Teaching resources an ally in times of pandemic and now in the classrooms

Recursos didácticos un aliado en tiempos de pandemia y ahora en las aulas

DEL CARMEN-MORALES, Yucels Anaí†*, DEL CARMEN-MORALES, Heidi and FELIPE-REDONDO, Ana María

Universidad Tecnológica de la Huasteca Hidalguense, México.

ID 1st Author: *Yucels Anaí, Del Carmen-Morales* / **ORC ID:** 0000-0003-2738-4780, **Researcher ID Thomson:** I-6613-2018, **CVU CONACYT ID:** 905179

ID 1st Co-author: *Heidi, Del Carmen-Morales* / **ORC ID:** 0000-0002-9686-1838, **Researcher ID Thomson:** O6682-2018, **CVU CONACYT ID:** 926525

ID 2nd Co-author: *Ana María, Felipe-Redondo* / **ORC ID:** 0000-0002-8579-6532, **Researcher ID Thomson:** O-7111-2018, **CVU CONACYT ID:** 835952

Abstract

The pandemic that arose with COVID has caused one of the greatest need to transform educational systems in history worldwide, affecting almost 1.6 billion students in more than 190 countries and all continents. After this sudden change suffered in education, we must focus on the redesign of face-to-face and virtual teaching, evaluate the impact of its implementation and the necessary technological transformation of learning spaces. (Domínguez, 2020). This work aims to develop didactic material in the area of basic sciences through multimedia educational activities for counseling and reinforcement of learning acquired in class. The "Methodology for the development of educational applications in multimedia environments" was used. (Bianchini, 1992). As a result, videos and a YouTube channel were created, teachers can share these materials through virtual classrooms such as Classroom, Microsoft Teams and UTHH Virtual among others. In addition to this, teachers can generate more interactive activities with the help of digital tools such as Neardpod, Wordwall, the new strategies help teachers have a way to streamline tasks, enhance learning and thus pose new challenges to students.

Resumen

La pandemia surgida con el COVID ha provocado una de las mayores necesidad de transformación de los sistemas educativos de la historia a nivel mundial, afectando a casi 1,6 mil millones de estudiantes en más de 190 países y todos los continentes. Tras este repentino cambio sufrido en la educación debemos poner el foco en el rediseño de la enseñanza presencial y la virtual, evaluar el impacto de su implementación y la transformación tecnológica necesaria de los espacios de aprendizaje (Domínguez, 2020). Ese trabajo tiene como objetivo desarrollar material didáctico en el área de ciencias básicas mediante actividades educativas multimedia para las asesorías y reforzamiento de aprendizaje adquirido en clase. Se utilizó la "Metodología para el desarrollo de aplicaciones educativas en ambientes multimedios" (Bianchini, 1992). Como resultado se crearon videos y un canal en YouTube, los docentes pueden compartir estos materiales mediante aulas virtuales como Classroom, Microsoft Teams y UTHH Virtual entre otras. Aunado a esto los maestros pueden generar más actividades interactivas con ayuda de las herramientas digitales como Neardpod, Wordrwall, las nuevas estrategias ayudan a que los docentes tengan manera de agilizar las tareas, potenciar el aprendizaje y así plantearles nuevos retos a los alumnos.

---

† Researcher contributing as first author.

Introduction

A diagnostic evaluation was applied by means of an instrument developed by the mathematics academy to a sample of 856 incoming students, as a result it indicates that the performance is regular (6.1 points) in Arithmetic and insufficient (4. 4) in Algebra (Mathematics Academy UTHH,2018); this information has been analysed and projects the following problems: failure rates, dropout, fear of mathematical calculations and the solution of problems related to their field of application, so it is proposed the development of teaching resources, practices and projects in the classroom and available on an institutional platform, were the reasons why the work began, but in an unprecedented event the academy of mathematics decided to generate resources and make them available through a free access platform.

The Universidad Tecnológica de la Huasteca Hidalguense has ten educational programmes, which are: Engineering in Information Technology, Mechatronics, Food Processes, Agrobiotechnology, Civil Engineering, Mechanics and Degrees in Gastronomy, Business Development and Innovation, Accounting, Marketing, all the curricula of these careers have subjects related to mathematics and in academy meetings it was decided to create teaching resources to support the review of activities seen in class, Considering that the students had connectivity problems due to bad weather, the area, and their places of origin, this strategy aimed to provide the students with resources that would help them to review topics they had seen or topics from other semesters that they needed in their current subjects.

