Received: 15 December 2024, Accepted: 30 June 2025,
Published on-line as Recently Accepted Paper: July 2025

DOI: https://doi.org/10.26529/cepsj.2059

# Analysis of Social Networks and Video Conferencing Systems in the Educational Context Through Data Science

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The aim of this mixed research is to analyse the perceptions of university students about the use of social networks and video conferencing systems during the COVID-19 post-pandemic through data science. The participants are 103 students of the Faculty of Sciences at the National Autonomous University of Mexico. The results of the deep learning algorithm indicate that social networks and video conferencing systems positively impact student autonomy and the exchange of ideas. The random forest algorithm facilitated the creation of the models on these tools considering the characteristics of the participants. Social networks facilitate use of multimedia resources, publication of school content and review of information. Likewise, video conferencing systems facilitate the realisation of classes in virtual modality through recordings and interaction between the educator and students. In conclusion, the use of social networks and video conferencing systems favour the planning and execution of new school activities at home and in the classroom.

**Keywords:** social networks, video conferencing systems, data science, deep learning

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# Analiza družbenih omrežij in videokonferenčnih sistemov v izobraževalnem kontekstu s pomočjo znanosti o podatkih

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Cilj te mešane raziskave je analizirati zaznave visokošolskih študentov o uporabi družbenih omrežij in videokonferenčnih sistemov v času po pandemiji covida-19 s pomočjo znanosti o podatkih. Udeleženci so bili 103 študentje Fakultete za znanosti na Nacionalni avtonomni univerzi v Mehiki. Izsledki algoritma globokega učenja kažejo, da družbena omrežja in videokonferenčni sistemi pozitivno vplivajo na avtonomijo študentov in izmenjavo idej. Algoritem naključnega gozda je olajšal ustvarjanje modelov za ta orodja, upoštevajoč značilnosti udeležencev. Družbena omrežja olajšujejo uporabo multimedijskih virov, objavo šolskih vsebin in pregled informacij. Podobno videokonferenčni sistemi olajšujejo izvajanje pouka v virtualni obliki s pomočjo posnetkov ter interakcije med učiteljem in študenti. Sklepno lahko rečemo, da uporaba družbenih omrežij in videokonferenčnih sistemov spodbuja načrtovanje in izvajanje novih šolskih dejavnosti doma in v učilnici.

**Ključne besede:** družbena omrežja, videokonferenčni sistemi, znanost o podatkih, globoko učenje

## Introduction

In order to face the challenge of the SARS-CoV-2 virus, schools, colleges and universities offered courses with the support of information and communication technologies (ICTs) (Al-Balushi et al., 2022; Isman et al., 2023; Kusumaningdyah et al., 2024; Rice, 2022). Social networks were used by teachers to offer new learning environments where the students actively participate in the educational activities (Al-Balushi et al., 2022; Caratiquit & Caratiquit, 2023; Guillén-Gámez et al., 2022). Video conferencing systems allow the realisation of the educational process at any time, as teachers can present topics from anywhere (Bailey, 2022; Nti et al., 2022; Unal & Yilmaz, 2024; Walcott-Bedeau, 2022).

During the COVID-19 pandemic, the incorporation of technological tools caused educators to modify their school activities and teaching methods (Camilleri & Camilleri, 2022; Cvitković et al., 2024; Rice, 2022; Sahin-Dogruer, 2023). The Internet facilitated the use of digital tools such as social networks and video conferencing systems in the teaching-learning process (Camilleri & Camilleri, 2022; Kastiro et al., 2022; Lena-Acebo et al., 2023).

Educators use social networks to share multimedia resources and disseminate course information (Bendayan et al., 2024; Caratiquit & Caratiquit, 2023; Lundgren et al., 2022; Muls et al., 2020). These tools favour the organisation of discussion forums and communication in the mixed modality (Caratiquit & Caratiquit, 2023; Lundgren et al., 2022; Quesnelle & Montemayor, 2020).

Video conferencing systems are essential technological tools for communication in distance education (Bailey, 2022; Faner et al., 2022; Walcott-Bedeau, 2022). Educators use Google Meet, Microsoft Teams and Zoom to present topics remotely (Camilleri & Camilleri, 2022; Nguyen et al., 2021).

Social networks and video conferencing systems allow the construction of creative educational spaces where multimedia resources are shared during the learning process (Chen, 2022; Nti et al., 2022; Walcott-Bedeau, 2022), while data science and machine learning algorithms allow users to find new information that facilitates the understanding of educational phenomena related to the integration of tools both inside and outside the classroom (Chen, 2022; Koyuncu et al., 2022; Nti et al., 2022; Žabkar et al., 2023).

### Social networks

Social networks are used as educational tools because they facilitate interaction, communication and collaboration between participants (Al-Balushi et al., 2022; Lundgren et al., 2022; Muls et al., 2020). Together with teachers,

educational institutions have transformed the learning process in medicine and science through social networks (García-García et al., 2023; Hasiloglu et al., 2020; Lundgren et al., 2022).

