The use of YouTube in Chemistry classes to motivate students

Gema López Guerrero[1], María del Mar López Guerrero[2]

[1]University of Malaga, Department of Analytical Chemistry, Faculty of Science, Malaga, Spain

[2]Secondary High School Ana Carmona, Mijas, Malaga, Spain.

Abstract

This communication describes an educational practice developed in the Chemistry subject, of the first year of the Degree in Electrical Engineering (University of Malaga, Spain). Based on the selection of a series of alternative methodologies to direct instruction, the students, through a prior inquiry process, have made, using the social network YouTube, an explanatory video of various points or important concepts included in the program of the subject. Based on the analysis of the videos (a total of 12), a questionnaire has been designed to determine the students' perceptions in relation to the tool and its educational implications, to which a total of 50 students responded. Based on the information collected, the students positively value the use of YouTube as a teaching resource, as well as the practice itself, highlighting a series of elements derived from the proposed teaching-learning process, such as creativity, fun and motivation in the acquisition of knowledge. Therefore, starting from the proposed research context, and taking into account its limitations, it can be determined that YouTube allows the development of communication skills, as well as the learning-to-learn competence, through autonomous, inquiring and experiential learning.

Keywords: Chemistry, YouTube, Learning, Teaching, Engineering Degree

1. Introduction

Teaching chemistry at the university level can be challenging for several reasons. Chemistry is inherently complex and abstract, with concepts that are difficult to visualize. Molecular models and atomic structures, for example, require a high level of mental abstraction. Additionally, chemistry demands significant time and effort, which can overwhelm students. Lack of prior knowledge and specific terminology can also hinder comprehension (Andersson, 1986; Fensham, 1994).

The demotivation of engineering students towards chemistry is a common issue. This may be due to the perception that chemistry is not related to their future profession, reducing their interest. Perceived difficulty in chemistry and past negative experiences also contribute to this demotivation, a phenomenon known in the literature as "chemophobia." Cavallo., McNeely, & Marek, 2003; Coll & Taylor, 2002; De Jong, Acampo, & Verdonk, 1995).

"Chemophobia" is a term used in the literature to describe the irrational fear or aversion to chemicals or chemistry in general. This phenomenon can hinder students' ability to concentrate, learn, and participate in the learning process (Chalupa & Nesměrák, 2020). It can also distort their perception of chemistry, leading them to view it negatively rather than appreciating its importance in everyday life and technology.

To address chemophobia, it is essential to promote education and scientific literacy, enabling people to make informed decisions about the safety and proper use of chemicals. Educators can help by addressing the risks and benefits of chemicals in education (Chalupa & Nesměrák, 2018; Guerris et al., 2020).

Hence, it is imperative to seek alternatives that inspire students, fostering their interest and aiding them in comprehending chemistry. There are various methodologies that can be employed, and in this instance, we will focus on the utilization of Information and Communication Technologies (ICT), specifically on YouTube. The utilization of platforms like YouTube, can prove to be a highly effective tool in motivating students and facilitating the comprehension of chemistry. By effectively integrating YouTube and other ICT tools, you can make the teaching of chemistry more accessible, engaging, and meaningful for students (Dughera et al., 2020).

YouTube, the popular social media platform, has emerged as an effective tool to enhance the learning process in educational contexts, including higher education. Although initially perceived as an entertainment platform, its educational potential is increasingly evident (Snelson, 2011).

Dughera et al. have organized related research into two distinct categories Dughera, et al. 2020). The first category involves literature that delineates how young people utilize YouTube, showcasing their engagement and interaction with the platform. The second category encompasses literature exploring potential connections between YouTube and learning, encompassing both formal and informal educational settings.

In the findings of the first category, it is confirmed that young users exhibit enthusiasm for YouTube. They utilize the platform not only to express themselves but also to share their preferences, engage in socialization experiences, find entertainment, and concurrently, acquire new knowledge Dughera et al., 2020).

Dughera et al. further classified studies linking YouTube to learning into four groups. Firstly, there are general and unfocused studies. Secondly, there are studies delving into the aspects of interest and informal learning Noetel et al. (2021). Thirdly, there are studies investigating the role of YouTube in formal education Noetel et al. (2021). Lastly, there are studies that describe the practices of creators on the platform.

