

YOUTH, SCIENCE, AND MEDIA: PERCEPTIONS OF ASTRONOMY AND SPACE SCIENCES IN FORMAL AND INFORMAL CONTEXTS

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ABSTRACT

The importance of the media, both in the acquisition of knowledge, and in the formation of opinions and representations of science subjects, has been widely acknowledged in research. However, there is still an insufficient number of studies which focus on how young audiences specifically access, understand and create science-related content via different platforms, thereby mobilising different literacies. The present empirical study seeks to explore some bridges in this regard. By looking at a young public interested in science, namely Astronomy and Space Sciences, we intend to ascertain what they value and how they appropriate scientific information in their social relations in order to build critical scientific literacy for decision-making and the formation of opinions about science. The main results of this study confirm that informal learning plays an important role not only in the development of identification with science by young people, but also in the search for related academic and professional pathways. Although it confirms that younger people do not seek science news, the current study suggests that they do engage in seeking science-specific information according to their interests. The absence of a reflection on how science discourses and news are produced and filtered by the media and other science communication agents underlines the relevance of promoting critical science literacy, which seems to imply a link to other literacies, media literacy included.

KEYWORDS

young people; science; media; scientific literacy; identity

JOVENS, CIÊNCIA E MÍDIA: PERCEÇÕES SOBRE A ASTRONOMIA E CIÊNCIAS DO ESPAÇO EM CONTEXTOS FORMAIS E INFORMAIS

RESUMO

O papel transversal dos *mídia* na aquisição de conhecimentos e na formação de opiniões e representações de assuntos de ciência tem uma importância reconhecida. Porém, existem poucos estudos que se debruçam sobre o modo como os jovens acedem, compreendem e criam conteúdos relacionados com a ciência, utilizando diversas plataformas e acionando diferentes literacias. O presente estudo procura explorar algumas pontes nesse sentido. Tendo como base públicos jovens interessados em ciência, nomeadamente em Astronomia e Ciências do Espaço, o estudo pretende averiguar o que estes valorizam na ciência e como se apropriam da informação científica para a tomada de decisão e a formação de opiniões sobre ciência. Os resultados confirmam que as aprendizagens informais têm um papel relevante no desenvolvimento de

uma identificação com a ciência e na escolha por percursos académicos e profissionais com ela relacionados. Apesar de não procurarem notícias de ciência em geral, pesquisam informação específica de ciência de acordo com os seus interesses. A ausência de uma reflexão sobre como os discursos e as notícias de ciência são produzidos e filtrados pelos *media* e outros agentes de comunicação de ciência faz ressaltar a relevância da promoção de uma literacia crítica de ciência, que implica a ligação a outras literacias, incluindo a literacia mediática.

PALAVRAS-CHAVE

jovens; ciência; *media*; literacia científica; identidade

INTRODUCTION

Notwithstanding the fact that the media play an important role shaping young people's identity (Buckingham, 2008; Davies & Horst, 2016; Dover, 2007; Nelms, Allen, Craig & Riggs, 2017), their influence in building a critical science literacy and in the forming aspects of identity that are related to (subjects of) science has been insufficiently explored hitherto. Little is known about young people's habits of consumption of scientific information, namely in science communication activities in informal contexts (in science centres and in the media, for example), as well as the influence this consumption may have on the development of a scientific literacy.

Several studies suggest that school education levels and the media played a role in the relationship audiences build with science, such as in the participation of science related matters throughout life (Besley & Nisbet, 2013; Brossard & Scheufele, 2013; Peters et al., 2008; Suerdem, Bauer, Howard & Ruby, 2013). In view of the constant presence of science in the media, either explicitly or indirectly, in addition to the importance of decision-making based on scientific research, the ability to critically analyse scientific information conveyed by the media is considered as a relevant indicator of scientific literacy by many academics (DeBoer, 2000; Jarman & McClune, 2010; Korpan, Bisanz, Bisanz & Henderson, 1997; Norris, Phillips & Korpan, 2003). However, studies aimed at measuring the scientific literacy of young people (e.g. Norris et al., 2003) have as primary focus the understanding of facts and scientific knowledge in the news, and not so much the ways in which their constructs and actors are represented in different media, thus influencing the perceptions of science and scientists that are being built.

