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NEW STRATEGIES IN SCIENCE EDUCATION? THE USE OF VIDEO ABSTRACTS IN ECOLOGY AND ENVIRONMENTAL SCIENCES IN THE CLASSROOM

NOVAS ESTRATÉGIAS NA EDUCAÇÃO? O USO DE VIDEO ABSTRACTS EM ECOLOGIA E CIÊNCIAS DO AMBIENTE NA SALA DE AULA

¿NUEVAS ESTRATEGIAS EN EDUCACIÓN? EL USO DE VÍDEO RESÚMENES DE ECOLOGÍA Y CIENCIAS AMBIENTALES EN EL AULA

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ABSTRACT | The constant changes societies have gone through over time make it necessary to adjust educational methodologies to new contexts. At the same time, the way we communicate science has changed with the advent of new technologies and the COVID-19 pandemic. In this new reality, video emerges as one of the essential tools for science dissemination. Video abstracts gained prominence among the different kinds of videos used for this purpose. As a link to scientific papers, it ensures quality and rigour, but despite its potential, little is known about how educators could integrate these innovative resources into their classes. For this purpose, a reception study using semi-structured interviews with Biology and Geology teachers was designed based on an original video abstract analysis. The results indicate that a video abstract should be short, with different formats and languages, and included in a broader pedagogical strategy. Also, this kind of resource works as a unique link between academia and high school.

KEYWORDS: Online video, Video abstract, Ecology, Science communication, Science education.

RESUMO | As mudanças que a sociedade tem sofrido nos últimos anos tem feito com que seja necessário ajustar as práticas educativas a novos contextos. Simultaneamente, com o advento das novas tecnologias e com o aparecimento da pandemia COVID-19 o modo como comunicamos ciência tornou-se mais complexo. Nesta nova realidade, o vídeo aparece como uma das ferramentas essenciais para disseminar o conteúdo científico. Entre os vários formatos utilizados para este fim, o video abstract tem ganho especial destaque. Como versão audiovisual do artigo científico, assegura a qualidade e o rigor, porém apesar do seu potencial, ainda se desconhece de que forma os professores e educadores podem incorporar este recurso nas suas salas de aula. Para isso foi aplicado um estudo de receção, através de entrevistas a professores de Biologia e Geologia e ex-alunos com base num vídeo abstract original. Os resultados indicam que o video abstract deve ser curto, utilizar diversos formatos e linguagens, sempre incluído numa estratégia global de ensino aprendizagem. Para além disso, estes recursos estabelecem uma ligação única entre a academia e o ensino secundário.

PALAVRAS-CHAVE: Vídeo online, Vídeo abstract, Ecologia, Comunicação de ciência, Educação em ciências.

RESUMEN | Los cambios por los que la sociedad ha pasado durante los últimos años hacen que sea necesario ajustar las prácticas educacionales a nuevos contextos. Simultáneamente, con la llegada de nuevas tecnologías y de la pandemia de la COVID-19, la forma de comunicar ciencia resulta más compleja. En esta nueva realidad, el vídeo aparece como una de las herramientas esenciales para la diseminación de contenidos científicos. Entre los formatos utilizados para este fin, el vídeo resumen viene ganando especial relieve. Como versión audiovisual del artículo científico, garantiza la calidad y el rigor, sin embargo, y pese a su potencial, todavía se desconoce de que forma los profesores y educadores pueden incorporar este recurso en sus clases. Para ello fue aplicado un estudio de recepción, a través de entrevistas a profesores de Biología y Geología y a exalumnos con base en un video resumen original. Los resultados indican que el video resumen debe ser corto, utilizar distintos formatos y lenguajes, siempre incluido en una estrategia global de enseñanza aprendizaje. Además, estos recursos establecen una conexión única entre la academia y la educación secundaria.

PALABRAS CLAVE: Vídeo online, Vídeo resumen, Ecología, Comunicación de ciencia, Educación en ciencias.