During the COVID pandemic, the incorporation of social networks in courses increased due to the ease of use and availability of these technological tools (Al-Balushi et al., 2022; Lundgren et al., 2022; Muls et al., 2020). Facebook facilitated the realisation of collaborative activities through the exchange of comments on the wall (Muls et al., 2020).

Social networks have modified interaction between the educator and students (García-García et al., 2023; Hasiloglu et al., 2020; Lundgren et al., 2022). In science courses, the use of Facebook and Twitter favours debate (Lundgren et al., 2022), while teachers also use social networks to promote the development of students through the dissemination of information and multimedia resources concerning science (Hasiloglu et al., 2020).

The use of Facebook in medical courses fosters debate and participation on the Internet (García-García et al., 2023; Nti et al., 2022; Quesnelle & Montemayor, 2020). Finally, the incorporation of social networks in universities favours the creation of spaces for reflection and discussion (Bendayan et al., 2024; García-García et al., 2023; Guillén-Gámez et al., 2022; Nti et al., 2022).

### Video conferencing systems

Learning management and video conferencing systems such as Google Meet, Microsoft Teams and Zoom enable the organisation of creative activities and the realisation of courses remotely (Camilleri & Camilleri, 2022; Nguyen et al., 2021; Walcott-Bedeau, 2022). For example, video conferencing systems such as Zoom facilitated the understanding of topics on medicine, English language and science, as students actively participated and resolved their doubts (Bailey, 2022; Faner et al., 2022; Walcott-Bedeau, 2022).

In Foreign Language courses, Zoom has been shown to facilitate communication, understanding of topics and analysis of English language content (Bailey, 2022). The video conferencing system studied even increased academic performance in the distance modality (Bailey, 2022).

In another study, medical students used Zoom to assimilate knowledge about biochemistry and interact with the teacher in real time (Faner et al., 2022). This video conferencing system allows the participants in the educational process to acquire a central role (Bailey, 2022; Faner et al., 2022; Walcott-Bedeau, 2022).

Zoom also facilitated communication between participants during a preclinical science course (Walcott-Bedeau, 2022). Video conferencing systems

allow the resolution of doubts in real time, the presentation of school topics from anywhere, participation from anywhere and the execution of the learning process in the distance modality (Bailey, 2022; Faner et al., 2022; Unal & Yilmaz, 2024; Walcott-Bedeau, 2022).

### Data science in the educational field

Data science and machine learning algorithms have been used to understand the educational phenomena related to learning, academic performance, school dropout, motivation and the incorporation of technology in school activities (Hussain & Khan, 2023; Lincke et al., 2021; Sghir et al., 2023).

According to Lincke et al. (2021), machine learning algorithms are used to personalise course information, analyse the impact of technological tools on educational institutions and adapt the content of educational platforms to the needs of students.

In fact, machine learning algorithms such as k-nearest neighbors, linear regression, Bayesian classifier, decision tree, random forest, support vector machine and deep learning allow forecasting events concerning the educational process and technological advances (Lincke et al., 2021; Sghir et al., 2023).

According to Li et al. (2025), the deep learning algorithm uses neural networks that facilitate finding the most efficient predictive models in decision making. This machine learning algorithm divides the sample into two sections: the training section to find the forecast function, and the evaluation section to determine the most efficient predictive model by obtaining the smallest squared error (Li et al., 2025; Shiao et al., 2023).

The deep learning algorithm is used to predict events related to the teaching-learning process, as this artificial intelligence technique establishes precise and reliable forecast models through hyperparameters such as the size of the training and evaluation sections, hidden layers and activation (Li et al., 2025; Shiao et al., 2023).

Salas-Rueda et al. (2025a) used the deep learning algorithm with Tanh activation and various sizes of the training and evaluation sections to establish predictive models on educational aspects such as active role, communication and comprehension of topics in a mathematics course and an information and communication technologies course.

Iyamuremye et al. (2024) and Ayanwale et al. (2024) highlight the importance of machine learning algorithms in the field of educational research due to the increase of articles published in this area; for example, the random forest algorithm is used to create tree-shaped predictive models (Beseiso, 2025;

Jin, 2025). This artificial intelligence technique builds various trees until it finds the most efficient predictive model considering the accuracy aspect (Beseiso, 2025; Jin, 2025).

Salas-Rueda et al. (2025b) used the random forest algorithm to create predictive models of enthusiasm and motivation during the use of an educational web application on mathematics in an applied geography degree programme. Similarly, Jin (2025) used this artificial intelligence technique to predict academic performance by considering teacher characteristics, educational resources, pedagogical strategies and parental interaction.

Lincke et al. (2021) used the algorithms of logistic regression, linear regression, extreme gradient-boosted tree, decision tree, deep learning and random forest to determine the most appropriate multimedia resources for students during the learning process about medicine.