In spite of the existing evidence that the media influence young people's cultural identity creation (Rahim & Pawanteh, 2009; Török-Ágoston, 2017), the implications brought along for shaping opinions and making decisions related to science, such as the aspiration and option for a scientific career, remain to be analysed. Several reports (e.g. Cardoso, Mendonça, Paisana & Lima, 2016) have attested that the youngest not only use multiple devices to access information (mobile phones, tablets and computers, in addition to television), but also favour social networks to access entertainment and search for and share information content. Part of this information may be about science,

bearing a significant weight in the interception between the formal and informal learning of the youngest (Halkia & Mantzouridis, 2005).

The role of the media, and of digital media in particular, concerning the knowledge and skills that the youngsters develop (Pereira, Fillol & Moura, 2019), including those related to science and scientists should not continue to be disregarded (Tang, 2013; Tang & Moje, 2010). If in knowledge societies the learning of scientific facts occurs through spontaneous exposure in different contexts (Falk, Storksdieck & Dierking, 2007), and especially for young people this learning is permeated by a strong presence of the media in their daily lives, it makes sense to look for the connections between the contribution of the media to the construction of their scientific literacy. For this reason, the interrelations between the diverse literacies built by young people, including media literacy and scientific literacy, deserve a continuous critical analysis from social scientists, bringing together communication and science-technology-society studies (Boczkowski, 2007).

This study aims to building bridges in this regard, setting as a reference young people interested in science, namely Astronomy and Space Sciences. The present research seeks to investigate the following issues: what these young people value in science, how they appropriate the scientific information they access by different means and what uses they make of it in their social relations. In this sense, the ensuing questions are addressed:

1. What platforms and media do younger audiences favour to access science-related content?
2. How do young people act with respect to sharing and dialoguing about science issues with family, friends and, eventually, at school and in the media?
3. What representations and aspirations do these audiences show regarding Space Sciences and scientists?

The article will begin by establishing theoretical considerations about the representations of science in the media, as well as about its role in forming the identity of young people, hence articulating with the construction of scientific literacy in formal and informal contexts. Upon this contextualisation and analysis of the data collected, we will provide concluding reflections on the need to give voice to the younger audiences, thus developing their training, agency and involvement in the creation of formal and informal places for the promotion of dialogue and participation between science and society, through the use of different literacies.

YOUTH, SCIENCE AND THE MEDIA: CULTURE, IDENTITY AND CRITICAL SCIENCE LITERACY

We cannot ignore the importance of the media in social, economic and cultural life in contemporary societies. The mediated speeches and the technological artefacts that assist them are present in the daily life of the so-called knowledge societies in such an indelible way that sometimes they become diluted in other contexts of interaction, making it difficult to isolate their effects in relevant aspects of people's lives. It is not easy to deny that these means, tools and digital networks lead to different forms of learning and

skills acquisition (Buckingham, 2008; Pereira et al., 2019). For Buckingham (2008), it is learning that is reflected in expressions of identity and in the ability of individuals to form opinions in an independent and creative way.

These social and cultural expressions of identity are of particular importance for young people, as they assume positions and decisions that can influence future choices in terms of professional options, relationships and ways of life. The symbolic resources that they find and use to build, express, or decipher their own identities, or those of others, involve using the media (Mendick & Moreau, 2013). Due to the fact that in the media content is not neutral, media literacy must go beyond functional learning, so as to take into account the ability to critically evaluate information, seeking to understand symbolic representations, their social effects, the intentions of those who produce media content, among other aspects (Boczkowski, 2007; Buckingham, 2008).