1. INTRODUCTION

In the past two years, a more powerful tide caught up with the rise of new technologies and their role in societies. A pandemic burst onto the shore of our lives, abruptly changing how we communicate, work, and live. All activities and sectors were affected, and so was Science, particularly in how it is produced, transmitted, and taught. The widespread confinement of the population meant that many researchers had to leave their laboratories and fieldwork stagnant. With their employees forced to work from home, the primary producers of scientific knowledge, like universities and institutes, had to readjust their goals, strategies, and funding. The same happened with formal teaching, where face-to-face classes evolved overnight into distance learning. This transition triggered profound changes in the day-to-day functioning of schools and their actors, leading to an inevitable increase in the use of technology (Pedro et al., 2021). Many devices associated with non-formal education, such as television and computers, had to be now structural elements of formal education (Dierks et al., 2016). Previously, both types of education were already regarded as necessary and complementary. Actors from both "worlds" agreed on the creation of bridges and further dialogue (Baram-Tsabari & Osborne, 2015) to attract more students to Science and Technology, sustaining a developed society (Fiolhais, 2016). Science and media education are essential components in this lifelong learning continuum, from preschool to active citizenship, which encompasses formal and non-formal education (Espanha & Lapa, 2019; Fiolhais, 2016; Hazelkorn, E.; Ryan, 2015). However, despite previous efforts to converge both systems of education, the COVID-19 pandemic served as a turning point in favour of online education worldwide, and it has implemented profound changes in the foundation of the education systems. A study from The National Education Council (Portugal) states that “the emergency remote learning situation may have triggered more changes in a short period than the discourse on innovation in education over the years” (National Education Council, 2021, p.182).

In Portugal, the Portuguese Government suspended twice (in March 2020 and January 2021) all classroom teaching and training activities at all levels of education. These new rules forced schools to replace presential time - 26 hours per week of face-to-face compulsory instruction - with online teaching and home-schooling, promoted most of the time by teachers and parents (OECD, 2020). Distance learning imposed new practical and theoretical methodologies built on more autonomy for the student, with new digital tools leading the way (National Education Council, 2021). However, not all schools and teachers were prepared for this transition (OECD, 2020). It is therefore important that these technologies are kept after the COVID-19 pandemic, and new training sessions about educational innovation are promoted, looking not only at the digital proficiency of the teachers but also the levels of confidence to use digital tools in their pedagogical, methodological, evaluative and professional practices (Pedro et al., 2021).

Hundreds of learning technologies are available to teachers (Bower & Torrington, 2020), and video is one of them. In the follow-up of previous work (Ferreira et al., 2021), in which we identified and categorized a series of video abstracts in Ecology and Environmental Sciences, we discussed our science video with Biology and Geology teachers. Recurring to a set of interviews, we were driven by the question: How can a video abstract operate as an educational resource in the classroom? So, the main goals of this study are :

(1) Characterize student's and teachers' behaviours towards science videos;

(2) Evaluate the potential of a video abstract as a pedagogical tool in the classroom;

(3) Understand the key factors that, according to teachers, a video abstract should have to work as an educational video.

This work brings new insights into the universe of science videos and proposes new strategies and collaborations to the educational environment. It explores for the first time the features of a video abstract in a classroom context, leading to new possibilities between students and scientists.

2. LITERATURE REVIEW

An online science video is a quick tool that aims to deconstruct scientific topics while maintaining rigour and accuracy (García-Avilés & de Lara, 2018; Morcillo et al., 2016). It can have different producers, purposes and formats and bears a growing mix of genres (Erviti, 2018; Erviti & Stengler, 2016; García-Avilés & de Lara, 2018; Welbourne & Grant, 2016). Researchers have studied the educational value of videos for decades (Kohler & Dietrich, 2021). In a classroom, teachers can use two types of videos: (i) non-narrative videos like scientific videos, technical videos, and documentary videos, presented with the explicit intention of instructing, and (ii) fictional narrative videos, which have pedagogical potential, despite not having been built from scratch for that purpose (Moreira & Nejmeddine, 2015). From a didactic point of view, videos can be used in different ways and work as a source of information, motivation, and form of expression (Moreira & Nejmeddine, 2015).

