ISSN 2523-2509

Volume 6, Issue 15 – January – June – 2022

Journal Educational Theory

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Journal Educational Theory, Volume 6, Issue 15, January – June 2022, is a journal edited semestral by RINOE. La Raza Av. 1047 No.-Santa Ana, Cusco. Peru. Postcode:11500, WEB: www.rinoe.org journal@rinoe.org. Editor in Chief: VALDIVIA - ALTAMIRANO, William Fernando. PhD. ISSN-2523-2509. Responsible for the latest update of this number RINOE Computer Unit. ESCAMILLA-BOUCHÁN, Imelda. PhD. LUNA SOTO, Vladimir. PhD. La Raza Av. 1047 No.-Santa Ana, Cusco-Peru.Postcode: 11500 last updated June 30, 2022.

Journal Educational Theory

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The works must be unpublished and refer to topics of Education economics, school demography, education history, education sociology, education philosophy and other topics related to Humanities and Behavioral Sciences.

Presentation of Content

In the first article we present, *Dual training and its impact on university student learning* by ESPERICUETA-MEDINA, Marta Nieves, SÁNCHEZ-RIVERA, Lilia, VILLARREAL-SOTO, Blanca and RODRÍGUEZ-MARTÍNEZ, Nidia Gisela, with adscription in the Universidad Autónoma de Coahuila, as the netx article we present, *Tree to predict if students want to continue with their high school studies by implementing machine learning* by LÓPEZ-GARCÍA, Lourdes, with adscription in the Tecnológico Nacional de México, Campus León, as the netx article we present, *Virtual Learning Environments: University faculty experiences during and after the COVID 19 pandemic* by AMAVIZCA-VALDEZ, Laura Olivia, GÁMEZ- WENDLANDT, Julio César, VAZQUEZ- MORENO, Erika Ercilia and TOLANO-GUTIERREZ, Helga Karina, with adscription in the Universidad Tecnológica del Sur de Sonora, as the last article we present, *Life-history in musical research. Leo Brouwer: A case study* by JUAN-CARVAJAL, Mara Lioba, JUAN-CARVAJAL, Dargen Tania, VDOVINA, María, with adscription in the Universidad Autónoma de Zacatecas and the Universidad de las Artes.

Content

Article **Journal Educational Theory**
June, 2022 Vol.6 No.15 1-5

Dual training and its impact on university student learning

La formación dual y su impacto en el aprendizaje del estudiante universitario

ESPERICUETA-MEDINA, Marta Nieves†, SÁNCHEZ-RIVERA, Lilia*, VILLARREAL-SOTO, Blanca and RODRÍGUEZ-MARTÍNEZ, Nidia Gisela

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DOI: 10.35429/JET.2022.15.6.1.5 Received March 14, 2022; Accepted June 29, 2022

Abstract

The general objective of the article was to relate the sport with the academic performance of the students of the Bachelor of Science, Education, and Humanities and of the Faculty of Engineering of the Autonomous University of Coahuila. It was a quantitative, cross-sectional, and correlational study. 80 subjects answered the survey, by means of a non-probabilistic sample for convenience. The central hypothesis was: There is a relationship between sport and academic performance. The working hypotheses: H1. There are significant differences between gender and the variables to be contrasted. H2. There are significant differences between the faculties and the variables to be contrasted. Statistical analyzes were performed: frequencies and percentages, comparative, correlation, and exploratory factorial. The contribution of the study lies in the fact that when the student body practices sports, it increases their concentration, makes it easier for them to integrate with their peers, improves their academic performance, and their studies, and allows them to prioritize their classes, which generates good evaluations. It can be said that, to the extent that the student community performs physical training, they improve their academic results and face situations positively as well as their emotions.

Sport, Academic Performance, Higher Education

Resumen

La presente investigación pretende conocer la relación que existe entre el modelo de formación dual y el modelo constructivista respecto al aprendizaje de los estudiantes de las maestrías en Ingeniería de Sistemas y Operacionalización y la maestría en Dirección y Gestión Educativa del Instituto Universitario del Norte. Los principales beneficiarios serán los estudiantes y profesores de la de la institución ya mencionada ya que serán quienes, a través de los resultados, procederán a analizar cómo la formación dual es un apoyo para los estudiantes en el ámbito laboral y cómo es que impactan las experiencias laborales en el aprendizaje de los profesionistas. Entre los resultados principales se encontró que cuando el docente aplica la didáctica de una forma creativa y esta es evaluada, los alumnos interactúan con sus compañeros y comprenden los temas haciendo con esto una sistematización en la forma de estudiar. Entre las propuestas de intervención se plantea que las empresas brinden más oportunidades a los estudiantes de maestría para que así tengan un campo laboral más amplio, así como que los estudiantes realicen exposiciones al público en general sobre los trabajos que han realizado a lo largo de su formación profesional para que así promuevan su trabajo.

Formación dual, Constructivismo, Aprendizaje, Maestría

Citation: ESPERICUETA-MEDINA, Marta Nieves, SÁNCHEZ-RIVERA, Lilia, VILLARREAL-SOTO, Blanca and RODRÍGUEZ-MARTÍNEZ, Nidia Gisela. Dual training and its impact on university student learning. Journal Educational Theory. 2022. 6-15: 1-5

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Introduction

The present research aims to find out the relationship between the dual training model and the constructivist model with respect to the learning of the students of the master's degrees in Systems Engineering and Operationalisation and the master's degree in Educational Management of the Instituto Universitario del Norte. The main beneficiaries will be the students and professors of the aforementioned institution since they will be the ones who, through the results, will proceed to analyse how dual training is a support for students in the workplace and how work experiences impact on the learning of professionals.

Dual training stands out because it serves as a basis for the students when they enter the work environment as they gain experiences, which will be useful for them in the workplace.

General objective

To find out the relationship between dual training and constructivism with the learning of students in the second and fourth trimester of the master's degree in Systems Engineering and Operationalisation and the master's degree in Educational Management of the Instituto Universitario del Norte.

Specific Objectives

– To recognise how students' learning strategies are characterised.
– To identify the relationship between dual training and constructivism with the learning of students in the second and fourth trimester of the master's degree in Systems Engineering and Operationalisation, as well as in the master's degree in Educational Management of the Instituto Universitario del Norte.

Theoretical framework

Dual training aims to develop students' theoretical and practical knowledge so that both can be applied in the labour field they intend to enter. Dual training for (Carolina, 2018) is given through the combination of theory and practice, young people get a solid foundation of skills and knowledge about the whole company.

This helps them so that when they graduate and join a company, they do not arrive at their area of work without prior knowledge, but know how the company works. Dual training and constructivism are linked because students take as a basis for their learning the experiences they acquire in the company and in the classroom, which they put into practice in these areas.

