Z Generation Youth and Interest in Science

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ABSTRACT

Each year there is increasing the behavior of dependence on individuals in relation to the use of technologies, especially among the young people of Z Generation, born after the year 2000 and currently attending high school. Despite this, the relationship of science with these technologies seems not to be observed, since in several countries there is a decrease in the interest of young people for science. In view of this, aiming to investigate the interest of the young people of Z Generation by school science, this article wants to give the students of Canoas/RS a voice about this theme. The methodology adopted involved the application of a questionnaire called "*Barometer: young people and science*", belonging to the Project Sapiens that investigates nationwide the opinions, attitudes and interests of young people in relation to science and technology. The data presented here were collected in 19 schools, with the participation of 1.331 young people. The results show that they have more interest in other areas of science, such as health sciences, for example, than in relation to technological science. Being this low interest more evidenced in the girls than in the boys. This fact leads to the conclusion that young Z are effective in making use of technologies, however, do not reveal an interest in understanding it. In view of this, it is up to reflection on the need for educational actions that can make science teaching, especially that which involves the most interesting technologies, since the perception of students about science is certainly Influence on your academic and professional choices.

Keywords: Interest in Science. Z Generation. Science Teaching.

Os Jovens da Geração Z e o Interesse pela Ciência

RESUMO

A cada ano que passa, nota-se crescente o comportamento de dependência dos indivíduos em relação ao uso das tecnologias, principalmente entre os jovens da Geração Z, nascidos após o ano 2000 e que atualmente cursam o Ensino Médio. Apesar disso, a relação da ciência com essas tecnologias parece não ser observada, uma vez que em diversos países se nota a diminuição do interesse dos jovens pela ciência. Neste sentido, objetivando investigar qual o interesse dos jovens da Geração Z pela ciência escolar, este artigo oportuniza dar voz aos estudantes de Canoas/RS acerca dessa temática. A metodologia adotada envolveu a aplicação de um questionário chamado

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"Barômetro: Os jovens e a ciência", pertencente ao Projeto SAPIENS, que investiga em âmbito nacional as opiniões, atitudes e interesses dos jovens em relação à ciência e tecnologia. Os dados foram coletados em 19 escolas, com a participação de 1.331 jovens. Os resultados revelam que eles possuem mais interesse em outras áreas da ciência, como as ciências da saúde, por exemplo, do que em relação a ciência tecnológica. Sendo esse baixo interesse mais evidenciado nas meninas do que nos meninos. Esse fato leva a concluir que os jovens Z são eficazes ao fazer uso das tecnologias, contudo, não revelam interesse em compreendê-la. Diante disso, cabe a reflexão acerca da necessidade de que ações educacionais que possam tornar o ensino de ciências, principalmente o que envolve as tecnologias, mais interessante, uma vez que a percepção dos estudantes acerca das ciências é certamente influenciadora nas suas escolhas acadêmicas e profissionais.
Palavras-chave: Interesse pela Ciência. Geração Z. Ensino de Ciências.

INTRODUCTION

Science and technology are present in the most varied items of consumption of modern society: mobile devices, computers, media and information, clothing and even in foods that are consumed. In this context, scientific education is of paramount importance for human development, for the creation of a nation's internal scientific capacity and the formation of conscious, participating and informed citizens. For this reason, access to science should be equitable, not only because of a social and ethical issue aimed at human development, but also because of its capital importance, because through it is possible to achieve the realization of the full potential of the communities Scientific, in order to guide the needs of mankind (Werthein & Cunha, 2009).

However, research reveals that there is a decrease in interest in science [citation of these researches] with the passing of school years, mainly from high school. In general, children in the early grades have a greater interest in science than young people (Gouw, Mota & Bizzo, 2013; Siegel & Ranney, 2003). The motivation of the students and lack of interest in scientific studies has now been one of the major concerns of all those who are directly connected with education, especially when it comes to the young people. This phenomenon has been observed in several countries, not only in Brazil. The general lack of interest of young people has triggered the students' low enrollment in scientific careers. However, in a deeper analysis, several authors agree that the biggest problem lies in the fact that school science does not produce a satisfactory education for the majority, thus causing adverse implications for the formation of future scientists (Bizzo & Pellegrini, 2015; Gouw et al., 2013; Osborne & Dillon, 2008).

