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Attitudes and perceptions towards the scientific search for extraterrestrial life among students of public and private universities in Peru

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Research Article

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Abstract

The objective of this study was to identify attitudes towards the scientific search for extraterrestrial life among students from public and private universities in Peru. This research was inspired by similar studies, realized in Sweden, which used the same instrument adapting it to our reality. The process consisted of a survey of the Peruvian student population by targeting it in different regions of Peru. The sample consisted of 1237 students from different academic areas. The findings show that 92% of the students believe in the existence of life outside our planet, with differences between the subgroups surveyed.

Introduction

Astrobiology considered as a scientific discipline, studies the origin, evolution, distribution and future of life on our planet and the Universe. This vision of astrobiology has multiple implications and dimensions, from the natural to the social sciences. In this way, its scientific results tend to impact society and affect the way we think about different areas of knowledge such as ethics, law, philosophy, theology, among others (Hays, 2015).

Therefore, from the social point of view, astrobiology has a considerable impact on humanity's interest in the future of the Universe, as it attempts to answer the age-old question of whether we are alone. The different aspects involved in the search for answers to this question are not only spiritual, but also epistemological, that is, it affects the body of knowledge that humanity possesses due to its potential effects. It is a way of doing science from a transdisciplinary perspective (Chon-Torres, 2019).

Similarly, in the educational field, to include in the curricular plans contents that lead to the reflection on probable forms of life outside the Earth, represents a transcendental motivation for both school and university students. Or as Kwok (2018) indicates: Astrobiology is an interdisciplinary subject that draws from research in astronomy, biology, biochemistry, chemistry, geology, microbiology, physics and planetary science, a non-exhaustive list. It is also comprehended upon the disciplines of history, philosophy and sociology. Education in astrobiology therefore helps students develop the awareness that all sciences are related.

In this way, a substantial contribution to education is to make possible the studies that help to corroborate that all sciences are related around the development of the human being, and for the same reason it is important to know the degree of interest that students have with reference to the scientific study of life in the Universe. In this context, astrobiology allows us to make explicit these connections between the different knowledge of the scientific disciplines, by providing sensitiveness to the treatment of complex problems.

In the case of Peru, as a Latin American country, the development of astrobiology is important because the nature of the problems requires a complex and strategic treatment. In other words, the know-how or procedure for problem solving in astrobiology is very useful, as it has a transdisciplinary approach. But what is the importance of its transdisciplinary aspect?

The way to attain an integrated concept and practice of knowledge, and consequently to address many crucial issues of our age through a transdisciplinary approach, does not lie in applying ready-made, 'mechanical' procedures based on automatic, stereotyped formulas and standardized recipes; but rather, in establishing various complex, integrative processes

to be mindfully and cautiously implemented in light of manifold criteria (United Nations Educational, Scientific and Cultural Organization, 1998, 2010).

Consequently, this research is fully justified not only by its scientific importance, but also by its social importance, since it directly affects students' critical reflection on how different fields of knowledge function and relate to each other. From this perspective, reality does not belong to a single scientific discipline or field of knowledge; rather, it corresponds to an incessant movement of disciplinary dimensions that require a critical sense capable of interweaving ideas and concepts that a single discipline does not have the sufficient capacity to address.

Under this approach, the study was based on one developed in Sweden with students from schools and universities, in which the trend of scientific attitudes towards extraterrestrial life was analysed (Persson *et al*., 2018). The importance of the investigation is based on the vindicating action of the student population's search for extraterrestrial life forms. In this sense, it has a multiple effect, since it allows us to reveal the level of interest that students have in the scientific study of extraterrestrial life and thus serve as an input for different institutions that are interested in promoting national research programmes with topics related to astrobiology.

To understand the attitudes towards a scientific field among students is important for several reasons. Firstly, it brings insights into how students perceive the field, its research questions and the subject area in general. Secondly, it enables us to assess the level of interest in the discipline; and finally, it helps us understand how scientific enquiries shape of public opinion and attitudes towards a given branch of knowledge (Persson *et al*., 2018).