Constructivist theory can be defined as the solution to a problem by means of scaffolding, scaffolding can be defined as the orientations that a person has had throughout his or her life, as these facilitate new learning. According to (EcuRed, 2017), educational constructivism proposes a paradigm where the teaching process is perceived and carried out as a dynamic, participatory and interactive process of the subject, so that knowledge is an authentic construction operated by the person who learns. Constructivism highlights knowledge as a construction that each person creates through experiences in the realities in which they interact, which in turn must also be of interest to the person.

Dual training always goes hand in hand with constructivism and learning, since through these there is a change in the way of thinking of the subjects and they will construct new experiences that will be useful to them when finding a solution to a problem. Learning is constructed through the realities that are observed around oneself.

For Zepeda (2022) the dual training model in Mexico is built on the criteria and values of a reference model, but fails to consider the context in which the students are inserted.

For the continuous improvement of learning in the classroom it is indispensable that the teacher can cooperatively organise any didactic task, of any subject and within the syllabus, since in this way the student's knowledge is not hindered by people in the school. Learning according to (Johnson, 1994) is something that the students do, learning itself cannot be created for the students, so it is of utmost importance that when working in teams, the same objective is set, in order to obtain results that benefit the whole team, since in this way the knowledge is broadened and the student can realise what he/she does not know.

ISSN 2523-2509

While individualistic learning, in which students work on their own to achieve goals, only manages to create learning that is disconnected from that of other students, so that learning is not meaningful because it is not subjected to comparison with peers in the classroom.

Cooperative learning is the didactic use of small groups in which students work together to maximise their own learning and that of others. The above information will be taken into account for application to master's degree students, the majority of whom are adults.

The students studying for a master's degree are adults, (Academia Mexicana de la Lengua, 2014) explains that, in recent years, the word maestrando has begun to be used to designate the master's degree student who has not yet graduated.

Research Design

This is a perimental research of quantitative type, given that only one instrument is applied for data collection. In order to provide a contextualisation, statistical processing of frequencies and percentages, characterisation, comparison and correlation will be carried out.
Universe, Population and Sample

All students of the second and fourth trimester of the master's degree in Systems Engineering and Operationalisation and the master's degree in Educational Management of the Instituto Universitario del Norte.

Seventy subjects will be surveyed, of which 35 will be from the first and third trimester of the master's degree in Systems Engineering and Operationalisation and the rest from the master's degree in Educational Management of the Instituto Universitario del Norte.

Results

Frequencies and Percentages

The variable master's degree is characterised by the master's degree in which the respondents study, which are the master's degree in Systems Engineering and Operationalisation and the master's degree in Educational Leadership and Management at the Instituto Universitario del Norte.

Fifty percent of the respondents are in the Master's degree in Systems Engineering and Operationalisation and the remaining 50 percent are studying in the Master's degree in Educational Management and Administration.

Characterisation

It was observed that the relative frequency works with 45 variables and 70 subjects.

In the Z-reading, it is observed that most of the variables that make up the study phenomenon are predictors of the population are greater than (Z = 1.96). It is inferred that these variables can be extrapolated to other populations with equal characteristics, since they have the levels of form accepted by science.

With respect to Xx, it is observed that the variables that make up the study phenomenon such as interaction (5.37), process (6.36), didactics (6.34), student (6.31), facilitate (6.33), evaluate (6.84), participate (6.83), understanding (5.67) and study (6.49) are within the mean values (5, 6) and are within the range of normality (n-: 4.53 Xx: 7.00 n+: 9.47). It can be inferred that when the teacher applies didactics in a creative way and this is evaluated, the students interact with their classmates and understand the topics, thus making the study process more effective.

Correlation

The correlational analysis presented below was carried out on the basis of parametric statistics consisting of 45 variables, using the Pearson correlation in which the significance of p= .01, which corresponds to a correlation of r= 0.33.

Correlational behaviour of the Thinking variable

Next, it is observed that a relationship is built on the Thinking and Behaviour (r= 0.57) that the students have in the classroom since by means of this it is possible the Application (r= 0.42) of different types of activities that the teachers plan, thus giving a positive Feedback (r= 0.33) of their classes and a Development (r= 0.35) of the knowledge. It should be noted that the way people think and act in the face of the stimuli that surround them, helps them to carry out activities that guarantee learning in a physical and intellectual way.

ISSN 2523-2509

With respect to the variable Behaviour, it is observed that the students see the teacher as a Facilitator (r= 0.40) who guides the Development (r= 0.43) of their learning and that of their school Skills (r= 0.42), even so, he Evaluates (r= 0.34) their knowledge, which is what they see in the teacher. 34) their knowledge, which serves as a Reflection (r= 0.34) on the topics they see in class, the facilitator is always willing to give feedback (r= 0.44) to his students even if they do not have the necessary Interest (r= -0.34) in the class. It is highlighted that teachers are very important in the educational process as they are the ones who support the formation of each student, this is because it motivates them to use their skills and thoughts in relation to education, however, students are not always willing to take advantage of the above mentioned.

Comparison

Next, a t-test of statistical comparison is presented in which it is shown which are the significant differences between the independent variable and the group of variables, considering as independent variable master's degree, understanding that the master's degrees in Systems Engineering and Operationalisation and the master's degree in Educational Management of the Instituto Universitario del Norte are contrasted, taking as dependent variables those elements whose characteristics have a significance level of p = .05 and accepting the null hypothesis.

It is observed that the variable that represents a difference with respect to the mean is Programme, which refers to the fact that it is the teacher who carries out the planning of the activities presented in the class. Likewise, it can be read that the teachers who facilitate the class programme more to the students are from the Masters in Educational Management, since the mean of this is (X=7.74) while the mean of the Masters in Systems Engineering and Operationalisation is (X=6.60). It is inferred that the teachers of the Master's Degree in Educational Management and Administration present their class planning to the directors, but not to their students, which means that they do not always know what topics they will deal with during the classes.

It can be read that the variable that represents a difference with respect to the mean is Interest, since it is the importance that the students give to their classes. The mean of the Masters in Systems Engineering and Operationalisation is (X=7.94), which means that the students of this institution have a better academic performance, while the mean of the Masters in Educational Management is (X= 6.57). It can be deduced that the students of the master's degree in Systems Engineering and Operationalisation show interest in learning in the classroom and are also interested in problematic situations that arise in the school.

Integrnacional

An Exploratory Factor Analysis was carried out, consisting of 13 factors, which have been the result of the 45 variables presented in the research. The method of analysis of communalities = multiple R was used, from which the normalised varimax rotation was employed, which will allow us to observe the probability of 0.33 of the study phenomenon.

Interfactorial

The phenomenon is made up of 45 variables which, when used, result in a total of 13 factors where the eigenvalue is 1, giving a total factor load of 7 percent.