In turn, the construction of scientific literacy implies calling out different contexts of learning and different ways of thinking and acting regarding science, viewing it critically (Carvalho, 2004; Priest, 2013). The perspective we have conceived for a critical science literacy comprises the capacities to understand motivations, values, symbols and power relations underlying scientific discourse (in its multiple modes – verbal, imagery and others), the contexts of production and the social functioning of science, besides its social, economic and political implications (Gregory & Cahill, 2009; Jarman & McClune, 2010).

Both mass and digital media are a primary source of information related to scientific issues (Brossard & Scheufele, 2013; Bubela et al., 2009; Gerhards & Schäfer, 2009). As science has evolved in its processes and practices, it has become more open and dependent on global and interdisciplinary collaborations and private funding. Furthermore, it started to adopt communication practices in line with those of other organisations and companies, using marketing and public relations, as well as media practices and logics (Bauer, 2008; Bucchi & Trench, 2014; Entradas, 2015). Scientific matters were multiplied in this virtual environment, leaving no doubt about the role of the media in the construction of science-related narratives, reflecting public concerns and affecting their perceptions (Feinstein, 2015). Through the widespread use of the media we are expected to think of them as more than “channels of scientific information” (Bucchi & Trench, 2014, p. 9). To achieve a conception of science literacy in an environment where the distinction between “entertainment, promotion, information, news and advertising” is not always clear (Priest, 2013, p. 140), the cognitive acquisition of scientific information is not enough; a critical perspective is needed to assess the contexts in which science discourses are created.

Thus, scientific literacy is related to the skills and knowledge that the individual must be able to build throughout his/her life (Falk, Storksdieck & Dierking, 2007), and which comprehend the reflection on the actions and intentions of several intervening agents, recognising that all information undergoes “filtering” (Hofstein, Eilks & Bybee, 2011, p. 1466). While Feinstein (2011) questions the role of the school in preparing its students for debates related to science topics, in the media as well as in other contexts of daily life, the ability to critically analyse scientific information conveyed by the media

is highlighted by other academics as an important goal in formal education (Jarman & McClune, 2010). The logics of mediation and “filtering” must be identified in the way science is communicated, acknowledging the public as an active social user and rebuilder of meanings related to science (Cope & Kalantzis, 2009).

Bearing in mind the fact that media literacy is expressed in the ability to access, understand and create communications in different contexts (Buckingham, Banaji, Carr, Cranmer & Willett, 2005), it is essential both to understand how it can be taken into account when the context is related to science subjects, and which role is played by the media in the development of scientific literacy and in the promotion of a science-related cultural identity. From a critical literacy perspective (Gainer, 2010; Kellner & Share, 2007), students are firstly encouraged to provide an analysis of the relationship between the media, audiences, information and power, and subsequently produce alternatives to the dominant discourse which tends to perpetuate inequalities (gender, racial and other).

The aforementioned aspects warrant special mention in science subjects since women, less privileged social classes, and some minority ethnic groups are underrepresented in science and technology careers, especially in the physical sciences and engineering (DeWitt et al., 2013). The traditional link between science, power and the male role constitutes an obstacle for some disadvantaged groups (DeWitt & Bultitude, 2018; Lane, Goh & Driver-Linn, 2012; Miller, Eagly & Linn, 2015). Media literacy may play an important role here, not only due its potential to enable the critical evaluation of science images perpetuated in the media, but also because it enables the construction of science narratives that take into account contexts and constraints in which it is made, by deconstructing discourses of power and enabling a critical look at the multiple dimensions of knowledge construction.

THE CONTEXT: AN INFORMAL SCIENCE COMMUNICATION ACTIVITY

Universidade Júnior (UJ) (Junior University)¹ served as a context to listen to young students of non-higher education. The data were collected during the “Summer in project” program “Astronomy: from concepts to practice”², offered by the Astrophysics Centre of the University of Porto (CAUP) and the Planetarium of Porto in July 2019.