There are other studies, such as the one carried out in Brazil (De Carvalho *et al*., 2010), in which we observe the interest of university students in reference to the religious position they have about the possibility of extraterrestrial life, but it does not take into account the scientific interest.

The White Paper called Astrobiology and Society in Europe clearly indicates the following:

> Training in astrobiology at the university is of particular importance because astrobiology provides fundamental and intriguing research questions for students and early stage researchers, questions that cannot be cleared by any other discipline alone (Capova *et al*., 2018).

This position fits in with the UNESCO proposal to promote education, and by extension it is also important for the scenario where the key piece is the cognitive interconnection of the transversal contents that students can perform. Now, in a country like Peru, where astrobiology is still seen as a science more close to science fiction, knowing that there are students interested in learning about the object of study of astrobiology, may mean the starting point for creating a future astrobiological institute or division sponsored by both the State and the interested private sector.

Therefore, it is very useful to know the position of university students. This would allow us to measure the degree of interest and potential to invest more in these issues. In addition, there is no similar study carried out in Peru as the one shown below, so it represents an important milestone in the comprehension of what students perceive about the scientific investigation of extraterrestrial life. Currently, there are only civil initiatives that try to develop it from different disciplines, but there is no institutionalization of astrobiology. This also represents an opportunity for other countries to approach the subject and conduct similar studies, with the purpose of making comparisons about the student's position regarding the great scientific reception that the search for extraterrestrial life is having.

In a way, this would divest and release many prejudices and misgivings that some academics might have locally on these issues, even though they already have a scientific basis. It is worrying to note that in Peruvian academia astrobiology is not yet given due weight, probably due to the lack of promotion and academic publications on the subject in the country. This work also represents a further step towards achieving one of the objectives of the NASA astrobiology roadmap, which states that 'The intrinsic public interest in astrobiology offers a crucial opportunity to educate and inspire the next generation of scientists, technologists, and informed citizens; thus a strong emphasis upon education and public outreach is essential' (Des Marais *et al*., 2008). Precisely, this represents a great opportunity for Peru, since it would not only be a way to promote the interest of astrobiology, but also an important educational resource because it connects with what is indicated in the UNESCO report (2010):

> From the perspective of science, students should develop key ideas and understand their interconnectedness, such as the relationship between the macro and micro-structures of materials and their properties, the concept of energy, ideas about cells and interdependence in biological systems.

It is precisely astrobiology, one of the scientific disciplines that maintains this perspective of interconnectivity of ideas and knowledge. Therefore, in a context where it is important to develop a focus on students who aspire to this complexity, knowing the level of interest they have in astrobiology-related topics can help us not only to know our place in the Universe, but also to change our way of thinking, which eventually has an indirect impact on how we develop in our world. This study should also be taken as a starting point by which other developing countries decide to carry out their own research on the interest that their student population has in these topics, this would give them the adequate support to start institutionalizing astrobiology in their respective research centres.

Materials and methods

Data were collected using an eight-question survey distributed among students from public and private universities in Peru. This version of the questionnaire was given to the students in Spanish because it is the main language in Peru. The questions were translated from English to Spanish and adapted to the Peruvian context, since, for example, the Swedish education system varies from that of Peru, as it is the case that in Peru we do not have an upper secondary school, and the ages included in that level are found in the first university levels. In this sense, it should not affect the results. It was distributed in two ways, printed on paper and in digital form through Google Form, in both cases the students were instructed that participation in the study was optional. The test contained a brief note about its purpose to encourage the student to participate.

The students who participated were from the following educational institutions

- Universidad de Lima
- Universidad Nacional de Ingeniería
- Universidad Nacional 'San Luis Gonzaga'
- Universidad Nacional de Cajamarca
- Universidad Nacional de San Antonio Abad del Cusco.

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Table 1. Do you believe that there is life outside this planet?