Similarly, Hussain and Khan (2023) used data science to forecast academic performance through machine learning algorithms. In particular, the linear regression and decision tree algorithms were used to analyse factors that influence academic performance in high school (Hussain & Khan, 2023). In addition, Kostopoulos et al. (2021) used light gradient boosted, logistic regression and gradient boosting algorithms to predict grades during the use of massive open online courses (MOOCs).

Data science allowed the identification of the relationship between student satisfaction and MOOCs through gradient boosting trees algorithm (Hew et al., 2020). In fact, this algorithm facilitated the construction of predictive models about MOOCs (Hew et al., 2020).

Hsu-Wang (2019) analysed the behaviour of students in the Moodle platform considering the flipped classroom, that is, the linear regression algorithm allowed the prediction of school activities carried out in this technological tool both inside and outside the classroom. According to Nti et al. (2022), machine learning algorithms such as the decision tree and random forest allowed researchers to predict conditions concerning academic performance and social networks.

Finally, educators and researchers use machine learning algorithms such as support vector machine, linear regression, k-nearest neighbors, decision tree, Bayesian classifier, random forest and deep learning to obtain new information about the relationship between educational phenomena and technology (Hussain & Khan, 2023; Lincke et al., 2021; Sghir et al., 2023).

### Research Problem

At science faculties, teachers need to know students' opinions on the use of technological tools in the educational field in order to organise and implement new course activities. According to Sghir et al. (2023), the deep learning algorithm allows the analysis of research hypotheses and the prediction of phenomena with great accuracy. Likewise, the random forest algorithm enables the construction of predictive models regarding technological and educational phenomena (Lincke et al., 2021; Sghir et al., 2023).

The particular aims are: (1) to analyse the use of social networks and video conferencing systems for student autonomy and the exchange of ideas through the deep learning algorithm, (2) to build models of the use of these tools considering the random forest algorithm, and (3) to analyse students' perceptions of social networks and video conferencing systems in the educational field.

### Research questions

The aim of this mixed research is to analyse the perceptions of university students about the use of social networks and video conferencing systems through data science (deep learning and random forest algorithms). The research questions are:

- How does the use of social networks and video conferencing systems influence student autonomy and the exchange of ideas in the educational field (deep learning algorithm)?
- What are the models on social networks and video conferencing systems to forecast student autonomy and the exchange of ideas in the educational field considering sex and age (random forest algorithm)?
- What is the perception of university students about the use of social networks and video conferencing systems in the educational field?

The research hypotheses about the use of social networks and video conferencing systems are:

- Hypothesis 1: Social networks positively impact student autonomy in the educational field.
- Hypothesis 2: Social networks positively impact the exchange of ideas in the educational field.
- Hypothesis 3: Video conferencing systems positively impact student autonomy in the educational field.

- Hypothesis 4: Video conferencing systems positively impact the exchange of ideas in the educational field.

## Method

### Participants

The participants were 103 students of the Faculty of Sciences (sample 1) at the National Autonomous University of Mexico (NAUM) during the 2022 school year. In the study, sample 2 consisted of 21 teachers who were completing a master's degree in Upper Secondary Education at the NAUM during the 2025 school year.

### Instrument

The study used the following model to analyse the use of social networks and video conferencing systems through data science (See Figure 1). In the study, the independent variables are social networks and video conferencing systems. The dependent variables are autonomy and the exchange of ideas, which are the target (predictive) variables used in the deep learning and random forest algorithms.

Autonomy refers to student interaction in the teaching-learning process through social networks and video conferencing systems at any time, while exchange of ideas refers to communication and discussion of school topics through social networks and video conferencing systems from any location.

**Figure 1**
*Model on social networks and video conferencing systems*


The research used the deep learning algorithm to create forecasting models. Li et al. (2025) explain that this artificial intelligence technique uses neural network hyperparameters such as activation, hidden networks, cycles and sample size for the training and evaluation sections in order to establish

predictive functions with great precision. Similarly, the random forest algorithm creates accurate predictive models, as it builds various trees until it finds the best option to forecast the phenomena (Beseiso, 2025; Jin, 2025).

In the present study, the random forest algorithm allowed the construction of the following models considering the characteristics of the participants:

- Model 1 on social networks, profile of the students and autonomy.
- Model 2 on social networks, profile of the students and the exchange of ideas.
- Model 3 on video conferencing systems, profile of the students and autonomy.
- Model 4 on video conferencing systems, profile of the students and the exchange of ideas.

In December 2022, data collection was carried out at the National Autonomous University of Mexico through a questionnaire (See Table 1). This measurement instrument consists of four closed-ended questions about technology, which were used in the quantitative approach. Two open-ended questions about social networks and video conferencing systems were used in the qualitative approach. The closed questions were validated using the values obtained from the Load Factor > 0.600 and Composite Reliability > 0.700 (See Table 2). The scale of the responses was designed considering an article on data science published by Salas-Rueda et al. (2025a).