Recent studies tried to understand what makes a compelling science educational video and establish practical guidelines. Almeida and Almeida (2021) created and evaluated natural science videos with teenagers and teachers. The authors concluded that teenagers appreciate, among others, these dimensions: the use of an onscreen host, a relaxed style of speech, the use of plain and straightforward language, short-length videos, the integration of different kinds of animations, the use of fast-paced editing and the integration of music or sounds effects (Almeida & Almeida, 2021). A large-scale study that applied a questionnaire to 5,000 participants of all ages also established a catalogue of 17 rules for a successful video. The authors emphasized that it is crucial to integrate experts on the video, specify sources, and use real-life footage or animations instead of showing only the presenter (Beautemps & Bresges, 2021). Style, format, and quality are essential parameters in an educational video (Castillo et al., 2021). Beyond successful educational videos, another kind of science video presents itself as a potential didactic resource: the video abstract. This film version of the written abstract of a scientific paper features the framework, the methods, the results, and the conclusions of the study (Berkowitz, 2013; Spicer, 2017). The creators of these videos can be the researchers, the science communication units, the communication offices or specialized companies. These producers have at their disposal a vast group of tools (e.g. images, videos, animations, graphics, and music) that can be used in flexible and inventive ways (Plank et al., 2017). The video abstract shares some characteristics with other science videos as it simplifies scientific processes, expands the research scope and encourages scientific discourse. They can be more successful than written and graphical abstracts in understanding scientific topics (Bredbenner & Simon, 2019). Also, they can expand narratives to new audiences, platforms, and networks (Romina Kippes, 2021). However, it is a unique tool because, as an academic peer-reviewed video, it ensures scientific rigour. In a world where

misinformation and pseudoscience are real threats (Allgaier, 2019; Fontes, 2021; Rosenthal, 2020), a resource like a video abstract can provide students, parents, and educators with actual scientific knowledge. Despite its positive input in disseminating scientific papers among its peers and the general public (Plank et al., 2017; Zong et al., 2019), no work has assessed its potential in science communication beyond academia.

3. METHODOLOGY

We structured our research into two stages. The first stage included the pre-production, production, post-production, and dissemination of a video abstract. The second stage involved semi-structured interviews with six teachers and alums students of the *Master in Biology and Geology Teaching in the 3rd Cycle of Basic and Secondary Education* at a public University in Portugal to understand the possible uses of a video abstract in the classroom.

3.1 Video abstract production

We developed the video over five months. The first step was to choose a paper that had not been published then. So, we started to exchange ideas with different research groups and laboratories. The research from FLOWer Lab (Castro et al., 2021), a research group at the Centre for Functional Ecology (CFE) of the University of Coimbra focused on plant-pollinator interactions, met our goals. The team converted the written abstract into a movie script in the pre-production stage. During some meetings, the researchers and the authors of this paper produced several screenplay versions. This writing used the six-question formula (Chan, 2019) to translate the paper's structure better. Working as a team, we tried to answer the six questions from the researcher's perspective. The answers worked as the text used in the narration. We structured the information in a grid with questions, predicted length, text, key concepts, and shots needed. Once we fulfilled the criteria set out in the grid, we had our narration and footage to produce our movie.

Several moments of recording constituted our production work: (i) voice-over (narration) recording; (ii) two filming sessions, one in the kiwi orchard and the other in the laboratory; (iii) filming the kiwi orchard at two different periods in the year, one with the kiwi tree flowering and the other some months later with the kiwi tree in the fruiting season; and (iv) recording in the laboratory to replicate some moments of the methodology used in the research. There was a series of constraints on what we could film in this process. So we searched online stock video sites to complement the fieldwork footage. Also, we produce small animations to illustrate some concepts about pollination and kiwi orchards distribution.