	No (%)	Yes (%)	*p*-value
Students from Universidad Nacional de Cajamarca	12	88	0.000
Students from Universidad Nacional San Antonio Abad del Cusco	18	82	
Students from Universidad Nacional San Antonio Abad del Cusco (Ica)	6	94	
Students from Universidad de Lima y Universidad Nacional de Ingeniería (Lima)	5	95	
Students at a private university	4	96	0.000
Students at a public university	11	89	
Male students	7	93	0.375
Female students	9	91	
Business and Economics students	5	95	0.033
Medical Science students	12	88	
Natural Sciences students	8	92	
Humanities, Arts and Education students	11	89	
Engineering and Architecture students	7	93	
Total number of students ($n = 1237$)	8	92	

The questionnaire was answered by a total of 1237 students, of which 515 were students from the private university and 722 from public universities, 593 of the respondents were women and 644 were men. Similarly, 356 were from Engineering and Architecture, 350 from Humanities and Art, 258 from Economic and Business Sciences, 152 from Natural Sciences and 121 from Medical Sciences. Some students did not indicate their specialty, gender or did not answer any question, these were discarded for analysis. Of all these universities, the Universidad de Lima is a private one.

In addition to the demographic questions, students also answered the following questions aimed at revealing their attitudes towards the scientific search for extraterrestrial life:

(1) Do you believe that there is life outside this planet? (yes, no) (Table 1, see also Table 3).
(2) How informed are you about scientific research concerning the search for extraterrestrial life? (A: very well informed, B: well informed, C: regularly informed, D: not very well informed, E: not informed at all) (Table 2, see also Table 3).
(3) How long will it take to find life outside our planet? (A: maximum 10 years, B: maximum 50 years, C: maximum 100 years, D: more than 100 years, E: never) (Table 4).
(4) How important is the search for extraterrestrial life? (A: very important, B: medium important, C: not important, D: not to be prioritized, E:to be avoided) (Table 5).
(5) What is the reason for your answer to the question above? (Open-ended question) (Table 6).

The student survey did not provide detailed definitions of what is meant by 'extraterrestrial life', 'seeking extraterrestrial life' or 'scientific search for extraterrestrial life'. It was decided not to use the word 'astrobiology' because it was not known whether the student surveyed would understand the meaning of the word. Long explanations were avoided so that the questionnaire would be short, simple, quick and easy to complete. It is quite likely that the student respondents were thinking about different forms of life (e.g. microbial, intelligent, etc.) as well as different methods of searching for extraterrestrial life (e.g. through telecommunications, space travel, etc.) when answering the questions. This was not important for our main question, since our goal was to improve the understanding of attitudes towards the scientific search for extraterrestrial life on a general level among university students, although some survey questions regarding these issues would surely have helped to interpret some of the study results. On the other hand, this indicates the need for further research regarding the forms of life students imagine when they think about alien life.

The first question in the above list was dichotomous with two Yes/No answer options. For the next three questions in the list, respondents were given five ordinal scale alternatives. Question 5 in the list above was designed as an open-ended, respondent centred question for writing one's own response. One reason for using an open-ended question was to give students the opportunity to respond in their own words and to express their own motivations. Another reason was that we expected not to be able to anticipate all possible reasons for responding to the question. This was particularly useful in minimizing the role of research bias, especially in qualitative analysis.

Excel 2018 was used for data entry and IBM SPSS Statistics was used for statistical processing. Statistical significance was calculated using Pearson's Chi square and likelihood ratio tests.

Results

Belief in life outside our planet (Table 1)

The analysis revealed that 92% of those who answered this question believed that there was life outside our planet. When we did the analysis in different categories, we also found that in each category (subgroup) a large majority (between 82 and 96%) of the respondents believed that there is extraterrestrial life outside our planet. We found statistically significant differences between cities (p-value = 0) and between public and private regime (p-value = 0). No statistically significant differences were found between gender categories (p-value = 0.375) and between fields of study (p-value = 0.033).

