RESEARCH https://doi.org/10.15198/seeci.2019.50.107-127
Received: 30/09/2019 --- **Accepted**: 10/10/2019 --- **Published**: 15/11/2019

TEACHING AND LEARNING IN DIGITAL SOCIAL NETWORKS: THE MATHGURL CASE ON YOUTUBE

ENSINAR E APRENDER NAS REDES SOCIAIS DIGITAIS: O CASO DA *MATHGURL* NO YOUTUBE

José António Moreira[1]: Open University. Portugal.
jmoreira@uab.pt

Camila Lima Santana e Santana: Federal Institute of Education, Science and Technology Bahia. Brazil.
camilalimasantana@gmail.com

Aitor González Bengoechea*: Complutense University of Madrid. Spain.
aitogonz@ucm.es

**This article was supported by scholarship FPU15 / 07114 from the Ministry of Science, Innovation and Universities (Spain).*

ABSTRACT

The development of the Internet, and in particular of digital social networks, have decisively stimulated learning beyond traditional educational structures. With Web 2.0 and the growth of social networks such as Facebook, Twitter or YouTube, network learning and the potential of these networks as a source of access to information and knowledge have been emphasized, as well as the ability to work and learn with other people in a creative global collaboration outside the conventional educational structures and marked by the will to connect the worlds of formal and informal learning. In this context of social networks, the number of youtubers has grown vertiginously, creating, some of them, channels and videos with educational purposes. Using a qualitative methodology, this paper seeks to analyze one of these channels, focusing on the case of the youtuber known as Mathgurl, a young Portuguese woman whose channel dedicated to teaching maths in a playful way has more than three million views and is a reference in this field. The main conclusions of this study lead us to the idea that these non-formal learning spaces should not be considered as substitutes for formal learning spaces, but they should function as

[1]**José António Moreira:** PhD in Educational Sciences from the University of Coimbra. Professor at the Open University, Portugal. Coordinator of the Center for Pedagogy Studies in Higher Education at the Center for Interdisciplinary Studies of the 20th Century, University of Coimbra.
jmoreira@uab.pt

complementary spaces with their own characteristics, online, open and in network, and as "triggers" motivators and mobilizers to users for learning maths.

KEY WORDS: digital social networks – YouTube – teaching learning – videos.

RESUMO

Os avanços da Internet, e em particular das redes sociais digitais, têm estimulado de forma decisiva a aprendizagem, para além das estruturas educativas formais. Com a *Web 2.0* e com o crescimento das redes sociais como o Facebook, o Twitter ou o YouTube*,* a ênfase tem sido colocada na aprendizagem em rede e nas potencialidades do designado software social para acesso à informação e ao conhecimento, bem como na capacidade para trabalhar e aprender com os outros numa colaboração global criativa fora das estruturas educacionais convencionais marcada pelo desejo de ligar os mundos da aprendizagem formal e informal. Neste contexto de *networking* social o número de *youtubers* tem crescido de uma forma vertiginosa, sendo que alguns destes têm criado canais e vídeos com finalidades educativas. Recorrendo a uma metodologia de cariz qualitativo este estudo procura, pois, analisar um desses canais, centrando-se no caso da *youtuber* conhecida como *Mathgurl*, uma jovem portuguesa cujo canal dedicado a ensinar matemática de forma lúdica tem mais de três milhões de visualizações e é uma referência neste campo. As principais conclusões deste estudo remetem-nos para a ideia de que estes espaços não formais de aprendizagem não devem ser encarados como substitutos dos espaços formais de aprendizagem, pelo contrário, devem funcionar como espaços complementares com características próprias, *online*, abertos e em rede, e como "gatilhos" motivacionais e mobilizadores dos sujeitos para a aprendizagem da Matemática.

PALAVRAS CHAVE: redes sociais digitais – YouTube – ensino – aprendizagem – vídeos.

ENSEÑANZA Y APRENDIZAJE EN REDES SOCIALES DIGITALES: EL CASO MATHGURL EN YOUTUBE

RESUMEN

Los avances de Internet, y en particular de las redes sociales digitales, han estimulado decisivamente el aprendizaje más allá de las estructuras educativas tradicionales. Con la Web 2.0 y el crecimiento de redes sociales como Facebook, Twitter o YouTube, se ha enfatizado el aprendizaje en red y el potencial de estas redes como fuente de acceso a la información y al conocimiento, así como la capacidad para trabajar y aprender con otras personas en una colaboración global creativa fuera de las estructuras educativas convencionales y marcadas por el deseo de conectar los mundos del aprendizaje formal e informal. En este contexto de las redes sociales, el número de youtubers ha crecido vertiginosamente, creando, algunos de ellos, canales y vídeos con finalidades educativas. Utilizando una metodología cualitativa, este estudio busca analizar uno de estos canales,

centrándose en el caso de la youtuber conocida como Mathgurl, una joven portuguesa cuyo canal dedicado a la enseñanza de las matemáticas de una manera lúdica tiene más de tres millones de visualizaciones y es una referencia en este campo. Las principales conclusiones de este estudio nos llevan a la idea de que estos espacios de aprendizaje no formales no deben ser considerados como sustitutos de los espacios formales de aprendizaje, sino que deben funcionar como espacios complementarios con sus propias características, en línea, abiertos y en red, y como "gatillos" motivadores y movilizadores de los usuarios para el aprendizaje de las matemáticas.

PALABRAS CLAVE: redes sociales digitales – YouTube – enseñanza aprendizaje – videos.