With all the footage, narration, and music selected, we edited our video. This process led to several interactions with the team about the aspects that could be improved. Entitled “Pollination deficit in kiwifruit”, a final version of the video was uploaded to the CFE YouTube channel (Ferreira, 2021) and on the webpage of Plants journal. We also promoted the video on social networks (Instagram, Facebook, Twitter) and personal and institutional profiles.

3.2 Interviews with Biology and Geology teachers

Our main goal was to talk with current students and alums students from the *Master in Biology and Geology Teaching in the 3rd Cycle of Basic and Secondary Education* from the University of Coimbra, where our research centre is hosted. Also, several researchers from our R&D unit coordinated and taught the course. The physical and scientific proximity to these professionals makes them the perfect subjects for our purposive sample (Palys, 2008). We obtained a list of thirty names and invited them via email to participate in the study. We made three different rounds of contact. Six ex-students expressed their interest and availability for the interview (Table 1). To fulfil all the ethical requirements, we produced a Consent Form approved by the host institution. This document provides all the participation information, the research details, the implications of being part of the study, the guarantees of confidentiality and anonymity, and all the specifics about posterior procedures with the collected data. Previously to the interviews, all six respondents received the document, accepted the terms and signed the Consent Form.

Table 1 *- Interviewee profile and occupation*

	Age	Year of graduation	Occupation	Education
Interviewee 1	28	2019	Teacher in a private school	Basic and Secondary
Interviewee 2	31	2014	Teacher in a private school	Secondary
Interviewee 3	39	2014	Research fellow	-
Interviewee 4	26	2019	Teacher in a public school	Basic
Interviewee 5	27	2017	Research fellow	-
Interviewee 6	27	2019	Teacher in a private school	Basic

We conducted the interviews by Zoom between September and October of 2021. During the interview, we asked twenty-five questions. After the ten initial questions, a pause was made to show the video abstract. Concluded the screening, we returned to the dialogue focusing the questions on the video and its possibilities as an educational tool.

We recorded and transcribed the interviews and subsequently completed a content analysis (Coutinho, 2018) using MAXQDA software. The responses were organized into different categories according to the theoretical referential, the interview structure, and other relevant information: (i) interviewee's motivations and current roles; (ii) course evaluation; (iii) behaviour with science videos; (iv) science videos in the classroom; (v) video abstract evaluation and (vi) video abstract as an education tool.

4. RESULTS

We have organized the responses and categories into two dimensions of analysis. First, we presented science videos, their applicability, their potential in the classroom, and the student perspective and receptivity. Secondly, we deconstruct the feedback about the film, discussing the video abstract as a potential pedagogical tool for the future.

4.1 Science videos inside and outside the classroom

Some initial questions allowed us to understand our interviewees' backgrounds and motivations. All described the choice to attend the Master in Biology and Geology Teacher Training as a transformative process over the high school and University years. Some of the main reasons for their choice went back to their youth: it was a child's dream, or in other cases, the passion grew by the influence of other teachers in their adolescence. They highlighted the importance of having role models that inspired them to embark on the educational journey and have a part in the world as educators. Also, the ability to communicate and interact with others and the joy from partaking in the communication processes were crucial factors. In this big communication circle, some teachers highlighted the passion for educating the younger generations and the welfare provided by contact with the younger ones.

The course challenged them to do several presentations, debate with the class, and discover different pedagogical strategies and questions. The training also allowed them to think and explore several resources, such as texts, pedagogical activities, PowerPoint presentations, interactive games, and videos. The need to be scientifically sound in all the pedagogical contents was another achieved skill. An educational professional must be aware of the whole domain and be up to date about the school's subjects. They also said that it is crucial to constantly explore oneself and self-reflect on the right and wrong actions.