Theoretical framework

Education in times of pandemic

The current covid-19 pandemic is having a devastating effect on the health and lives of a large part of the world's population. In addition to the enormous human losses, the dire effects are already beginning to be felt on the economies of almost all countries: we are experiencing one of the greatest recessions in history.

To protect their populations and mitigate the contagions, which are multiplying exponentially, governments have recommended and, in some cases, forced their citizens to take shelter in their homes.

Among the first measures to contain the spread of the disease was the closure of schools at all levels of the education system. According to UNESCO reports, as of 30 March, 166 countries had closed their schools and universities. Globally, 87 per cent of the student population was affected by these measures, or some 1.52 billion students. In addition, around 63 million teachers worldwide were no longer working in the classroom. Faced with the abrupt and unexpected suspension of their academic activities, education systems around the world have resorted to digital media to continue their school activities. This emergency has also highlighted the gaps and inequalities in both the availability of such resources and the preparation of teachers and students for the transition to distance learning modalities. In a recent report, Brown and Salmi give an international overview of the reactions of some universities and higher education institutions (HEIs) to the transition to online education. Although many universities have closed and attempted to adopt online learning, very few are well prepared to make this change quickly and abruptly. Much confusion and improvisation has occurred, and administrators, faculty and students struggle to implement online learning widely and effectively. The transition to online learning requires effective learning management systems, video-education and conferencing facilities, and academic staff with experience in distance education.

But not all universities have accepted the transition to online education. Several faculties at the University of Buenos Aires have decided to postpone classes and reorganise the academic calendar, arguing that only face-to-face courses can guarantee quality. In other institutions, such as the National University of Science and Technology in Zimbabwe, facilities were closed until further notice, and in Malaysia, the Ministry of Higher Education suspended online education along with face-to-face activities. In several countries, students have mobilised to resist the digital transition. For example, in Tunisia, the main student association called for a boycott of digital platforms as discriminatory.

Students at the University of Chile and the University of San Sebastian (private) staged online strikes. In addition, in the UK, more than 200,000 students signed a petition demanding refunds of their tuition fees, pointing out that online instruction was not what they had paid for. (Alcántara, 2020).

School trajectories in higher education in the face of the pandemic: continue, discontinue or drop out?

In the context of the covid-19 pandemic in the world, the different public and private higher education institutions (HEIs) in Mexico closed their campuses to comply with the measures issued by the federal government, and began to implement various strategies and tools to move from face-to-face courses to online and distance modalities. This measure affected more than four million higher education students and more than 400,000 teachers. While a significant number of students have access to technological resources, many of them do not have the necessary means to make the transition. According to the National Survey on the Availability and Use of Information Technologies in Households 2019, only 44.3 per cent of the population has a computer and 70.1 per cent has access to the internet; however, this data varies across socio-economic levels. The difference in internet access between the high and low strata is 70 percentage points, and in the availability of a computer, 63 percentage points, both in favour of the high stratum. Sometimes, there is only one computer in the home, which is shared with other family members, and many of the students do not have a space for their school work. Moreover, being at home, the time available to them is fragmented between various activities, household chores and caring for other family members. In addition, although there is a belief that these students belong to the technological generation, many of them lack the necessary skills to develop virtual learning activities, as well as the self-discipline that these modalities demand, in an environment of stress, uncertainty and socio-economic restrictions derived from the pandemic.

Tools as an ally in education

a) Microsoft Teams tools

This platform is free to register, has an unlimited number of meetings, hosts a maximum of 100 participants and the chat is also unlimited (Cedeño, Ponce, & Lucas, 2020).

b) Classroom

For a personal Google Classroom account it allows 250 class members either teachers or students, 30 classes can be created per day, the number of invitations to class members that can be sent is 100 per teacher. It is a free application that is part of the programme available to the university community called Google Apps for Education (GAE). (Vélez, 2016).

c) Moodle

Moodle is an educational content management system (CMS) that enables the organisation of courses through the creation and combination of educational resources managed within the same platform, (Reynaldo, Rojas, & Paulí, 2008)

d) Facebook in education

When the main reason for the existence of a community changes from the mere exchange of information to learning and professional development, then we are dealing with a virtual learning community (Llorens, 2011), Facebook is a tool that has been used this year as a means of communication, as it consumes little data compared to other networks and is freely available on telephone plans.

e) YouTube

- It is not recommended to make videos too long, you can opt for a duration of 1-4 min, 80% of users see only the first 10 seconds and it is in this period when they realise whether the video will be useful or not.