Numerous authors have shown an interest in comprehending the factors influencing the behavioral intention to use YouTube for educational purposes. For example, Technology Acceptance Model (TAM), which attributes the intention to use technology to positive attitudes toward it (Davis, 1989). According to TAM, these positive attitudes are influenced by the perceived usefulness, defined as "the degree to which a person believes that using a particular system would enhance their job performance," and the perceived ease-of-use, defined as "the degree to which a person believes that using a particular system would be free from effort" (Davis, 1989).

Three of the examined studies utilized TAM-related models to investigate the acceptance of YouTube in formal or informal educational settings (Lee and Lehto, 2013; Chintalapati and Daruri, 2017; Hong, Chen, and Ye, 2020). Additionally, two other studies employed the Unified Theory of Acceptance and Use of Technology (Bardakcı, 2019; Oteyola, Bada & Akande, 2019). Which explicates the behavioral intention to use technology through four constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh et al., 2003). These constructs are moderated by factors such as gender, age, experience, and voluntariness.

In addition to TAM and Unified Theory of Acceptance and Use of Technology, some authors explored the acceptance of YouTube based on older theories, including the Theory of Reasoned Action (Omiunu, Longe, & Igwe, 2019), the Theory of Planned Behavior (Alhamami, 2014), and the Social Cognitive Theory (Dyosi & Hattingh, 2018). This diverse theoretical foundation reflects the multifaceted nature of studies examining the acceptance of YouTube in educational contexts.

Certain scholars have noted that educators endorse the use of YouTube due to its potential to enhance students' confidence (Brook, 2011) and alleviate anxiety (Albahlal, 2019). Numerous authors underscore the richness and vividness of content available on YouTube, presenting an appealing opportunity for educational purposes. YouTube provides a diverse array of content sources, including lectures, tutorials, and real-time examples (Dyosi & Hattingh, 2018; Sulistianingsih et al., 2019), employing versatile methods for content explanation (Jackman and P. Roberts, 2014). Lastly, approximately 15% of the benefits associated with utilizing YouTube in education are attributed to its free, easily accessible, and

convenient nature, as indicated by (Sulistianingsih, 2019; Mukwakungu, Bakama, & Mbohwa, 2019).

The challenges associated with the use of YouTube in education can be categorized into four distinct groups. The predominant issues often revolve around the integration of YouTube into the classroom setting. Notable challenges include difficulties in classroom management (Krauskopf, Zahn, & Hesse, 2012), the absence of systematic assessment of learner progress (Lange, 2013), and the potential politicization of the classroom when dealing with controversial topics, leading to hindrances imposed by school policies (Chun, 2012). Additionally, challenges may arise from the occasional lack of teachers' digital competence (tasdelen, 2019).

The second category of challenges pertains to the content itself. A significant concern is the absence of measures to assess content quality (Krauskopf, Zahn, & Hesse, 2012), leading to the time-consuming task of locating useful videos (Burke, Snyder & Rager, 2009).
Technical challenges constitute the third category, particularly in developing countries. These challenges encompass issues related to internet connectivity, the availability of necessary devices, and the unstable supply of electricity (Oteyola, Bada, & Akande, 2019).

The final category addresses potential risks to students who utilize YouTube for learning, young learners may be exposed to inappropriate content (Brook, 2011).

The effectiveness of YouTube in enhancing learning outcomes hinges on the strategies employed by teachers and the behaviors exhibited by students during its use.

It's important to note that the use of YouTube in teaching chemistry or any other subject may vary depending on the institution, student group, and specific learning objectives. Adapting these strategies to the needs and preferences of students is essential to achieving a positive impact on the learning process. (Curran et al. 2019, 2020; Nagler et al.)

In addition to the mentioned references, exploring the experiences and strategies shared by educators on blogs and social media platforms can provide practical ideas on how to effectively implement YouTube in teaching chemistry. (Lamy, & Zourou, 2013; Lederer, 2012)

Ultimately, the use of YouTube and other digital tools in education can be an innovative way to engage students and make complex concepts more accessible and appealing. However, as you mentioned, it's important to consider the diversity of approaches and needs in different educational contexts.

YouTube allows for concise presentation of educational concepts through short videos, facilitating understanding and retention of information. Educators can leverage this format to effectively convey key ideas (Snelson, 2011).

In addition to its brevity, YouTube makes learning accessible and engaging by fostering creativity and ingenuity. This motivates students and improves information retention.

The platform also promotes active participation by using viral challenges and trends as opportunities for debates and projects related to course content, creating an online community, and encouraging collaboration among students (Snelson, 2009).

Finally, YouTube facilitates interaction and collaboration by allowing students to ask questions, express opinions, and share resources. It can also be used for project assessment and feedback (Snelson, 2011).