How to cite the article:

Moreira, J. A.; Lima Santana e Santana, C. & González Bengoechea, A. (2019). Teaching and learning in digital social networks: the *MathGurl* case on YouTube. [Ensinar e aprender nas redes sociais digitais: o caso da *MathGurl* no YouTube]. *Revista de Comunicación de la SEECI,* (50), 107-127.
doi: http://doi.org/10.15198/seeci.2019.50.107-127
Recovered from http://www.seeci.net/revista/index.php/seeci/article/view/622

1. INTRODUCTION

Over the next 50 years, we will witness an explosion of access, production and distribution of videos by communities that previously could not produce them in their homes, schools and offices. As computers and graphic programs have given consumers the power of the press at their desks (but the Internet is required to make each one, an editor, since it lacked a distribution channel), and how digital audio and the new genres of music producers show it, the computer video technology will enable these people and new communities to make videos as part of their daily communication[2] (Davis, 1997, p. 46).

Although one could not foresee what would happen to the communication and entertainment industries when a common subject could control the means of production and distribution of communication and culture, long before the creation of audiovisual content platforms on the Internet, academics were saying that, with the development of digital technology, anyone with access to and knowledge of the use of technical tools could produce audiovisual and digital amateur content at home. Although the literature on digital social networks indicates that the development of digital technologies in the context of Web 2.0 has allowed the emergence and growth of participatory cultures, we understand, like Jenkins (2009), that the opposite is also true.

> If YouTube seems to have appeared all of a sudden, it is because there were already a myriad of groups waiting for something like YouTube; they already

[2] Translation by the authors.

> had their practicing communities that promoted media production, they had already created their video genres and built social networks through which such videos could travel. YouTube may represent the epicenter of today's participatory culture, but it is not the point of origin of any of the cultural practices associated with it (Jenkins, 2009, p. 145).

This implies the understanding that digital technologies, web 2.0 and even digital social networks have improved human practices, desires and behaviors that already existed and / or were idealized, prospected. These behaviors, enhanced by digital technologies such as web 2.0 and digital social networks, redefine social practices such as entertainment, information search and learning. As a result, two new types of users have emerged, "Baby Boomers" and digital natives. The former is an evolution of the recipient and passive consumer, capable of breaking with the traditional communication scheme and becoming a producer and consumer of content, thanks to the capabilities of digital information and communication technologies. The latter, the digital native, is a user who conceives the Internet and technology as a way of life and does not understand the activities of his daily life, such as having fun, learning or being informed outside of his network connection.

These subjects, therefore, who have the Internet as a place of experience and production of content, knowledge and knowledge, properly use cyberspace, modifying and creating new forms of interaction, communication, dissemination and construction in the social dimension of communication and education, areas of knowledge that matter in this study.

In the context of communication, analyzing and understanding the context of digital social networks, their potential to achieve, their dynamics of growth and popularization and the impact of these new spaces on the circulation of information, for example, is a natural process, common and even expected. However, when the same discussion is directed to the field of education, it often acquires other contours, ranging from the understanding of digital social networks as pure tools to be used in curricular educational contexts to the discredit of their possibilities as building spaces. Effective social problems, including teaching and learning.

Therefore, understanding informal learning spaces on the Internet, such as digital social networks, is an important challenge for education in the context of the digital age, as these environments add and combine legitimate experiences of social life and learning that integrate, nurture and sustain knowledge networks. YouTube, the second largest digital social networking site in the world today and the largest open platform for audiovisual content, presents itself as the challenge of teaching and learning in "closed" school contexts when you have all kinds of content, knowledge and knowledge freely shared on the Internet, outside formal education spaces, and with more access, commitment and participation than often the formal educational actions and activities offered by conventional institutions.

In this sense, this paper focuses on the analysis of an individual initiative, separated from any educational institution and using the common spaces of the

network to teach or exchange specific knowledge in the disciplinary area of mathematics through the production of free and involuntary audiovisual content A qualitative methodology is used in this study, which seeks to analyze the MathGurl channel on YouTube, created by a young Portuguese, who we interviewed, whose channel dedicated to the teaching of mathematics in a playful way has more than three million visits and is a reference in this field.

2. YOUTUBE REVOLUTION

YouTube was born in 2005 in the United States at the hands of Steve Chen, Chad Hurley and Jawed Karim and quickly captured the interest of large technology companies, which Google bought in 2006, when it only had 30 million visitors per month (El País, 2006). The main feature of YouTube, which is the basis of its success, is that it allows users to publish, share, watch and comment on videos freely, unlimitedly and without restrictions, and on the other hand, public or private viewing can be classified by topic, generating conversations between users through possible comments (Guzmán and Del Moral, 2014).

Since its inception, YouTube has not stopped growing and, like the rest of social networks, it is already part of the daily routine of people connected to the Internet. Currently, the network has 1.9 billion users, being the second social network in the world, just behind Facebook. In terms of content, YouTube has more than a billion hours of video views per day, which means that users watch around 115,000 years of audiovisual content every day on YouTube. In addition, YouTube can currently be enjoyed in 80 languages, which means that 95% of Internet users can use their language to surf the platform (YouTube, sf).

Regarding age, there is no comprehensive data on the number of users by age group, but data from YouTube users existing in the United States are significant and are likely to be a reference for the rest of the world 's population. According to Statista data (2018), 96% of young people aged 18 to 24 access YouTube, a figure that remains above 75% in all those under 65, and falls to 66% for those 65 to 75 years old, 51% being over 75 years old.

As YouTube users have grown, so have the content creators who publish their videos on this platform, the creators who have been called "YouTubers" and who define themselves as "Internet users who publish a YouTube video" (Rissoan, 2016, 384). These youtubers receive financial compensation based on the views of the videos on the platform and gather millions of followers or subscribers when they upload or comment on the topic of the next video. According to the platform's own data, the number of channels that earned more than $ 100,000 increased more than 50% over the previous year and the number of channels with more than one million subscribers increased approximately, in one year, 75% with respect to the previous year (YouTube, s.f.). Of all these youtubers, some stand out for the number of followers such as *PewDiePie*, which has 95 million subscribers, *HolaSoyGerman*, with 40 million subscribers or *elrubiusOMG* with 34 million subscribers (Wikipedia, 2019).