- Include 2 to 4 times a keyword to improve the video's ranking performance. The description should contain combinations of words for the platform to display when users search for certain topics.

– A good choice for the thumbnail photo that appears as a preview of the video should be included as a strategic part for YouTube.

– Share the video on other social networks so that it can be seen by more people.

– Personalise the channel. Add links to your website, social networks, blog.

– As is done on other social networks, you can encourage the community to leave comments by asking a closing question in the videos that appeals directly to the viewer.

– You can create a list and add all the videos of the same topic, so that every time a video is finished, another one will automatically play (Socialtools, 2017).

f) Virtual UTHH

The UTHH virtual platform is a space where students complement their training with activities in the subjects of written oral expression and socio-cultural training, in this section students can view activities, entering the platform using their institutional registration.

Students can perform the following actions: Submit assignments, view assignments and activities, view content topics, play videos, write comments.

g) Hybrid models for learning

A model that brings the two worlds together is the so-called Hybrid Model, which is designed to take advantage of the competencies that the face-to-face model of education gives the learner with the best practices of the online model. In this hybrid model, educational platforms and activities are used for online learning. These online activities are complemented by classroom activities. The classroom activities are different from the activities that would be carried out by the teacher in a traditional face-to-face system, if the so-called "flipped classroom" methodology is used. In the hybrid model classroom, the student participates by doing assignments, projects and presentations to peers. The teacher changes his or her role from that of an all-knowing guru to that of a mentor, guide and advisor to his or her students.

Classroom activities change to allow students to work collaboratively with each other in small working groups. In addition, in order to present their work to their peers, discussion of different topics is also encouraged in order to foster the development of soft skills, such as respect, interaction, tolerance and collaborative work, among others.

Many higher education experts agree that the trend in educational models and universities is towards a hybrid model with the inverted classroom methodology. It is worth remembering that due to the pandemic, teachers and their students do not have access to a classroom or physical space for face-to-face activities, which were mentioned above. However, thanks to technology it is possible to have a videoconference in real time or synchronously and in this way carry out most of the activities that take place in the classroom. (Arizona State University, 2020).

Problem statement

The creation of didactic resources for educational practices is applied to students from the different degree courses at the university. A pilot group was taken from the Information Technologies degree course, which includes the subjects of linear algebra, mathematical functions, statistics, differential calculus, integral calculus, multivariable calculus and differential equations in the syllabus. The students of the University are originally from the Huasteca region, which includes the north of Veracruz, the south of Tamaulipas, the north of Puebla and the east of Hidalgo, with a predominance of Nahuatl. It is worth noting that in an unprecedented event, classes were suspended due to the confinement caused by COVID-19 and have been taught online since March 2020, A connectivity survey was applied at institutional level to find out the availability of equipment for students and equipment, the data collected were considered for the organisation of classes, the time, the form of evaluation, the form of communication, interaction with both students and parents was determined in the academy. It should be noted that due to the nature of the course, a good percentage of the students had a laptop and the computer maintenance area of the course supported the students so that they had the necessary tools, but the internet was a determining factor due to the geographical area of the region.

Method

The "Methodology for the development of educational applications in multimedia environments" (Bianchini, 1992) was used to create interactive digital activities for the UTHH virtual classroom, which consists of four phases that are divided into stages.

Phase: Research and analysis

It was decided to generate didactic resources through videos, considering the phases of content design, scripts, editing, publication and availability through the UTHH Virtual Classroom, a channel on the YouTube platform, and given the confinement, teachers began to use tools such as classroom, Teams, videoconferencing, which had not been explored or used in a large percentage of cases.

An analysis was carried out using a comparative table where digital tools such as Nearpod, Educaplay, Wordwall, Edpuzzle, Genial.ly, Liveworksshets, Learning apps, Proprofs, Constructor 2.0 were analysed. (Nearpod, 2020), (Educaplay, 2021), (Wordwall, 2021), (EDpuzzle, 2021), (Genially, 2020), (Worksheets, 2020), (LearningApps, 2020), (ProProfs, 2017), (Constructor, 2019), (Plickers, 2019) .These tools allowed to generate and complement students' educational practices.