**Table 1**

*Measurement instrument about social networks and video conferencing systems*

| No. | Approach | Scope | Variable | Dimension | Question | Answer |
|---|---|---|---|---|---|---|
| 1 | Quantitative | Descriptive and causal | Use of technology | Social networks | 1. Social networks facilitate learning | Very much (1)<br>Much (2)<br>Little (3)<br>Very little (4) |
| | | | | Video conferencing systems | 2. Video conferencing systems facilitate learning | Very much (1)<br>Much (2)<br>Little (3)<br>Very little (4) |
| | | | | Autonomy | 3. Digital tools facilitate student autonomy in the educational field | Very much (1)<br>Much (2)<br>Little (3)<br>Very little (4) |
| | | | | Exchange of ideas | 4. Digital tools facilitate the exchange of ideas in the educational field | Very much (1)<br>Much (2)<br>Little (3)<br>Very little (4) |
| 2 | Quantitative | Descriptive | Student | Sex | 5. Sex | Man<br>Woman |
| | | | | Age | 6. Age | 20 years<br>21 years<br>22 years<br>23 years<br>24 years<br>25 years |
| 3 | Qualitative | | Students | Use of social networks | 7. What do you think of social networks? | Open |
| | | | | Use of video conferencing systems | 8. What do you think of video conferencing systems? | Open |
| | | | Teachers | Social networks and video conferencing systems | 9. What are the benefits of social networks and video conferencing systems in the educational field? | Open |

Table 2 presents the validation of the measurement instrument on social networks and video conferencing systems.

**Table 2**
*Validation*

| Variable | Dimension | Load Factor | Average Variance Extracted | Composite Reliability |
|---|---|---|---|---|
| Use of technology | Social networks | 0.623 | 0.560 | 0.833 |
| | Video conferencing systems | 0.665 | | |
| | Autonomy | 0.806 | | |
| | Exchange of ideas | 0.874 | | |

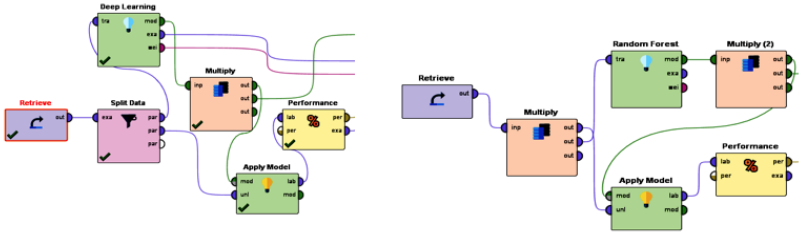
The research was supported by an Excel spreadsheet to calculate the frequencies of educational phenomena and the RapidMiner tool to calculate the deep learning and random forest algorithms. The deep learning algorithm requires the sample to be split in order to create the training and evaluation sections, while the random forest algorithm requires auxiliary variables such as sex and age in order to identify the relationship between the independent and dependent variables.

Data science and machine learning algorithms allowed an analysis of the use of social networks and video conferencing systems during the COVID-19 post-pandemic through the RapidMiner tool (See Figure 2).

In the deep learning algorithm, using the values of 60% ($n$ = 62), 70% ($n$ = 72) and 80% ($n$ = 82) of the sample allows the construction of predictive models (training section), while using the values of 40% ($n$ = 41), 30% ($n$ = 31) and 20% ($n$ = 21) of the sample identifies the most significant linear function to predict through the squared error (evaluation section).

In the present study, hyperparameters on the size of the training and evaluation sections, cycles ($n$ = 10), hidden layers (50, 50) and Tanh activation were used to identify the best predictive models of autonomy and the exchange of ideas considering the use of social networks and video conferencing systems.

**Figure 2**
*RapidMiner tool*




(a) Deep learning (b) Random forest

Through the random forest algorithm, information about social networks and video conferencing systems is used to build models considering the sex and age of the participants, while the objective variables are student autonomy and the exchange of ideas in the educational field.

Finally, Excel allows descriptive analysis in the quantitative approach for questions about social networks, video conferencing systems, autonomy and exchange of ideas by calculating the frequencies.

### Research design

The questionnaire was distributed to the students through Google Form under the direct supervision of the teacher, ensuring compliance with established ethical standards. The instructions were communicated in detail through Google Form. Participation in the study was entirely voluntary and no incentives were offered or provided.

## Results

Digital tools facilitate student autonomy in the educational field very much ($n$ = 52, 50.49%), much ($n$ = 41, 39.81%) and little ($n$ = 10, 9.71%) (See Table 3). Digital tools facilitate the exchange of ideas in the educational field very much ($n$ = 38, 36.89%), much ($n$ = 43, 41.75%), little ($n$ = 18, 17.48%) and very little ($n$ = 4, 3.88%).