For young people, the social impact that the technological advances of modern society impose, increasingly, make teaching science a matter of extreme relevance. Therefore, it is necessary to know the interest of young people by science, since this knowledge favors a significant way to relate the relevance of this theme to students and to investigate how science influences their personal formation, their future choices and the relationship with the surrounding environment (Pereira, Santos-Gouw, & Bizzo, 2007).

Under this perspective, the way young people think and act in relation to science and technology (S&T) can also be analyzed from a sociological standpoint. According to

Fávero, Spósito, Carrano & Novaes (2007) in order to succeed in the pedagogical process of teaching-learning, it is imperative to understand how young people are affected by the ongoing social transformations, as well as what their perceptions and previous conceptions about the world are. The world perception or young people is radically divergent from the adult world. The young man lives in a completely new universe, whose categories of intelligibility he is helping to build. For this reason, to interrogate and discuss the social processes that influence them, their perceptions and the motivations that lead their way of thinking and acting, allow not only a "*better understanding of the universe of references of this particular age group, but also of the new transformed society that emerges from this mutation*" (Peralva, 1997, p.9).

About education and pedagogical praxis, the paradoxical contrasts associated with the conflict of age generations make teachers strive more to develop the ability to perform didactic transposition in the face of the reality of a new world which is constantly built. In relation to these conflicts Santos Neto e Franco (2010, p.12) claim that:

> Many of the current teachers were born in a time when television was the main means of communication and, as such, provoked many changes in various aspects of life in society. These same teachers live today with children and young people who are almost all the time in a technological and virtual reality much more advanced than the one they experienced in their trajectory: internet, mobile phones, computers, iPods, video games with magnificent graphics, videos and televisions with high definition and 3d, games played on the internet, social networks, etc. It is natural that these differences provoke the emergence of problems, disappointments and challenges that require a permanent reinventing of teacher education and work.

In this perspective, this article aims to investigate the interest of young people of the Z Generation, born between the years 2000 and 2010, and who are in high school, by science in order to contribute to the understanding of this particular social group and also to the discussion about the role of education and science teaching, as well as its influence on the construction and development of opinions and attitudes of these young people in relation to S&T.

RESEARCH ON INTEREST IN SCIENCE

In the last decades, both in academia and in the political environment, the social perception of science and technology has been a topic of great relevance. In this sense, knowledge of the attitudes and opinions of people about science, technology and its economic, political and ethical implications are crucial for the formulation and evaluation of public policies aimed at advancing civilizations as a whole (Castelfranchi, Vilela, Lima, Moreira & Massarani, 2013).

The first survey of public perception of science was made in the United States (USA), in 1957, by the National Association of Science Writers (NASW) and demonstrated that although the Americans demonstrated positive attitudes towards science, their factual knowledge of specific scientific content was low. For this reason, in the following two decades, the US government has invested several billion dollars in science education, especially in public schools, generating a movement that has repercussions worldwide, including in Brazil. Since the first investigation, research on public perceptions about S&T continues to occur annually in the United States (MCT & CGEE, 2015).

In Brazil, the first research carried out with this end took place at the end of 1987. Subsequently, the *Ministério da Ciência e Tecnologia* – MCT presented three other researches with the same objective, which occurred in the years 2006, 2010 and 2015. These studies were conducted with people of different age groups, from 16 years of age, where data were collected regarding the levels of scientific information of the population, their social representations and visions about scientists, their perceptions and attitudes pertaining to science, technology and innovation, as well as on the interviewees' perception of the risks and possible impacts of S&T (Instituto Gallup, 1987; MCT, 2007, 2010; MCT & CGEE, 2015).

