Students' perception about an educational application on Mathematics

RICARDO-ADÁN SALAS-RUEDA

Instituto de Ciencias Aplicadas y Tecnología
Universidad Nacional Autónoma de México
México
ricardo.salas@icat.unam.mx

Abstract

The aim of this mixed research is to analyze the students' perceptions about the use of the Web Application for the teaching-learning process on the T-Test (WATT) during the COVID-19 post-pandemic considering data science. The participants are 33 students from the National Autonomous University of Mexico (NAUM). The results of linear regression indicate that the simulator of WATT positively influences the learning, motivation, and active role. Finally, technological advances such as WATT facilitate the performance of the school activities from anywhere and promote the participation at any time.

Keywords

ICT, learning, data science, web application

Résumé

Le but de cette recherche mixte est d'analyser les perceptions des étudiants sur l'utilisation de l'application Web pour le processus d'enseignement-apprentissage sur le T-Test (WATT) pendant la post-pandémie COVID-19 en considérant la science des données. Les participants sont 33 étudiants de l'Université nationale autonome du Mexique (NAUM). Les résultats de la régression linéaire indiquent que le simulateur de WATT influence positivement l'apprentissage, la motivation et le rôle actif. Enfin, les avancées technologiques telles que WATT facilitent la réalisation des activités scolaires depuis n'importe où et favorisent la participation à tout moment.

Mots-clés
TIC, apprentissage, science des données, application web

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Introduction

According to Rafsanjani et al. (2022), COVID-19 caused educational institutions to modify the courses virtually. In fact, this virus provoked educators to rapidly transform the course content through technological tools (Unver & Sungur, 2022). Even the functions of the participants in the educational process were affected during this period (Burguete & Urrego, 2023; Drvodelic & Domovic, 2022; Javornik et al., 2022). For example, educators incorporated web simulators in the Mathematics and Statistics courses to encourage the personalized learning (Salas-Rueda & Alvarado-Zamorano, 2022).

Information and Communication Technologies (ICTs) such as web applications, educational strategies and pedagogical models improve the learning conditions in the distance modality (Kaniawati et al., 2021; Jiménez-Becerra & Segovia-Cifuentes, 2020; Salas-Rueda & Alvarado-Zamorano, 2022). At universities, high schools, secondary schools and elementary schools, professors are being trained through the courses about the integration of tools in the educational field (Beach et al., 2021; Vittorini & Galassi, 2021; Yao, 2024). In the courses of mathematics, educators use GeoGebra to facilitate the learning about functions (Yao, 2024).

Educational institutions promote the use of technological tools to improve the educational quality, offer flexibility of time and space, favor the active participation, and promote the personalized learning (Bogiannidis et al., 2022; Casillas-Martín et al., 2020; Zhang, 2019). For example, educators use web applications and Learning Management Systems (LMS) to organize new student-centered activities (Bogiannidis et al., 2022; Chou et al., 2019; Kulikowski et al., 2021; Xu et al., 2020). According to Salas-Rueda and Alvarado-Zamorano (2022), the incorporation of web simulators in the Mathematics and Statistics courses allows that students learn at their own pace from anywhere.

Zhou et al. (2022) mention that the incorporation of ICTs in the educational institutions positively influences the behavior of the students outside and inside the classroom. Also, teachers organize and carry out creative school activities and laboratory practices with the support of technological advances to increase the motivation (Doo, 2022; Wang & Lyu, 2021; Zhou et al., 2022). According to Van-Borkulo et al. (2023), the Excel sheet is essential in the teaching-learning process about statistics.

The incorporation of technological tools in the educational field can be analyzed considering the aspects of Learning (Chaisriya et al., 2023; Hu & Raman, 2024), Motivation (Choi et al., 2024; Sung & Huang, 2024) and Active role (Chaisriya et al., 2023; Gómez-García et al., 2022) to evaluate the perception of the students during the educational intervention.