The “Summer in project” initiative has a nationwide scope and is promoted by the University of Porto within the scope of the Junior University, and is extensively sought as a holiday occupation for children and young people from the 5th year to the 11th year of schooling. Implemented since 2005, the initiative has a very high demand, with around 6.000 vacancies in the 2019 edition. It includes activities promoted by different organisational units of the institution, from colleges to research centres, which adapt their offer to the public according to age and program’s purpose. Children and young people have the opportunity to get to know different spaces at the University and participate in

¹ For more information about the initiative, visit <https://universidadejunior.up.pt/programas.php?p=verao-em-projeto-9-10-e-11>

² Retrieved from <https://universidadejunior.up.pt/atividades.php?a=astronomia-dos-conceitos-a-pratica>

various projects and activities, from laboratory practices, field work, field visits, group work, among others. Participants select the program or programs that best suit their interests among the diverse list made available by the project. In 2019, as in other years, a specific activity related to Astronomy was offered to young people from the 9th to the 11th grade.

ASTRONOMY: FROM CONCEPTS TO PRACTICE

The activity which was promoted by CAUP – “Astronomy: from concepts to practice” – was held over two weeks in July (8-12 July and 15-19 July 2019) and involved two groups of 20 participants each. Its main objective consisted in ensuring “that the participants get to know a little more about the Universe that surrounds us”³. Each week, young people were able to participate in classes which offered varied contents (stars, galaxies, cosmology, exoplanets, telescopes, how to make a presentation), practical labs (on meteorites, exoplanets, printing), planetarium sessions, and lastly, a conversation session with researchers. Table 1 below characterises each group of participants.

		WEEK 1	WEEK 2
Gender	Female	13	9
	Male	7	11
Attended school year 2018/2019	9 th	6	11
	10 th	11	7
	11 th	3	2

Table 1: Participants' profile

From the sample provided, it was possible to characterise the participants regarding: 1) motivations associated with the frequency of an action of this kind; 2) platforms and means they used to access Astronomy information and knowledge; 3) attitudes and behaviours regarding interaction and dialogue about Astronomy issues with family, friends and, eventually, at school and in the media. Our search focused on aspects that are associated with critical science literacy and its relationship with other literacies.

METHODOLOGY

An appropriate choice for this study consisted in the combination of methodologies sustained in a critical and emancipatory investigation paradigm. Different methodologies for collecting and processing data (quantitative and qualitative) were used since they are complementary, nonetheless, each is constituted by specific strengths and limitations.

³ Retrieved from <https://universidadejunior.up.pt/atividades.php?a=astronomia-dos-conceitos-a-pratica>

Hence, information was collected using mixed methodologies, namely: surveys by online questionnaire, group discussions, focus groups, and participant observation using a field diary. The data collected via audio records complies with ethical standards and the General Data Protection Regulation (GDPR)⁴.

The sample of young respondents we interviewed within the scope of the “Summer in project” activity is not be representative of young people “in general”. Bearing in mind the fact that there are recognised inequalities concerning access to science, participants in this activity most likely come from more favoured socio-economic contexts and their views on science are influenced by this context. However, the manifest interest in science and the frequency with which they participate in an informal activity related to it makes them a group of particular relevance to the objectives of this exploratory study.

DESCRIPTION

The exploratory study allowed for the possibility of listening to young people aged between 14 and 18 years old regarding their relationship with science in informal spaces. In Portugal, it is around the age of 14 and 15 that students have to make choices about their future path in secondary education, deciding whether to enrol in scientific-humanistic courses, specialised artistic courses or professional courses. At this stage, students’ preferences, attitudes, and opinions regarding science are expected to be established at a sufficient level to enable them to make this decision. Therefore, the young people who attended this program expressed an interest in Physics, Astronomy and Space Sciences, and considered pursuing any of these areas as an academic and professional path in the future.