In summary, YouTube has become a powerful and versatile tool to enhance the learning process in higher education. Its ability to convey information concisely, make learning accessible and engaging, foster active student participation, and create an interactive learning environment makes it a valuable resource for educators and students.

Teachers can use YouTube to create short videos that summarize key concepts, present challenging questions, or illustrate the relevance of academic concepts. They can also design challenges related to course content and promote collaboration among students. However, it is important that the use of YouTube in education is complementary to other teaching methods and aligned with the course's learning objectives. Additionally, platform privacy and security policies must be respected when interacting with students online. YouTube represents an ever-evolving educational innovation that can significantly benefit the learning process in higher education.

2. Methodology

The employed methodology is defined by the objectives set forth in this research, aimed at testing the initial hypothesis. A survey assessment was conducted to examine the impact of participation in video creation on interest and assess the degree of content acquisition by students.

This study employed a survey research design (Bisquerra, 2012). The questionnaire used in the research was divided into two parts. The first section included inquiries about students' experiences with YouTube, while the second section focused on their perceptions of YouTube's utility in the context of education. As for the survey format, it consists of Likert-type questions, allowing students to assess specific aspects on a scale from 1 to 5, where 1 is certainly disagree and 5 certainly agree.

Following the completion of the questionnaires, the data will be studied and statistically analyzed to draw conclusions that can confirm whether the null hypothesis is true. Collected quantitative data were analyzed using frequencies and percentages, while qualitative data from open-ended questions were categorized into major themes to facilitate the drawing of conclusions.

Populations. The study focused on first-year students from the School of Industrial Engineering at the University of Malaga, specifically those enrolled in the Electrical Engineering, Electrical and Mechanical Engineering, and Electrical and Electronics Engineering degree programs. The respective student populations for these programs were 20, 25, and 25. The study included the anonymous participation of 10, 22, and 18 students, respectively. The study comprised 50 participants from engineering degrees, at University of Malaga. The questionnaire was administered to the students via Moodle of the university.

Educational Videos. Students were encouraged to form groups of three individuals to create these videos. The topics for the videos were assigned by the teacher, such as explaining alpha, beta, and gamma radiations, metallic, ionic, or covalent bonding, the order of elements in the periodic table, etc. Each group selected a topic and had to produce a video on that concept, limited to a maximum duration of 6 minutes.

Once created, the videos were submitted to the teacher for verification of accuracy and subsequently showcased in class. In this manner, a total of 7 videos covering 7 different concepts, each with a duration not exceeding 6 minutes, were presented in class.

Following the viewing, students were required to complete a questionnaire containing questions about the difficulty of creating the video, as well as inquiries regarding the knowledge or learning they had gained from watching the video.

Data. The collected data were statistically analyzed using the SPSS software, version 15.

3. Results and Discussion

The results obtained from the study are discussed in this section. Currently, the availability of technological resources has multiplied the possibilities of introducing innovative dynamics and methods. Additionally, access to information has streamlined the process to the point of making it immediate.

The findings are divided into two sections, aligning with the research objectives. The initial section pertains to students' YouTube usage experiences based on the questionnaire described by Ilianis Adnan and Nur Morat. The first and second questions were closed-ended, offering students the choice between 'yes' and 'no'.

1. Do you use the YouTube application?
2. Have you experimented with producing your own YouTube videos?

Table 1. Students' questionnaire about the use of YouTube

Questions	Yes(%)	No(%)
Do you use the YouTube application?	72.7	27.3
Have you experimented with producing your own YouTube videos?	16.5	83.5

Table 1 presents data regarding students' YouTube experiences, specifically focusing on their application use and engagement with its video creation feature. As depicted in the table, the majority of students (72.7%) reported using YouTube, while only 27.3% answered "no." These results suggest that YouTube primarily attracts a youthful demographic, aligning with Hou's (2018) observation.

Concerning their experiences with YouTube's video creation feature, a notable 83.5% of students indicated that they had not ventured into creating their own YouTube videos, whereas approximately 16.5% had engaged in video creation. It's worth noting that some prior research studies yielded contrasting findings, suggesting that students were highly motivated to craft their YouTube videos as a means of self-expression, identity creation, and seeking social recognition and validation (Bahiyah, Omar & Dequan, 2020; Yang, 2020). Conversely, some students may have felt apprehensive about recording and sharing videos of themselves, as observed in a study conducted by Andiappan et al. (2022). Furthermore, as emphasized by Xiuwen & Razali (2021), proficiently creating self-recorded YouTube videos requires mastering the application's technical skills.