The graph below shows the relationships between the factors, which can be read as follows: factor 9, named Teacher Flexibility, is related to factor 6, named Efficient Preparation, by means of the variable courses; factor 6 is related to factor 2, named Education, by means of the variable courses; factor 6 is related to factor 2, which is named Education, by means of the variable courses; factor 6 is related to factor 3, which is named Education, by means of the variable courses; factor 4 is related to factor 5, which is named Education, by means of the variable courses, which is named Education, by means of the variable behaviour, factor 2 relates to factor 5, which is named School Councils, by means of the variable teaching, factor 5 relates to factor 1, named Suitability, by means of the variable company, factor 1 relates to factor 11, which is named Analyse, by means of the speciality variable, factor 11 is related to factor 10, which is named Stimulate Progress, by means of the motivation variable, factor 10 is related to factor 8.

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Which is named Enable Analysis, by means of the development variable, factor 8 is related to factor 7, named Attract Interest, by means of the skills variable, and factor 7 is related to factor 4, named Useful Relationship, by means of the application variable, however, there are three factors in which their relationship is null, they are factor 3, entitled Establishing Analogies, factor 12, named Encouragement to Collaborate, and factor 13, named Perseverance.

Conclusions

- People who are interested in further education like engineering and education equally.
- The variables can be extrapolated to other populations with equal characteristics as they have the levels of form accepted by science.
- When the teacher applies the didactics in a creative way and this is evaluated, the students interact with their peers and understand the topics, thus making a study process.
- The way people think and act in response to the stimuli that surround them helps them to carry out activities that ensure that they learn physically and intellectually.
- Teachers are very important in the educational process because they are the ones who support the formation of each student, this is because it motivates them to use their skills and thoughts in relation to education, however, students are not always willing to take advantage of the above.
- The teachers of the MA in Educational Leadership and Management present their lesson plans to the management, but not to their students, which means that the students do not always know what topics they will cover during the lessons.
- The teachers of the Master's degree in Educational Management present their lesson plans to the directors, but not to their students, which means that they do not always know what topics they will be dealing with during the lessons. The students of the master's degree in Systems Engineering and Operationalisation show interest in learning in class and are also interested in problem situations that arise in the school.

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ISSN 2523-2509

Article **Journal Educational Theory**
June, 2022 Vol.6 No.15 6-9

Tree to predict if students want to continue with their high school studies by implementing machine learning

Árbol de decisión para predecir si los alumnos quieren continuar con sus estudios de bachillerato implementando aprendizaje automático

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DOI: 10.35429/JET.2022.15.6.6.9 Received March 14, 2022; Accepted June 29, 2022

Abstract

The timely identification of students who do not wish to continue their high school studies is a problem that should be addressed urgently since it is possible to recognize those factors that are determining their decision, through the psychologists of the educational institutions can offer personalized advice to each student. To address this problem, a decision tree was developed using machine learning techniques to predict whether students are interested in continuing with their high school studies, a data set of student performance in secondary education was implemented. The data attributes include social demographic characteristics and are related to two schools, collected through school reports and questionnaires.

Decision tree, Machine learning, Data set

Resumen

La identificación a tiempo de los alumnos que no desean continuar sus estudios de bachillerato es una problemática que se debe abordar con urgencia ya que se pueden reconocer aquellos factores que están determinando su decisión, mediante los psicólogos de los planteles educativos se les puede ofrecer asesoramiento personalizado a cada estudiante. Para abordar dicha problemática se elaboró un árbol de decisiones utilizando técnicas de aprendizaje automático y de tal manera predecir si los alumnos tienen interés en continuar con sus estudios bachillerato, se implementó un conjunto de datos del rendimiento estudiantil en la educación secundaria. Los atributos de los datos incluyen características demográficas sociales y están relacionadas con dos escuelas, se recopilaron mediante informes y cuestionarios escolares.

Árbol de decisiones, Aprendizaje automático, Conjunto de datos

Citation: LÓPEZ-GARCÍA, Lourdes. Tree to predict if students want to continue with their high school studies by implementing machine learning. Journal Educational Theory. 2022. 6-15: 6-9

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Introducción

In this document, the data of high school students with the social demographic characteristics that were collected through school reports and questionnaires, using the Python programming language, were analyzed , likewise, machine learning techniques were applied to develop a decision tree (López-Garcia *et al*., 2022). With the objective of identifying those high school students who do not wish to continue with their high school studies to channel them with campus psychologists in order to persuade them to continue with their basic studies.

One of the objectives of the analysis of educational data is to find patterns and predictions that allow characterizing the academic development of students, however, it is required the collection of data on the characteristics of students taking into account the context, in order to achieve a better understanding of the results obtained. Some of these characteristics are socioeconomic factors, family and school data of the student (Rico Páez & Gaytán Ramírez, 2022).

Literature review

Decisions Tree

These are supervised learning models used to predict an answer in the variable *Y* by making use if the *p* predictor variables of *X*. A binary tree is created where each of its internal nodes creates a division in the space of the *p* predictor variables *X* by means of a question or logical rule, until reaching a leaf node or response node that yields a predicted value (Torres Steel, 2022).

The predictions within the leaf nodes are the product of all the segmentations created by the tree, which, when the target variable has two categories, will be a group of ones and zeros and the final prediction will be the most repeated class of the two within the leaf node (Torres Acero, 2022). The main node of a decision tree is the first segmentation of the data set, if possible, into two parts, in order to group the most similar observations in the two divided areas. The internal nodes of decision trees refer to the intersections that exist between the branches, where a question is posed within each branch in order to create a division.

Finally, the leaf nodes are the tips of the branches of the tree, where the possible predictions resulting from the rules of the internal nodes are found (Torres Acero, 2022).

Torres Acero (2022) posits that the *Gini* index, which measures the total variance within each node, expressed as:

$$G = \sum_{i=1}^{2} p_i(1 - p_i) \quad (1)$$

Where *Pi* is the proportion of observations that belong to a node and to class *i*; and the entropy, which refers to the impurity within the nodes, the impurity being a variety of classes within the node, and its calculation is:

$$D = \sum_{i=1}^{2} p_i log(p_i) \quad (2)$$

These calculations allow finding the possible splits of the node, when its value is minimized being the closest to zero as possible; the value of these two metrics fluctuates between one and zero and is lower the purer the node is (Torres Acero, 2022).

Methodology

Tools used

The project was coded with *Python* programming language, which is the most efficient for data science. In the data processing section, the *Pandas* libraries were imported, *Numpy* specifically for linear algebra, *Seaborn* for data visualization and finally *Matplotlib* for the creation of predictive model graphics, together with *Scikit-learn*, which is a collection of algorithms. (López-García *et al*. al., 2022).