Data was collected from the two groups of 20 participants in order to better understand the relationship that the participants in this activity develop with science, as well as the contribution of the media in this relationship.

At first, the information was collected using a field diary which focused on the activity designated “Conversation with researchers”. This occurred after informed consent was given and confirmed. Afterwards, each week all participants answered a survey questionnaire, with simultaneous group discussion. For this purpose, computer software Wooclap⁵ was used, which highlights and displays on a large screen the relative frequencies of the answers given to each question. In this way, qualitative data were also produced and collected, as these responses complemented by the simultaneous group discussion allowed for the assessment of the reasons presented for the options taken and enabled the clarification of questions not provided in a closed questionnaire. Thus, our main aim was to understand the ideas, attitudes, opinions, and experiences of young people who relate to science and to the activity they attended that week.

Furthermore, six focus groups (three each week) were held comprising six to eight participants. Each group had to answer questions related to the objectives shown in

⁴ Information to parents was added to the other authorizations required by UJ.

⁵ Information available at <https://www.wooclap.com/>

Table 2⁶ and adapted to the participants' interventions. Discussions lasted between 35 to 55 minutes and were recorded on audio.

1.	Identify the main representations and the most common meanings associated with astronomy and astronomers, as well as the main sources of these representations (family, media, school, peers, or others)
2.	Identify attitudes, beliefs and values towards science in general, and astronomy and space exploration
3.	Identify conceptions about professions associated with astronomy and space exploration
4.	Identify professional aspirations
5.	Identify sources of information (consumption of science information) in the media
6.	Identify perspectives on dialogue and public participation in matters of science in general, and astronomy in particular

Table 2: Specific objectives for data collection through the questionnaire and focus groups

After the transcription and familiarisation with the data provided was accomplished through multiple readings, we proceeded to the analysis of the information gathered, looking for themes based on a constructivist paradigm of interpretation of meanings. In the thematic analysis, we took into account study objectives, the topics present in the participants' speeches and the addressed subjects in the discussion groups. Next, we present the analysis undertaken concerning motivations, professional aspirations, professional representations and media consumption in relation to science subjects.

DATA ANALYSIS

Upon review of the contributions of young participants, carried out by various means regarding the way they perceive their motivations, attitudes and behaviours in relation to Astronomy, below we present some considerations that involve setting up bridges with the media and the school.

MEDIA CONSUMPTION AND INFORMATION SHARING

Sources of information on science: questionnaires revealed that participants rarely seek and/or access information on science in conventional media and most of them never or hardly ever share or comment on that information. When accessing information on science, two thirds of the participants favour a search engine and a visit to institutional sites of reference in the area – those from the National Aeronautics and Space Administration (NASA) and the European Space Agency (ESA) were mostly cited. All participants mentioned their use of social networks and some of them follow YouTube channels or institutional channels that regularly publish information and content about science.

⁶ In addition to the objectives indicated in this article, the study also sought to 1) identify motivations for attending to science communication actions and associated contexts; 2) identify what these audiences know and value about the discoveries and scientific applications of astronomy in their daily lives; 3) identify preferences regarding the form and content of science communication actions; 4) analyse the self-assessment of their knowledge of astronomy and of the processes of knowledge production (way of doing science); 5) identify changes in the aspects mentioned above attributed to the participation in an astronomy communication action.

If the information is of interest to them, these young people invest in finding more information using a search engine and selecting reliable sites. They do not look for science news in general, but rather, they search for science information on topics of interest to them and this interest may even have arisen through a news item they saw in their news feed on social networks. Their initiative to follow institutions on social networks, such as NASA and ESA, which publish news and information about science may thus be highlighted. Often these publications serve as a motto to search for additional information on the topic, using the search engine (usually Google) or following the links suggested in them.

