

Chemistry Scientific Dissemination Video: Impact on the Perception of University Students

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Cite This: <https://doi.org/10.1021/acs.jchemed.2c01071>



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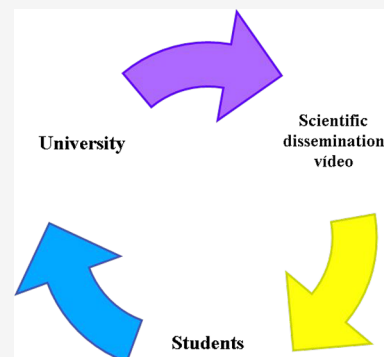
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ABSTRACT: This article reports the development of a dissemination work and analysis of the influence of a chemistry science dissemination video on the perception of university students in relation to scientific research carried out at the public university, to scientific dissemination itself and the use of scientific dissemination videos as learning tools. The didactic video of scientific dissemination of a university research in Chemistry was made available as an activity in a distance class for undergraduates of a General Chemistry II course. As a way of complementing the study and, at the same time, evaluating the teaching/learning of the students of the course, it was proposed that they produce didactic videos of scientific dissemination of some research of the Institute of Chemistry related to the theme seen in the classes, chemical bonds. The results obtained showed that didactic videos of scientific dissemination can be produced by undergraduates and that, in their perception, these videos are capable of propagating the value and importance of scientific dissemination and of scientific research carried out in public universities, and in addition, they are a good teaching/learning tool.

KEYWORDS: Public understanding/Outreach, First year graduation, Communication, Distance learning, Multimedia-based learning



INTRODUCTION

Communication is one of society's biggest challenges. The way it is made and behaves varies according to place and time, thus creating the languages necessary to understand and understand the world and communicate its perceptions. The communication of scientific discoveries is extremely important to reduce the distance between the scientific community and the general population.¹ In this sense, the scientific language is re-elaborated so that it becomes a language accessible to the general public. In this way, scientific dissemination seeks to democratize access to scientific knowledge and thus consolidate the conditions for achieving scientific literacy.¹

Scientific dissemination is also an opportunity to promote literacy scientific, with regard to Niezer, Silveira, and Sauer² scientific literacy consists of the need for all people to have a minimum of scientific knowledge to exercise their rights in modern society. Thus, the transfer of discoveries and the process of scientific initiation are extremely important for social and cultural development, since communication between the academic environment and society is fundamental, since all the knowledge and research developed have the central objective of guaranteeing the return of society.

According to Sentanin et al.,³ scientific dissemination has an extremely important role, because when science has little prestige in the general population, several problems arise. For example, the image that society has of chemistry is not always positive, being often related to negative facts and mis-

conceptions. With regard to Belenguer-Sapiña, Briz-Redón, and Domínguez-Sales,⁴ the population identifies this discipline with industries and pollution, while its positive contributions are generally ignored. This fear of chemistry can affect society's opinion of not only science but also scientific work itself. Another problem is the image of science and of scientists themselves. As for Schummer,⁵ outreach activities can affect how scientists are perceived, perceptions of who can do science, and what science tells us about important issues. In this way, scientific dissemination can be responsible for the demystification of the scientist, science, and chemistry.

Scientific dissemination can be carried out in different ways, such as books, encyclopedias, large museums, exhibitions, magazines, and currently following the development of information technologies and media, such as TV, radio, videos, and the Internet, use of social media.⁶ According to Reina et al.,⁷ videos promote a different approach to teaching chemistry as they facilitate the understanding of the content. This understanding is facilitated as the videos allow undergraduate students to animate abstract concepts,^{8–12} facilitate asynchro-

Received: November 2, 2022

Revised: December 31, 2022

nous learning (inverted classroom) in lectures,^{12–14} and in addition to presenting expensive experiments and/or dangerous.^{15,16}