During the COVID-19 pandemic, students developed new technological skills due to the use of educational tools (Hu & Raman, 2024; Glasserman-Morales et al., 2024). For this reason, educators design new applications that facilitate the learning from anywhere and at any time. At the National Autonomous University of Mexico (NAUM), the professor of the Teaching of Mathematics II course decided to update the educational process through the incorporation of technology. In particular, WATT presents the data simulation for the calculation on the mean, standard deviation, statistical error and statistical value t.

The benefits about the web simulator of WATT are the autonomy and control of the educational process from anywhere because the students learn at their own pace. The general aim of this mixed research is to analyze the students' perceptions about the use of WATT considering the decision tree and linear regression techniques (data science).

Use of technology in the teaching-learning process

Videos, web platforms and tools are changing the communication and interaction in the educational institutions (Georgieva-Tsaneva, 2021; Jebli et al., 2021; Vittorini & Galassi, 2021). In the English course, the use of multimedia resources, educational software and web applications facilitated the learning and allowed the development of grammatical and verbal skills (Zhou et al., 2022). Even pedagogical models such as Flipped Classroom (FC) favor the active role before, during and after the face-to-face sessions by consulting the videos and using ICTs (Doo, 2022).

Various authors (e.g., Kaniawati et al., 2021; Georgieva-Tsaneva, 2021; Jebli et al., 2021; Wang & Lyu, 2021) improved the teaching and learning process through the design and construction of technological tools. For example, Wang and Lyu (2021) created an application to facilitate the learning in the Music course. Similarly, Georgieva-Tsaneva (2021) designed and built an educational software to improve the understanding of biomedical data, develop the clinical skills and enhance the learning on heart rhythm.

In the Physics course, Kaniawati et al. (2021) built an application to assimilate the knowledge on force and vibration, develop the mathematical skills and facilitate the active role. In fact, these participants increased their motivation through the simulations about simple harmonic motion.

In the field of computing, Jebli et al. (2021) built an intelligent system to facilitate

the teaching on UML Diagrams. Finally, technological advances favor the creation and organization of new virtual spaces where the student acquires a main role (Georgieva-Tsaneva, 2021; Kaniawati et al., 2021; Wang & Lyu, 2021).

Technological tools in the mathematics and statistics courses

Technological tools favor the active role of the participants during the teaching-learning process about mathematics and statistics (Lavidas et al., 2020; Salas-Rueda et al., 2020; Vásquez et al., 2023). For example, Salas-Rueda et al. (2020) built a web game called Web Game On Descriptive Statistics (WGODS) to facilitate the understanding of the topics on the frequency calculation. In fact, this tool allowed the personalized learning, active role, and autonomy in the Statistics course (Salas-Rueda et al., 2020).

Yao (2024) incorporated GeoGebra in the school activities in order to develop the skills on function graphing, facilitate the learning through mobile devices, and increase the motivation during the Mathematics course.

In the Mathematics and Statistics courses, educators rely on technological applications such as STEP, DESMOS, WIMS and Labomep to create fun and useful educational spaces (Trgalová & Tabach, 2023).

In the Financial Mathematics course, the technological tool called Web Application for the Teaching-Learning Process on Bank Savings (WATLPBS) facilitated the learning about bank savings and interest through the web simulator (Salas-Rueda & Alvarado-Zamorano, 2022).

In the secondary schools, the students rely on spreadsheets to understand the statistics topics and resolve the doubts about the exercises (Van-Borkulo et al., 2023). Likewise, these participants developed their technological skills through the use of the formulas in the spreadsheet.

Finally, technological tools are changing the interaction in the Mathematics and Statistics courses because students assume the main role during the teaching-learning process before, during and after the virtual or face-to-face classes (Gattupalli et al., 2023; Sun 2023; Van-Borkulo et al., 2023).

Software to calculate the t-test

Nowadays, students can rely on technological tools such as XLSTAT, SPSS, and EXCEL to calculate the mathematical operations related to the T-Test, ANOVA-Test, and Linear Regression (Cascante-Calderón & Villacís-Altamirano, 2022; Rivadeneira-Pacheco et al., 2020; Vidal et al., 2020).