In this subsequent section of the results, we delve into the students' perceptions concerning the use of YouTube in an educational context. Similar to the previous section, data for this portion was gathered using three specific questions. Questions one and two employed closed-ended formats, enabling students to respond with either 'yes' or 'no'. Question three was open-ended, permitting students to provide detailed written responses. The questions posed were as follows:

1. Have you employed YouTube for educational purposes?
2. Do you believe YouTube offers advantages in the realm of education?
3. What advantages or benefits do you associate with using YouTube for learning?

Table 2. Students' perceptions on the utility of YouTube

Questions	Yes(%)	No(%)
Have you employed YouTube for educational purposes?	65.45	34.54
Do you believe YouTube offers advantages in the field of education?	56.36	43.63

The data presented in Table 2 underscores a prevalent reliance on YouTube among students for educational purposes, with a substantial majority (65.45%) acknowledging its

usage. Moreover, a noteworthy proportion (56.36%) expressed a positive perception of the educational benefits offered by YouTube. The analysis of responses to question three revealed three prominent themes, indicating that students perceive YouTube as not only a source of entertainment but also as a tool for enhancing English language skills and accessing a variety of learning resources, as chemistry. These findings highlight the multifaceted role that YouTube plays in supporting educational endeavors, suggesting its potential as a versatile platform for both academic and linguistic enrichment.

According to the students, using YouTube for learning was described as "interesting," "entertaining," and "fun." These findings corroborate the earlier study conducted by Lawrence (2020), which identified a positive correlation between entertainment value and motivation to use YouTube. Additionally, Yang (2020) discovered that real-life stresses prompted individuals to turn to YouTube as an immediate source of pleasure and entertainment. Therefore, it can be inferred that entertainment, including humorous or amusing videos, significantly influences YouTube's popularity. This aligns with the findings of Bossen and Kottasz (2020), who determined that fulfilling entertainment was the primary motivation for students to use YouTube, irrespective of whether it involved passive or active consumption.

Students express that a bidirectional relationship between teachers and learners is more intense in a dynamic environment, as is the case with video sessions. This aspect was already emphasized by the European Higher Education Area. In the work of Fernández Muñiz (2016) students highlight the importance of conducting learning through simulations, videos, and practical experiences, displacing traditional notes. Students indicate that video sessions are easier, and they believe that the homework required to reinforce the knowledge covered in class is reduced when the class has utilized audiovisual resources prepared for the transmission of explained concepts.

On the other hand, when students are asked about the quality of the practical methodology compared to other common methodologies, they respond with a highly positive evaluation of the methodology. The result reflects a high regard for the conducted activity. Based on subjective perception, there seems to be a sense of students' involvement in this activity, their effort to be creative, and their success in conveying information in an engaging manner. The individual involvement achieved proves to be crucial for the success of the activity.

The creation and editing of videos by students involve teachers and students in a dynamic of positive feedback, the effects of which extend to the dynamism of classroom sessions and academic outcomes. Both teachers and students who have experienced this methodology recognize the significant motivation that videos bring to the learning process. However, it is essential to assess the retention and application of the concepts transmitted over longer periods, in the medium or end of the course, to emphasize the dimension of the achieved formative improvement.

4. Conclusion

These preliminary study findings hold significant importance, shedding light on the usage patterns of YouTube among university students and their perspectives on its potential educational benefits. Given that most students are already acquainted with YouTube, have employed it for educational purposes, and express optimism about its educational merits, further research endeavors should be undertaken to explore the integration of YouTube into teaching and learning processes. Additionally, it is imperative to consider the challenges articulated by students in utilizing YouTube when devising teaching strategies for its incorporation.

The use of videos within the Chemistry subject helps increase students' interest in the material. Additionally, students find the sessions more attractive, consider having learned valuable aspects, and understand the content explained more easily and with less effort.

Audiovisual resources constitute a useful didactic tool that can be used complementarily to traditional methodologies. The compatibility of this type of resource can provide effective support for a teacher employing a traditional methodology.

A teacher with a proactive attitude towards active utilization and personal training in new technologies makes it possible for these tools to have a greater impact on the educational process

5. Limitations.

One of the limitations we encountered is that the participating students are exclusively those enrolled in the chemistry course from the aforementioned degree programs, and being the instructor one of the authors of the manuscript.

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