With this reach and global numbers, YouTube has positioned itself as a leader in entertainment for new users, although its potential as an educational tool is also increasingly seen. This idea is shared by García and Gil (2018), who point out that YouTube has a great educational capacity in the stories of the videos it presents, giving as an example the *Kurzgesagt* channel, which presents informational scientific content. Soukup (2014) also highlights that, among the appropriations that the author details about YouTube, there is education and dissemination of content about art and culture, among others.

2.1. Credits on YouTube: from production to the audience

Digital social networks are based on varied operating rules and this implies differentiated appropriations, based on their specific characteristics. YouTube is one of the appropriate online spaces to build social networks and strengthen social relationships. As with other digital social networks, YouTube has occupied the spaces through the appropriations, conventions and uses that subjects make and the purposes assigned to them. According to Orihuela (2007), it is necessary to explore the potential of these tools in areas such as journalism, education, politics and marketing.

By analyzing several channels on YouTube, you can see that they can be classified in some aspects, such as the topic, the target audience, the scope, the dynamics and others. Appropriation, therefore, is an important element to be defined and understood, because, even the digital social networks created with an intention by their developers, it is from effective use that the subjects appropriate the environments and give them meaning.

In this context, ownership can be understood as the creativity adopted by Internet users in a cyberculture context and which is generally very different from the initial proposal of the systems (Zago, 2011). The initial idea of YouTube, for example, was to propose, to any ordinary user that produces audiovisual content, something like a television where the content producer is the user himself, and his main commercial strategy is the advertising revenue from the attention attracted by the public, of the large video volumes of the platform (Jenkins, Green and Ford, 2013, p. 80).

While education, science and technology, for example, are categories on YouTube, selected by the creators of the platform so that videos can be identified with their descriptions and during the search process. The platform was not born as educational but rather with the aim of entertaining and stimulating the production of large-scale content for ordinary citizens around the world with unlimited, decentralized and interactive access. However, many users perceived and appropriated YouTube as an important space for the construction of collective intelligence (Lèvy, 2011), that is, the knowledge produced by humanity and stored in cyberspace, considering that no human being can know all, but humanity collectively, yes.

While humor and music content remain the most shared and accessed videos on YouTube, there are at least sixteen popular categories for content stored on the platform, according to the Mediakix study[3]. The proposed analysis and rating consider that YouTube has not only transformed the way in which audiovisual content is consumed, but that it has produced completely new genres, thousands of symbols and icons of pop culture and new professions in the 21st century.

Thus, in the typology of the classification of YouTube videos of Mediakix (2016), we are interested, above all, in two categories: *Tutorials/Tutorials* and *Educational*. How-Tos videos feature tutorial content, do it yourself or learn yourself, and are one of the three best rated and most visible categories on YouTube. These videos are educational and didactic in nature, designed to help the audience learn about a specific task or topic, in a timeless manner. On the other hand, educational videos are generally aimed at a specific audience, segmented by demographic data such as age, educational level or area of interest. Educational videos provide information to the public through content typically presented in dynamic and fun formats.

These two categories include content that keeps the audience informed, often answering questions, analyzing and solving simple and complex problems, presenting interesting illustrative facts to understand concepts and, therefore, they are responsible for high traffic and repeated opinions, which can accumulate high numbers of visits and generate visibility and popularity for their content producers. Visibility and popularity are values that YouTube content producers crave, this type of social capital feeds the platform's economy, whose standard is to generate value through the circulation of content. That is, the people who produce content for YouTube, promoting new ownership of the platform, make up a team, which also includes the audience. Therefore, new models of production, distribution and consumption of information and knowledge are instituted, with little institutional filtration or control bureaucracy.

The social capital that circulates on networks, such as YouTube, is closely related to the audience profiles they have on the platform. The audience is an important element in the communication processes as a whole, since people write and speak to someone, that is, to an audience.

According to Alzamora (2012), the audience is a definition of communicational studies since the 1940s, when the effects of the media on mass society are researched. The author rescues communication approaches to the perception of the audience, trying to understand the concept in the light of cyberculture. A perspective is associated with cultural phenomena, devices and artifacts promoted by and for Web 2.0 and considers the various communication logics that coexist on the Internet, in relation to social mediation models and, consequently, with multiple audience contexts. The views, likes, subscriptions and comments that list the most popular videos on YouTube; friends, likes and comments on Facebook; Twitter followers,

[3] https://mediakix.com/blog/most-popular-youtube-videos/

retuits and trending topics, likes, comments and Instagram views attract audiences on these digital social networks (Santana, 2014).

Although considering quantitative elements, the audience, in the context of intermediate Web 2.0, is associated with *production* (Alzamora, 2012). The concept of *produsage*, disseminated by Bruns (2007; 2011), is based on the argument that, within the communities that involve collaborative creation, the expansion of information and the circulation of knowledge, the different consumer and user roles have disappeared.

While in the media the audience derives mainly from marketing strategies based on privileged transmission centers, in social networks the audience derives mainly from the diversification of social mediations, the exchange and social appropriation of information (Alzamora, 2012, p. 56). This differentiated dynamic, especially of convergence, implies thinking that, in the field of Internet, individual profiles, *centers*[4] or small groups influence other groups and networks and even the media, depending on the size of the network that is formed around each topic. On YouTube, this can be seen in the number of subscribers of the channel, the *tags* used in the videos that indicate the indexers used for the classification and search, the most commented topics, the classification of the video and the channel and, consequently, the size of the surrounding network content or Youtuber (Santana, 2014).

This two-way team contributes to building a freer, more autonomous and personalized audience and transmission, since the actors in the network are producers and consumers, often and simultaneously, but above all because they are direct, producers , and the consumer is attributed with another sense of cultural dimension, reducing barriers to participation, but also creating social incentives for people to produce and share their productions with each other, increasingly expanding the catalog of platforms such as YouTube. "These practices make their practitioners better 'readers' of their own culture and more aware and critical of the culture in which they operate, and thus allow them to be more conscious participants in the dialogues within that culture" (Benkler, 2006, p. 15).