In the field of statistics, the XLSTAT software allows calculating the T-test to solve

various everyday problems such as food quality (Vidal et al., 2020). However, this program requires the purchase of a license and doesn't show the detailed procedure to calculate the T-Test.

Cascante-Calderón and Villacís-Altamirano (2022) explains that the Excel spreadsheet allows dentistry problems to be solved using the T-Test. In fact, students can use various formulas to calculate the T-Test or use the "Data Analysis" option to obtain the results without the detailed procedure.

Likewise, the SPSS software is used to solve a wide variety of science-related problems considering the quantitative and qualitative approaches (Rivadeneira-Pacheco et al., 2020). Finally, this paid software allows calculating the T-test without showing the detailed procedure.

Research questions

The research questions are:

- How does the simulator of WATT influence the learning, motivation, and active role of the students?
- What are the models about WATT and the characteristics of the participants considering the decision tree technique?
- What are the perceptions of the students about the use of WATT in the educational field?

Method

This study uses the mixed approach. The particular aims are (1) build WATT, (2) analyze the use of WATT for the learning, motivation and active role through the linear regression technique, (3) build the predictive models about the use of WATT through the decision tree technique, and (4) analyze the students' perceptions about the use of WATT during the COVID-19 pandemic.

The participants are 33 students (8 women and 25 men) enrolled in the Faculty of Sciences at the National Autonomous University of Mexico. The average age is 22.12 years. This sample is not probabilistic.

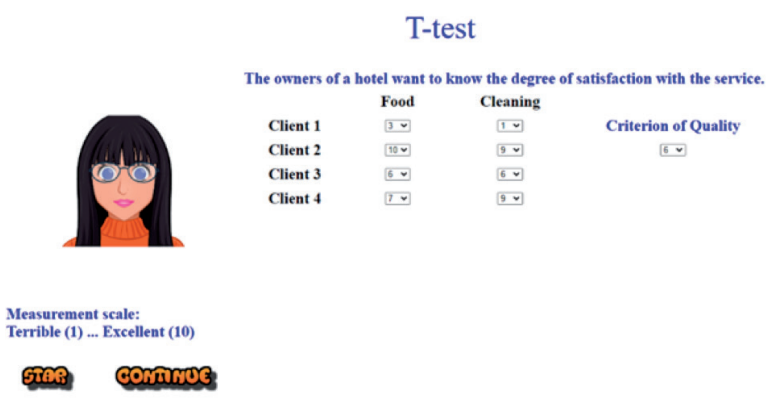
Procedure

In the field of Statistics, it is necessary that educators seek new technological-educational strategies to facilitate the teaching process and encourage the students' interest in learning (Salas-Rueda et al., 2020). In the Statistics courses, students have trouble to understand the topics about the T-Test because they don't understand the steps necessary to perform this mathematical calculation. For this reason, the construction

of WATT is valuable for the field of mathematics because this web application presents the detailed procedure on the use of the T-Test through the simulator. This tool allowed students to learn at their own pace, increase their motivation through the web simulator and promotes the active role through interaction with the web interface.

The professor of the Teaching Mathematics II course decided to improve the educational process through the design and construction of the WATT which is available at http://sistemasusables.com/2022/sistema3/inicio.html (see Figure 1).

Figure 1



WATT

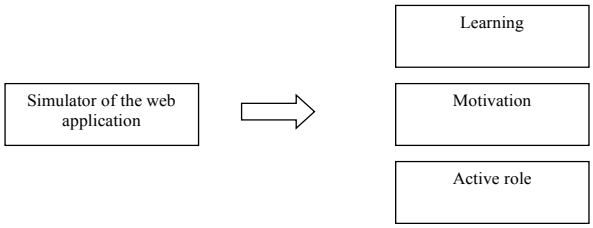
WATT presents the data simulation for the calculation on the mean, standard deviation, statistical error and statistical value t (see Figure 2). It is important to mention that programs such as XLSTAT, SPSS and EXCEL allow performing the calculation on the T-Test. However, these programs are not free and don´t present the detailed mathematical procedure.