Phase: Design

In this section, the standardisation and description of the typography, the design of content, scripts, the logical design of the videos were carried out.

Design in UTHH Virtual:

The following figure shows the main menu and the submenu with the sections that will make up the units, then it is described in detail what will contain identifying each section with numbers.
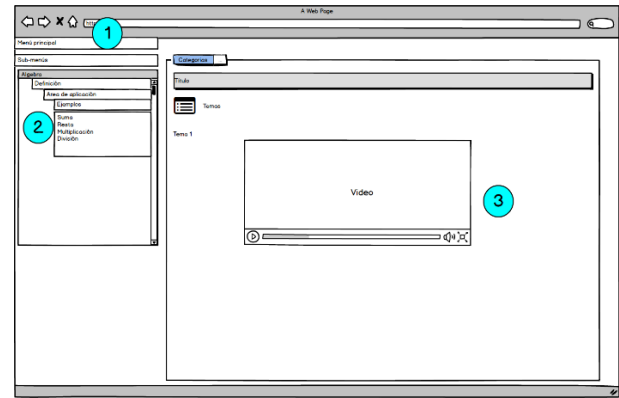

Figure 1 Sections that make up the UTHH virtual classroom
Source: Own elaboration

At the top you can find the logo.

a)   Video search bar

b)   Microphone icons.

c)   Video upload icon.

d)   YouTube Apps.

e)   Notifications

f)   In the centre is the space where the video in playback is displayed.

g)   Inside the box are the options: Play, Pause, Autoplay, Settings, Cinema mode, Thumbnail mode, Full screen.

h)   At the top you can see the name of the video, the logo and the name of the channel.

i)   Like, Dislike, share, save and report reactions.

j)   Subscribe button.

Phase: Development

In this stage the videos were developed, edited, recorded, multimedia production and content generation.

Figure 2 Video on the UTHH Mathematics YouTube Channel
Source: Own elaboration

Description:

The topics were selected, taking into account diagnostic assessments, algebra line subject topics, sequential subjects, subject sheets and the mapping of all basic science subjects in the educational programmes.

Scripts were developed.

The videos were made in three modalities, video design using multimedia tools, recording of teachers explaining a topic (blackboard, whiteboard, etc.), recording of teachers explaining a topic in screen capture mode.

- Editing and evaluation of the videos.

- Creation of a YouTube channel

- Publication of videos on the platform

- Generation of content in the Virtual UTHH.

With all the previous steps in the virtual platform, a section was created on the subject, areas of application, examples taking the links of the videos generated and published on the YouTube channel, a section of practices. Initially it was only a space for review, but according to the emergency health teachers we saw the need to explore other tools such as google classroom where we generated the same content, but also like the platform offered the option to publish practices and generate evaluations, so the freedom of teaching was respected, but all make use of the videos, which are available to students, the university community and the general public. https://www.youtube.com/channel/UC3SZebAt P0pglt0uf4rylWg/
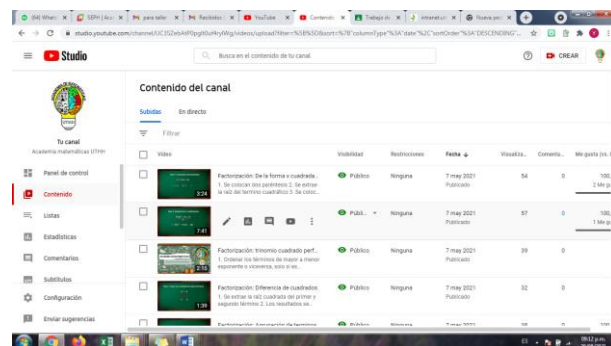
Figure 3 Content of the video sum of polynomials on YouTube
Source: Own elaboration

f) Resources

The following resources were used for the development of the project:
Editing software, computer equipment, camera (mobile phone), microphone, light ring, blackboard, whiteboard.

For the availability of resources:

- Classroom platform, Virtual UTHH platform, social networks.

Phase of: Evaluation

The videos were made available to the student community through an official letter issued by the academy of mathematics for academic management and educational programmes, an instrument was proposed to be used as a reference for points of improvement.

Results

Failure rates, students' fear of mathematical calculations, problem solving and collaborative work are aspects that Mathematics teachers face in the classroom in their educational work.