In this context, videos have been used as a teaching tool and have effectively contributed to student learning.¹⁷ Jaffar¹⁸ evaluated the use of videos by students in problem-based learning and Benedict and Pence¹⁹ discuss the use of new resources such as videos accessed by QR-code via smartphones used to teach chemistry. Other works found in the literature, such as Ranga,²⁰ used video instead of face-to-face discussion in sessions in General Chemistry courses, while Richards-Babb et al.¹⁴ used videos as substitutes for general chemistry exam review sessions, and Ramachandran, Sparck, and Levis-Fitzgerald²¹ used them as homework assignments to complement lessons in a general chemistry course. In all works, the authors found that the use of videos contributed to improving students' learning and interest in chemistry, reinforcing understanding of important fundamental concepts. Since students could watch as many times as necessary, this optimized studies and classroom time and promoted pedagogical benefits, such as opportunities to learn 24/7 and at an individual pace.

Videos were also produced to assist in laboratory classes, according to Jordan et al.,²² who studied the effectiveness of instructional videos of Organic Chemistry laboratory techniques compared to instructions provided by a teaching assistant. Stieff et al.²³ reported the use of prelaboratory videos, and Louise Mellin and Shaw²⁴ reported the use of videos containing information about laboratory equipment accessible via QR-code. In all cases, the authors found that with the use of videos, students were able to be more independent in the laboratory and felt more confident in using the equipment, in addition to improving the learning experience.

Still in this context, it is worth mentioning that students have produced chemistry videos. Gallardo-Williams et al.²⁵ highlighted in his article that these student produced videos are growing in popularity in both general education and chemistry teaching. According to the authors, the interest in using these videos in chemistry is grounded in the visual nature of chemistry, laboratory work, and the aspiration to improve digital literacy skills. Smith²⁶ reported in his work the production of videos (YouTube) by students of a module on polymer chemistry. The author noted that the students enjoyed producing the videos, developed public presentation and engagement skills, honed their creativity, and trained themselves as global educators in their own right.

There are also reports of works using videos to disseminate chemistry, such as the work of Hayes et al.²⁷ who used TikTok, a social media video-based phone app that allows creative and engaging videos to be shared on social media platforms worldwide, to create fun, exciting, and engaging chemistry education educational videos, to encourage public dissemination of science with a systems thinking approach, the work of Hight, Nguyen, and Su²⁸ who described the results of implementing an activity called the "ChemClout Challenge" in a general chemistry course at UC Riverside, where students worked in groups to make chemistry-themed videos, that was posted them on social media platforms, and the work of Haran and Poliakov²⁹ who reported the creation of a chemistry video channel for YouTube, which was created with the aim of making a short video about each of the 118 elements of the periodic table. The authors reported the success of the Periodic Table of Videos (PTOV) project, reaching large audiences. In

all cases, the authors found that social media videos were highly effective for audience learning and engagement in chemical concepts.

In this scenario, it is clear that videos have been widely used in classes to improve learning, assist in laboratory classes, and even to disseminate chemistry in a fun way, but with regard to the dissemination of scientific research carried out by universities, there are few reports of this type of disclosure, such as the works of Burgin et al.,³⁰ that evaluated the impact of viewing a video produced on the synthesis and applications of metal–organic structures (MOFs) on high school students' conceptions of authentic chemistry practices and applications. The authors found that students who watched the video reported learning more about the nature of laboratory work in chemistry than other students who did not watch the video. In view of this, it can be assumed that the use of scientific dissemination videos of chemistry university research as an activity in a school subject for university students can positively impact this audience with regard to research carried out in universities and also the importance of scientific dissemination. Demystifying the ideas that scientists are brilliant people, antisocial people, without emotions or feelings and also the idea that science, especially chemistry, is usually associated with environmental disasters, pollution, poisoning, among other negative aspects.^{31,32} Thus, the following research question was proposed for this study: What is the impact of the chemistry scientific dissemination video on the perception of university students in relation to scientific research and the public university?