FIGURE 2

Simulator of WATT

Figure 3 shows the proposed model to analyze the use of WATT.

FIGURE 1



Model used in this research

Various authors (e.g., Ergul-Aydin et al., 2021; Kassymova et al., 2023; Meyer et al., 2021) mention that educational institutions incorporate technological tools to improve the teaching and learning. For example, Trgalová and Tabach (2023) explain that educators use web applications to facilitate the learning about mathematics and statistics. In this research, the learning variable refers to the understanding and use of mathematical formulas to calculate the T-Test. Therefore, Hypothesis 1 is: The simulator of WATT positively influences the learning.

Likewise, technological applications allow the construction of virtual spaces that motivate the students during the educational process (Ecalle et al., 2021; Kassymova et al., 2023; Upadhayaya et al., 2021). In fact, the use of Web applications allows the student to learn, develop mathematical skills and be motivated during the school activities (Yao, 2024). Therefore, Hypothesis 2 is: The simulator of WATT positively influences the motivation during the learning process.

Today, students increase their participation through ICTs (Kassymova et al., 2023; Nguyen et al., 2021; Upadhayaya et al., 2021; Yurdal et al., 2021). In addition, Salas-Rueda et al. (2020) highlight the importance of using technological tools in the Statistics courses because students acquire an active role during the teaching-learning process. Therefore, Hypothesis 3 is: The simulator of WATT positively influences the active role during the learning process

On the other hand, the decision tree technique allows identifying the following predictive models about the use of WATT:

- Predictive Model 1 (PM1) about WATT and learning
- Predictive Model 2 (PM2) about WATT and motivation
- Predictive Model 3 (PM3) about WATT and active role

Data collection

Table 1 presents the questionnaire about WATT used to collect the information during the month of November 2021. The independent variable is Simulator of the web application. On the other hand, the dependent variables are Learning, Motivation and Active role. The answers to the questions are very much (1), much (2), little (3) and very little (4) in order to optimally classify the information for the Decision Tree algorithm. Educators of mathematics and statistics courses consider that it is important analyze technological-educational phenomena considering the aspects of Learning, Motivation and Active role because these criteria can be used to evaluate the educational intervention.

TABLE 1

Questionnaire about the use of WATT

No.	Variable	Dimension	Question	Answer	n	%
1	Profile of the students	Sex	1. What is your sex?	Man	25	75.76%
				Woman	8	24.24%
		Age	2. What is your age?	21 years	6	18.18%
				22 years	19	57.58%
				23 years	6	18.18%
				24 years	2	6.06%
2	WATT	Simulator of the web application	3. The simulator of the web application facilitates the education from anywhere	Very much (1)	11	33.33%
				Much (2)	20	60.61%
				Little (3)	2	6.06%
				Very little (4)	0	0.00%
		Learning	4. The web application facilitates the learning	Very much (1)	10	30.30%
				Much (2)	22	66.67%
				Little (3)	1	3.03%
				Very little (4)	0	0.00%
		Motivation	5. The web application increases the motivation during the learning process	Very much (1)	5	15.15%
				Much (2)	24	72.73%
				Little (3)	4	12.12%
				Very little (4)	0	0.00%
		Active role	6. The web application increases the active role during the learning process	Very much (1)	7	21.21%
				Much (2)	24	72.73%
				Little (3)	2	6.06%
				Very little (4)	0	0.00%
3	Perception of the students	WATT	7. Do you consider that the web application is useful during the COVID-19 pandemic?	Open question	-	-

Table 2 shows the values to validate the questionnaire about the use of WATT in the educational field.