Data set

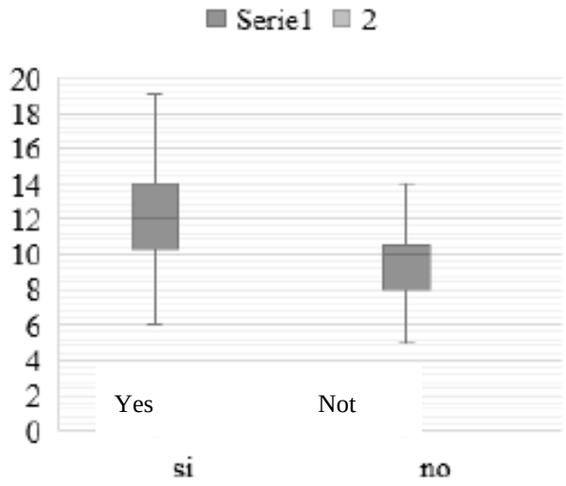
The decision tree was developed from a data set on student achievement in secondary education (Cortez & Silva, 2008). The data attributes include social demographic characteristics and are related to two schools, were collected through school reports and questionnaires (López-García *et al*., 2022).

Two sets of data are provided about achievement in two different subjects: Mathematics and Spanish. The target attribute for the data analysis is: *'final grade'* as it corresponds to the final average of the year (López-García *et al*., 2022).

ISSN 2523-2509

A box or whisker plot was elaborated with the objective of analyzing the final grade variable of the data set, this variable has a range between 0 to 20 points.

It can be observed in graph 1 that students who obtain less than 10 points in their final grade are those who decide not to study high school.



Graphic 1 Distribution of data in quartiles
Source: Own Elaboration

Decisions Tree

In order to predict whether students are interested in continuing with their high school studies, a decision tree was developed. First, in order to use the categorical values from the database, these variables were converted to numbers using the *get_dumies function*.

Subsequently, the explanatory variables were selected and the variable 'secondary,' which indicates whether the students want to pursue higher education (high school) as an objective variable.

The *DecisionTreeClassifier* function of the *Python Scikit-Learn* library was implemented for the elaboration and training of *the decision tree*.

It can be seen, that placed the *First_partial variable* at the base of the tree since it is the most important factor in the decision of students to continue with their high school studies.

After the creation of the tree, the training observations are grouped into terminal nodes. To predict a new observation, the tree is traversed according to the value of its predictors until it reaches one of the terminal nodes. In this case, being classification tree, the mode of the response variable is usually used as the prediction value, that is, the most frequent class of the node in this case was *Primer_partial.*

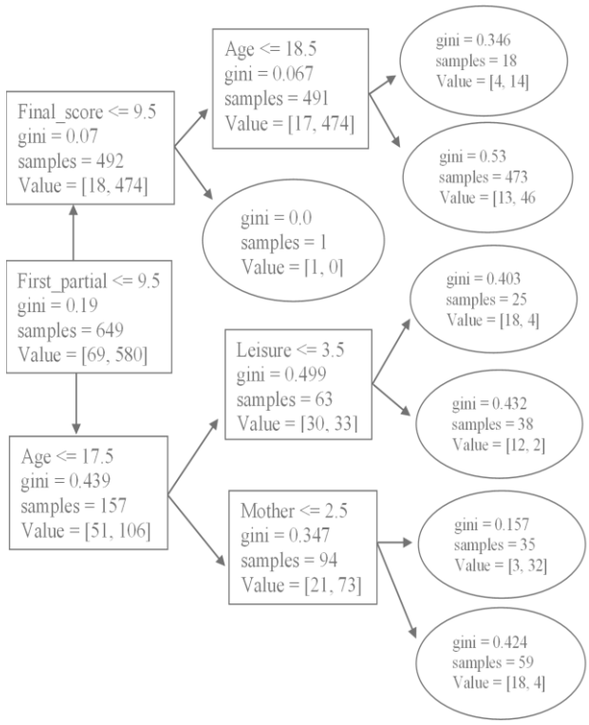
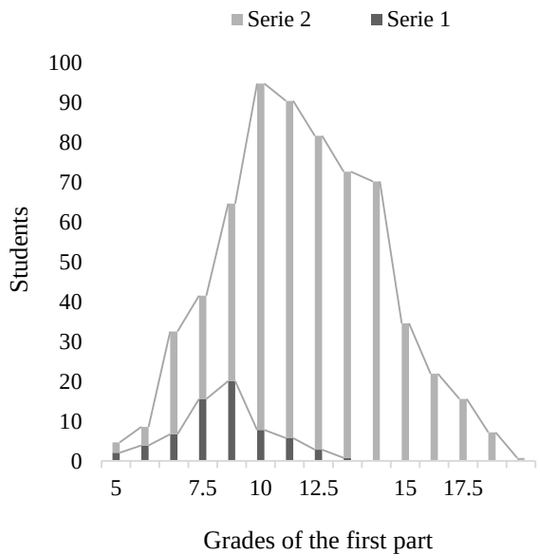


Figure 1 Decision tree
Source: Own Elaboration

Results

It can be observed in Graph 2 that the higher the grade, the more interest students show in continuing with their higher education, which indicates that school dropout can be avoided if students are attended to with academic advising in time.



Graphic 2 Students' interest in continuing their studies
Source: Own Elaboration

A pressure of 91% was obtained in the predictions, which indicates that the model is good.

Prediction accuracy
0.9121725731895224

Tabla 1 Precision of the decision tree
Source: Own Elaboration

Conclusions

It was detected that grades are the most important factors in persuading students to study high school, and these factors can be corrected from the time they enter high school. In order to improve the present project, it is necessary to compile a larger data set with the database of middle and high school students, to be able to compare different social groups (educational centers).

Acknowledgments

I would like to thank the Tecnológico Nacional de México / Instituto Tecnológico de León for the support provided to this research.

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Article **Journal Educational Theory**
June, 2022 Vol.6 No.15 10-20

Virtual Learning Environments: University faculty experiences during and after the COVID 19 pandemic

Entornos Virtuales de Aprendizaje: Experiencias del docente universitario durante y después de la pandemia COVID 19

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DOI: 10.35429/JET.2022.15.6.10.20 Received March 14, 2022; Accepted June 30, 2022

Abstract

To improve and innovate the teaching and learning process, it is necessary to develop or use technological means that allow effective communication between teachers and students. Likewise, the use of virtual learning environments, with the appearance of COVID 19, have become a priority in teaching practice, revolutionizing many fields of engineering and the educational system in general. A mixed approach research with descriptive and correlational design was carried out in a sample of 59 teachers, whose objective is to share the experiences of professors of a higher education institution, during and after the pandemic, on the use of virtual environments, such as Moodle and Google Classroom. Also, the benefits and difficulties encountered in virtual classes and currently, in face-to-face classes. Some of the results are 67.2% of the professors already knew about the use of learning environments, but even so, 98.2% concluded that they did develop new skills and aptitudes, most frequently 71.4%, in the creation of courses in virtual platforms and 66.1% in basic competencies in the use of virtual learning platforms, as others to promote quality and educational innovation in the institution.