Self-awareness of how informed they are about the scientific search for extraterrestrial life (Table 2)

The analysis revealed that only a small fraction of the students surveyed (5%), described themselves as very well informed and a relatively well informed 10% about the scientific search for extraterrestrial life. A total of 38% described themselves as not very well informed or clueless about the subject. Students at public universities were rated as better informed about the subject compared to those at private universities. Male students typically judged themselves to be better informed than females. When divided by field of study, it was found that Natural Sciences students described themselves as better informed, followed by Humanities, Arts and Education students, Engineering and Architecture students, Medical Science students and finally Business and Economics students, in that order. It can also be noted that the better informed the students are according to

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Table 2. How informed are you about scientific research concerning the search for extraterrestrial life?

	Very well informed (%)	Well informed (%)	Regularly informed (%)	Not very well informed (%)	Not informed at all (%)	*p*-value
Students from Universidad Nacional de Cajamarca	3	10	35	40	12	0.00
Students from Universidad Nacional San Antonio Abad del Cusco	11	21	41	22	4	
Students from Universidad Nacional San Antonio Abad del Cusco (Ica)	4	11	46	35	4	
Students from Universidad de Lima y Universidad Nacional de Ingeniería (Lima)	3	6	32	44	14	
Students at a private university	3	6	32	44	15	0.000
Students at a public university	6	14	41	34	7	
Male students	6	13	38	32	10	0.00
Female students	3	8	35	43	10	
Business and Economics students	4	6	32	41	17	0.00
Medical Science students	2	7	42	45	5	
Natural Sciences students	9	18	45	22	7	
Humanities, Arts and Education students	6	11	37	37	9	
Engineering and Architecture students	4	11	35	41	9	
Total number of students ($n = 1237$)	5	10	37	38	10	

Table 3. Correlation between the belief of life outside the planet and the degree of information regarding its scientific search?

	No (%)	Yes (%)	*p*-value
Students who consider themselves very well informed	3.4	96.6	0.000
Students who consider themselves well informed	8.5	91.5	
Students who consider themselves regularly informed	5.9	94.1	
Students who consider themselves not well informed	8.1	91.9	
Students who consider themselves not informed at all	19.2	80.8	

their own assessment, the more likely the belief in the existence of extraterrestrial life is (Table 3).

Correlation between the belief of life outside the planet and the degree of information regarding its scientific search (Table 3)

Statistically significant differences were found between different subgroups, between universities, between study regimes, between genders and between fields of study (p-value = 0).

How long will it take to find life outside our planet? (Table 4)

The most frequent answer about the time it will take to find life outside our planet was 'maximum in 50 years' with 34%, followed by 'maximum in 100 years' and 'more than 100 years' with 21%, then 'maximum in 10 years' with 16% and finally 'never' with 8%. At the level of subgroups (categories), it was also verified that the most frequent response was 'maximum in 50 years'.

Very few students chose the extremes: 'maximum 10 years' and 'never'. However, we can note a higher percentage of students from public universities (17%) compared to students from private universities (14%) believed that the search would be successful in the next 10 years. Female university students are more optimistic about this, with 18% of women believing that the search would be successful in the next 10 years compared to 13% of men. Among the different fields of study, Natural Sciences students were the most optimistic, 18% thought the search would be successful within 10 years. The most pessimistic about success within 10 years were medical science students (11%). In almost all subgroups, <10% thought the search would never be successful, except for medical science students who were the most pessimistic where 16% thought they would never encounter extraterrestrial life, while business and economics students were the least pessimistic about it (6%).

Statistically significant differences were found between cities on the time it will take to find life outside our planet (p-value = 0), between study regimes (p-value = 0.001) and between study fields (p-value = 0). However, no statistically significant differences were found between men and women (p-value = 0.352).

How important is the search for extraterrestrial life? (Table 5)

The most frequent response regarding the importance of searching for alien life was 'very important' and 'moderately important', both with 38%. At the subgroup level, these same responses were also the most frequent.

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Table 4. How long will it take to find life outside our planet?