TABLE 2

Validation of the questionnaire

Variable	Dimension	Load factor	Average Variance Extracted	Cronbach's Alpha	Composite Reliability
WATT	Simulator of the web application	0.692	0.405	0.651	0.729
	Learning	0.555			
	Motivation	0.700			
	Active role	0.587			

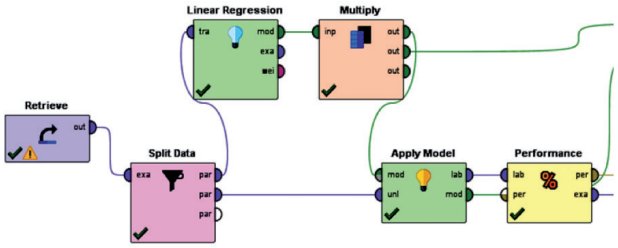
Data analysis

The RapidMiner tool allows calculating the linear regressions and building the models about the use of WATT. Salas-Rueda and Alvarado-Zamorano (2022) explain that the linear regression algorithm allows identifying the functions that most accurately predict educational phenomena through the evaluation section. Likewise, the training section uses the independent and dependent variables to calculate the linear regression.

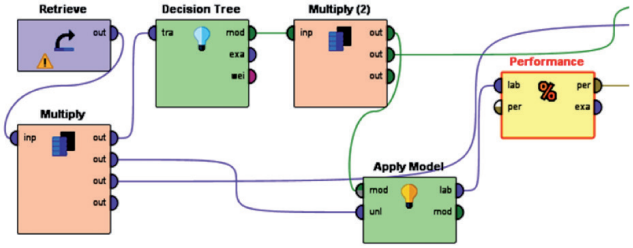
In machine learning, 70%, 80%, and 90% of the sample (training section) allow calculating the linear regressions. Also, 30%, 20% and 10% of the sample (evaluation section) allow identifying the accuracy of these regressions.

According to Salas-Rueda et al. (2020), the decision tree algorithm uses the independent variable to identify the predictive conditions on the dependent variables (target variable) considering the profile of the students. In this study, the sex and age of the students allow the construction of the models about WATT through the decision tree technique (see Figure 4).

FIGURE 4



(a) Linear regression



Use of RapidMiner tool

RESULTS

The simulator of WATT facilitates very much (n=11, 33.33%), much (n=20, 60.61%) and little (n = 2, 6.06%) the education from anywhere (see Table 1). Also, the results of the linear regression technique indicate that the simulator of WATT positively influences the learning, motivation, and active role (see Table 3).

TABLE 3

Linear regression technique

Hypothesis	Training	Linear regression (machine learning)	Conclusion	Value of t	Squared error
HI: Simulator of WATT → learning	70%	y = 0.323x + 1.205	Accepted HI: 0.323	1.566	0.404
	80%	y = 0.395x + 1.069	Accepted HI: 0.395	2.108	0.600
	90%	y = 0.340x + 1.106	Accepted HI: 0.340	1.707	0.498

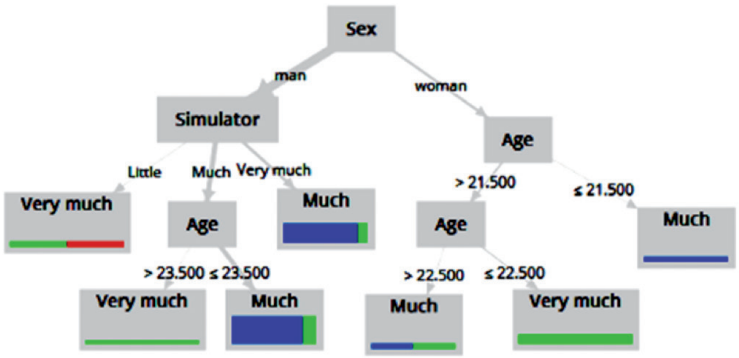
Hypothesis	Training	Linear regression (machine learning)	Conclusion	Value of t	Squared error
H2: Simulator of WATT → motivation	70%	y = 0.655x + 0.651	Accepted H2: 0.655	2.452	0.470
	80%	y = 0.499x + 1.000	Accepted H2: 0.499	2.140	0.440
	90%	y = 0.590x + 0.803	Accepted H2: 0.590	3.015	0.538
H3: Simulator of WATT → active role	70%	y = 0.264x + 1.441	Accepted H3: 0.264	1.267	0.384
	80%	y = 0.197x + 1.534	Accepted H3: 0.197	0.984	0.346
	90%	y = 0.170x + 1.553	Accepted H3: 0.170	0.836	0.287

Learning on statistics

The web application facilitates very much (n=10, 30.30%), much (n=22, 66.67%) and little (n=1, 3.03%) the learning (see Table 1). Furthermore, the results of machine learning with 70% (0.323), 80% (0.395) and 90% (0.340) of training indicate that Hypothesis 1 is accepted (see Table 3). Therefore, the simulator of WATT positively influences the learning.