METHODOLOGICAL ASPECTS

Chemistry Scientific Dissemination Video

A scientific dissemination video of a university research in chemistry was produced, which design involved pedagogical and technical care. Among the pedagogical issues, was considered the duration of the video,³³ the care with epistemological obstacles in the way science is presented³⁴ and the contextualization of the content with the daily life of society.³⁵ Technical issues were dealt with professional production advice, where scripts were set up including filming and interviews.

It is worth emphasizing the importance of laboratory safety rules,^{36–38} which is a crucial precaution that aims to avoid production of videos that do not comply with safety standards. It is extremely important to have an understanding of safety standards in laboratories, to prevent accidents and learn to respond to any danger in a basic and research chemistry laboratory.³⁸

The video was developed to promote the project entitled "Study and application of electrochemical technology for analysis and degradation of endocrine disruptors: materials, sensors, processes and scientific dissemination". In addition to addressing aquatic and terrestrial contamination by dyes, drugs, and pesticides, it also presents electrochemical processes as possible treatments for these contaminated matrices. In the video, the importance of dyes for everyday life is discussed and how much they have been the subject of research for their degradation. Furthermore, the formation of free radicals is addressed to explain the degradation of the Reactive Blue 19 dye, an environmental contaminant. The video shows the importance of scientific research and its relationship with society, also highlighting the importance of group working,

besides partnerships with other national and international groups and laboratories. In general, the video aims to demystify science and to show the scientist as an ordinary person, who works responsibly.

The link to access the video is as follows: <https://www.youtube.com/channel/UC3Jipx8EpUwpHa2bIllynIeA>.

The Study with Undergraduate Students

This study was based on two activities applied in the discipline of General Chemistry II of the Licentiate in Exact Sciences Course at the University of São Paulo, Campus de São Carlos. The activities were applied in Block III of the discipline that dealt with chemical bonds. It should be noted that the course was divided into four blocks, as follows, Block I—Periodic Table and Periodic Properties, Block II—The atom and atomic theories, Block III—Chemical bonding, molecular geometry and bonding theories, and Block IV—Intermolecular forces. The discipline had to happen remotely through the Moodle platform (UPS's virtual environment), and the activities were done completely separately, due to the social distance caused by the Covid-19 Pandemic. Students who carried out the proposed activities were all in first-year of the degree in Exact Sciences. General Chemistry II is offered in the second semester of course's first year.

In the first activity, the video was used as a way to introduce the topic of scientific dissemination to the course students and to evaluate the impact on the university school public with regard to research carried out in universities and also the importance of scientific dissemination. It should be noted this first activity was mandatory for a total of 50 students who participated in this activity (25 women and 25 men), aged between 18 and 25 years.

In the second activity, it was proposed to the students to prepare a scientific didactic dissemination video, from some IQSC research group, which encompassed the theory seen in the classes and also explained the research carried out by the chosen group. The objective of this activity, in addition to bringing students closer to the IQSC researches and showing the importance of their dissemination, was to make a link between the contents of the research and of the discipline. It should be noted that in this activity, students were invited to produce a didactic video for scientific dissemination of some IQSC research. A list of existing IQSC research groups was sent to students so that they were free to choose the research they would like to disseminate. Students were also asked to include in their videos the topic of chemical bonds, in addition to the IQSC research. Regarding the duration of the video, the students were free to create the video in the way they thought necessary to promote a good explanation and understanding to the viewers. The activity was optional, and students who completed it would have an increase of 2.0 points in their grade. The activity was evaluated in terms of content, the IQSC research scientific dissemination, the language used in the video, and the students' creativity. A total of 28 students participated in this activity (15 women and 13 men), aged between 18 and 25 years.

All the videos produced by the students met the objectives specified in the activity. The videos were produced for the elementary school audience and also for the general public and can be seen at the link: <https://www.youtube.com/channel/UC3Jipx8EpUwpHa2bIllynIeA>.