All the respondents usually search and watch science videos. What differs is the motivation. Half of them watch science videos on a personal level. Full-length documentaries or popular science videos from channels like *Veritasium* or *Smarter Every Day* allow them to think differently and deepen their knowledge about a scientific topic. Although the interviewed teachers separate personal and professional viewing of science videos, they admit that the two worlds overlap. Sometimes, they come in touch with helpful videos for a current topic or a future approach. The other half acknowledge that they only watch science videos for professional purposes. They search on video channels with the only goal of finding audio-visual content to use in the classroom. Among the examples shown to the students, they pointed *TedEducation* and *TedTalks* videos and animations to explain a concept or a complex process (e.g., enzymatic protein Rubisco photosynthesis or convection currents in the Earth). Videos about the History of Science (e.g., cellular theory), medium-length documentaries, videos from Virtual School (a resources platform created by a Portuguese publisher), and news videos to establish a connection between the educational contents and the current times (e.g., the volcano in La Palma Island to teach volcanism), were also mentioned. Regardless of the strategies and categories, all the teachers agreed on two points. The first one is not to show only videos in a lesson; being essential to merge them with other tools; as a spark to discuss or recap the topics presented, the video is always complemented with additional resources.

> So, I usually use videos to introduce a particular topic because videos give us the freedom to generate a discussion period. They are stimulating at the auditory and visual levels. It ends up catching attention right at the beginning of the topics. It is the starting point for a discussion in the classroom and, from there, a beginning to include more theoretical content. (Interviewee 5)

> If I only showed them videos, they would at some point say, "oh no, another video!". There is always a balance. Sometimes it is drawings; sometimes, it is videos; sometimes, it is schematics. And sometimes it is news. (Interviewee 4)

The second common point is that the video has to be short. Usually, the interviewees avoided showing full-length documentaries because it takes up the class's total time and does not allow for later discussion and comprehension. Also, if the video is too long, the students may lose the motivation to see it. Teachers pointed out that an ideal length is between 3 and 7 minutes, always depending on how the content is presented.

> I never like to post very long videos, i.e. a ten-minute video in a class is overkill in terms of length. Five is a bit. Even though it is a video, that surprise/novelty effect is lost. Three minutes is the ideal time, but it also depends. It can be a five minutes video or even a little longer. Still, maybe I will explore it in another way. I will go ahead, ask questions, go a bit further, and ask questions, so there are not eight minutes at a time of video-only exposure. (Interviewee 2)

These two factors impact students' interests. The student's receptivity is good when the teacher keeps the diversity, showing short videos between other class materials.

> But in general, they like it. It is a break, and if they have not understood some things I have said, they will understand it with the video. Or if they are students with special needs, I think the videos have more impact on them.
> (Interviewee 6)

Furthermore, we were interested in understanding if the students consumed science videos outside the school environment, i.e., in their homes, with their family and friends. There was no clear feedback on this. Some teachers said that it depended on the family's education and environment. Others pointed to the explanation videos to study a specific topic. Nevertheless, there was a consensus that they only saw the YouTube videos suggested by the teacher. Some students followed the teacher's recommendations of sites and channels and gave feedback in class. To the teachers, this is a positive response because most of the students cannot distinguish a rigorous science video from a non-rigorous one. So, the teacher also took an active role in choosing and showing accurate science videos.

> It depends on the student. Some students are motivated toward Science; they end up looking for these videos and even signalling these errors. Others do not have this motivation. Therefore, by seeing the videos, they will take everything for granted. (Interviewee 5)

> I would say that some videos are not very accurate. I do not know if there are many or few. […] sometimes, it also depends on what we want because something without rigour can be helpful. I have already picked up countless news items to discuss the scientific error within that information. Now it is dangerous if you are going to explore alone. And then I do not know. It depends on the age. Maybe students at the end of secondary school already have a little bit of this ability. Those in the second and third cycles will not have it. Most will not be able to perceive or critically analyze if that video seems scientifically correct. (Interviewee 6)

> They see the videos in front of them; they do not look much more. I am more concerned that they are able to identify the Science in the daily information that shows up to them. (Interviewee 4)

In summary, there is a global acceptance of short videos integrated into different formats. The variety of strategies seems to be the key.