Figure 5 shows 7 conditions of the PMI, accuracy of 84.85%. For example, if the participant considers that the simulator of WATT facilitates much the education from anywhere, has an age > 23.5 years and is a man then this web application facilitates very much the learning.

FIGURE 5



PM I about the use of WATT

Also, the sex establishes 7 conditions. For example, if the participant considers that the simulator of WATT facilitates very much the education from anywhere and is a man then this web application facilitates much the learning.

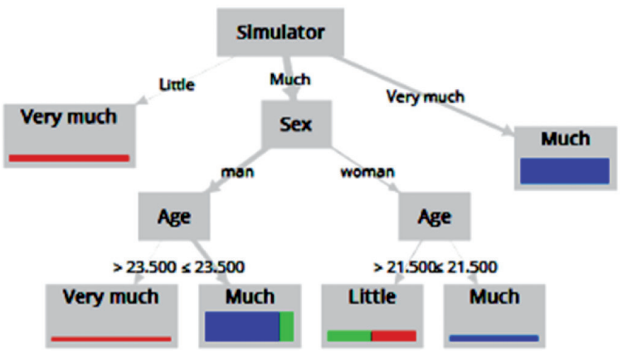
On the other hand, the age establishes 5 conditions of the PMI. For example, if the participant considers that the simulator of WATT facilitates much the education from anywhere, has an age ≤ 23.5 years and is a man then this web application facilitates much the learning.

Motivation

The web application increases very much (n=5, 15.15%), much (n=24, 72.73%) and little (n=4, 12.12%) the motivation during the learning process (see Table 1). The results of machine learning with 70% (0.655), 80% (0.499) and 90% (0.590) of training indicate that H2 is accepted (See Table 3). Therefore, the simulator of WATT positively influences the motivation.

Figure 6 shows 6 conditions of the PM2, accuracy of 87.88%. For example, if the participant considers that the simulator of WATT facilitates much the education from anywhere, has an age ≤ 23.5 years and is a man then this web application increases much the motivation during the learning process.

FIGURE 6



PM2 about the use of WATT

Also, the sex establishes 4 conditions. For example, if the participant considers that the simulator of WATT facilitates much the education from anywhere, is a woman and has an age ≤ 21.5 years then this web application increases much the motivation.

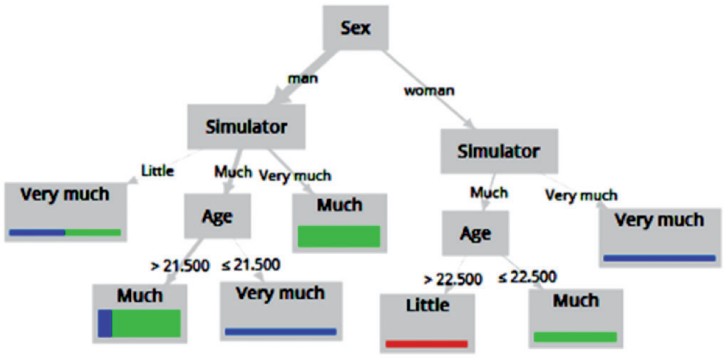
The age of the students determines 4 conditions of the PM2. For example, if the participant considers that the simulator of WATT facilitates much the education from anywhere, is a man and has an age > 23.5 years then this web application increases very much the motivation during the learning process.