The undeniable fact that YouTube has become the scene of all kinds of authorship and activity produced by different social groups (athletes, fans, artists, activists, teachers, scientists, activists, fans, etc.) has taken to the platform features, innovations and content history, as well as production of aggregate media of which social actors are part. This movement contributes to the democratization of communication channels, but also to the dissemination of knowledge and specific and unique knowledge. It should be noted, however, that this dynamic does not imply overcoming other models of communication and interaction Jenkins (2006) but instead it builds the rhetoric of the initial speculations about the digital revolution, outlining the concept of convergence culture, which means that, in this digital

[4] There was a type of connector for social networks. He said that, because he was connected to many of us, he played a central and connection function for a network. It would be an opinion leader, capable of influencing other actors, for the role that na rede plays (Barabási, 2003).

context, the most diverse digital media and technologies have not buried everything that is analog. On the contrary, they both live together, dialogue and converge in their complex interactions and collaborations. Although the author's discussion is in the field of communication, it can be extended and transposed into education, where the context is very close, although it faces greater resistance to changes in social contexts.

Therefore, this large catalog or public collection of audiovisuals present on video-sharing platforms, such as YouTube, in addition to inviting Internet users to produce content and share it on a network, to some extent calls people who circulate on the network to consume the content produced freely. This group of people who produce, disseminate and consume information and knowledge freely and without intermediaries seems to mark the beginning of a new teaching and learning context.

2.2. Teach and learn in YouTube

Beyond the Gutenberg Galaxy, described by McLuhan (1977), governed by the culture of the manuscript, the printed page, the typographic culture in ancient times and the Middle Ages, modern society entered the industrial era driven by industrialization, the end of the colonial society, mechanization, production and the increase in the volume of production and consumption of industrialized goods (Santana, 2006). Today, the post-industrial society is immersed in the Networking Internet Galaxy (Castells, 2003), based on the digital revolution or the fourth industrial revolution (Schwab, 2019), the result of complex, intense and high transformations in all sectors of society. A change of paradigm in the way we work, communicate, express, inform, have fun and learn.

The last two centuries can be remembered for the large volume of continuous public investment in formal education, that is, schools, institutes and universities, to ensure what Hartley calls low-cost printed literacy (2009, p. 169). However, today the subjects who are in the process of training at a regular age, especially in schools and, to some extent, in universities, are those who were born in the digital society, submerged in a sea of information (Martino, 2005), interacting with each other, in daily life, initially with remote controls, *joysticks* and then with keyboards, *mice*, computers, *mp4,* mobile phones, laptops, smartphones, *tablets* and other digital technologies.

Children of a media culture and simulations, these subjects consume their elements, their products, but they do not do so unilaterally, because they also produce, recreate and manipulate them. These young people, the so-called *screenagers* (Rushkoff, 1999), *the digital natives* (Prensky, 2001), the *@generation* (Feixa, 2006), or integrated into so many other denominations presented by the academic and scientific community, are more than consumers of digital technologies and network information, they feed them, send them content, recreate.

> Clearly, teenagers do not see computers as technology. It is as if they had developed an innate ability for text messages, iPod use, video games and multitasking behavior on multiple platforms. They can share the stories of

> their lives on Facebook, have fun with each other on YouTube, entertain themselves philosophically in the blogosphere, contribute knowledge in Wikipedia, create premium art on Flickr and compile files. Some can almost do most of these things at once and then present their results with ethical and in line with the collective intelligence and the cyclical upturn that is essentially a scientific way. But they learn very little about this at school (...) (Hartley, 2009, p. 170).

What Hartley (2009) points out is that today's youth are learning digital language and everything that comes from it outside of school and in a very different way from what the school is used to. These digital natives not only consume or learn but also teach from their peers that, like them, understand codes, languages and assimilate well the notions and concepts of time and space in the context of the digital revolution. In addition, as the author also points out, formal education systems have responded to the digital era by prohibiting access to digital artifacts and environments within their institutional spaces, including YouTube, with rare exceptions and, in these cases, under strong control and surveillance. Everything that was non-school information or content was treated as useless entertainment.

Therefore, it seems that, at the beginning of this process of digital revolution, young people began to appropriate the spaces of the network, far from excessive vigilance and the limitations of the flexible curricula of formal institutions, to develop creativity, the production of dynamic content, more freely interactive and playful about what they knew, discovered or in the interest of knowledge. "So, while schools and universities have kept their distance, *useless entertainment has* satisfied a demand for personal and creative communication and expression among young people" (Hartley, 2009, p. 170).

While consumer participation in the digital context often narrowed to their views on what they read or saw, the digital revolution that begins with Web 2.0 has allowed creative content to be produced, especially DIY or DIWO. "Do it yourself" or "do it with others" by the users themselves, without the need for approval, filtering or hierarchical limitation.

Thirty years ago, McLuhan (1986) already pointed out that most of what was taught and learned was out of school, given the amount of information disseminated by the media that exceeded the amount of information communicated by school instruction, and which, at that time, already caused some inconvenience in educational institutions when dealing with these non-school spaces. McLuhan's considerations precede the popularization of the Internet and point to contexts of information consumption, teaching and learning beyond school walls. This situation, enhanced by the media in the twentieth century and amplified by digital technologies in the twenty-first century, required a new look at pedagogical practices to dialogue with a world full of information and rapid changes, demanding new learning, methods, spaces and ways of teaching and communicating (Santana, 2019).