Instruments, Data Collection, and Analysis

This research comprises the use of a qualitative instrument for data analysis,³⁹ based on three questionnaires, two of which were used in the first activity and one in the second activity. In the first activity, the first questionnaire (Box 1) was answered before the students watched the video, and the second (Box 2) was answered after the students watched the video. In the second activity, the third questionnaire (Box 3) was answered after the production of the videos.

Box 1. Questionnaire to answer before the video is shown

- Question 1 What is your opinion about the Public University?
- Question 2 In your opinion, what is the importance of scientific research carried out in public universities for society?
- Question 3 Do you know the research carried out at the University where you study?
- Question 4 What is your opinion in relation to scientific dissemination?
- Question 5 Have you heard about AOP (Advanced Oxidative Process)?
- Question 6 In your opinion, what is the importance of disseminating scientific research carried out in public universities to basic education students?
- Question 7 What is your opinion regarding scientific dissemination videos?

Box 2. Questionnaire to answer after the video is shown

- Question 1 Now that you have watched the scientific dissemination video, is your opinion regarding the importance of scientific research carried out in public universities for society still the same?
- Question 2 As a future teacher, do you think it is important to present the content of scientific research carried out in Universities in a contextualized way to your students? Why?
- Question 3 Now that you've watched the science communication video, is your opinion on science communication still the same?
- Question 4 Explain what you understood about AOP (Advanced Oxidative Process).
- Question 5 What are the chemical bonds of the substances shown in the science communication video?
- Question 6 What is the importance of the chemical bonds of the molecules that participate in the AOP (Advanced Oxidative Process)?
- Question 7 In your opinion, what is the contribution of this scientific dissemination video in relation to the Public University?
- Question 8 What did you understand about the importance of this research?
- Question 9 Leave your message for the researchers of the GPEA group.

Box 3. Questionnaire to be answered after the production of the videos

- Question 1 Do you think it is important to disseminate scientific research carried out in public universities to basic education students?
- Question 2 In your opinion, what is the importance of disseminating scientific research carried out in public universities to basic education students?
- Question 3 What is your opinion regarding the use of didactic videos as a learning tool?
- Question 4 What is your opinion regarding the use of didactic videos of science communication as a learning tool?
- Question 5 How was the experience of producing a didactic scientific dissemination video? What were the main difficulties encountered?
- Question 6 In your opinion, did the production of the video contribute to the learning of the concepts seen in Block III of the discipline? If so, in what way?
- Question 7 In your opinion, what would be the contribution of the didactic scientific dissemination video produced by you (if it were released) in relation to the Public University for society in general and for high school students?
- Question 8 In your opinion, did producing a didactic scientific dissemination video contribute to your training as a future teacher? If yes, in what way?

The data were analyzed using the simple categorization process⁴⁰ by separating the passages that correspond to or permeate the themes considered: public university, scientific research, scientific dissemination, and scientific dissemination videos. Coding initially took place in isolation. Afterward, the authors discussed and compared the codebooks to reach a consensus in terms of categories. And so, four categories were created to analyze and discuss the results: The Perception of the Public University, the Importance of Research at the Public University, the Importance of Scientific Dissemination and the importance of didactic videos of scientific dissemination for learning.

RESULTS AND DISCUSSION

The Perception of the Public University

In order to verify the perception of undergraduate students in relation to the public university, the following question was asked: Question 1 (Box 1)—What is your opinion about the Public University?

According to the results observed it is noted that all students were able to recognize the importance of the Public University. They talked about teaching of universities, research, extension, and the social role of the public university, as can be seen from the report:

I believe public university is an excellent instrument for technological, scientific and human development in a country. It can be used as an instrument of social transformation, both to improve conditions for people who do access university and to promote social mobility.