	Maximum in 10 years (%)	Maximum in 50 years (%)	Maximum in 100 years (%)	More than 100 years (%)	Never (%)	*p*-value
Students from Universidad Nacional de Cajamarca	21	30	17	19	13	0.000
Students from Universidad Nacional San Antonio Abad del Cusco	11	20	32	22	14	
Students from Universidad Nacional San Antonio Abad del Cusco (Ica)	18	39	14	22	7	
Students from Universidad de Lima y Universidad Nacional de Ingeniería (Lima)	15	38	22	21	5	
Students at a private university	14	38	22	20	5	0.001
Students at a public university	17	30	20	21	11	
Male students	13	35	21	22	9	0.352
Female students	18	33	21	20	8	
Business and Economics students	15	42	21	17	6	0.000
Medical Science students	11	21	16	37	16	
Natural Sciences students	18	31	23	19	9	
Humanities, Arts and Education students	17	34	22	18	9	
Engineering and Architecture students	16	33	22	22	7	
Total number of students ($n = 1237$)	16	34	21	21	8	

The percentage of respondents who thought it was very important to search for extraterrestrial life differed slightly between private and public university students. A total of 39% of students at private universities and 37% at public universities thought it was very important. Among male and female students there was a slight difference in favours of women, who 39% thought it was very important to search for extraterrestrial life compared to 36% of men. There was also a difference between Natural Sciences students (41%) and Humanities and Art students (36%) likely to think it was very important to seek extraterrestrial life.

Very few respondents in all subgroups (between 1 and 7%) thought that seeking extraterrestrial life was something we should avoid. The most hesitant were those in Natural Sciences, but even in this group the percentage of students who thought we should avoid looking for extraterrestrial life was very low (7%).

Only statistically significant differences were found between cities regarding the importance of searching for extraterrestrial life (p-value = 0). Although there were slight differences between the study regimes, these differences were not statistically significant. Something similar occurs between men and women and between the different fields of study.

Motives (Table 6)

Respondents gave a variety of reasons for their answers about how important they thought it was to seek out alien life. The answers in parentheses are a paradigmatic example of the type of response we are looking for each classification, following the Swedish version of this study. The reasons were grouped into six categories:

(1) *Interesting* (e.g. 'interesting in its own right', 'great').
(2) *Uninteresting* (e.g. 'I'm not particularly interested in this, so I don't care', 'I haven't thought about it and I don't find it exciting').
(3) *Useful* (e.g. 'we can learn from them', 'knowledge sharing').
(4) *Useless* (e.g. 'what's the point', 'irrelevant to my life').
(5) *Financial reasons* (e.g. 'we have more pressing problems spending our money', 'they are unnecessary expenses').
(6) *Other reasons*. This category consists of several different reasons that were stated by very few students. These can be roughly divided into the following subcategories:
   (a) Low probability of success (e.g. 'because we will probably never find anything', 'why look for something, that doesn't exist').
   (b) Risk (to us or to them) (e.g. 'they may be dangerous to us', 'we would simply exterminate them').
   (c) Risk management (e.g. 'If there is extraterrestrial life it is important to find it before it finds us', 'we need to find a place where we can move when our Earth is no longer habitable').
   (d) Loneliness (e.g. 'I feel isolated', 'I want to meet an alien').
   (e) We are not ready (e.g. 'we don't have the technology to look beyond our solar system', 'it won't happen until we are ready').
   (f) Related to science fiction (e.g. 'cf. the game Mass Effect', 'wants to know if the worlds in Star Wars really exist').

The most important reason in total, as well as for all the subgroups, was 'useful' positive reason (i.e. reason to assign a high priority to searching for extraterrestrial life). The second most important reason was 'useless' negative reason (i.e. reason to assign a low priority to searching for extraterrestrial life) for all subgroups.

When we looked at the data in more detail, we found that students from Cusco and Ica were motivated by the usefulness of finding extraterrestrial life (50%) compared to students from Cajamarca (38%) and Lima (43%). Similarly, students motivated

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Table 5. How important is the search for extraterrestrial life?