Teaching experiences, COVID-19, Virtual environments

Resumen

Para mejorar e innovar el proceso de enseñanza y aprendizaje, es necesario desarrollar o utilizar medios tecnológicos que permitan una comunicación eficaz entre profesores y alumnos. Asimismo, el uso de entornos virtuales de aprendizaje, con la aparición de COVID 19, han resultado prioritarios en la práctica docente, revolucionando muchos campos de la ingeniería y del sistema educativo en general. Se realizó una investigación de enfoque mixto con diseño descriptivo y correlacional, en una muestra de 59 docentes, cuyo objetivo es compartir las experiencias de los profesores de una institución de enseñanza superior, durante y después de la pandemia, sobre el uso de entornos virtuales, como Moodle y Google Classroom. También, los beneficios y dificultades encontradas en las clases virtuales y actualmente, en las clases presenciales. Algunos de los resultados son 67.2% de los profesores ya sabían sobre el uso de ambientes de aprendizaje, pero aun así, 98.2% concluyeron que sí desarrollaron nuevas habilidades y aptitudes, con mayor frecuencia 71.4%, en la creación de cursos en plataformas virtuales y 66.1% en competencias básicas en el uso de plataformas virtuales de aprendizaje, como otras para promover la calidad y la innovación educativa en la institución.

Experiencias docentes, COVID 19, Entornos virtuales

Citation: AMAVIZCA-VALDEZ, Laura Olivia, GÁMEZ- WENDLANDT, Julio César, VAZQUEZ- MORENO, Erika Ercilia and TOLANO-GUTIERREZ, Helga Karina. Virtual Learning Environments: University faculty experiences during and after the COVID 19 pandemic. Journal Educational Theory. 2022. 6-15: 10-20

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1. Introduction

Mid-March 2020 began with an atypical situation in all contexts, which had its origin in the wake of the emergence of the pandemic caused by COVID-19 which caused a scenario of mandatory confinement, a measure that was adopted by governments and health systems in different countries with the purpose of caring for the health of citizens, this in turn led to many educational institutions, at all levels and countries, had to close their doors and therefore, to the suspension of classes. However, the United Nations Children's Fund (UNICEF) stated that education is a priority and despite the health emergency, classes must continue, even more so when the pandemic caused by covid-19 has affected millions of students in Mexico. (UNICEF, 2020).

Certainly, it was a year of many changes for education, with Information and Communication Technologies (ICT) being the protagonists of this transition, since, characteristics such as interactivity and interconnection (García-Jiménez & Ruiz-de-Adana-Garrido, 2013), make them a desirable mechanism to guarantee the continuity of the educational process between teachers and students. However, despite technological advances and relevant government measures, the e-learning model leaves many gaps in the development of students at all levels. Therefore, the use of technological tools that initiate the restructuring of pedagogy in the educational field are of utmost importance, and their advantages focus on breaking the limitations of time and space and creating dynamic and intuitive scenarios that enhance the student's academic training process.

On 6 April 2020, UNESCO, through the International Institute for Higher Education in Latin America and the Caribbean (IESALC), presented the document: "Covid-19 and higher education: from immediate effects to the day after. Analysis of impacts, response and recommendations". This document shows the impact of the pandemic on higher education actors, including students, teachers, non-teaching staff, public policy, as well as the institutional response to the context of the pandemic.

It also allows to review the impact of temporary closures of face-to-face operations of HEIs, the disruption of daily life, the fear of facing crises and the generation of anxiety due to the demands of students are related to their impact on the quality of online education which is not the same as face-to-face classes; (UNESCO IESALC, 2020, p. 13).

However, several universities in Mexico, public or private, have expressed their opinion on this issue and, in general, it seems that this change of approach has not been received positively. Part of the dissatisfaction stems from the fact that the content offered was never designed as part of a distance higher education course but in an effort to reduce the absence of online courses followed by virtual courses without additional or prior preparation (UNESCO IESALC, 2020, p. 16). This meant that the training process will move from face-to-face to virtual, but without losing the forms of face-to-face classes: synchronisation of space-time, activities and feedback, rigid timetables and the same number of contents.

On the other hand, there is a disparity between technological advancement and learning and teaching skills, i.e. skills for the knowledge society, as students and teachers say they need support and see new barriers to participation in virtual classes emerging. This means that age or generation is not a determining factor in technological literacy; a reality that suggests that experts in Technology for Learning and Knowledge (TAC) stress that education today is in crisis because there is a gap between technological advances, curricula, methods and students' needs. This unexpected fact has highlighted the difficulties and failures of the education system at all levels to adapt to virtuality, as well as the various technologies that can be used to face this challenge.

However, in order to be able to continue with the teaching-learning process, institutions have sought through the training of their teachers to attack these difficulties as much as possible and offer students tools and means with which they can work, so much so that they have even managed support strategies for those who lack easy access to education due to economic issues or distance.

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Considering that online classes need a series of situations to achieve successful learning and that there are certain factors on the part of the student such as motivation, responsibility and autonomy to develop their learning. In reference to the teacher, he/she must pay special attention to ensure that the design of the materials is of high quality, that the methodologies used are adapted to the required learning and that the tutoring and counselling process is carried out in an agile and efficient manner.

At the Technological University of Southern Sonora, considering the changes brought about by the confinement, virtual training was offered to teachers where they could learn to design, with the necessary basic elements, the courses of the subjects they would be teaching at that time, and seeking to ensure that virtual education was centred on the main educational actors such as the teacher and the student. It also focused on interactive learning, didactic material and the evaluation process for the achievement of the objectives set and not on ICT as the main instrument.

It can be said that, like other institutions, UTS designed strategies in order to successfully complete the current term and start the next one. The strategies established were directly related to the use of ICT, Virtual Environments and a little bit about educational paradigms, all with the aim of achieving the necessary interactions and effective communication between teacher and student. According to preliminary results obtained through the Survey on Teaching and Learning in Quarantine Times published by the Inter-University Observatory on Society, Technology and Education (2020), it seems that everyone resorted to what they had at hand (sometimes more, sometimes less) to continue the dialogue with their students: WhatsApp, Email, YouTube, Moodle, Google Classroom, Zoom,Jitsi, Meet, among others.

Learning in most educational institutions during the pandemic is associated with the introduction of virtual learning environments that were not used before and had some shortcomings or were used by few, but have been able to get off to the best possible start due to the contingency.

During this time, virtual education has become an opportunity to acquire important skills such as: cooperative learning, discipline and autonomy, internationalisation, time organisation, acquisition of technological and digital skills, aiding academic development.

Therefore, we should not lose sight of the fact that "virtual" is only a development scenario and "learning" is relevant to quality.

Virtual does not represent the juxtaposition of face-to-face education, but can be transformed into a more effective application of education by combining technology and the development of students' professional skills in educational institutions supported by virtual platforms.

In Mexico and Latin America, according to Peña (2009), the following should be recognised as an object of study: a) the contribution of the virtual to educational innovation and b) assessing its impact on educational processes, with the aim of generating knowledge about the use and contribution of digital resources, which will allow the development of digital skills to be systematised.