I think, for the start, for example, a person who follows NASA on Instagram looked for information, right? Because if you follow is because you are interested. (Female participant, 10th grade, focus group 6)

In the focus groups, participants tended to agree with the following statement:

most young users get the news on their mobile devices as a result of being on platforms like Facebook or Twitter. They come across the news, rather than actively looking for it. They do this as part of living in the media, rather using media. (Boczkowski, Mitchelstein & Matassi, 2017, p. 1785)

Yes, yes, yes, when you're following something, you find some information. To find out more, we must look for it, but we come across that information, we don't actually search it. (Male participant, 9th grade, focus group 5)

I believe that [following science institutional sites] presents advantages and disadvantages because we can find news that may be of interest to us, but that we would never specifically have looked for that specific one. So, we follow things that have subjects we like, and we find the news, then of course we can keep searching and so on, but it is an advantage. (Female participant, 9th grade, focus group 5)

Although the participants mentioned not looking for science news in the media, we observe that they were informed about the most prominent news in the press - they recognised the photograph of the black hole captured by the international Event Horizon Telescope (EHT) team, for example, which shortly before the accomplishment of this study had had a strong presence in the conventional media. The casual finding of news related to science on social media appears to be satisfactory since it raises awareness about science news widely covered by the media.

The search for reliable sites and accurate information was frequently mentioned by participants, who pointed out that the school neither succeeds in training students to search for science information on digital platforms, nor does it promote debate and decision-making strategies on science issues. As far as they are concerned, the school

subject Citizenship and Development could teach them more about this topic, given its importance on “learning how to be a citizen” (male participant, 9th grade, focus group 6).

Yes, school is the starting point for us to become citizens, so we should learn everything, that is, learning this is very important so that we can make a decision and make a change in something, and at least be able to do it in an informed way (sic). (Female participant, 9th grade, focus group 5)

For these young people, the institutions will be responsible for giving credibility to the information found, because when asked about the criteria used to ascertain whether science news is credible or not, they refer to names of people or institutions most popular in the scientific world (such as NASA sites). Nonetheless, they admit that it is not always easy to assess the credibility of scientific information and state that school should enable them to learn how to distinguish between reliable information from other types of information:

of course, there are sites which you almost immediately know [that they are fake], but some other sites you do not detect, those that have wrong or outdated information. So, I thought it was important to know how to look for credible information. (Female participant, 9th grade, focus group 5)

With regard to information and science-related knowledge, the discussions in the focus groups revealed trends in media consumption among the participants. Those interested in the area highlighted reading books (Stephen Hawking was mentioned several times), watching series (especially the *Cosmos* series), documentaries and presentations (mainly from National Geographic or TedTalk). Book reading of and the watching series seem relevant in finding and adopting a posture that tends towards a professional identity related to science (physicist and astronomer, in this case). In fact, all participants with a manifest interest in the area shared the following media consumptions: they followed pages of institutions related to space, such as those of NASA, ESA and European Southern Observatory (ESO) on social networks (especially on Instagram); they read science dissemination books related to Physics or Astronomy; they watched series and documentaries on television or on YouTube. These young people were looking for aspects with which they identified, not only with the other participants, but also the researchers with whom they contacted, as is shown in the excerpt below:

I would also like to say that when talking with the researchers, one of them encouraged me a lot because I really like Physics and another one in particular said that when he read Stephen Hawking’s book for the first time he started to like Physics. That made me think –“It was very much what I was going through!” – I read Stephen Hawking’s books and that’s where my interest in this area comes from. (Male participant, 10th year, focus group 3)

Regarding the creation of content, the participants indicated school works and presentations for educational purposes. They stated that educational agents assume

that young people know how to conduct research on the internet and select information, disregarding the fact that they should teach how to do it, whether for science or other subjects. Participants also mentioned that they had little support from school agents concerning initiatives that would meet their science interests, such as lectures, debates, and other events, attaching great significance to them to become valued citizens.