**Table 3**

*Results of social networks and video conferencing systems*

| Question | Answer | *n* | % |
|---|---|---|---|
| 1. Social networks facilitate learning | Very much (1) | 34 | 33.01% |
| | Much (2) | 51 | 49.51% |
| | Little (3) | 16 | 15.53% |
| | Very little (4) | 2 | 1.94% |
| 2. Video conferencing systems facilitate learning | Very much (1) | 35 | 33.98% |
| | Much (2) | 45 | 43.69% |
| | Little (3) | 20 | 19.42% |
| | Very little (4) | 3 | 2.91% |
| 3. Digital tools facilitate student autonomy in the educational field | Very much (1) | 52 | 50.49% |
| | Much (2) | 41 | 39.81% |
| | Little (3) | 10 | 9.71% |
| | Very little (4) | 0 | 0.00% |

| Question | Answer | *n* | % |
|---|---|---|---|
| 4. Digital tools facilitate the exchange of ideas in the educational field | Very much (1) | 38 | 36.89% |
| | Much (2) | 43 | 41.75% |
| | Little (3) | 18 | 17.48% |
| | Very little (4) | 4 | 3.88% |
| 5. Sex | Man | 34 | 33.01% |
| | Woman | 69 | 66.99% |
| 6. Age | 20 years | 15 | 14.56% |
| | 21 years | 4 | 3.88% |
| | 22 years | 18 | 17.48% |
| | 23 years | 46 | 44.66% |
| | 24 years | 13 | 12.62% |
| | 25 years | 7 | 6.80% |

The results of deep learning indicate that social networks and video conferencing systems positively impact student autonomy and the exchange of ideas (See Table 4).

**Table 4**

*Deep learning algorithm*

| Hypothesis | Training | Deep learning | Predictive model | Conclusion | Squared error ($e^2$) | Value of *p* |
|---|---|---|---|---|---|---|
| H1: Social networks → student autonomy | 60% | Cycles: 10<br>Hidden layers: 50, 50<br>Activation: Tanh | y = 0.020x + 1.715 | H1: Accepted | 0.662 | < 0.050 |
| | 70% | | y = 0.064x + 1.592 | H1: Accepted | 0.716 | < 0.050 |
| | 80% | | y = 0.044x + 1.649 | H1: Accepted | 0.636 | < 0.050 |
| H2: Social networks → exchange of ideas | 60% | | y = 0.031x + 1.811 | H2: Accepted | 0.845 | < 0.050 |
| | 70% | | y = 0.043x + 1.621 | H2: Accepted | 0.953 | < 0.050 |
| | 80% | | y = 0.131x + 1.901 | H2: Accepted | 0.819 | < 0.050 |
| H3: Video conferencing systems → student autonomy | 60% | | y = 0.126x + 1.409 | H3: Accepted | 0.629 | < 0.050 |
| | 70% | | y = 0.055x + 1.404 | H3: Accepted | 0.673 | < 0.050 |
| | 80% | | y = 0.098x + 1.725 | H3: Accepted | 0.666 | < 0.050 |
| H4: Video conferencing systems → exchange of ideas | 60% | | y = 0.373x + 1.120 | H4: Accepted | 0.758 | < 0.050 |
| | 70% | | y = 0.257x + 1.252 | H4: Accepted | 0.835 | < 0.050 |
| | 80% | | y = 0.380x + 1.098 | H4: Accepted | 0.720 | < 0.050 |

### Social networks

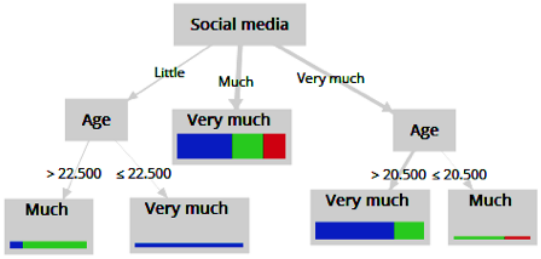
Social networks facilitate learning very much ($n$ = 34, 33.01%), much ($n$ = 51, 49.51%), little ($n$ = 16, 15.53%) and very little ($n$ = 2, 1.94%) (See Table 3). The results of the deep learning algorithm with 60% (0.020), 70% (0.064) and

80% (0.044) of the sample indicate that Hypothesis 1 is accepted (See Table 3). Social networks positively impact student autonomy.

Figure 3 shows Model 1 on social networks to predict student autonomy. The random forest algorithm determined five predictive conditions. For example, if the student thinks that social networks facilitate learning very much and has an age > 20.5 years, then digital tools facilitate student autonomy in the educational field very much.

**Figure 3**

*Model 1 to predict student autonomy considering the use of social networks*

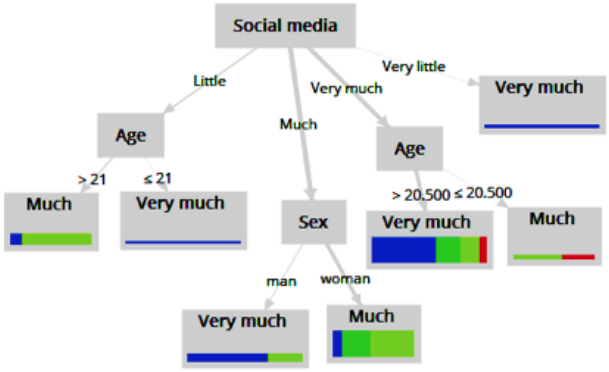



Age determines how social networks and the use of digital tools are related for student autonomy. For example, if the student thinks that social networks facilitate learning very much and has an age ≤ 20.5 years, then digital tools facilitate autonomy in the educational field much.

