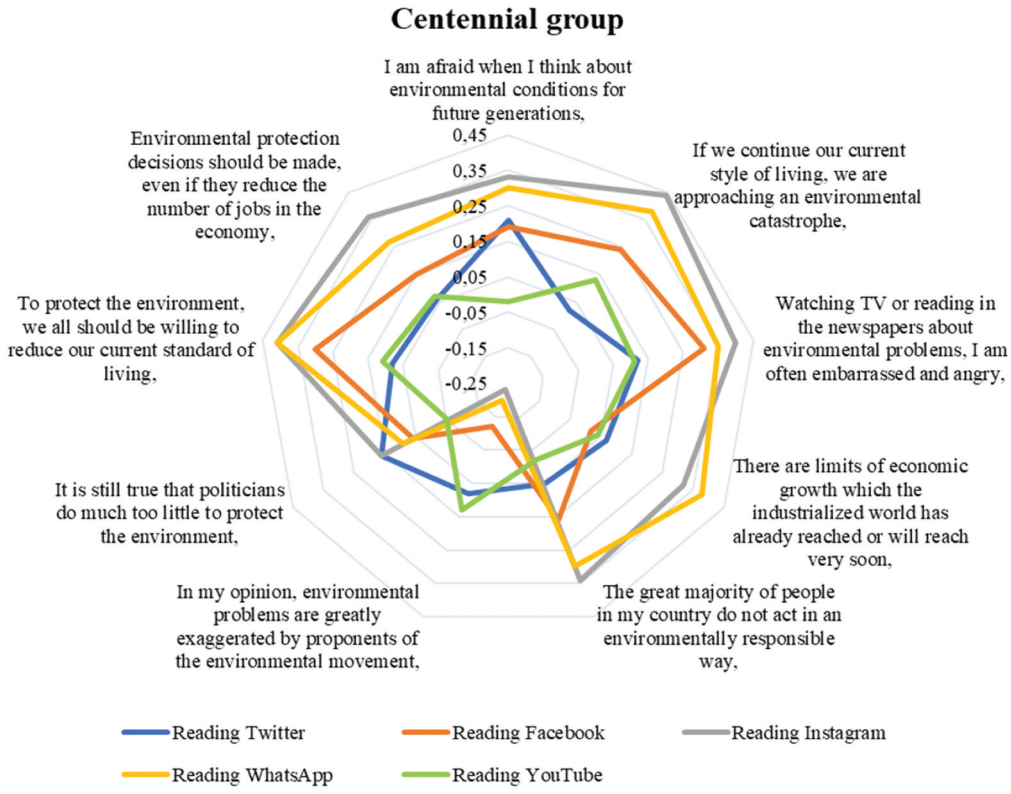
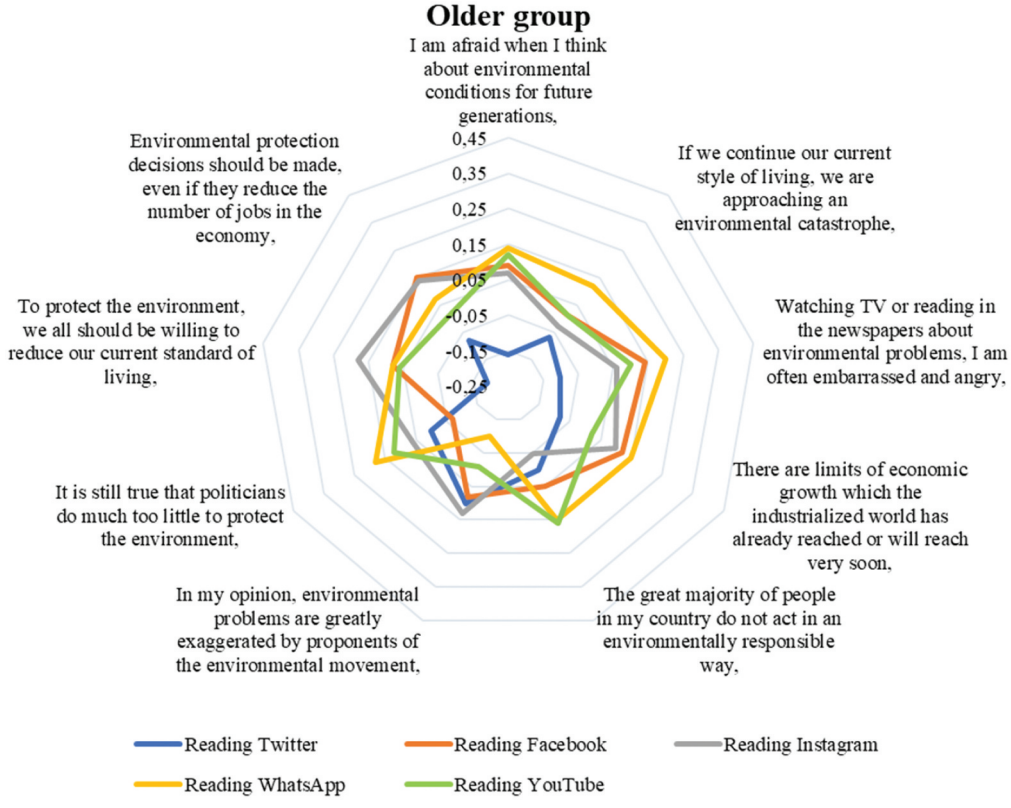