According to Castelfranchi et al. (2013), the results of the first polls, both global and Brazilian, emphasized the low knowledge of the population about basic principles of science and the scientific method, so a large part of the interviewees from all countries was considered true "scientific illiterate". For the authors, these first results contributed to the strengthening of dissemination and scientific education. Specifically in the academic field, students' interest in science has become more widely discussed in Brazil with the dissemination of the results of the implementation of the Program for International Student Assessment – PISA, promoted by the Organization for Economic cooperation and development – OECD, where we perceived the low performance of young Brazilians in relation to matters related to the sciences. The program, which is an international assessment conducted by OECD member countries, has as one of its objectives to evaluate the knowledge and skills that are needed in real-life situations, considering reading, mathematics and science. PISA assessments take place every three years, with each edition of the program having a greater emphasis on each of these thematic areas (INEP, 2016a).

In the year 2000, when the first evaluation of PISA was performed, it was observed that the results that represented the Brazilian students were the worst considering all the 32 participating countries, with Brazil being the 32nd placement. In the year 2006, when the emphasis of the research was the discipline of sciences, Brazil occupied 52nd placement, in a total of 57 participating countries. And again, in the year 2015, when the sciences were the focus of the research, once again, the results demonstrated the low placement that Brazil occupies in this scenario, being in 63rd place, considering the 70 participating countries (INEP, 2001, 2003, 2008, 2013, 2016b).

Another worldwide project widely applied in more than 40 countries, but without the bias of the government as the PISA, is the project ROSE – Relevance of Science

Education. The ROSE began to be discussed institutionally in 2001, in an attempt to respond to the various dilemmas faced by researchers in the field of science education and by society itself, with regard to the decrease in the interest of young people to follow scientific careers, and the decrease of interest in science throughout basic schooling (Schreiner, 2006).

Characterized by having as public of fifteen years old, ROSE investigates the affective dimensions of how students relate to S&T to gather and analyze information about the relevance of science education and the various factors influencing the students in their attitudes and their motivations to learn science. The questionnaire, elaborated with the collaboration of several researchers in the field of science teaching in different countries, is characterized by being an instrument that seeks international cooperation. The data collected by the countries are made available to all researchers involved. This possibility allows discussion and more in-depth comparison of the similarities and discrepancies between the results of the countries investigated (Neresini, Crovato, & Saracino, 2010; Sjøberg, 2000).

In Brazil, ROSE was applied twice: in 2007, in the form of a pilot project in two Brazilian cities, and 2010 nationwide, involving almost 2,400 students, from 84 Brazilian schools, contemplating samples from all states. The two experiments demonstrated that, although the international Project ROSE has contributed with a vast database, the experience of research conducted with students from Brazil considered that the size of the questionnaire caused discomfort in the students, mainly depending on the number of questions, which demanded considerable time to answer it (Amestoy, Nascimento, Nunes & Tolentino Neto, 2013; Santos Gouw, 2013; Tolentino Neto, 2008).

In the applications of the ROSE questionnaire in the participating countries, including Brazilian investigations, it was observed that there is a difference in perceptions about science in relation to girls and boys. Girls, especially in richer countries, are more unbelievers than boys are about the importance of S&T for society. In addition, it has also been noted that young people from developing countries are more interested in science than young people from developed countries (Schreiner & Sjøberg, 2010).

THE YOUNG PEOPLE FROM Z GENERATION

Although most commonly known as Z Generation, young people born between the years 2000 and 2010, can also be called Digital Generation, Net Generation, On-line Generation, Connected Generation or simply, *Zappiens*. This reference regards the term "zapping" since they are accustomed to switching from one channel to another on television without stopping in virtually any (Veen & Vrakking, 2007).

In sociology area, studies on this generation are still cautious, because their representatives are attending basic education (elementary or middle school) or, at most, entering the university or starting in the labor market, since the oldest ones have not yet completed 20 years old. However, most studies agree that they exhibit a totally

differentiated behavior from previous generations, being more active, direct, impatient, uncontrollable and undisciplined than their predecessors (Ceretta & Froemming, 2011; Fagundes, 2011; Maurer, 2013; Tapscott, 2010; Veen & Vrakking, 2007).

Fagundes (2011), reflecting on these findings, says that they are nothing more than the fruit of global cybernetic culture, based on multimedia, in which this generation was created. The mass coexistence with the technologies influenced not only the way of thinking and the behavior of the Zappiens but also has consequences in their attitudes and abilities. The anxiety and immediacy of them, for example, is based on digital speed, where everything happens quickly and presents instantaneous results, as occurs when they are connected to social networks or seek some information on the internet. This speed leads them to think that, in life, logic should be the same.