The results of the deep learning algorithm with 60% (0.031), 70% (0.043) and 80% (0.131) of the sample indicate that Hypothesis 2 is accepted. Social networks positively impact the exchange of ideas.

Figure 4 presents Model 2 on social networks to predict the exchange of ideas. The random forest algorithm determined seven predictive conditions. For example, if the student thinks that social networks facilitate learning very much and has an age > 20.5 years, then digital tools facilitate the exchange of ideas in the educational field very much.

**Figure 4**
*Model 2 to predict the exchange of ideas considering the use of social networks*




Sex and age determine how social networks and the use of digital tools for the exchange of ideas are related. For example, if the student thinks that social networks facilitate learning very much and has an age ≤ 20.5 years, then digital tools facilitate the exchange of ideas in the educational field much.

According to the university students surveyed, social networks are useful to review the material, postings, comments and information of courses.

"It is useful to keep informed about courses."

"Social networks are useful for distance education."

Social networks allow teachers and students to communicate from anywhere during the learning process These technological tools also facilitate the dissemination of school information.

"It serves to establish communication between teachers and students."

"It is a good tool for the dissemination of information."

In addition, social networks allow students to consult the multimedia resources of the courses.

"Multimedia content is easier to handle."

"When educational content is disseminated on the networks, the information is very attractive."

Finally, the use of social networks promotes collaborative learning and the exchange of ideas in virtual modality.

"They have become tools that allow collaborative learning, involve

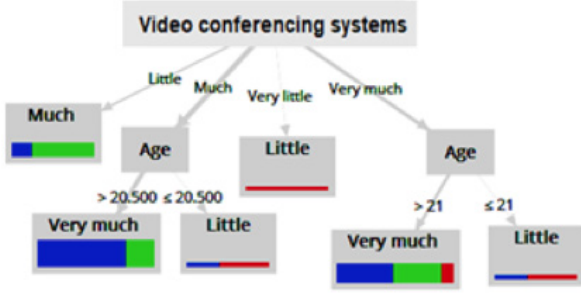
spaces for the exchange of information and encourage cooperation."
"They are dynamic and serve to share interesting content."

### Video conferencing systems

Video conferencing systems facilitate learning very much ($n$ = 35, 33.98%), much ($n$ = 45, 43.69%), little ($n$ = 20, 19.42%) and very little ($n$ = 3, 2.91%) (See Table 3). The results of the deep learning algorithm with 60% (0.126), 70% (0.055) and 80% (0.098) of the sample indicate that Hypothesis 3 is accepted (See Table 3). Video conferencing systems positively impact student autonomy.

Figure 5 shows Model 3 on video conferencing systems to predict student autonomy. The random forest algorithm determined five predictive conditions. For example, if the student considers that video conferencing systems facilitate learning very much and has an age > 21 years, then digital tools facilitate autonomy in the educational field very much.

**Figure 5**
*Model 3 to predict student autonomy considering the use of video conferencing systems*



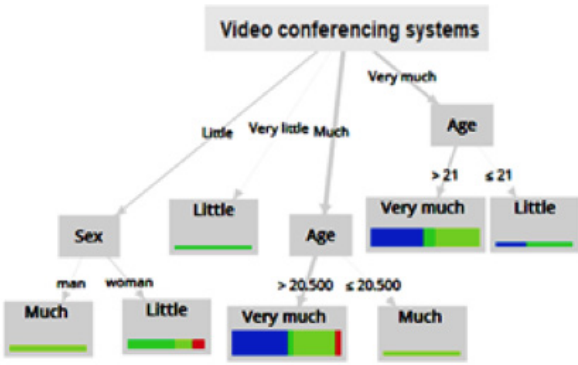

Age determines how video conferencing systems and the use of digital tools are related for student autonomy. For example, if the student considers that video conferencing systems facilitate learning much and has an age > 20.5 years, then digital tools facilitate autonomy in the educational field very much.

The results of the deep learning algorithm with 60% (0.373), 70% (0.257) and 80% (0.380) of the sample indicate that Hypothesis 4 is accepted (See Table 3). Therefore, video conferencing systems positively impact the exchange of ideas.

Figure 6 shows Model 4 on video conferencing systems to predict the exchange of ideas. The random forest algorithm determined seven predictive conditions. For example, if the student considers that video conferencing systems facilitate learning very much and has an age > 21 years, then digital tools facilitate the exchange of ideas in the educational field very much.

**Figure 6**

*Model 4 to predict the exchange of ideas considering the use of video conferencing systems*




Age and sex determine how video conferencing systems and the use of digital tools for the exchange of ideas are related. For example, if the student considers that video conferencing systems facilitate learning much and has an age ≤ 20.5 years, then digital tools facilitate the exchange of ideas in the educational field much.