Behind a device and a platform there is a set of factors that give meaning to its use: study plans and programmes, the mission and vision of educational institutions, teacher planning, especially if we consider that "in Mexico, priority continues to be given to the distribution of equipment and software, but no profound changes are documented in the forms of teaching" (Guerrero and Kalman, 2010, p. 214).

Before concluding this section, it is important to mention that the Universidad Tecnológica del Sur de Sonora has had the Moodle institutional platform in operation for more than 15 years. This platform was initially implemented in the Information Technology (ICT) educational programme and is currently used by all the degree courses offered at the institution. Undoubtedly, it has been a great support for teaching practice in face-to-face classes since it began its operation.

ISSN 2523-2509

However, currently, due to the number of applications and courses designed in it, it has been showing some deficiencies in its performance and it has not been possible to invest sufficient economic resources to optimise the processes that can be worked on in it. Likewise, for some time now, various training courses have been offered on the use of Moodle and its different resources. Even so, there is resistance from a few teachers of different ages who prefer not to use a platform to support and innovate with the implementation of technological tools in the teaching and learning process.

At the beginning of the pandemic, in March 2020, a group of teachers from the ICT career, designed a course for the acquisition and strengthening of technological skills and design of courses in Moodle platform, synchronous and asynchronous at the same time, because it is the institutional environment, which was not completed by all teachers, presenting again a little resistance to the use of technologies and preferring individual methods to establish communication and delivery of their virtual classes. Following this, the university received the opportunity, in August 2020, to offer teachers training with Arizona State University on the use of Google Classroom, but some teachers did not complete the training and it was offered again in order to achieve a greater number of trained teachers.

From discussions among teachers, Classroom is mostly heard of for its ease of use and flexibility in delivery for students, although it has fewer resources than Moodle. This is considered inadequate, as the university and those who are part of it must move forward and seek to be on a par with other universities and thus, in due course, attract more enrolments by expanding the coverage that could be offered by implementing more flexible modalities than only the face-to-face one. In this sense, and through this research, the aim is to find out through the opinion of the teachers their experiences of using virtual environments during and after the pandemic and thereby generate a series of proposals to improve the quality and educational innovation in the institution, seeking the application of best practices in the teaching and learning process to achieve the professional competences that are set out in the syllabuses and a teaching staff that is able to face the diversity of emerging changes that may arise.

2. Methodology

The development of this research was carried out considering the following aspects:

A. Type of research:

The methodological approach of this study is of a mixed type with a descriptive design because it aims to collect statistical data on the subject under study, also the experiences of teachers on the use, benefits and difficulties encountered during and after the confinement in the teaching and learning process mediated by virtual environments in order to thereby generate proposals that seek to improve educational quality and continue to innovate in teaching practice.

B. Resources

As material resources, to collect data, a survey was designed with the Google Forms tool and distributed through the WhatsApp social network by means of managed institutional groups. The application is carried out in this way as it was requested during the holiday period. It was decided to use Google Forms because it allows statistics to be obtained in real time and at the time of implementation. In this way, it is possible to keep track of the subjects who have answered and those who have not, in order to comply with the significant sample or more requested for the research.

This survey has 37 items divided into 4 categories of study, the type of responses is designed as closed-ended, with multiple response options, single response, as well as Likert and dichotomous scale responses.

Likewise, a statistical calculator published online at Netquest.com was used to calculate the sample, where the universe was 68 teachers, resulting in a sample of 58 for it to be significant. See figure 1

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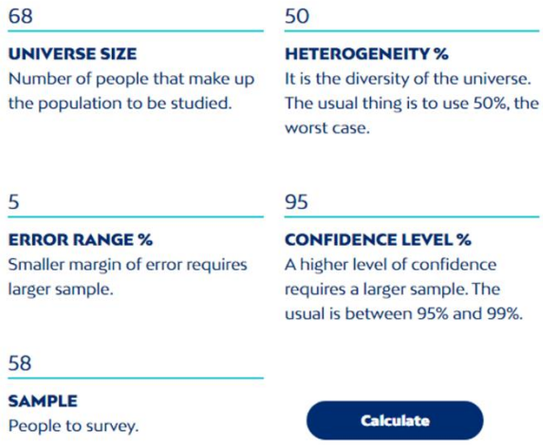

Figure 1 Statistical calculator
Source: Netquest.com

C. Procedure

For the execution of each of the tasks in this study, first and foremost, as mentioned in the previous paragraphs, the type of research and the elements that comprise it are defined, as well as the material and human resources necessary for the orderly execution of this study.

Following this, the survey is applied to a total of 59 teachers in a population of 68, from the different educational programmes offered at the university, with no age limit, who have participated in hybrid mode when returning from the pandemic or who have taught virtual classes during the confinement, as well as those who teach at least one subject at the institution. The research is conditioned to the fact that they can only be answered by teachers, given that they are the element of study in this research and meet the necessary characteristics to be studied and analysed. However, there was one finding where a female teacher who complies with the above did not answer some questions and a male teacher who is starting out as a teacher and is teaching hybrid classes. Subsequently, after 3 days of application and follow-up in filling out the survey until the requested sample was completed, the survey was closed and the results analysed, which will be presented in the corresponding section.

3. Results

Currently, UTS is implementing the hybrid mode, classes with face-to-face hours from Monday to Thursday and virtual classes only on Fridays, but it is planned to return, in January 2023, to only the face-to-face mode.

The following questions arise from the above: Will it be appropriate for the university, once it has moved to the virtual mode during the pandemic, and once it has returned to the hybrid mode after the pandemic, to go back to the face-to-face mode? What factors will be decisive in making the decision on this return? Do teachers have or do not have the basic technological skills necessary to continue operating the hybrid mode? How can this backtracking impact on the teaching-learning process? Do teachers and students have sufficient tools and resources to operate in both modes? Will the student be affected in any way by continuing in the hybrid mode or changing to the face-to-face mode? Some of the questions will be addressed in this research and the rest in the next one.

The results obtained in this research on the experiences of teachers during and after the pandemic about the use of virtual environments, the benefits and difficulties they presented are:
As can be seen in table 1, out of 59 teachers only 19 did not know about Virtual Learning Environments (VLE), of which 7 were female and 12 were male; they belong to the following careers: 2 in Automotive After-Sales Service, 8 in Marketing, 2 in Information Technology, 4 in Mechatronics and 3 in Industrial Maintenance.

The age ranges with the highest frequency of knowledge about VAS are 23 to 35 and 36 to 45; in the range of 46 to 65 was where there is the highest frequency of teachers whose age is located in it, but it is where there was the highest frequency of lack of knowledge about VAS and also dominated the largest number of educational programmes (EP), 4 out of 6 to be exact, with teachers in this situation. Another important aspect obtained is that male teachers were the ones who most frequently answered that they had no knowledge, 12 out of 19. In terms of degree programmes, the Business Development programme predominates in the two areas it offers: Automotive After-Sales Service, with two teachers, and Marketing, with eight. However, this educational programme represents 39% of the surveyed sample and 16.9% of its active teachers showed a lack of knowledge.