3. METHODOLOGY

This study is intended primarily, and as mentioned above, to analyze the channel YouTube, known as *MathGurl,* which has been dedicated since its creation to education in the science of mathematics. The nature of the question led us to consider it relevant to make a qualitative study, where direct speech is subjected to an interpretive logic that, framing and explaining the position, the founder of the channel, tries to account for the vision of the channel she created. Therefore, in a framework of non-positivist and interpretative paradigm of a phenomenological and ideographic nature (Cohen and Manion, 1990), this piece of research uses a qualitative methodology that emphasizes the revaluation of the "person" as a subject of knowledge capable of reflecting, rationalizing, communicating and interacting. In order to increase the occurrence of data on the study, resorting to the use of semidirectional interviews and in order to analyze data from the interviews, we used a research technique capable of encoding the semi-free and apparently disordered statements: content analyses (Bardin, 1977).

4. RESULTS

As already mentioned, this paper focuses on the analysis of the MathGurl channel, created on YouTube in 2012, and the oldest video present on the channel was published in September 2015.

***Image 1*:** *MathGurl channel description screen.*
Source: Authors.

The author and the production of the content of the channel are Inês Guimarães, a twenty-one-year-old Portuguese student studying mathematics, author of the book *Mathematical Challenges that Will Drive You C*razy, with eighty thousand two hundred forty-nine (80,249) subscribers and one hundred twenty, more than three million one hundred thousand views of the one hundred twenty eight (128) posted

videos[5]. The production of mathematical content began on Facebook when she was thirteen with a page of curiosities and mathematical challenges. The content began to be produced on Facebook in text and images, until Inês Guimarães, who was not yet MathGurl, realized that the way she liked to communicate was orally.

> Why am I expressing myself in writing if the way I like to communicate is on video? Then I started to put videos about math curiosities on Facebook, but then I thought... um, maybe Facebook is not the most popular platform for videos, because there is YouTube, dedicated exclusively to videos. Then it was decided to create a channel there. At first I called it Inês Guimarães but, on YouTube, most of the channels do not have names of people. And I thought there could be something more allusive to mathematics. At the beginning I made videos in Portuguese and English because I thought it might reach more people. So I wanted to give it a name that wasn't Portuguese, but it was English to be more universal and I wanted something with *math*. Then I used a username generator in Google where we basically put the keywords and it makes suggestions. I put the word *math* and one of the suggestions was Math Guru. Well, I'm not a guru, I'm still a baby in math, but I thought that guru looks a lot like a *girl*... so I know that *girl* writes with me, but you get more style, inspired by this about the guru Then they came to tell me that *gurl* is equivalent to a girl here in Portugal, that is, a *girl*, with i, is a girl and gurl, with you, is a girl, but great... (verbal information[6]).

Thus the *MathGurl* channel was born, which, although being born in Portugal and created by a Portuguese, has its largest audience among the Brazilian public. In the early years of the channel, the Brazilian audience reached 80% of the audience, currently, according to Inês, the audience between Portuguese and Brazilians is more balanced, with 40% of users residing in Portugal and 60% of users who reside in Brazil. This panorama can be understood from some parameters, one of them is knowledge of the profile of Internet users according to their geographical location of access. In this case, Brazilians are third parties among those who spend more time and interact on the Internet[7],which may be one of the factors for *MathGurl* to have such a significant audience in another country. The fact that Brazil and Portugal are Portuguese-speaking countries and that the content is produced in the same language is another element to consider. Youtuber *@mathgurl* draws attention to another consideration, given what he knows of his audience located in Brazil.

> I think it's because Brazilians have much more culture of watching educational channels and videos, learning from videos. Here in Portugal my channel is the only one. There is no culture of learning to watch videos...because, of course, Brazilians are also much more. Brazilians are also more open, interactive and comment more. And, of course, the Brazilian attracts the Brazilian...but, perhaps, public education may be malfunctioning in Brazil, so Brazilians may

---

[5] Data taken from the YouTube channel Mathgurl (https://www.youtube.com/channel/UC5RV_s1Jh-jQI4HfexEIb2Q/videos) on June 17, 2019.
[6] Interview granted by Inês Guimarães. Interview I. [May 2019]. Braga, 2019. 1 .mp3 file (38 min.).
[7] https://www.tudocelular.com/mercado/noticias/n119125/brasil-internet.html

> have more need to learn through online content. Not long ago I was talking to a person from Ti T Ube from Brazil and he told him: in Portugal You T Ube was delayed about four years for Brazil. And in Brazil there are more educational channels, because people use videos as online media to study for the university entrance exam and for school (verbal information).

The testimony of *@mathgurl* indicates two important variables: the cultural issue and the gaps in formal education in Brazil. With respect to the former point, it should be noted that the Brazilian culture is diverse and multiple and that the Internet and the Brazilian appropriation of its spaces is an element of a much wider picture. Thus, although cultures hybridize (Canclini, 1997) and the subject is fragmented into different identities that relate and coexist (Hall, 2005), there are aspects that define people. With respect to the network society, several pieces of research indicate, since the popularization of the Internet in the late 1990s, Brazil as a great user of the network for its communicative profile, standing out as the second most consuming population of Internet content, just behind the United States. The other important variable refers to the weaknesses of education in the country, especially in public schools. In this sense, young Brazilians are big consumers of online content, either because of the need to complement the gaps in formal education, perhaps existing, or to interact, move networks and, often, be content producers. A different dynamic from Portuguese society, which consumes and produces less content and less intensity. Therefore, although there are also some weaknesses in the Portuguese public education system, it seems that Portuguese subjects have not yet appropriated the network as a space where they teach and learn informally, as in Brazil.

It is important to highlight the understanding of the teaching-learning process as a process linked to human development through which skills, competencies and knowledge are built from the assimilation of concepts, procedures, values, etc., whether through experiences, experiences, observation or interaction in formal and informal pedagogical spaces. From the perspective of this study, the teaching and learning process is sociocultural and, therefore, forged in the presence of articulated knowledge derived from world culture and experiences.