The resources were used with the students of the University, as a result, the knowledge, know-how, analysis, collaborative work, and use of mathematics and programming logic in problem solving were evaluated, based on the didactic resources (videos) created by the teachers.

To cite an example: Operations with polynomials, the students were told the meaning of the topic, rescuing previous knowledge, then the definition, the examples were shown in videos of the operations of polynomials, it should be noted that the example of the sum of polynomials was developed in the context of requesting orders of tacos, then the teacher placed a practice through a crossword puzzle or problem solving and was evaluated. The use of didactic resources was very interesting as the following situations arose.

- If a student did not attend the virtual class session due to connectivity problems, he/she was informed that he/she had to watch the video.

- He had to watch the videos before the class: This allowed the term "flipped classroom" to be coined, which meant that the teacher had to provide material prior to the class in which the student arrived at the virtual session with knowledge of the subject and could make the most of the time to practise and resolve any doubts.

- It was advantageous for both parties: the teacher did not have to repeat the explanation and the student could use the resources when his or her connectivity problems allowed it.

- At the beginning of 2022 the fear of a return to face-to-face classes was notorious and the student community was offered the possibility of two modalities, virtual and face-to-face. The Hybrid Model was coined, which commits the student to a prior review of topics in class and brings together the advantages of the competences of the face-to-face and online models.
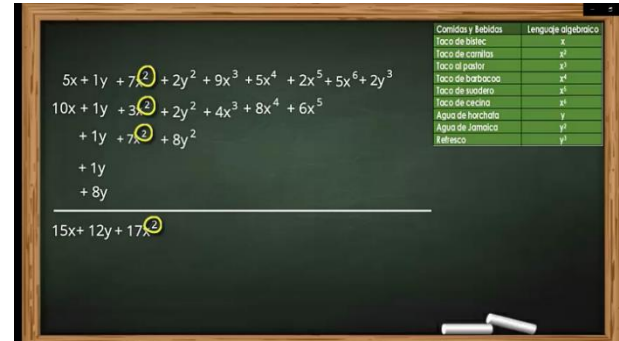

Figure 4 Video sum of polynomials
Source: Own elaboration

Derivadas Clase 7 Formula c por x

Figure 5 Video class on derivatives
Source: Own elaboration

In order to define the functioning of the didactic material, tests were carried out with a pilot group of third-year students of the subject of derivatives. Considering the following information:

$$n = \frac{NZ^2 pq}{e^2(N-1) + Z^2 pq}$$

Figure 6 Sample design formula for finite populations
Source: Based on (Bolaños, 2012) and (Murray & Larry, 2009)

n= size of the sample sought

N= size of the population or universe

Z= statistical parameter obtained using constant confidence levels:

90% equals 1.645

95% equals 1.96

95% equals 2.58

e = maximum accepted sampling error.

Use between 1% (0.01) and 9% (0.09).

Researcher's criterion

p= probability of occurrence of the event under study

q= (1-p) = probability of occurrence of the event studied.

Data:

n =?

N= 70 students

Z= 90% = 1.645

e = 10% = 0.1

p= 0.5

q= (1-p) = 0.5

$$n = \frac{(70)(1.645)^2(0.5)(0.5)}{(0.1)^2(70-1) + (1.645)^2(0.5)(0.5)}$$

Figure 7. Sample calculation for finite populations
Source: Own elaboration

n= 34.65 = 35 Students

The questions were in relation to the following:

- Identification data (University, Faculty, subject, credits).

- Quality (Resolution).

- Audio and Volume

- Text (spelling and grammar rules).

- The relationship between image, text and narration corresponds to each moment of the video.

- Accurate and updated information based on the syllabus.

- Bibliography

- Sequential content, from simple to complex.

- Key concepts.

- Resources (graphs, charts, illustrations, examples, exercises).

- Language for target audience.