4.2 From academia to the classroom

After watching the video, we confronted each teacher with a group of specific questions. Our goal was to have their feedback on some video features, to understand how they would improve the video and use it in the classroom. One of the critical factors explored in the previous questions was the length of the science video. There is a consensus that this specific running time (of five minutes and twenty seconds) is within the upper limit. However, the difficulty of summarising so many aspects of the research in such a short time is recognized. Some teachers mentioned the need to have gap moments and replay the video several times to explore it with their students. It was pointed out its complexity and the need to analyze some of the presented topics. The eighth-grade curricula, specifically "Sustainability" and "Ecosystems" (*Aprendizagens Essenciais - 2.º e 3.º Ciclos Do Ensino Básico | Ciências Naturais*, 2018), seemed to be the perfect fit for this presentation.

> We could use this video in a classroom because it has an ideal length for attracting students' attention. There is the topic of dioecious species; they have difficulty understanding what is monoecious and dioecious, so it was spectacular to introduce this topic in this exciting way. […] Therefore, I would use it over several academic years and in different ways. (Interviewee 5)

> If this were a video I presented in the classroom, I would pause it. But it would not be a video to introduce to younger ages either […] it is a video for a slightly more advanced target audience. It would make sense to follow up with a worksheet and ask questions. This specific video could also include the question of science on the making and what is an expected job in the laboratory […]. The application of this video would be very versatile. (Interviewee 2)

The versatility pointed out in the previous testimony led us to another characteristic of our video: the presence onscreen of the leading researchers. According to our interviewees, the students need to see the researchers explaining their work to give them the idea that they are all normal people. To have a sense of proximity and look at the researcher as ordinary persons who think about Science the same way they are stimulated to think. The idea that they could be the ones in that laboratory creates a bond, complemented by face-to-face visits of the researcher to the classroom. Sometimes, these researchers are friends of the teacher from their University days.

> I think it is good. I think the video with real people working, people who work on the project, is good. If only to remind you that someone does this work […] real people with faces and hair, beautiful, ugly, fat and thin, ordinary people like everyone else. Science is done by people. (Interviewee 4)

> A researcher is an ordinary person who thinks about Science in the same way that students are encouraged to think. It makes perfect sense. (Interviewee 2)

The onscreen presence of researchers leads us to discuss the students' misconceptions about scientists. Most respondents state that students still have that disconnected image of a scientist associated with popular culture references (e.g. science fiction movies, CSI series). Students still associate the idea of someone older, with a white coat and funny hair, in the laboratory. Their world is still far from day-to-day life in science research centres and institutions. Students do not know how and by whom Science is produced. So, the teacher has the essential role of deconstructing these concepts to show them that researchers are ordinary people like them and that a science career is a possibility for their future. That Science is accessible and universal.

> There is the idea that Science is not for everyone. And the goal is to be for everyone […], so we are not all going to work for the same, nor do the same thing, but there is room for everyone. That is my opinion, and the students still think it is not for everyone. (Interviewee 5)

One of the paper's authors was also the narrator of the film. We discussed this choice, asking how it works as an alternative to the professional narration. There is an agreement that this choice offers a sense of proximity besides spotting the difference between an amateur and a professional narration (e.g., accent). The language chosen by the narrator was also a point of debate. As one of our goals is to disseminate the scientific paper among peers, we use English as our primary language. So it was essential to understand if this is suitable in a scholarly context or if, on the contrary, we should have chosen to speak in Portuguese with English subtitles. On the one hand, it can be important to show these contents in English to older students (Secondary level) because it is a way to improve their skills in this language and understand that this is the most worldwide spoken language in Science. On the other hand, if our target is a younger group or students with special needs, a video in Portuguese is always a better choice.

Looking at the chosen formats, we can say that this video is a grand mixture: it has a documentary style intercalated with animations and interviews. Most of the teachers agreed that combining these elements is the best choice. However, they see animation as the most appealing format, especially for the younger generations. Also, animations and graphics are a better way to explain the concepts.