MOTIVATIONS, REPRESENTATIONS AND PROFESSIONAL ASPIRATIONS

About half of the participants (59% in week 1; 39% in week 2) stated that they were interested in Astronomy and Space Sciences, and had considered following that academic subject or a similar one, so they attended this activity as a way of validating their intention, in order to better understand what an astronomer does and also to get in touch with the science subjects they intend to study at university. For the most indecisive, this action would allow eliminating possibilities regarding academic or professional options. Others were curious to know a little more about Astronomy, choosing to spend their free time on vacation following the suggestion of parents or friends.

We do not perceive gender differences regarding the aspirations of these young people in relation to Physics or Astronomy. In fact, boys and girls alike have acknowledged their interest in the area. In spite of considering that there are no noticeable gender differences when taking up the profession of astronomer (in the questionnaires the vast majority disagreed with the statement: “space scientists are usually men”), when they discussed scientists they knew, such as authors of books in the field or series, as well documentaries they saw, they referred only to men (Stephen Hawking, Neil deGrasse Tyson, Carl Sagan, Michio Kaku). One of the participants reported:

there are more male astronomers than women but it has more to do with the fact that (...) the informal education that women receive is a bit different than that of men. Therefore, women are usually less connected to areas like astronomy than men. Informally, for example with toys, or with series or with... in the informal world, from an early age men are more connected to science and technology-related areas of than women, and hence this is observed in the percentage of women that are connected to Astronomy. That's what I think. (11th year, questionnaire discussion group at week 1)

Despite assuming they do not have any stereotypes regarding what being an astronomer represents, participants emphasised that stereotypes are present in society, especially as regards older people, since they see the astronomer as a “closed, antisocial person, who is focused on calculations, and does not have much ability to talk to people, yes, very focused on his area ” (female participant, 9th grade, focus group 5). Younger people “are already aware that this is not the case, older people see it that way” (male participant, 9th grade, focus group 5).

To undo stereotypes, they suggest that if the elderly contact professionals in the field they will see that there is no typology related to gender or culture, but a diversity

of people with a common interest. This awareness regarding the existence of stereotypes related to science and scientists, assuming that these representations do not exist among UJ participants, may result from in the UJ experience, which included getting in contact with professionals of different genres and cultures.

When asked about the preferences of certain leisure activities, the participants highlighted TV programs about Space (*Cosmos*, for example) and films about Space (*Interstellar* and *Lost on Mars*, for example). This suggests that, although young people do not often seek scientific journalism, other media content for entertainment and fiction has a strong involvement. Other options that were mostly mentioned in the questionnaires were: “talk to someone about Space” and “find out more about Space on the internet”. In group discussion, video games about Space were criticised by some participants as being unrealistic and more of science fiction than science. “The simulations are better” (male participant, 10th year, questionnaire discussion group in week 2).

The action “talking to someone about the subject of Astronomy” was discussed among young people, who see the week at UJ as a way of sharing their common interest. At school, with friends and teachers, this possibility does not exist, as they often do not find people who show interest in Astronomy and feel that talking to teachers can be misunderstood by peers (such as “schmoozing”). Sharing Astronomy information on the internet is also “not worth it” (female participant, 11th grade, focus group 4). Thus, participation in this event was also a way of meeting and interacting with other young people interested in the area. The lack of interest most participants referred to when talking about friends and family is attributed to the fact that Astronomy related contents were removed from the curriculum, which – they say – compromised the general interest of people in the subject.

Participants also reported that the school neither teaches them to read scientific articles, nor to interpret science information. They often feel the need to improve their understanding of the vocabulary used in science communication and find that scientific-technological courses do not teach them how to communicate, debate and present scientific results. In fact, they suggest that, such as the subject Mathematics Applied to Social Sciences was created for secondary courses in the Humanities, there should also be a subject designated Portuguese Applied to Sciences. The latter would encompass these aspects which they consider crucial for a putative professional future in the sciences. This is a relevant point if we consider that one of the indicators of scientific literacy is precisely to be able to interpret science content, such as scientific reports published in the media.