Active role

The web application increases very much (n=7, 21.21%), much (n=24, 72.73%) and little (n=2, 6.06%) the active role during the learning process (see Table 1). Also, the results of machine learning with 70% (0.264), 80% (0.197) and 90% (0.170) of training indicate that Hypothesis 3 is accepted (See Table 3). Therefore, the simulator of WATT positively influences the active role during the learning process.

Figure 7 shows 7 conditions of the PM3, accuracy of 90.91%. For example, if the participant considers that the simulator of WATT facilitates very much the education from anywhere and is a man then this web application increases much the active role.

FIGURE 7



PM3 about the use of WATT

Also, the sex establishes 7 conditions. For example, if the participant considers that the simulator of WATT facilitates very much the education from anywhere and is a woman then this web application increases very much the active role.

The age of the students establishes 4 conditions of the PM3. For example, if the participant considers that the simulator of WATT facilitates much the education from anywhere, is a woman and has an age ≤ 22.5 years then this web application increases much the active role.

Perception

According to the students of the Faculty of Sciences, WATT allowed improving the quality of the learning process and updating the school activities during the COVID-19 pandemic. "Yes, it is a useful tool in the context of the pandemic because I can learn through the simulator" (Student 2, woman, 22 years old). "Yes, because it is not easy to learn from home and not all teachers have the resources to teach the distance classes" (Student 5, woman, 23 years old).

The advantages about the incorporation of the WATT in the educational field are the flexibility of space and time to consult the school contents related to the T Test and the autonomy of the students. "Yes, because it is an easily accessible tool and I can work remotely" (Student 1, man, 21 years old). "Yes, students can use this tool to learn" (Student 30, woman, 22 years old).

During the COVID-19 post-pandemic, educators used technological advances to facilitate the learning process. In fact, WATT facilitated the understanding of the issues and formulas related to the T-Test. "Yes, it is useful and allows learning the topic about the T-Test. Also, it is easy to use (Student 20, man, 20 years old). "Yes, it is very useful. It allowed that education continues" (Student 27, man, 20 years old).

According to the students of the National Autonomous University of Mexico, WATT facilitated the learning of the topics on the mean, standard deviation, statistical error and statistical value t in the distance modality. "Yes, because I learned how to calculate the T-test from home" (Student 9, man, 22 years old). "Yes, because it allows the distance learning" (Student 25, man, 22 years old).

Discussion

Technological tools are changing the implementation of the educational process (Arora & Arora, 2021; Nacak et al., 2020; Yurdal et al., 2021). According to 60.61% of students, the simulator of WATT facilitates much the education from anywhere. The findings from this study suggest that WATT transformed the teaching and learning process in the field of statistics by the data simulation on the mean, standard deviation, statistical error and statistical value t. For example, the simulator of WATT facilitates very much (n=11, 33.33%) the education from anywhere. Therefore, the majority of the participants (93.94%) have a favorable opinion. In the current literature, the incorporation of technological applications allows the updating of courses in the distance modality during the COVID-19 post-pandemic (Alduraywish et al., 2022; Ebenezer et al., 2022; Garcez et al., 2022).

Learning

Various authors (e.g., Ergul-Aydin et al., 2021; Hawamdeh & Soykan, 2021; Meyer et al., 2021) mention that the incorporation of technological tools in the educational field facilitates the assimilation of knowledge, active role and development of skills. According to the participants (66.67%), WATT facilitates much the learning. One of the advantages of this web application is the personalization of learning, that is, the student learns at their own pace. Likewise, this web application facilitates very much (n=10, 30.30%) the learning. Therefore, the majority of the participants (96.97%) have a favorable opinion.

The use of technological tools in the field of mathematics improves the teaching-learning conditions (Sengil-Akar & Kurtoglu-Erden, 2021; Skaik & Tumpa, 2022). During the COVID-19 post-pandemic, WATT facilitated the understanding of the issues and formulas related to the T-Test.

According to Trgalová and Tabach (2023), technology plays a fundamental role in the educational field because educators create useful teaching-learning spaces. The results about H1 are higher than 0.320, therefore, the simulator of WATT positively influences the learning.