	Very important (%)	Moderately important (%)	Not important (%)	It is something we should not prioritize (%)	It is something we should avoid (%)	*p*-value
Students from Universidad Nacional de Cajamarca	41	33	8	13	5	0.000
Students from Universidad Nacional San Antonio Abad del Cusco	27	40	15	11	6	
Students from Universidad Nacional San Antonio Abad del Cusco (Ica)	44	36	5	10	5	
Students from Universidad de Lima y Universidad Nacional de Ingeniería (Lima)	38	39	10	12	1	
Students at a private university	39	39	9	12	1	0.021
Students at a public university	37	37	10	12	5	
Male students	36	36	12	12	4	0.143
Female students	39	39	7	12	3	
Business and Economics students	38	39	11	11	1	0.164
Medical Science students	40	40	8	8	3	
Natural Sciences students	41	34	7	11	7	
Humanities, Arts and Education students	36	35	11	14	4	
Engineering and Architecture students	38	40	8	12	3	
Total number of students (n = 1237)	38	38	9	12	3	

by a judgement that knowledge of extraterrestrial life would be useless were higher in Cajamarca (25%), followed by Cusco (23%), Lima (22%) and Ica (20%). However, these differences were not statistically significant (p-value = 0.310).

With respect to the study regime, no statistically significant differences were found between public and private university students regarding the reasons for the importance of the search for extraterrestrial life (p-value = 0.674).

Something similar occurs between males and females, no statistically significant differences were found between male and female university students on the reasons for the importance in the search for extraterrestrial life (p-value = 0.884). However, we could note that women were more motivated by a judgement that finding extraterrestrial life was interesting (11%) compared to men (8%).

When compared by field of study, we found that Engineering and Architecture were the fields with the highest motivation for the usefulness of finding extraterrestrial life (48%), followed by Humanities, Arts and Education (47%), the other fields of study only reaching up to 43%. In addition, between 21 and 24% of the different fields of study were motivated by the uselessness of finding extraterrestrial life. It should also be noted that the students of Medical Sciences and those of Natural Sciences were more motivated than the other students by a judgement that finding extraterrestrial life was interesting (in both fields it reached 14%). Although there were some differences in the reasons for the importance of the search for extraterrestrial life between the different fields of study, these were not statistically significant (p-value = 0.185).

Belief in extraterrestrial life versus belief in finding extraterrestrial life (Table 7)

The percentage of students who believe that there is no extraterrestrial life (8.2%) is very similar to the percentage of students who believe that life will never be found outside our planet (8.5%). Private university students who think that there is no extraterrestrial life (3.7%) is slightly less than those who believe that life will never be found outside our planet (5.2%). In public university students the opposite is true, those who think that there is no extraterrestrial life (11.5%) are slightly higher than those who believe that life will never be found outside our planet (10.8%). Male students who think that there is no extraterrestrial life (7.3%) are fewer than those who believe that life will never be found outside our planet (9.5%). However, in female students the opposite is true, those who think that there is no extraterrestrial life (9.2%) are greater than those who believe that life will never be found outside our planet (7.6%). When making the comparison in the different fields of study, it is observed that the percentage of those who think that there is no extraterrestrial life is less than the percentage who believe that life will never be found outside our planet, except for students of Humanities and Art where the opposite is observed.

The results in Table 7 are derived from the other tables using the results of the subgroups. It can be noted that these results have a similarity to that of Sweden, where the percentages were No life to be found (10%) and No success in finding life (6%) and it was suggested that future research should try to better explain this

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Table 6. What is the reason for your answer to the question above?