Jordão (2016) when discussing the profile of Generation Z explains that they can be considered globalized individuals since with the internet they have access to the same clothes and products as another young person in the United States or Japan. For this reason, too, they are more inclusive and less prejudiced, since they are much more exposed to diversity. About their expectations towards the future and professional careers, these young people want immediate results and do not accept the vertical hierarchy.

In the educational sphere, researches about the Zappiens are rarer than in the sociological field, but what is already known is that they arrive at school with the knowledge acquired, and this basic knowledge results from their wide access to technology. Because of this, your learning is not restricted to books or classroom, with teachers. They have laptops, tablets, smartphones, have access to the internet, and at the same time, they seek to learn, in a certain way, define what, when and how they want to acquire knowledge. The challenges of teaching these young people and their characteristics in educational terms were mentioned by some researchers, as can be seen in Table 1:

Table 1
General and specific contents worked in each scientific area.

Reference	***Feature***
Santos Neto e Franco (2010)	*Fast and agile with computers. However, they have difficulties with traditional school structures. Verbal communication is hinted by technologies, present always. Its written language is fully reconfigured because it does not have the habit of reading.*
Jordão (2016)	*They live in a world of updating, where ancient concepts are exchanged for novelties, which often causes a shock with the traditional teaching model. They write better and faster on your phone, iPad and laptop, then with pencils and paper.*
Obregon et al. (2016)	*They are extremely creative and have new forms of expression. Because they seek information on the internet only, it is common to practice plagiarism and piracy, and therefore it is also common to consider false information as true.*
Bortolazzo (2012)	*First time in history in which children play the role of teachers, teaching something to adults – usually the management with the technologies, tools in which they are immersed from birth. They are "multitasking", having cognition with several centers, capable of assimilating different information at the same time.*

Reference	Feature
Fagundes (2011)	*They have a natural ability to synthesize information. However, they need to learn how to search for this information, analyze it, synthesize it, and evaluate it critically.*
Veen & Vrakking (2007)	*They demonstrate hyperactive behavior and limited attention to small intervals of time. They want to be in control of what they engage in and have no patience to hear a teacher explain the world according to their own convictions.*

Veen and Vrakking (2007) in his work titled "Homo Zappiens: Growing up in a digital age" explains that the task of teaching these young people so peculiar has become an even more challenging practice. That is because they find the content-centered approach irrelevant, they consider the learning at school is dull and unchallenging. In other words, the young Zappiens are digital, but the school education approach remains analogue.

As you can see, many are the implications that describe the Z Generation, although they are still in the process of constructing identities and values. Despite this, changes that these young people represent are already perceived by the whole society. These changes can be a possibility of positive transformation, considering the beneficial social aspects attributed to the characteristics of these future adults (such as their cognitive abilities, flexibility, tolerance to diversity, collaborative capacities and creativity). On the other hand, it serves as an alert in relation to the ethical and social aspects that seem, at some point in history, to have been lost, being evident in their specific attitudes, such as their individualistic and consumerist orientation.

METHODOLOGY

The study presented in this article was conducted with young people, high school students, private and public schools located in the city of Canoas, located in the metropolitan area of Porto Alegre, capital of the state of Rio Grande do Sul-RS. The municipality has a total of 26 high schools, but 19 schools participated in the study. Each school randomly selected a class, representative of each year of High School (1st, 2nd and 3rd years), of the day shift (morning or afternoon).

The research is linked to the Sapiens Project, which derives from the application of the ROSE Project in Brazil. For this reason, the instrument adopted for data collection was the questionnaire "Barometer: Youth and Science". The questionnaire was elaborated by the Sapiens Project and is the result of the reduction of the items of the original ROSE, through statistical analysis, yet preserving its internal consistency (Bizzo & Pellegrini, 2015; Pinafo, 2016).

In this article, it was considered the predominantly quantitative approach of the research, for this reason, the analysis of the collected data was made through statistical tools. The results of the nominal variables were expressed through frequency analysis and the results of the continuous variables through mean ± standard deviation, to present the characteristics of the sample and identify the interest and opinions of young people

in Relation to science and technology. In addition to the respondents' gender, the type of school that young people attend (whether public or private) was also considered in the analysis of the data.