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Age range	¿ I knew about the EVAs?		Sex		To which race do they belong?				
	Yes	No	F	M	SPA	MKT	MA	TIC	MI
23 -35	5	2	0	2	1	1	0	0	0
36 -45	17	4	0	4	0	1	2	1	0
46 -65	18	10	6	4	1	5	0	1	3
66 o +	0	3	1	2	0	1	2	0	0
	40	**19**	**7**	**12**	**2**	**8**	**4**	**2**	**3**

Table 1 Total number of teachers by age, gender and career who did not know about Virtual Learning Environments
Source: Own Elaboration

In table 2, it can be seen that the most used means by those who did not know about virtual learning environments was institutional training. It is worth mentioning that in previous paragraphs we talked about the two trainings that were given in pandemic, highlighting the importance that the institution should continue to offer them as it is a means of support for teaching practice. Following this, it was found that the most frequent means of attention to attend the virtual classes were WhatsApp and watching videos, with 4 teachers using them frequently for each one. Likewise, the age range and the resources used to attend the virtual classes, the teachers who expressed not having the knowledge, even so, 4 teachers had used Moodle, 3 Google Classroom and 1 none.

Age range	¿ I knew about the EVAs?	¿ How did you attend your virtual classes in times of pandemic?				
	No	I used other means and resources	For WhatsApp	Watching videos	By institutional training	By email
23-35	2			1	1	
36-45	4	1	1		2	
46-65	10	1	3	3	3	
66 o+	3				2	1
	19	**2**	**4**	**4**	**8**	**1**

Table 2 Type of resource used by teachers who had no knowledge of Virtual Learning Environments (VLE)
Source: Own Elaboration

Table 3 shows how the adaptation process was for those who had no knowledge of EVA, showing that 8 of the 19 had a very easy process but 7 found it difficult to adapt and their age ranged from 46 onwards.

Age range	¿ I knew about the EVAs?	Being in a pandemic, what was the adaptation process like?		
	No	very easy to adapt	Little easy to adapt	hard to adjust
23 - 35	2	2		
36 - 45	4	3	1	
46 - 65	10	3	2	5
66 o Más	3		1	2
	19	**8**	**4**	**7**

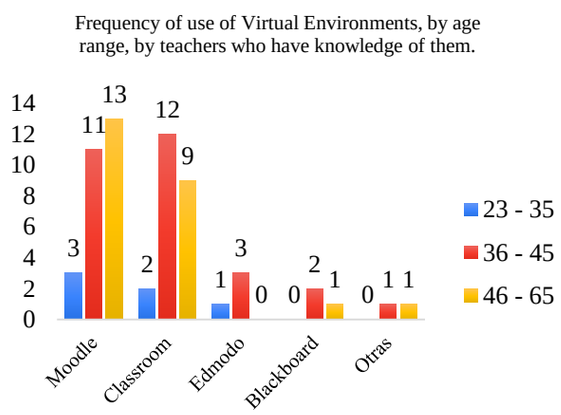
Table 3 Adaptation process of teachers who had no knowledge of Virtual Learning Environments (VLE)
Source: Own Elaboration

Table 4 shows that of the 40 teachers who did have knowledge of the use of VLE, 29 were able to adapt easily and 1 was unable to adapt, and their age range was between 25 and 35 years old. It is also important to mention that this statistic does not show those aged 66 and over, as they had no knowledge of learning environments.

Age range	¿ I knew about the EVAs?	Being in a pandemic, what was the adaptation process like?			
	Yes	very easy to adapt	Little easy to adapt	hard to adjust	I couldn't adapt
23-35	5	1	1	2	1
36-45	17	15	1	1	0
46-65	18	13	4	1	0
	40	**29**	**6**	**4**	**1**

Table 4 Adaptation process of teachers who did have knowledge of Virtual Learning Environments (VLE)
Source: Own Elaboration

With regard to the virtual learning environments that the 40 teachers who mentioned having knowledge of them had already used, it was possible to obtain a frequency of 27 teachers who had used Moodle and 23 who had used Google Classroom. As mentioned in previous paragraphs, the Moodle platform has been in use for approximately 15 years, around 2007 it began to operate in the Information Technology programme, and after that, the other educational programmes began to incorporate it. In the case of classroom, in the year 2020 training was carried out on this platform and in that short time it has been taking a lot of use by teachers due to its ease of use and flexibility. However, Moodle has more resources to work with and implement in teaching practice, but it does present greater control of delivery times, where the teacher can establish the total closure of the activities versus in classroom the student can continue to deliver even if a delivery date and time is set. See graph 1.



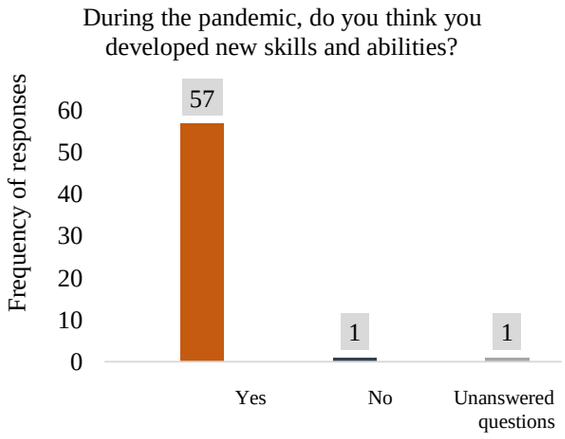
Graph 1 Frequency of use of virtual learning environments by teachers who do have knowledge
Source: Own Elaboration

ISSN 2523-2509

Concluding the first phase of the results of this research, it can be argued that it is so important to be trained in the different technological platforms and tools, given that by using them it would be increasingly easier and with better quality that they could be integrated into the teaching and learning process and innovate, why not. It is also observed that it is not a question of age but rather of attitude and willingness to change, since 37 (62.7%) teachers say that it was very easy to adapt to the process during the pandemic with and without knowledge in the use of EVA.

The results of the teachers' experiences during the confinement are shown below, focusing on the following aspects:

Development of skills and aptitudes: in this aspect it can be seen in graph 2 that 57 (96.61%) of the 59 teachers surveyed mentioned that they did develop new skills and aptitudes and only 1 teacher said that they did not; they also did not require any training to teach their virtual classes but stated that they had to request training in the creation of courses on virtual platforms. With regard to the 59 teachers who say that they have developed skills and aptitudes, table 5 shows the following.