	Interesting (%)	Uninteresting (%)	Useful (%)	Useless (%)	Financial reasons (%)	Other reasons (%)	*p*-value
Students from Universidad Nacional de Cajamarca	11	4	38	25	1	22	0.310
Students from Universidad Nacional San Antonio Abad del Cusco	8	4	50	23	2	14	
Students from Universidad Nacional San Antonio Abad del Cusco (Ica)	11	4	50	20	1	14	
Students from Universidad de Lima y Universidad Nacional de Ingeniería (Lima)	9	4	43	22	2	20	
Students at a private university	9	4	44	22	2	19	0.674
Students at a public university	10	4	45	23	1	17	
Male students	8	4	45	23	2	18	0.884
Female students	11	4	44	22	1	18	
Business and Economics students	11	5	40	21	2	21	0.185
Medical Science students	14	2	43	22	0	18	
Natural Sciences students	14	3	41	24	1	18	
Humanities, Arts and Education students	8	5	47	23	2	16	
Engineering and Architecture students	7	3	48	22	2	18	
Total number of students (n = 1237)	10	4	45	22	2	18	

result, as it could be due to the fact that respondents consider it more important to focus research attention on climate change (Persson *et al.*, 2018). The Peruvian case is no exception, so we also recommend expanding this aspect of the research in order to be sure of why we have this result.

Discussion

Belief in life outside our planet (Table 1)

Interestingly, most respondents believe that extraterrestrial life does exist. However, there are differences between the subgroups, especially between cities and public and private regimes. This may be due to the proliferation of information and interest in the search for extraterrestrial life. Coincidentally, Lima and Ica were two of the first places to take an interest in developing astrobiology.

Also, the belief they may have in this aspect can be explained by the influence that science fiction films can have on students, an aspect that is identified (Laprise and Winrich, 2010; Surmeli, 2012). Thus, science fiction films that refer to the possibility of life on other worlds abound in our time, which could increase students' interest and expectations about whether or not we will encounter extraterrestrial life.

Student self-evaluation of how well informed they are about the scientific search for extraterrestrial life (Table 2)

Although 92% (Table 1) said that they believe that there is life on another planet, only 5% said that they are self-aware that they are well informed. Would they believe less in life outside of Earth if most were well informed? A belief can be based on many assumptions, so it is difficult to trace exactly which of those assumptions people admit to believe in extraterrestrial life. We could not assume that because they are not well informed they necessarily have to believe in other life forms. This could be an opportunity for further study. This also reflects a reality that is lived in Peru, since it does not have an institutionalization by the State nor promotion on a large scale of the search for life in other worlds, and at the civil level there are only two registered institutions that promote and are dedicated to astrobiology. There is still much work to be done in this area and this work may encourage new initiatives in the direction of future development of astrobiology in the country. Regarding the subgroup differences on self-assessment of what they know about extraterrestrial life, it was to be expected that students of Natural Sciences are better informed as they are more in touch with research articles in their area, where they are more likely to find astrobiological reading material, while students of humanities and arts, for example, do not normally have day-to-day access because of the nature of their careers.

We see that it is men who are perceived to be the best informed. Perhaps this can be explained by the study made by Litzler *et al.* (2014), where they indicate that men have a higher degree of self-esteem in the STEM area. Other studies such as Cooper, Krieg and Brownell show 'that men had significantly higher academic self-concept relative to their groupmate compared with women' (2018).

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Table 7. Belief in extraterrestrial life versus belief in finding extraterrestrial life

	There is no extraterrestrial life (%)	Life will never be found outside our planet (%)
Students from Universidad Nacional de Cajamarca	11.9	12.9
Students from Universidad Nacional San Antonio Abad del Cusco	17.6	14.3
Students from Universidad Nacional San Antonio Abad del Cusco (Ica)	5.5	7.5
Students from Universidad de Lima y Universidad Nacional de Ingeniería (Lima)	4.6	5.2
Students at a private university	3.7	5.2
Students at a public university	11.5	10.8
Male students	7.3	9.5
Female students	9.2	7.6
Business and Economics students	5.0	5.8
Medical Science students	12.4	15.7
Natural Sciences students	7.9	8.6
Humanities, Arts and Education students	10.9	9.1
Engineering and Architecture students	6.7	7.3
Total number of students ($n = 1237$)	8.2	8.5

Correlation between the belief of life outside the planet and the degree of information regarding its scientific search (Table 3)

The general perception of the respondents is mixed, although the opinion prevails that they have no idea about the subject. This can be contrasted with Table 2, which shows that students' scientific knowledge of extraterrestrial life is low. Obviously, if one considers that he or she knows little about a subject, he or she will have the perception that he or she has no idea about it. However, the results in Table 3 also show the belief that extraterrestrial life does exist.