In all, the responses of young people to 26 questions investigating the interest of young people in learning about the subjects or themes related to science were analyzed. The response options varied in a Likert-type scale, containing only 4 points, and the levels of interest represented by indices 4 (very interested) and 3 (interested) and of lack of interest represented by indices 2 (disinterested) and 1 (very disinterested). Moreover, to identify which areas of science are considered more or less interesting by young people, we chose to categorize the questions of the questionnaire according to the scientific area to which they relate (Table 2).

Table 2
Classification of issues by scientific area.

Area	Issues
Health Sciences	*1 to 7*
Earth and Environment Sciences	*8 to 10, 15*
Astronomical Sciences	*11 and 12*
Folk Science, Beliefs and Mysteries	*13, 14, 16, 21*
Technological Science	*17 to 20*
History and Philosophy of Science	*22 to 26*

RESULTS AND DISCUSSION

A total of 1.331 young people participated in the research, with mean ages between 14 and 18 years. The distribution by gender in the sample was equal, counting with the participation of 666 girls and 665 boys. In total, the participation of students from public schools was higher than individuals, with the whole 1.151 (86.5%) young people from the public school and 180 (13.5%) from the private school.

It was observed that, in the general group, the highest rate of interest for young people refers to the statement "*A4- How to provide first aid*", since it obtained an average index of 3.22. The lowest rate of interest for young people is related to the affirmation "*A22- Famous scientists and their lives*" since it obtained an average of 2.13. By analyzing separately, the indices of greater and less interest among boys and girls, it is noted that among boys the subject of greatest interest is attributed to the affirmation "*A26- Phenomena that scientists have not yet managed to explain*". Among the girls, remains the statement "*A4- How to provide first aid*" followed by the statement "*A2- How can we treat cancer*", as shown in Figure 1.

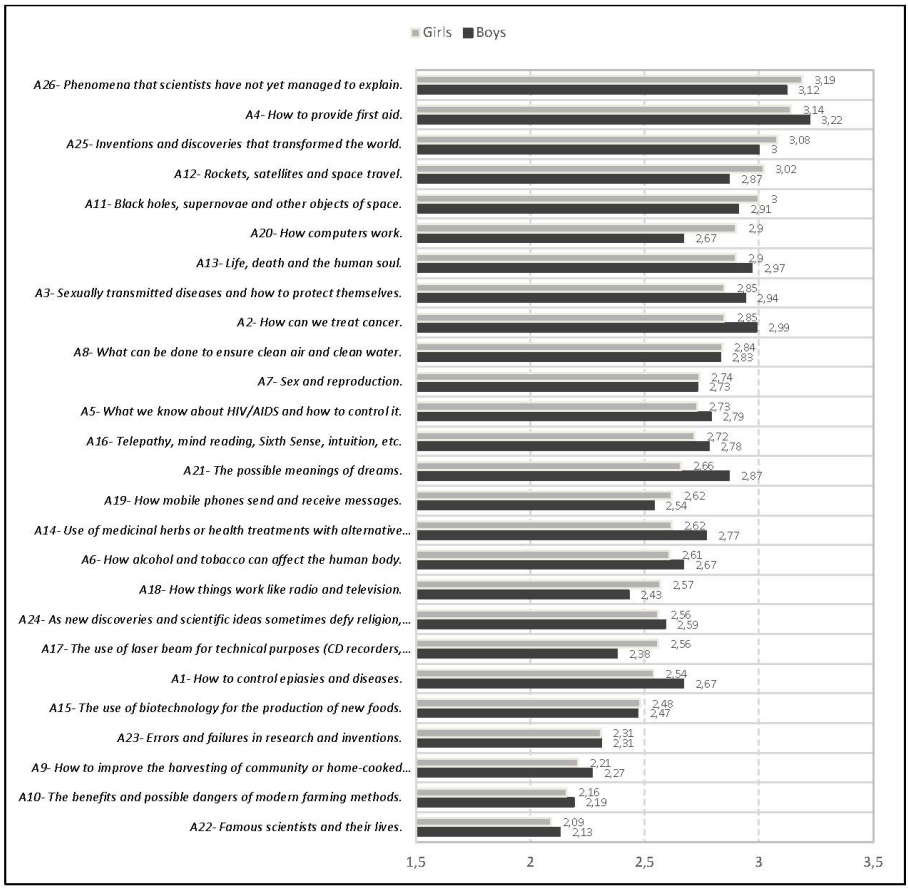

Figure 1. The questionnaire affirmations by boys and girls.