In general, the participants were very critical of the absence of Astronomy and Space Sciences in formal learning spaces, suggesting that lectures and debates or participation in study visits and projects are essential for the promotion of this scientific area (and even other subjects of interest to other students) at school. In this sense, from the participants’ discourse we can infer that school fails in the training of citizens, either by not making available a wide diversity of offers, or by not encouraging its students to participate and interact in science matters, namely using the media.

CONCLUSIONS

An interesting conclusion of this study was the acknowledgement of almost unanimous criticism from the participants to the lack or little expressiveness of the topic Astronomy and Space Sciences in school curricula in Portugal. As the school does not promote interest in this area, it seems clear that informal activities play an important role in its promotion. Books, films, documentaries and presentations in different formats seem to be predominant in defining an identity related to science, which highlights the role of informal learning, namely in the media, in this definition. We can infer that the consumption of the aforementioned formats contributes to the image and knowledge of science that the younger ones are building, thus contributing to their scientific literacy (Tang, 2013; Tang & Moje, 2010). In this sense, in addition to considering the analysis of news from scientific reports published in the media as an indicator of students' literacy level (Korpan et al., 1997; Norris et al., 2003), providing a critical analysis of information and representations of science in the different types of media content, may be a more robust indicator of critical scientific literacy.

Although the participants of this study refer to stereotyped representations of science in society (gender, class and ethnicity, for example), they said that they are immune to them, showing a certain degree of critical analysis that may result from their own experience at UJ, and the encounter with the diversity of elements of the scientific community working at CAUP. Despite this, when referring to scientists they followed in the media, they only highlighted male scientists, in a discreet allusion to a male role of authority, power and credibility of science which is still prevalent in several spaces, formal and informal, namely in the media (DeWitt & Bultitude, 2018; Lane et al., 2012). Taking this aspect into account, it appears that the potential contribution media and science learning in non-formal contexts have in the development of critical science literacy looks unexplored, notably in questioning discourses about science and representations of scientists in the media.

What we observe appears to contradict the idea that young people do not seek information about science. Although they do not deliberately search for science news in general, but rather find it haphazardly, young people follow pages of institutions that meet their interests, on social media. These casual encounters with science news often serve as a motto for researching complementary information, driven by the participant's particular interests. Young people understand that this attitude is related to the search for science news, at leisure, when they are using social platforms, which is consistent with the consumption of news in general. Boczkowski et al. (2017) state that the consumption of news by young people appears in an undifferentiated form from the rest of the social information and entertainment in digital social networks. Furthermore, they state that this casual consumption is linked to frequent internet access on mobile devices, accessing the information several times a day wherever they are, seeing only its partial content, usually superficially. This superficial and casual form may justify the scant or almost non-existent attitudes of sharing or commenting on the news, also observed in relation to the science news in this study.

Most of the participants identified an affinity with some areas of science (namely Physics and Astronomy), which were often undertaken in opposition to other areas such as Arts and Humanities. Speeches that included references to “them” and “us” were frequent, raising concerns about the compartmentalised way in which science processes are achieved, with little reflection on other contexts and connections of science in society, in addition to the facts, knowledge or applications of science. The idea that science can “save” and improve people’s lives seems to disregard the constraints of the social, economic and financial processes and contexts in which science is undertaken, to which the participants seem to be completely oblivious (except for the question of financing, mentioned by some in their speeches).

We realised that the participants were comfortable as recipients of science information in spaces that they considered to be of authority and credibility. Helping them envision themselves as future scientists by initiating debates on how they can communicate their own science work (in the media and elsewhere) as well as how they can promote the democratic participation and governance of science (Lewenstein, 2015) in a dialogical relationship between science and society, could be encouraged at school and in informal contexts of science communication. The development of skills as not only consumers, but also as potential content producers could be an opportunity to work on critical literacies for science and the media in convergence.

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