To wrap up the video features, we asked what they would change in the film. The main suggestion was to add some animations, titles, numbers, or schematics to some moments, specifically those with complex ideas. Adding more visual elements to represent what was said could help students assimilate the video's message better.

To close the circle, we asked if a video abstract could be a way to create communication paths between Secondary Schools and Universities.

> It is a missing link. […] I remember from my student years something that was missing. The professors at the University complain a lot about this. The kids are poorly prepared in manipulation, practice, scientific reasoning, etc. […] However, I think videos like this can bridge the gap very smoothly, and I think they are suitable for kids. (Interviewee 2)

> Yes, I think so. I guess it turns out to be an informal way of bringing people into what they believe is very formal. Therefore, I think it simplifies the question of Science and reaches

> the younger public who do not yet have the necessary maturity to read, for example, a scientific article. (Interviewee 5)

> Suppose I was teaching in the 11th grade. In that case, I could discuss the nature of scientific knowledge and the scientific method […] in the different steps needed to develop new scientific knowledge. And that, in this video, is also very well explained. (Interviewee 4)

As shown in the last testimonies, the general feedback is that the video abstract can be a new and more effective way of connecting high school students to academia. It can be a gateway to scientific research and scientific careers. However, how can we create these bonds between the different intervenients? The first suggestion from the interviewees would be to promote regular workshops and training sessions to equip the teachers with digital tools and digital literacy and deepen their knowledge of specific topics. In this case, our communication office could schedule annual workshops about pollination, ecological networks, and other topics presented in the school guides. As science communicators, we would act as an intermediate between the school and the University. These videos can be shown during that training sessions and promoted as a helpful tool.

The other idea is to work closely with scholar publishers. If a video abstract could be present in a digital school manual, it would easily be known by the scholar community. Sharing these videos and establishing a partnership with the publishers enable us to reach a more significant number of teachers. Also, governmental platforms like Virtual School are excellent places to present video abstracts. In conclusion, the first step would be to develop agreements with existing organizations instead of creating a new site for these contents.

> We do not have time, however much we want, to do things from scratch. Therefore […] the publishers save our lives many times in many circumstances when they provide us with ready-to-use material. I am sure that if they give these materials through training, these resources as teaching resources, the teachers will use them. (Interviewee 6)

5. DISCUSSION

With this set of dialogues, it was unanimous that this pandemic impacted most of the work in the classroom, especially in a curricular unit such as Biology and Geology, with an enormous practical component. The teachers found it more challenging to scientifically present the topics if they were not interacting directly with the students, seeing their faces and perceiving their feedback. The computer screen appeared as a communication barrier to the classroom reality and other processes with other education actors (e.g., meetings with peers and parents). Despite being widely recognized that one cannot replace face-to-face learning, such an agitated period also resulted in new opportunities and partnerships. Looking at that positive perspective and focusing on the future of video abstracts, four key ideas emerged:

(i) Science videos should be part of a broader educational strategy in the classroom. The use of different approaches and other resources in the classroom, like images or texts, should be encouraged. When the teacher presents a variety of content throughout the class, the student's receptivity increases; therefore, as a

pedagogical resource, the video should always be aligned with educational goals and curricula and integrated into a plan (Moreira & Nejmeddine, 2015). Also, the journey to produce a video abstract can be explored as a learning process. With the six-question formula (Table 2), the students could deconstruct and rethink scientific topics, putting themselves in the shoes of filmmakers and researchers.

Table 2 *- Six-questions formula (adapted from Chan,2019)*

Question	Time (seconds)	Text	Key Concepts	Shots
What is the problem?				
Why is it a problem?				
What are you doing to solve the problem?				
What have you found out?				
What is the impact of the research?				
What is the next step in the research?				