Thus, the world of social life is the first basis of the teaching and learning contexts. That is, the social condition of the apprentice of the human being precedes any formal institution intended for this purpose. Teaching and learning, therefore, is a phenomenon located in the sphere of the constitution of knowledge, a construction that involves dialogue and knowledge accumulated by humanity. From this perspective, learning is more than retaining, accumulating, decorating data, information. Learning is contextualizing and establishing the meaning of dialogue, in a context that, above all, is socio-historical and makes sense to the subject.

For these reasons, learning is not permanently and exclusively linked to a specific space or institution. Learning is for school, for dialogues through the Internet, for interaction through shared content on digital social networks and for various other experiences of man and his social environment. In the context of digital social

networks, we realize that one of the elements for the production of content is precisely the understanding that it must be contextualized, make sense to the audience and, in some way, also to those who produce it.

In the case of the content produced for the *MathGurl* channel*,* in addition to the concern for the context and ownership in relation to the content, the author tries to produce the content considering two other aspects: new ways of presenting concepts so as not to disturb the followers and the use of language and procedures that add and do not distract the audience.

> Regarding the themes of the videos, I do a lot of research on the Internet. Sometimes I get inspired by the things I learn in class, other times I hear suggestions from friends, teachers and followers. First of all, I try to be subjects that do not require much prior knowledge so that everyone can learn with a certain level of effort...but I also try to bring several levels of difficulty: more basic things, advanced things...deep down not to lose anyone...so those who already know more about math don't get bored. I always try to bring a new perspective, some new and different way of looking at that topic, and for people who don't know much about math, they can also follow it (verbal information[8]).

@mathgurl's concern about allowing any subscriber of the channel to follow the content it produces does not mean that the author produces it without worrying about the truth or legitimacy of the information. After all, she is someone who, in addition to having an affinity with the area to which she produces, studies, that is, updates and has her own community as an evaluator of what she shares. However, it should also be emphasized that Inês Guimarães is committed to trying to understand how her audience would like to learn about the content she produces. This is possible thanks to the author's proximity to the universe in which she inserts, by knowing her audience, through the tools provided by YouTube and, therefore, putting herself in the place of those who seek or follow the content. This aspect is closely related to the personalization of learning environments, an important element in contemporary teaching and learning contexts. This allows autonomy for those who wish to learn about an area, review content they already know and freedom to build a less universal and more specific learning itinerary.

> I try to be as accurate as possible in the content I transmit, without being too strict so as not to lose people. I try not to be wrong and I always try to provide a different perspective on mathematics, something that people did not think about, examples that were not given, new curiosities (...) I think: if it was me, what would be the best way of transmitting this? I think those on the other side are people like me (verbal information[9]).

The more democratic use of the Internet, and the culture derived from it, have allowed social relations of enormous social, economic and political impact at local

[8] Interview granted by GUIMARÍES, Inês. Interview I. [May 2019]. Braga, 2019. 1 file.mp3 (38 min.)
[9] Entrevista concedida por GUIMARÃES, Inês. Entrevista II. [mai. 2019]. Braga, 2019. 1 arquivo.mp3 (30 min.)

and global level, generating new spaces of power related to knowledge in which we find gaps for educational actions. In the case of digital social networks, the possibilities of social constructions, knowledge production and communicative exchanges through synchronous and asynchronous interaction are numerous. The networks that are organized and constructed from the content shared on platforms and websites of digital social networks are composed of virtual partners with interests ranging from scientific knowledge to spontaneous knowledge. The subjects use these spaces for intellectual, social, emotional and cultural exchanges, allowing the emergence of feelings and establishing networks of relationships, mediated by digital social networks.

> I have had very positive comments. Above all, what motivates me to make videos is this support from people on the other side ... I feel, perhaps, that I may be doing something useful. I receive many messages from people who say: I didn't like math, but now with your videos, I realized that it was a different area; your videos motivate me to study mathematics; I had 100% in the last test because now I like math. Of course, some of these comments are only exaggerated sympathies, because it is not by watching a video that suddenly a person comes to know mathematics. But my goal is really the motivational part and to show that mathematics can be viewed in a different and fun way. I am much happier for people to say so well and appreciate what I do and seem to get something from it (verbal information[10]).

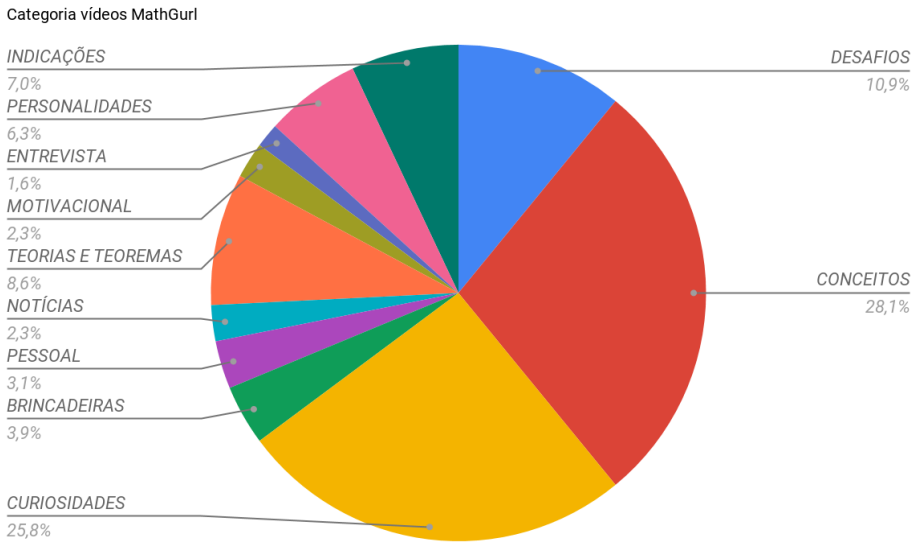
We can see in the speech by @mathgurl that, although she produces content related to an area of knowledge that has a vast scientific and academic production, its audience indicates that, from the content produced by her, the subjects are motivated to know and, many times. Sometimes she deconstructs the tension around an area that is often resolved at school in a decontextualized way, moving students away instead of bringing them closer together. Therefore, motivation and fun are two important axes in the production of student content for her channel. It is the production of someone who has learned mathematics in a traditional way and realizes that this model distances the student from an area that is fundamental to human development.