Student 08

These results demonstrate the perception of respondents, and it is possible to verify through this report the relationship between the tripod research, teaching and extension, this perception is in agreement with Chauí.⁴¹ It is also worth mentioning the social role of public universities according to the interviewees promotes social mobility, as it offers quality and free education, transforming people's lives, especially those with low income who cannot afford university education. This perception is in agreement with de Souza et al.,⁴² who state that the role of Brazilian public universities goes beyond of the mission of training professionals it must also prepare these professionals for act like citizens, committed to issues political and social.

Importance of Research at the Public University

Box 4. Category "Importance of Research at the Public University" and percentage of responses obtained through the questionnaires

Questions	Importance of Research at the Public University	Student Responses (%)	
1 (Question 2 - Box 1)	"In your opinion, what is the importance of scientific research carried out in public universities for society?"	Important	Not important
		100.00	0.00
2 (Question 3 - Box 1)	"Do you know the research carried out at the University where you study?"	Yes	No
		56.00	44.00
3 (Question 1 - Box 2)	"Now that you have watched the scientific dissemination video, is your opinion regarding the importance of scientific research carried out in public universities for society still the same?"	Yes	No
		80.00	20.00
4 (Question 2 - Box 2)	"As a future teacher, do you think it is important to present the content of scientific research carried out in Universities in a contextualized way for your students? Why?"	Yes	No
		100.00	0.00

According to the results observed in Box 4, it is noted that for question 1 all students said that scientific research is extremely important for society, as can be seen from the report:

I think it is essential that scientific research and knowledge are taken to society, especially to the public outside academic environments or who do not have access to these spaces ... as it is the general population that finances universities. In my opinion, the importance of research is to ensure greater social development and quality of life for as many people as possible.

Student 24

Through the results, it is possible to verify that this research is directly related to the advances of science and should not be restricted to the scientific community, as they must also transform society and people's lives, including those not

directly related to research, which is in agreement with Tala and Vesterinen.⁴³

In contrast to the previous results, it appears that for question 2, only 56% of the students said they knew about the research carried out at the University where they study, and this knowledge is very scarce, as can be seen in the report:

I don't know much about the research produced within my university. I don't even know where I have access to that information.

Student 11

Among the respondents who said they did not know the research carried out at the university where they study (44%) can be seen in the report:

No. I have very little contact with productions, and I usually end up not being interested because I have difficulty understanding what they are about

Student 02

From the analysis of the students' reports, one can see the lack of scientific dissemination, where one of the students says he does not even know where to look for this information. All respondents say that scientific research is extremely important for society, but many are not even aware of the research carried out at the university where they study. Clearly this problem is due to the lack of dissemination that exists in relation to researches. This perception of the respondents is in agreement with Thorn and Sôo⁴⁴ who state that in the case of Brazil, universities assume responsibility for teaching, researching and also disseminating their knowledge to the community. According to Scharrer et al.,⁴⁵ it is important to highlight that "scientific dissemination presupposes a process of recoding, that is, the transposition of a specialized language to a nonspecialized one". If this transposition is not carried out, the viewer loses interest in what is being disclosed. This can explain the report of student 02 who, because he does not understand what the research is about, ends up losing interest.

In relation to question 3, it is observed that 80% of the students continued with the same opinion regarding the importance of scientific research for society and that 20% changed their opinions. The report demonstrates in what sense these opinions were modified:

It remains practically the same, but the view has been added that research carried out at the University can bring direct benefits to the well-being of the population. What had not occurred to me before, perhaps because of the false connection between research and theoretical knowledge, which often cannot be applied in a practical way at first.

Student 10

From this report, the issue of contextualization can be emphasized, where scientific dissemination must be contextualized with the daily life of society so that there is a better understanding of the research, as evidenced in the report of student 10 and according to the considerations of Perin⁴⁶ and de Vaino et al.⁴⁷ who discuss the importance of "personalizing" the learning situation by making clear to students the relevance of the topic addressed, giving current and local examples, relating the topic to everyday applications, relating theory to practice, relating learning of science with students' future plans or needs and show the value of a given task.