(ii) A video abstract should be short, with different styles and languages. The length of the video is significant in a class context. Shorter videos are preferred when compared to longer ones. Previous work settled that online science videos should be brief (García-Avilés & de Lara, 2018; Slemmons et al., 2018). However, all of our respondents agreed that a five-minute video presentation has the potential to explore different approaches. One idea from this study was adding title segments to the video to ease its didactic application. Adding titles with the six questions or main topics can help to structure the lesson and improve students' attention. The use of a format with various styles is a winning choice for this kind of content, but animation and schemes were also referred to as preferable formats and should be used the most possible. Visual representation is always an advantage (Brennan, 2021) if the video comprises several different and complex concepts. For the last and broader use of the video (between all years and ages), two versions should be prepared: one in English with Portuguese subtitles (for the older students at Secondary levels) and a Portuguese version with English subtitles (for the younger students). This ambivalence ensures video comprehension, independent of the student's age and language skills.

(iii) Like other science videos with the presence of researchers (Chen & Cowie, 2014; Krebs et al., 2020; Wyss, 2013), video abstracts align with science education goals as it inspires children and teenagers to pursue scientific careers (Hazelkorn, E.; Ryan, 2015). Although the student's age and background may influence it, the teachers from our sample agree that most students have a conceptualization of what a researcher does and looks like that is still far from reality. This kind of video allows the teacher to deconstruct these preconceptions, showing their students

that researchers are ordinary people and that Science is reachable. So, it is essential to give a pivotal role to the researcher in the video, either through narration or interviews.

(iv) Video abstracts can work as a link between academia and high school. Projects and collaborations between primary/secondary schools and universities are decisive in approaching students to sciences (Fiolhais, 2016). The teachers presented two different calls to action to disseminate this content better. Firstly, they pointed out the publishers as essential vehicles to achieve this goal. Future strategies can englobe partnerships between the science centres or universities and the school publishers to include this content in their books and online platforms. It is a win-win situation as the teacher has a set of rigorous scientific videos available for use in class, and the researchers/institutions see their work disseminated among the youngsters. The second piece of advice was to create training sessions about these scientific areas and these scientific tools. As science communicators and researchers, we suggest that these training sessions should be planned as part of a global plan. The research centres, the universities, the science journals and other actors should work in unison with a concerted strategy to promote this type of content.

6. CONCLUSIONS

This paper presents the first known interaction between video abstract production and primary and secondary teaching. One of the things we felt when conducting the interviews was that this kind of dialogue was critical. These works should always be accessible to teachers since they are the source of new ideas and educational inputs. As frontline agents, they can be valuable partners in producing scientific content. From their point of view, a video abstract like this one has the potential to be used alongside other resources. A short video using different formats, showing the actual researchers and offering different language options seems to be the best formula for connecting students to academic research.

This work is another step towards a more comprehensive and collaborative science communication. For the future, it is necessary to take advantage of these new channels, moving forward with training, dissemination strategies, and evaluation moments, transforming video abstracts into an increasingly transversal resource.

7. IMPLICATIONS

Our paper introduces video abstracts to a new audience: the teachers. As an educational and national publication, readers from around the country will be presented with this new scientific tool and its potential. Teachers will be able to spread the word among their colleagues and explore video abstracts already published online, not only in Ecology and Environmental Sciences and Portuguese institutions but in other fields of science and worldwide. With this positive feedback from our sample, teachers could use this resource in their classes and reach the

students and their families. Children, parents and educators could explore scientific and media literacies using video abstracts as a new guided route.

Furthermore, it represents an opportunity for the universities and institutes to tighten their bonds with schools, promoting their research and interest in Science. Beyond talks, science fairs and school visits, this paper has shown that video abstracts are an accessible and practical way to communicate and explore science. As a hybrid tool, it can be explored in different contexts, exploring the dynamics of media participation and collaboration among students. This line of work could also unlock investment in communication offices and other institutions devoted to science communication.

Lastly, with a concrete example of the production and reception of a video abstract, we contribute to those interested in creating this kind of content. Journalists, science communicators, researchers and teachers have here some valuable lessons and tips on best practices for producing a science video with educational goals.

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