**Figure 4. Correlations between environmental concern and social media use frequency in older group.**



The higher moral reasoning in older students highlights the importance of the use of social media in the centennial generation, since they can transmit information that develops moral awareness in young people, which in turn could strengthen their ethical behaviours in their future professional performance in the leadership of work teams in companies.

## 6. Conclusions

The study has explored the link between exposure to social media sites and moral reasoning and environmental concern. Such knowledge is relevant because social media constitute a source of information which can influence higher education students' opinions. In particular, the statistically significant correlation coefficients have supported that frequency of social media exposure is positively related to a moral reasoning and environmental concern and that this relationship is higher in students who belong to the centennial generation. These results support a significant generational difference in undergraduate engineering and business students in Latin America and allow to support the hypothesis 1, 2, 3 and 4 proposed.

This study recommends that higher education institutions dedicated to training engineers and business administrators, should incorporate social media into their classrooms. Particularly, social media sites could be used as a resource of information for students to discuss business cases involving information related to moral or environment which is sharing in social media. Moreover, the findings suggest that it is important to differentiate the sources of information used in the education of engineering and business students; in particular, that the use of social media should be more relevant among young students belonging to the centennial generation. These initiatives could have important benefits in social groups that will be affected by decisions of managers, such as the development and sale of environmentally responsible products.

## 7. Limitations and future research

The sample of this research is made up of only business and engineering students from Chile, and it is necessary to consider this restriction when generalizing the results obtained. The sample size used was not high; however, several research studies associated with entrepreneurship have evaluated a similar number of responses (Boubker et al., 2021; Shahin et al., 2021; Soomro & Shah, 2021), and the students surveyed represent the socioeconomic characteristics of most university students in Chile. Perceptual relationships are assessed according to the frequency of social media exposure, without corroborating causality using an experimental research design. Next researches could evaluate the link between the frequency of social media reading, moral reasoning and environmental concern covering larger samples of students from different continents. Additionally, it is relevant to more deeply understand the way in which exposure to social media is associated with moral reasoning and environmental concern; for this purpose, it is pertinent to use qualitative research methodologies such as focus groups and in-depth interviews.

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**Data availability**
The data used in the preparation of this document are available.

**Ethical approval**
All precautions related to scientific ethics have been taken into account from the conception to the writing of this paper, as well as the submission to the said journal.

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