For question 4, it is observed that 100% of the students believe that it is important to present the content of scientific

research carried out in Universities in a contextualized way for their students. As can be seen in the report:

Yes, primarily to justify the public university and the cutting-edge research developed there. In this way, we will create a generation that is more aware of the importance of valuing the university and researchers. However, this is not all, presenting the research content to students also serves as a motivator for these students to engage in study and even possibly integrate these groups in the future

Student 03

It appears that all respondents agree with the fact that research from public universities should be better disseminated so that there is an awareness of the lay population in relation to scientific research and also the demystification of the scientist and science. This result is corroborated by Carpenter, Phillips and Jakubinek⁴⁸ who claim that offering young people the chance to get to know a university environment is a unique opportunity. And also in relation to the view that students have in relation to scientists who, according to Finson⁴⁹ are stereotyped as brilliant people, so it is extremely important that the video shows undergraduate, master, doctoral, postgraduate-doctoral students and the professor/researcher responsible for the project, so that high school students can see that they are ordinary people, but that they have a great interest in science and in how to do science within the university through scientific research, making students high school students may believe more in their own abilities.^{50–52}

Importance of Scientific Dissemination

Box 5. Category "Importance of Scientific Dissemination" and percentage of responses obtained through the questionnaires

Questions	Importance of Research at the Public University	Student Responses (%)	
1 (Question 7 – Box 1)	"What is your opinion regarding scientific dissemination videos?"	Important	Not important
		100.00	0.00
2 (Question 3 – Box 2)	"Now that you've watched the science communication video, is your opinion on science communication still the same?"	Yes	No
		84.00	16.00
3 (Question 7 – Box 2)	In your opinion, what is the contribution of this scientific dissemination video in relation to the Public University?	Important	Not important
		100.00	0.00
4 (Question 7 – Box 3)	In your opinion, what would be the contribution of the didactic scientific dissemination video produced by you (if it were released) in relation to the Public University for society in general and for high school students?	Important	Not important
		100.00	0.00

According to the results observed in Box 5, it is noted that for the first question all students (100%) said that scientific dissemination videos are important as tools to bring the university and society together. The following account demonstrates these views:

Scientific dissemination videos are of great importance, as they present the content in a playful and dynamic way, in addition, they provide a more accessible vocabulary, allowing someone who is not a professional in the area to understand the topics covered more easily.

Student 31

Analyzing the students' reports, it is important to highlight that they are in agreement with Scharrer et al.,⁴⁵ who say that "scientific dissemination presupposes a process of recoding, that is, the transposition of a specialized language to a nonspecialized one". If this transposition is not carried out, the viewer loses interest in what is being disclosed. Therefore, the role of the scientific disseminator is to make the knowledge

acquired through the development of research accessible to the greatest number of people.

Regarding the second question, it is observed that 84% of the students continued with the same opinion in relation to scientific dissemination to society and that 16% changed their opinion. The following account demonstrates in what sense these opinions have been modified:

After watching the video, I realized how important scientific dissemination is for the development of society. Since the publication of scientific research has a fundamental role in the community so that the population obtains greater knowledge about the discoveries of science, and with that the most needy can acquire a scientific culture.

Student 22

From the report, it appears that all respondents agree with the fact that research from public universities should be better disseminated so that there is an awareness of the lay population in relation to scientific research and also the demystification of the scientist and science.

Regarding the results presented for the third and fourth questions respectively, it is observed that 100% of the students believe that the scientific dissemination video is important for presenting the content of scientific research carried out in Universities in a contextualized way for society. And that 100% of students believe that the didactic video of scientific dissemination produced by them would be an important tool to bring scientific research closer to the public. The report exemplifies these responses:

Society still does not have a solid view of the Public University, its importance, its contributions, its real meaning, and much of this is due to the fact that a large part of the Brazilian population does not have and did not have access to this education. A didactic video, in addition to transforming a complicated subject into something easier to understand and democratize access to that information, also demonstrates and corroborates the importance and usefulness of the Public University and its students, professors and researchers.