When analyzing the results by type of school, it was observed that the statement "*A4- How to provide first aid*" prevailed, between the greatest interest, both public and private. However, in the index of lesser interest, the statement "*A10- The benefits and possible dangers of modern farming methods*", was the most strongly rejected in private schools (2.06).

When analyzing the data considering the classification of subjects by scientific area, it was noted that the categories "*Health Sciences*" and "*Folk Science, Beliefs and Mysteries*" stand out as areas of greatest interest among girls. While for boys, the area of greatest interest is that of the category "*Astronomical sciences*", as can be observed in the averages shown in the graph of Figure 2.

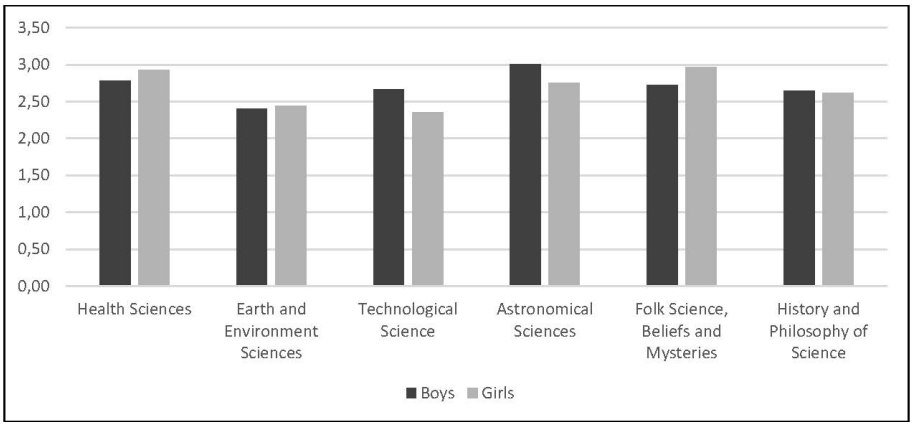

Figure 2. Averages by scientific areas of interest.

According to Cunha et al. (2014), one of the probable causes for the differences in preferences between girls and boys may be associated with the informal education process established by the family, media and social relations. The authors consider that their affinity for matters that involve more health sciences occurs because, from the young age, girls are encouraged to deal with this theme, through games of care with dolls, with beauty and with welfare. The boys receive more stimuli with instruments and toys that refer to tools, cars, rockets, machines and computers. Which, under this perspective, could justify their preference for planetary sciences and technological science, to be much more significant than that observed among girls.

This logic corroborates the results of the girls, who presented the lowest index of interest (2.35), precisely in matters related to technological science. As the studies showed, girls and boys have different interests. For Wender (2004) the fact that girls are less interested than boys, by the subjects of technology, is related to the stereotypes to which they are submitted and states that, despite being evident the differentiated forms as the different genres perceive technology, when stimulated and encouraged through the contextualized teaching of science, they can be so or more interested than them.

Another interesting fact, observed in the present study, concerns the high interest of the boys by the health sciences (2.78) since it was observed in their results an index higher than that observed in relation to technological science (2.66). A similar phenomenon was also found in the studies by Pinafo (2016) and Santos Gouw (2013), who concluded that although with higher indices among girls, the themes involving human health also have great interest on the part of the boys.

Regarding the specific interest of technology, it is perceived that the indices between boys and girls are quite different. Among the girls, the average index 2.35 leads to consideration the low interest in this subject, while the average index of 2.66, attributed

to the boys, shows that they have a greater interest, however, it is not possible to admit that this interest is high, since it is just slightly above the neutrality limit, which is 2.5.