@mathgurl's perception and purpose of developing a YouTube channel comes first from the desire to share what she knows in a way that motivates people, knowing, however, that this space she builds does not replace the formal school space, but It can be a complement or even a trigger for subjects to mobilize to meet, know or even have fun with mathematics.

It is worth noting that, although MathGurl is considered an entertainment channel, it is classified on YouTube as science and technology and, when analyzing the content published by its creator, we can see that the videos produced address concepts, procedures and notions of the same mathematics that, however, is discussed in formal spaces, with a language close to everyday life, practical examples

[10] Interview granted by GUIMARÍES, Inês. Interview I. [May 2019]. Braga, 2019. 1 file.mp3 (38 min.)

and playful dynamics, which seeks to entertain and ensure the audience's attention to the understanding of theories, theorems and concepts that are often complex.



Graph 2: *Categorization of MathGurl videos in YouTube.*
Source: Authors.

Considering the previous graph, more than 50% of the content produced is the dissemination of mathematical knowledge in the dimension of the clarification of mathematical concepts, mathematical curiosities and mathematical challenges always supported in the literature of the area of knowledge, with clear examples and dynamic and funny language. It should also be taken into account that, although the author is concerned about the references she presents, with the rigor of the data presented, she also adapts the produced content to the dynamics of the users who access this type of product. Therefore, the videos are short, less than ten minutes long; have an identity, the same greeting and farewell to the audience; dialogues with other media elements, especially resources and associations with pop culture; refer to other videos produced by the author, sometimes even proposing continuity; and she uses a language that seeks to bring the audience closer to the person who produces the content, especially by inviting interaction and / or responding to the comments sent for each content.

It should also be noted that, in many videos, MathGurl emphasizes the importance of learning in many different ways, reinforcing the importance of teachers and institutions as spaces that are legitimately responsible for this process and, therefore, must be respected and valued.

"Although it's a bit utopian, I think people should enjoy learning because knowing things is the best we can do. I value knowledge a lot and I always need to learn new things" (verbal information[11]).

[11] Interview granted by GUIMARÍES, Inês. Interview I. [May 2019]. Braga, 2019. 1 file.mp3 (38 min.)

Although MathGurl reinforces in the videos that she is not a teacher, although some people recommended her for the best teacher award in Portugal, for example, and highlighted in the interview that she does not intend to be a teacher, it cannot be denied that the content generated due to her dissemination of knowledge and the scientific dissemination of mathematics is in the dimension of teaching freely and on a network, around the pedagogies of connections. The pedagogies of the connections established within the scope of the digital revolution favor free access to content and shared knowledge in the most diverse forms on the network, promoting ubiquitous learning in cyberspace, forging new professional roles and learning spaces. This dynamic of teaching and learning informally, especially in digital social networks, often has a beginning and an end in itself, which has a direct impact on formal education, which are faces of the same object as education (Santana, 2019).

In the case of YouTube, the videos produced directly for the platform aim to disseminate information and knowledge in cyberspace, portraying its original and essential proposal: "Transmit yourself" or "transmit yourself". These are content produced independently by ordinary people who basically want to produce video content and share it. Therefore, the revolutionary thing about YouTube in the context of what we have called the pedagogies of connections is that it represents a common appropriation of discourse (Jenkins, 2009), where both media are used and recombined at the same time. Amateur media gain large-scale public access. In the teaching and learning dimension, the context is similar, since academic, scientific and pedagogical assumptions are evoked, non-formal pedagogical practices gain space, visibility and build networks that teach and learn.

5. CONCLUSIONS

Recently, there have not been many studies that try to identify and exploit the educational potential of digital social networks such as *MySpace*, *Orkut*, *Ning*, *Facebook* and especially *YouTube,* referring, for example, that this network can improve communication and exchange. It can allow the development of more dynamic and interactive teaching and learning capacities and strategies, open and creative, allowing greater stakeholder participation, better use of resources and greater mobility of information and knowledge.

Therefore, and in light of this reality, it seems to us that it makes less and less sense to keep "pre-digital" curricular organization models focused on a rigidly hierarchical organization of static content under the teacher's control.

Our study confirms this idea by highlighting the need to create alternative models and pedagogical spaces with a strong motivating and playful component. However, and as can be concluded, these spaces should not be seen as substitutes for the formal school space, but as complementary spaces where subjects are mobilized to acquire new knowledge and have fun learning mathematics. Reinforcing this idea, in many of her videos, MathGurl underlines the importance of learning from teachers and educational institutions, since they are formally responsible for the educational process and, therefore, must be respected and valued.

We conclude that, while MathGurl sees her channel as a place of entertainment, short videos being less than ten minutes long each with their own concepts, procedures and notions of the same mathematical identity. There is discussion in formal spaces, but with a less formal language that seeks to entertain and ensure the audience's attention to the understanding of often complex theories, theorems and concepts. In fact, this is a space with its own characteristics that leads us to a digital education network, open and non-formal, in the vicinity of a connected pedagogy, with free access to content and shared knowledge on the network, promoting ubiquitous learning in cyberspace.

When it comes to the use of the possibilities of digital social networks, it is certain that any conclusion that must be drawn must be considered transitory and momentary, since the frequent evolution of these spaces generates very rapid changes. However, despite this constant flow in the impulse of the relativity of these findings, the results of this study allow us to affirm that the creation of non-formal learning spaces on the network *You can be* configured as environments with technical and functional potential, favor connections between network participants and interactive learning; which allow you to organize content on network nodes for quick access; and that facilitate the exchange of materials, knowledge and experiences of collaborative and participatory learning (Allegreti *et al.*, 2012; Basso *et al.,* 2013).