How long will it take to find life outside our planet (Table 4)

The answers given by most respondents are towards a moderate prognosis, i.e. neither so close (10 years) nor so far (100 years) from the present. All together 71% consider that in 100 years at most we have evidence of a second genesis. Natural Sciences students are more optimistic about finding extraterrestrial life in the next 10 years, which can be explained, again, by their being more in touch with up-to-date material on the subject. As for the cities and study regimes, the differences are difficult to explain as there is disparity in each.

How important is the search for extraterrestrial life? (Table 5)

Most believe it is very important or moderately important to seek out alien life, no matter where or what field of study, whether in public or private universities, the tendency is to want to know whether we are alone in the Universe. Again, and in relation to previous tables, those of Natural Sciences have an uptick on the importance of the search for extraterrestrial life.

Motives (Table 6)

The majority of participants responded positively to the priority that should have been given to the search for extraterrestrial life, however, the second largest group felt that it was futile. These conflictive opinions may be due to the degree of information available to the participants, and the thought that we may have more important problems to solve in the country. In a Latin American country like Peru that is in the process of developing and facing different economic and political problems, it would be understandable to think that the average of the population believes that it is not so useful to seek life in other worlds.

As for the difference found between cities like Cusco and Ica, this can be explained because astrobiology has grown slowly through small groups interested in the subject. There is no significant difference between public and private university students, in the same way between the male and female genders, however, we perceive that more women than men find it interesting to find extraterrestrial life. A finding to explore in future studies is that the results between universities are related to geographic differences. A student from the capital Lima may have different answers than one from Cajamarca and not necessarily because they are from different universities. Peru is a multicultural country and this can be manifested in the results.

In terms of specialties, the areas of Engineering and Architecture were the fields with the most motivation in finding extraterrestrial life, followed by the Humanities, while the other fields showed less interest. As for the Medical Sciences and Natural Sciences, there is an interest as well, but their motivations may differ, perhaps due to the focus that each discipline has.

Belief in extraterrestrial life versus belief in finding extraterrestrial life (Table 7)

At this point, respondents responded with a tendency to believe that there is no extraterrestrial life rather than never finding it. That is, the minority believes it will never be found, an answer that is in line with the tables above. Except for a difference in the response in women where it is believed that life will never be found outside the planet, the position is generally more

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optimistic about the future, since the term 'never' refers to an absolute that will not change.

Conclusions

Great interest can be seen in students about the search for extraterrestrial life, which coincides with the results also obtained in Persson *et al.* (2018) in which they obtained 90% who believe that there is life outside the Earth from 492 respondents, while in this study we have 92% of 1237. And just like them, we also note the need to scientifically promote these areas of interest, for which the State should promote topics related to astrobiology in the country. There is a great niche that can be exploited for the good of the development of astrobiology.

Although it is true that in developing countries like Peru there is no great infrastructure or investment in aerospace issues, this does not take away the opportunity to at least carry out major campaigns to popularize science by attracting people with the theme of extraterrestrial life. This could be a start to later increase investment in research related to these issues, and it would also help people understand that it is not just a matter of looking outwards to see if we are alone, but that the technology developed for these purposes can serve our planet in a positive way.

The data and information obtained in this survey are very helpful because they give us a picture of how a developing country perceives the search for extraterrestrial life through its university students. It would be interesting, along these lines, to compare these results with others that may be done in the future in other countries, perhaps by continent, in order to evaluate in a more panoramic way how humanity perceives this topic.

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