The lack of interest of the young by science in general has been discussed in many countries, being more evident in developed countries than under-developed (Schreiner & Sjøberg, 2007). A study conducted in Portugal, for example, revealed, in a preoccupied way, the low interest of young people in areas related to S&T, claiming that several factors have contributed to this situation, for example, the primacy of the fun on the effort, considering that the disciplines related to S&T (Mathematics, Chemistry, Physics and Biology) are considered more difficult. In addition, they also contribute to the deficit of scientific training in high school, the reduction of belief in science and insufficient visibility and little prestige, associated with the image of the scientist (Carrapatoso et al., 2005).

When analyzing the results by type of school, it was observed that three scientific areas (Health sciences; Folk science, beliefs and mysteries; and History and philosophy of science) presented results with statistically significant differences ($p < 0.05$) within the analyzed levels, since the highest averages in these categories are associated with private schools (Table 3).

Table 3
Classification of questions by scientific area.

Area	Overall average	Public School	Private School	*P (value)*
Health Sciences	2,90	2,84	2,95	0,01**
Earth and Environment Sciences	2,40	2,43	2,38	0,17
Astronomical Sciences	2,49	2,51	2,48	0,42
Folk Science, Beliefs and Mysteries	2,89	2,88	2,90	0,86
Technological Science	2,89	2,83	2,94	0,03**
History and Philosophy of Science	2,68	2,62	2,75	0,02**

*** Significant at 0.05 level. Kruskal-Wallis Test.*

The analysis of the data also calls attention to the low indices associated with the area "Earth and the environment sciences". This issue has identified as of lesser interest among young people in general, being considered even less attractive by boys and students from private schools (although in relation to the type of school, no statistical differences are evidenced). Regarding this finding, it is possible to believe that this result is associated with the detachment of young people in relation to nature, since Canoas (study site) is an industrial city, highly urbanized, with few leisure options outdoors and without rural areas.

This hypothesis is corroborated by the research by Tolentino Neto (2008), who, despite not using the same classification for the questions, found this tendency to compare the interest of young people by science in two Brazilian cities: one predominantly

industrial, São Caetano do Sul-SP, and another whose economy is mainly agribusiness, Tangará da Serra-MT. The results of São Caetano do Sul, similarly to that found in this research, pointed to low interest of young people, especially among boys, for matters related to the Earth sciences, such as knowledge about plants, agriculture and Food production. In Tangará da Serra, the results of the issues associated with this same theme obtained relatively high averages.

RESEARCH CONSIDERATIONS

In analyzing the results of this research, it can be noted that although the young to Z Generation are constantly connected and are already born on the strong technological perspective, in general, their interest in technological science is not superior to the interest in other areas of science, such as health sciences, for example. On the contrary, it is perceived that, especially among girls, the knowledge about technology and its direct relationship with the sciences is not a very attractive subject.

In view of this fact, we perceive the concordance of the data with what Fagundes (2011) says when saying that the Zappiens are effective in making use of the technologies, however, do not show interest in understanding it. In general, it is noted that the behavior of Z Generation in relation to interest by the C&T is not different from the youngsters of the previous generation, Y generation or millennials, with which investigations were carried out through the researches of Tolentino Neto (2008) and Santos Gouw (2013), who the model of this research, also investigated the interests of young people by science.

In relation to the different results observed for the interest of boys and girls, it is important to reinforce what Cunha et al. (2014) affirm that there are still some stereotypes that should be widely discussed, especially family and school obligation to work on these prejudices in order to promote a cultural balance between men and women, establishing a relationship of equality between them.

For Molfino & Zucco (2012) recent statistical data strongly support that there is a broader presence of women in science since in several countries it is already possible to observe their success. For the authors, women have a more holistic view of their research activities than men, more interested in contextualization and interdisciplinary approaches, and this look is increasingly necessary for the scientific environment.

However, for this to occur, it is necessary to rethink the role of science teaching and its influence on the perception of young people about science. The way young students come to science, including their relevance and social recognition, certainly influences their academic and professional choices. A negative or disinterested perception of young people in relation to science, not recognizing it as an agent of transformation and problem solving, can be a negative influencer in the learning of content related to their issues.

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