Student 27

From this report, the issue of contextualization can be emphasized, where scientific dissemination must be contextualized with the daily life of society so that there is a better understanding of the research, according to the considerations of Perin⁴⁶ and de Vaino et al.⁴⁷

Importance of Didactic Videos of Scientific Dissemination for Learning

Box 6. Category "Importance of didactic videos of scientific dissemination for learning" and percentage of responses obtained through the questionnaires

Questions	Importance of Research at the Public University	Student Responses (%)	
1 (Question 5 – Box 1)	"Have you heard about AOP (Advanced Oxidative Process)?"	Yes	No
		4.00	96.00
2 (Question 4 – Box 2)	"Explain what you understood about AOP (Advanced Oxidative Process)."	Explain	Not explain
		100.00	0.00
3 (Question 6 – Box 3)	"In your opinion, did the production of the video contribute to the learning of the concepts seen in Block III of the discipline? If so, in what way?"	Yes	No
		100.00	0.00
4 (Question 8 – Box 3)	"In your opinion, did producing a didactic scientific dissemination video contribute to your training as a future teacher? If yes, in what way?"	Yes	No
		100.00	0.00

According to the results observed in Box 6, it is noted that for the first question (Question 5—Box 1) only 2 students (4%)

stated that they had already heard about the AOP. Another 48 students (96%) had never heard of it about the AOP. This result shows that undergraduates, even though they are within the university and having the perception of the importance of the research carried out in the university, do not know the research carried out at the university where they study. This fact makes clear the lack of scientific dissemination because, if not even the students of the university itself know the scientific researches, the general public even less.^{1,41}

In the question 2 of Box 6 (Question 4—Box 2), all 50 students were able to explain the advanced oxidative process, AOP, even in a simplified way, as can be seen in the report described below:

"these processes are based on the generation of free radicals, mainly the hydroxyl radical, which has a high oxidizing power and promotes the degradation of various polluting compounds efficiently."

Student 13

From the students' report, it can be seen that they managed to learn a little about the advanced oxidative process, even if in a little depth, the didactic scientific dissemination video was able to provide this learning to the students. These results are in agreement with the results found in the studies by Hayes et al.,²⁷ Hight, Nguyen, and Su,²⁸ and Poliakoff,²⁹ who observed that social media videos were highly effective for audience learning and engagement in chemical concepts.

Regarding question 3 of Box 6 (Question 6—Box 3), all 50 students answered that the video production contributed to the learning of the concepts seen in Block III of the discipline, as can be seen in the reports described below:

Yes very much. In order to make a teaching video, it is necessary to have mastery of what you are intending to present, it is necessary to transform an academic content into something of basic or medium level, and for this to happen without losing the quality and veracity of the information, it is extremely important to study that content well and understand all its implications. Thus, we who produced the videos had to review and adapt the content, studying it several times and seeking to clear up any doubts we had."

Student 21

Yes, the content stuck in my mind differently than if I had done a written work or a summary of the subject."

Student 10

This result is interesting, as it shows the students' engagement in the activity of producing the videos, in addition to showing that the activity provided a more meaningful learning, as in the report of student 10 who claimed to have learned more in this activity than he would learn in other traditional activities (such as reading or summarizing the content). It is also noteworthy that the production of videos can be a good tool to be used in student learning, because according to the students' reports, they had to deepen their studies of the content of block III in order to produce a quality video. These results corroborate to Snelson,¹⁷ who states that videos have been used as a teaching tool and have effectively contributed to student learning.

And finally regarding question 4 of Box 6 (Question 8—Box 3), again all 50 students answered that the producing a didactic scientific dissemination video contributed to your training as a future teacher, as can be seen in the reports below:

Yes, didactic video production strengthens the power of content synthesis; the diversification of technological and media resources; the dynamization of teaching; among other positive experiences."