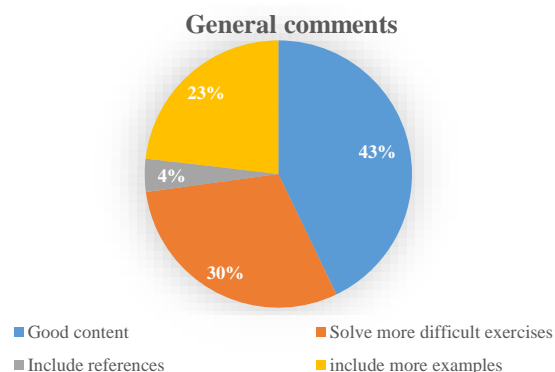- Typographic resources and colours

Figure 8 Recommendations for improvement
Source: Own elaboration

Conclusions

The project's objective was to develop didactic material in the area of basic sciences through multimedia educational activities for assessment and reinforcement of learning acquired in class on a platform where it is available considering the digital gaps of the region, this experience was very interesting, none of the teachers who participated at the beginning of the pandemic had used classroom, google meet and much less created a YouTube channel, it was an enriching experience for teachers, but also for students to have material that they can play at the time they want and when they have connection availability. While these are times of empathy, they are also times of change for teachers, returning to technology as an ally in teaching performance.

References

Alcántara, A. (2020). *Educación y Pandemia una Visión académica*. Obtenido de Instituto de Investigaciones sobre la Universidad y la Educación - Universidad Autónoma de México: https://www.cencos22oaxaca.org/wp-content/uploads/2020/08/educacion_pandemia.pdf#page=75

Arizona State University. (2020). Curso La era del aprendizaje activo. Mexico.

Bianchini. (1992). *Metodologia Desarrollo de Aplicaciones educativas en ambientes multimedia.* Obtenido de http://www.ldc.usb.ve/~abianc/mmm.html

Bolaños, E. (2012). *Área Académica: Gestión Tecnológica.* Obtenido de https://www.uaeh.edu.mx/docencia/P_Presentaciones/tizayuca/gestion_tecnologica/muestraMuestreo.pdf

Cedeño, M., Ponce, E., & Lucas, Y. (22 de Julio de 2020). *Polo del conocimiento.* Obtenido de https://polodelconocimiento.com/ojs/index.php/es/article/view/1525/html

Constructor. (2019). *caracteristicas.* Obtenido de https://constructor.educarex.es/#Aviso

Domínguez, S. C. (2020). *Dialogia.* Obtenido de Educación en tiempos de pandemia con Silvia Carrascal Domínguez: https://periodicos.uninove.br/dialogia/article/view/18849/8699

EDpuzzle. (2021). *edpuzzle.* Obtenido de https://edpuzzle.com

Educaplay. (2021). Obtenido de https://es.educaplay.com

Genially. (2020). *Caracteristicas.* Obtenido de https://www.genial.ly/es?gclid=Cj0KCQjwsqmEBhDiARIsANV8H3YiOkT_vyguHqXXhWfjhQYM_1t9ERYRvOuXIRW5ihqu295nwmeforMaAapTZEALw_wcB

LearningApps. (2020). *contenido.* Obtenido de https://learningapps.org

Llorens, F. (Julio de 2011). *Posibilidades de la plataforma Facebook para el aprendizaje colaborativo en línea.* Obtenido de https://www.redalyc.org/articulo.oa?id=78018793004

Murray, R., & Larry, J. (2009). *Estadística.* Mexico, D.F.: Mc Graw Hill.

Nearpod. (2020). *caracteristicas.* Obtenido de https://nearpod.com

Plickers. (2019). *Caracteristicas.* Obtenido de https://get.plickers.com

ProProfs. (22 de Junio de 2017). Obtenido de https://www.capterra.mx/software/129610/proprofs-quiz-maker

Reynaldo, P. C., Rojas, C. J., & Paulí, H. G. (2008). *Algunas experiencias didácticas en el entorno de la plataforma Modle.* Obtenido de https://lccvirtual.com/pluginfile.php/59/mod_resource/content/1/A1mar2008.pdf

Socialtools. (Julio de 2017). *¿Cómo conseguir más visualizaciones en YouTube?* Obtenido de https://www.socialtools.me/blog/como-conseguir-mas-visualizaciones-en-tus-videos-de-youtube/

Vélez, M. (2016). *Google Classroom en la enseñanza: Manual sobre las funciones básicas y mejores prácticas de uso.* Obtenido de https://cea.uprrp.edu/wp-content/uploads/2016/10/manual.pdf

Wordwall. (2021). Obtenido de https://wordwall.net/es/features

Worksheets, L. (2020). *Sobre este sitio.* Obtenido de https://es.liveworksheets.com/aboutthis_es.asp#:~:text=Liveworksheets%20te%20permite%20transformar%20tus,enviar%20sus%20respuestas%20al%20profesor.