According to the university students surveyed, video conferencing systems facilitate communication and allow interaction.

> "I consider that it is the main means of communication. It is the closest thing to a class between the students and teacher."
>
> "Necessary applications for the development of distance education."

As mentioned by the participants in this study, video conferencing systems allow classes to be recorded. Zoom has an interface that is very simple to use during the educational process.

> "Zoom is great since it allows recording the session. The interaction is not complicated. It is very intuitive to use."
>
> "They are wonderful, it is very easy to create a meeting."

Video conferencing systems allow a larger number of students to enrol in courses. Moreover, this technological tool allows the recording of classes, which can be consulted at any time.

> "They are extremely useful because they allow a greater number of people to take the courses. In addition, they allow the creation of support material for the following generations."
>
> "They are very useful for taking classes anywhere."

According to the participants of the study, video conferencing systems facilitate the realisation of classes in a virtual modality.

> "Very efficient for online classes."
>
> "They are very useful for distance classes."

Finally, the study presents teachers' responses to the question: What are the benefits of social networks and video conferencing systems in the educational field?

According to the teachers surveyed, social networks and video conferencing systems facilitate learning at any time.

> "These tools allow for more interactive work with students remotely."
>
> "They help students learn among peers."

These technological tools also facilitate the creation of virtual environments in which the student is the fundamental focus of the educational process.

> "These tools allow access to information at any time and encourage students to take an active role."
>
> "They help students act actively."

The benefits of the use of social networks and video conferencing systems include autonomy, motivation and participation during the teaching-learning process.

> "They foster autonomy in the user, spark interest and facilitate the retrieval of information that requires feedback."
>
> "These applications motivate students during the learning process and encourage participation."
>
> "They improve autonomy and skill development among students."

Teachers also believe that these communication tools facilitate the access and dissemination of content during the educational process.

> "The availability of materials online."

"Accessibility of classroom materials."
"They are easy to use and available at any time of day."

Finally, social networks and video conferencing systems facilitate communication between participants of the educational process from anywhere.

"Improved the teacher-student communication."
"To answer questions at different times. Communication is immediate between the participants."

## Discussion

Educators and institutions are currently transforming activities through new technological developments (Al-Balushi et al., 2022; Cerda-González et al., 2022**;** Dominguez-Castillo et al., 2022**;** Lena-Acebo et al., 2023). In the present study, 90.30% of the participants think that digital tools facilitate student autonomy in the educational field very much or much. Likewise, 78.64% of the students surveyed consider that digital tools facilitate the exchange of ideas in the educational field very much or much. Most of the participating university students have a favourable opinion on these aspects.

### Social networks

Today, teachers are looking for new tools such as social networks to create learning environments (Al-Balushi et al., 2022; Bendayan et al., 2024; García-García et al., 2023; Lundgren et al., 2022). In the present study, 82.52% of the students surveyed consider that social networks facilitate learning very much or much.

In educational institutions, the incorporation of social networks has increased due to their availability and ease of use (Bendayan et al., 2024; Lena-Acebo et al., 2023; Lundgren et al., 2022). According to the university students surveyed, social networks are useful to review the material, postings, comments and information of the courses. The results regarding Hypothesis 1 indicate that social networks positively impact student autonomy in the educational field, with a value of $p < 0.050$. The participating teachers believe that the use of social networks and video conferencing systems allows the creation of virtual environments in which the student is the fundamental focus of the educational process.

The students of the National Autonomous University of Mexico mention that social networks allow the communication and dissemination of

information. In Model 1, the random forest algorithm determined six conditions considering the students' profile. In particular, age determines how social networks and student autonomy are related. Furthermore, this model establishes three predictive conditions where digital tools facilitate student autonomy in the educational field very much.

As mentioned by Hasiloglu et al. (2020), teachers use social networks as tools to encourage interaction and collaboration. Similarly, the use of social networks at the National Autonomous University of Mexico allows students to consult the multimedia resources of the courses. The results on Hypothesis 2 indicate that social networks positively impact the exchange of ideas in the educational field, with a value of $p < 0.050$. In the present study, the educators surveyed state that the use of social networks and video conferencing systems in the teaching-learning process favours communication between participants from anywhere.

According to the participants, the use of social networks promotes collaborative learning and the exchange of ideas in virtual modality. In Model 2, the random forest algorithm determined seven conditions considering the students' profile. In particular, age and sex determine how social networks and the exchange of ideas are related. Furthermore, this model establishes four predictive conditions where digital tools facilitate the exchange of ideas in the educational field very much.

**Video conferencing systems**

As mentioned by Camilleri and Camilleri (2022), video conferencing systems such as Google Meet, Microsoft Teams and Zoom are technological tools that facilitate the presentation of school topics from anywhere. In the present study, 77.67% of the students surveyed think that video conferencing systems facilitate learning very much or much.