Student 50

Yea, even more with distance learning, and YouTube, which makes it possible to provide video lessons, technology will always be present and increasingly in the profession, so having contact in the production of a didactic video at the beginning of graduation was very interesting."

Student 01

From the results and the students' reports, it can be seen that the production of videos was important for the students in their training as future teachers, as it provided the development of various skills, as mentioned by student 50, the power of synthesis of contents, diversification of technological resources and media, pedagogical dynamism. These results are in agreement with the results found by Smith²⁶ who observed that students enjoyed producing videos, they developed public presentation skills, engagement skills, honed their creativity, and train themselves as global educators in their own right.

In this study, it was verified that it is possible to carry out the dissemination of scientific research through videos used as an activity in a school subject for university students.

CONCLUSIONS AND FUTURE IMPLICATIONS

The objective of this study was reports the development of a dissemination work and analysis of the influence of a chemistry science dissemination video on the perception of university students in relation to scientific research carried out at the public university, to scientific dissemination itself and the use of scientific dissemination videos as learning tools. The didactic video of scientific dissemination of a university research in Chemistry was made available as an activity in a distance class for undergraduates of a General Chemistry II course. As a way of complementing the study and, at the same time, evaluating the teaching/learning of the students of the course, it was proposed that they produce didactic videos of scientific dissemination of some research of the Institute of Chemistry related to the theme seen in the classes, chemical bonds. The analysis was carried out through the application of questionnaires with participating students. Based on the results obtained, it was found that didactic videos of scientific dissemination can be produced by undergraduates and that, in their perception, these videos are capable of propagating the value and importance of scientific dissemination, of scientific research carried out in public universities, and in addition, they are a good teaching/learning tool.

As the literature shows, the image that society has of chemistry is not always positive, being often related to negative facts and misunderstandings, while their positive contributions are often ignored. This fear of chemistry can affect society's opinion not only of science, but also of scientific work itself. Likewise, there is a mystified image of science and scientists themselves. In this sense, science communication plays an extremely important role, as it can affect the way scientists are perceived, the perceptions of who can do science, and what science tells us about important issues. In this way, scientific dissemination activities can be responsible for the demystification of the scientist, science and chemistry.

Thus, it is important to seek the development of activities that use devices that seek to overcome limitations, such as the

592 distancing of the scientific community from the general and
593 school public. It is important to carry out activities that can
594 show university students the importance of disseminating
595 research carried out in public universities, such as the scientific
596 dissemination video, presented in this study. As well as
597 encouraging these future teachers to use these didactic
598 scientific dissemination videos as learning and dissemination
599 tools in their classes. Since, through the data obtained,
600 university students demonstrated the importance and useful-
601 ness of scientific research in Chemistry for their lives, as well as
602 understanding the role of the public university and scientific
603 research in Brazil, arousing interest in being part of this
604 knowledge construction process. Therefore, the present work
605 makes a significant contribution to the advancement of the
606 area, since it presents a tool for the presentation of new
607 approaches to scientific dissemination, in addition to bringing
608 strategies capable of bringing students closer to the research
609 carried out at the public university.

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625 Funding

626 The authors are also grateful for the financial support provided
627 by the São Paulo Research Foundation (FAPESP) [grant
628 numbers 2017/10118-0, 2018/20145-7, 2019/04543-5], Na-
629 tional Council for Scientific and Technological Development
630 (CNPq) [grant numbers 304087/2021-1, 407164/2022-7],
631 Coordination for the Improvement of Higher Education
632 Personnel (CAPES) [grant 88.887.126/2017/00], and Learn-
633 ing with the Community Program of the Dean of Under-
634 graduate Studies at USP (PRG-USP).

635 Notes

636 The authors declare no competing financial interest.

637 ■ ACKNOWLEDGMENTS

638 The authors wish to express their gratitude to IQSC, to the
639 IQSC research groups, and to the University for the materials
640 and facilities provided in support of this research.

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