Data science determines 7 conditions of the PM1 with an accuracy greater than 84.00%. The age and sex establish how the simulator of WATT influences the learning.

Motivation

The use of technological tools favors the construction and planning of educational spaces where students are motivated (Aydin et al., 2021; Ecalle et al., 2021; Mwangi, 2021). According to 72.73% of the students, WATT increases much the motivation. In the present study, the benefits of this application in the educational field are related to the flexibility of time and space for carrying out the school activities. WATT increases very much (n=5, 15.15%) the motivation during the learning process. As a result, the majority of the respondents (87.88%) have a favorable opinion.

Likewise, the use of technological tools allows the organization of new activities in the distance modality (Aldossary, 2021; Phan et al., 2022; Sengil-Akar & Kurtoglu-Erden, 2021). According to the students of the National Autonomous University of Mexico, WATT facilitated the learning of the topics on the mean, standard deviation, statistical error and statistical value t in the distance modality.

According to Yao (2024), the incorporation of technological tools in the fields of Mathematics and Statistics creates virtual spaces where the student is motivated during the educational process. The results about H2 are higher than 0.490, therefore, the simulator of WATT positively influences the motivation during the learning process.

Data science determines 6 conditions of the PM2 with an accuracy greater than 87.00%. The age and sex establish how the simulator of WATT influences the motivation.

Active role

Teachers use technological tools to facilitate the participation from anywhere (Arora & Arora, 2021; Aydin et al., 2021; Mwangi, 2021). According to 72.73% of the students, WATT increases much the active role during the learning process. Technological advances such as WATT allow the consultation of the information from home, office and work (Aydin et al., 2021; Mwangi, 2021). Likewise, WATT increases very much (n=7, 21.21%) the active role. Therefore, the majority of the participants (93.94%) have a favorable opinion.

In the field of mathematics, the students actively participate with the support of

ICTs (Abuhassna et al., 2022; García et al., 2022; Sengil-Akar & Kurtoglu-Erden, 2021). According to the students of the Faculty of Sciences, WATT allowed improving the quality of the educational process and updating the school activities during the COVID-19 post-pandemic.

As mentioned by Salas-Rueda et al. (2020), web applications favor the active role of the students during the Statistics courses because the student has control of the learning process. The results about H3 are higher than 0.160, therefore, the simulator of WATT positively influences the active role during the learning process.

Data science determines 7 conditions of the PM3 with an accuracy greater than 90.00%. The age and sex establish how the simulator of WATT influences the active role.

Finally, this study suggests that web applications such as WATT play a fundamental role to innovate the educational practices in the distance modality, improve the learning process during the COVID-19 post-pandemic and promote the personalized learning from any place.

Conclusion

Educators look for new technological options to facilitate the teaching and learning process in the distance modality. In the Statistics courses, students have trouble to understand the topics about the T-Test. For this reason, the construction of WATT is valuable for the field of mathematics because this web application presents the detailed procedure on the use of the T-Test through the simulator.

In particular, WATT presents the simulation of data for the calculation on the mean, standard deviation, statistical error and statistical value t. The results indicate that the simulator of WATT positively influences the learning, motivation, and active role. This tool allowed students to learn at their own pace, increase their motivation through the web simulator and promotes the active role through interaction with the web interface.

This research recommends the incorporation of tools in the educational field to facilitate the learning process. For example, WATT is a technological tool that allows meeting the educational needs during the COVID-19 post-pandemic because the students learn at their own pace and review the school topics at any time.

The limitations of this research are the sample size, data science techniques and analysis about the use of WATT for the learning, motivation, and active role. Therefore, future research can analyze this web application for the development of mathematical skills and assimilation of knowledge about the T Test in various educational institutions such as universities, high schools, and secondary schools. Likewise, future studies can analyze the perception of professors about the benefits of WATT in the distance modality through the neural networks technique.

In conclusion, the design and construction of technological tools facilitate the learning and promote the participation at any time. In particular, WATT is an educational web application that favors the distance learning and encourages the active role during the educational process.

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