As Bailey (2022) establishes, the use of Zoom facilitates understanding of topics and analysis of school content. According to the students surveyed in the present study, video conferencing systems facilitate communication and interaction during virtual classes. The results on Hypothesis 3 indicate that video conferencing systems positively impact student autonomy in the educational field, with a value of $p < 0.050$. The teachers participating in the study believe that social networks and video conferencing systems facilitate the access and dissemination of school content from anywhere.

According to the participants, one of the advantages of video conferencing systems is the recording of classes to review the topics. In Model 3, the random

forest algorithm determined six conditions considering the students' profile. In particular, age determines how video conferencing systems and student autonomy are related. Furthermore, this model establishes two predictive conditions where digital tools facilitate autonomy in the educational field very much.

Zoom is a communication tool that allows the resolution of doubts in real time (Faner et al., 2022; Unal & Yilmaz, 2024; Walcott-Bedeau, 2022). Moreover, video conferencing systems have a simple, fast and useful interface for the educational field. The results on Hypothesis 4 indicate that video conferencing systems positively impact the exchange of ideas in the educational field, with a value of $p < 0.050$. In this sense, the educators from the NAUM believe that social networks and video conferencing systems facilitate learning at any time.

According to the participants of the present study, video conferencing systems facilitate the realisation of classes in a virtual modality. In Model 4, the random forest algorithm determined seven conditions considering the students' profile. In particular, age and sex determine how video conferencing systems and the exchange of ideas are related. Furthermore, this model establishes two predictive conditions where digital tools facilitate the exchange of ideas in the educational field very much.

Finally, the training section was modified with values of 60%, 70% and 80% of the sample to identify the best function to predict autonomy and the exchange of ideas. The lowest value related to the squared error ($e^2$) allows establishing the most significant function to predict these events, that is, the function of $y = 0.044x + 1.649$ with $e^2 = 0.636$ for model 1, the function of $y = 0.131x + 1.901$ with $e^2 = 0.819$ for model 2, the function of $y = 0.126x + 1.409$ with $e^2 = 0.629$ for model 3, and the function of $y = 0.380x + 1.098$ with $e^2 = 0.720$ for model 4.

## Conclusion

Universities are currently changing their teaching strategies supported by technological advances. In this study, the use of social networks and video conferencing systems favour the creation of educational spaces where the student is the protagonist of the teaching-learning process.

The deep learning algorithm allows the analysis of technological and educational phenomena in order to construct predictive models considering hyperparameters such as activation, training and evaluation section sizes, cycles and hidden layers. Similarly, the random forest algorithm facilitates the construction of trees to predict events.

The results of the deep learning algorithm indicate that social networks and video conferencing systems positively impact student autonomy and the exchange of ideas. This machine learning algorithm used the smallest value of the squared error to determine the forecast considering these technological tools. Educational interventions designed considering the support of these technological tools will therefore create a teaching-learning space where the student is autonomous and exchanges ideas.

This research proposes various functions for predicting student autonomy and the exchange of ideas based on the use of social networks and video conferencing systems in the educational context. All of the predictive models indicate a positive relationship between these study variables.

The random forest algorithm allowed the analysis of these technological tools considering sex and age. This machine learning algorithm used student autonomy and the exchange of ideas as the target or prediction variables.

The limitations of this mixed study are the dependent variables, the educational strategies and the sample size. Future research could analyse the use of social networks and video conferencing systems considering the active role, the development of skills, participation and collaborative work in various universities. Similarly, researchers could create predictive models that consider educational strategies through the deep learning and random forest algorithms.

Predictive models related to the use of social networks and video conferencing systems could consider the opinion of educators in order to predict variables associated with the teaching-learning process. Similarly, trees obtained from the random forest algorithm could use the characteristics of teachers to find various relationships between technology and the educational process.

Social networks facilitate use of multimedia resources, publication of school content and review of information, while video conferencing systems facilitate the realisation of classes in virtual modality through recordings and interaction. The present mixed research recommends the use of social networks and video conferencing systems during the organisation of educational interventions, as these technological tools favour the creation of virtual environments for teaching and learning.

Social media and video conferencing systems facilitate interaction between participants of the educational process. The results of the deep learning and random forest algorithms indicate that educators can use these technological tools to plan creative and dynamic activities that foster student autonomy and the exchange of ideas.

The surveyed teachers' opinions on the use of social networks and video conferencing systems indicate that these tools facilitate learning at any time,

access and dissemination of the content, creation of virtual environments and communication between participants in the educational process from anywhere.

In conclusion, teachers can incorporate social networks and video conferencing systems into the educational field to organise and implement new virtual spaces where students become the axis of the learning process.

## Ethical statement

This research study was approved by the Ethical Research Committee of the Institute of Applied Sciences and Technology, National Autonomous University of Mexico.

## Disclosure statement

The authors have no conflict of interest to declare.

## Acknowledgement

This work thanks the Data Science and Artificial Intelligence Laboratory for its support.

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