6. REFERENCES

Allegretti, S., Hessel, A., Hardagh, C. & Silva, J. (2012). Aprendizagem nas redes sociais virtuais: o potencial da conectividade em dois cenários. *Revista Contemporaneidade, Educação e Tecnologia,* (2), 54-60.

Bardin, L. (1977). *L´analyse de contenu.* Paris: PUF.

Basso, M.; Bona, A.; Pescador, C.; Koelher, C. e Fagundes, L. (2013). Redes sociais: espaço de aprendizagem digital cooperativo. *Conjectura: Filosofia e Educação,* (18), 135-149.

Castells, M. (2003). The Network Society: From Knowledge to Policy. Em M. Castells & G. Cardoso (Eds.). *The Network Society, From Knowledge to Policy* (pp. 3-21). Washington DC: Johns Hopkins Center for Transatlantic Relations.

Cohen, L. e Manion, L. (1990). *Métodos de Investigation Educativa.* Madrid: La Muralla.

Davis, M. (1997). Garage Cinema and The Future of Media Thecnology. Em *Communications of The ACM (50th Anniversary Edition Invited Article,* 2, (pp. 42-84). Disponível em: https://marcdavis.me/wp-content/uploads/Publications/1997_CommunicationsACM_GarageCinemaFutureMediaTechnology.pdf

Díaz, A. (2015). ¿Hacemos un uso inteligente de las redes? Em J. Criado e F. Rojas. *Casos de éxito en redes sociales digitales de las administraciones públicas*. (pp. 8-10). Barcelona: Escola d'Administració Pública de Catalunya. doi: http://dx.doi.org/10.2436/10.8030.05.6

El País (2006). *Google compra la web YouTube por 1.300 millones*. Disponível em: https://elpais.com/tecnologia/2006/10/10/actualidad/1160468878_850215.html

García, F. e Gil, F. Youtubers (2018). Mundos éticos posibles. *Index.comunicación,* 2, 151-188.

Guimarães, I. (2019). Entrevista I. Entrevistador: Camila Lima Santana e Santana. [1 arquivo.mp3]. Braga.

Guzmán, A. e Del Moral, M. (2014). Tendencias de uso de YouTube: optimizando la comunicación estratégica de las universidades iberoamericanas. *Observatório Jornal*, (1), 69-94.

Prensky, M. (2001). Digital Natives, Digital Immigrants*. On the Horizon,* (5), 1-6.

Rissoain, R. (2016). *Redes sociales. Comprender y dominar estas nuevas herramientas de comunicación***.** Barcelona: ENI.

Soukup, A. (2014). Looking at, with, and through YouTube. *Communications Research Trends, 33*(3), 3-34.

Statista. (2018). *Percentage of U.S. internet users who use YouTube as of January 2018, by age group*. Disponível em: https://www.statista.com/statistics/296227/us-youtube-reach-age-gender/

Wikipedia. (2019). *Anexo: Canales de YouTube con más suscripciones***.** Disponível em: https://es.wikipedia.org/wiki/Anexo:Canales_de_YouTube_con_m%C3%A1s_suscripciones

YouTube. *YouTube para la prensa.* Disponível em: https://www.youtube.com/intl/es-419/yt/about/press/

AUTHORS:

José António Moreira
PhD and Master in Educational Sciences from the University of Coimbra. He has a postdoctoral degree in Educational and Communication Technologies at the University of Coimbra. Degree in Art History from the Faculty of Letters of the University of Coimbra. He is a professor in the Department of Education and Distance Learning (DEED) at Open University. He is currently Director of the Porto Regional

Delegation of the Open University and Coordinator of the Development Unit of the Local Learning Centers of the same university. He is the Scientific Coordinator of the Mobile Site Studies Research Unit and a researcher at the Center for Interdisciplinary Studies of the 20th Century at the University of Coimbra and at the UAb Laboratory for Distance Education and eLearning (LE@d). He is also Coordinator of the Center for Pedagogy Studies in Higher Education (NEPES) based in CEIS20. He has published scientific articles in peer-reviewed journals and books in the areas of Teacher Training and Digital Technologies.
jmoreira@uab.pt
Orcid ID: https://orcid.org/0000-0003-0147-0592
ResearchGate: https://www.researchgate.net/profile/J_Antonio_Moreira

Camila Lima Santana e Santana
PhD in Education from the Federal University of Bahia, Master in Education and Contemporaneity from the State University of Bahia and Pedagogue, graduated from the State University of Bahia. She is a researcher and teacher at the Federal Institute of Education, Science and Technology of Bahia, in the Degree in Chemistry and in the Postgraduate Program in Professional and Technological Education. Member of the Virtual Communities research groups (UNEB); Education, Sociotechnical Networks and Digital Cultures (UFBA); and Science Education (IF Baiano). She is currently developing a postdoctoral internship at the University of Coimbra, investigating the interface of education and digital social networks in the context of digital culture.
camilalimasantana@gmail.com
Orcid ID: https://orcid.org/0000-0002-5696-7443
ResearchGate: https://www.researchgate.net/profile/Camila_Santana5

Aitor González Bengoechea
PhD Student in Audiovisual Communication, Advertising and Public Relations from the Complutense University of Madrid. Graduated in Journalism from Jaume I University of Castellón. He has a Masters degree in Organizational Communication from the Complutense University of Madrid. He has published works related to the dynamics of social networks in communication and other related fields.
aitogonz@ucm.es
Orcid ID: https://orcid.org/0000-0002-1509-8106
ResearchGate: https://www.researchgate.net/profile/Aitor_Gonzalez_Bengoechea