Graph 2 Frequency of teachers who feel they developed skills and abilities during the pandemic
Source: Own Elaboration

Age range	During the pandemic, Do you feel you developed new skills and abilities during the pandemic??		Required training?		Sex	
	Yes	No	Yes	No	F	M
23 - 35	7	0	3	4	1	6
36 - 45	20	1	9	12	8	13
46 - 65	27		21	6	13	14
66 o más	3		3	0	1	2
	57	**1**	**36**	**22**	**23**	**35**

Table 5 Teachers who say they did develop new skills and abilities during the pandemic
Source: Own Elaboration

Table 6 shows the results obtained on the training that teachers say they have requested or requested during the pandemic. The most frequent courses are the creation of courses on virtual platforms with 28, in second place with 25 Introduction to EVA (Moodle, Classroom, others), in third place with 23 Design of planning for virtual courses, in fourth place with 21 Management of Google tools and finally with 18, Management of stress and anxiety. Interestingly, these courses, except for the last one, were offered in the two trainings mentioned in previous paragraphs, one was institutional which contemplated the first four most frequently and the other, which was given by the University of Arizona, was totally focused on Google Classroom and its tools. But, the ones that were not given during the pandemic were the last one with the highest frequency and the rest with lower frequencies. What this means is that the focus during the pandemic was on the use of virtual environments to carry out teaching practice and the aim was to adapt to change in accordance with the possibilities of each teacher at home.

Training that should have been requested or requested by the teacher during the pandemic	Frequency	%
Emotion management	13	22.03%
Creation of courses on virtual platforms	28	47.46%
Designing course plans for virtual courses	23	38.98%
Introduction to EVA (Moodle, Classroom, others)	25	42.37%
Management of Google tools	21	35.59%
Stress and anxiety management	18	30.51%
Time management	10	16.95%
Use of social networks (Facebook, WhatsApp)	4	6.78%
None	5	8.47%

Table 6 Training requested or to be requested during the pandemic
Source: Own Elaboration

Similarly, the teachers were asked whether, during the pandemic, the institution provided them with the necessary facilities, flexibility and resources to be able to conduct their classes virtually. The following responses were obtained, from highest to lowest frequency: out of 59 teachers surveyed, 25 (42.37%) said regularly, 21 (35.59%) said always, 9 (15.255) said almost always and 3 (5.08%) said never, while one teacher did not answer again.

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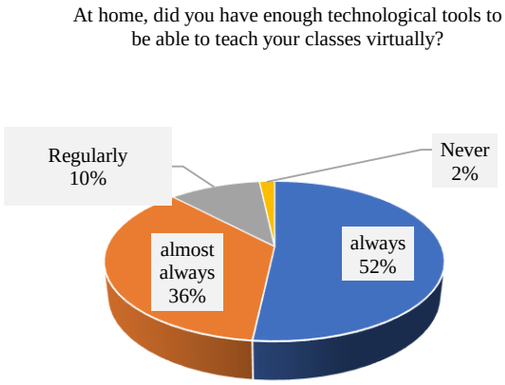
Consequently, the elements studied on the teachers' experiences during the pandemic were obtained with respect to the question "In your home, did you have sufficient technological tools to be able to teach your classes virtually? In graph 3 we can see that 30 (52%) of the teachers affirm that they had sufficient technological tools for their virtual classes, as well as 21 (36%) say that almost always and 6 (10%) and 1 (2%) affirm that they regularly and never had the tools. The most frequently used tools at home were: 1) Laptops 91.53%, 2) Mobile phones 69.49%, 3) Webcam 59.32% and, 4) Microphone 54.24% of the teachers surveyed. The two most used communication tools were: WhatsApp (94.8%) and email (79.3%) by the teaching staff during the pandemic.



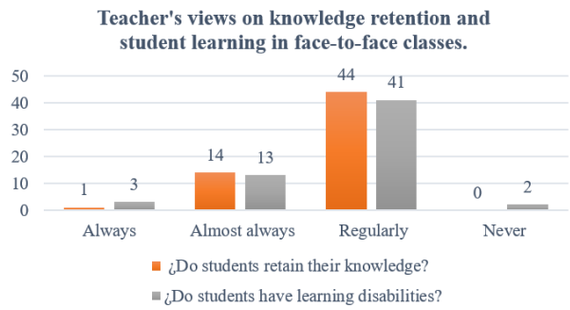
Graph 3 Percentage of teachers who had, at home, the technological tools to work in virtual classes
Source: Own Elaboration

Likewise, the teachers stated in the survey, "What were the most frequent difficulties you encountered? The five most frequently reported by teachers were: 1) Low student participation in virtual sessions and the increase in telephone and internet charges with a percentage of 43.1% each, 2) Internet access with 37.9%, 3) Interruptions in classes with 32.8%, 4) Low performance devices with 31% and 5) Stressful moments with 27.6%. In the case of students, they also presented different difficulties, according to the opinion of the teachers surveyed, the most frequent were: 1) Access to internet with 91.53%, 2) Lack of equipment and technological tools with 88.14%, 3) Low performance devices with 64.41%, 4) Difficulty to concentrate in the sessions with 59.32%, 5) Integrating and organising school with work was presented in 52.54% and finally the organisation of their work with 50.85%.

Another aspect, and more important than having a good, is the health aspect, where the teachers surveyed showed that due to the lack of mobility or the sedentary lifestyle that arose as a result of the pandemic, they had some health problems: 1) Weight gain in 29 (49.15%) of the 59 teachers surveyed, stress in 25 (42.375%) teachers, decreased vision in 23 (38.98%) teachers and anxiety in 21 (35.59%) teachers.

There were also changes in the cognitive process such as: Slow processing in 25 teachers, poor retention of information in 22 and forgetfulness of information in 20 teachers out of 59 respondents. Students regularly attended class according to 32 of the teachers and that, regularly, 48%, 28 teachers mentioned that the student's role was active during the teaching and learning process in pandemics.

Regarding the experiences of the teachers after the confinement, the cognitive process, according to the opinion of the teachers, students regularly have problems in retaining knowledge and learning due to the difficulty of concentration since the pandemic.



Graph 4 Students' knowledge retention and learning problems, according to the teacher's opinion in the face-to-face mode
Source: Own Elaboration

The teachers (36 out of 59) perceive that the student's performance, although they had some difficulties in pandemic and currently in classroom mode, has a good performance (see graph 5).

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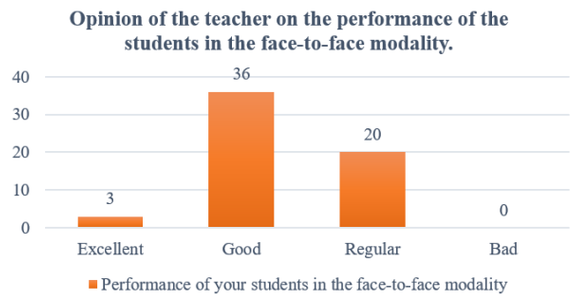

Graph 5 Student performance in face-to-face mode, according to the teacher's opinion
Source: Own Elaboration

Another element of the study was whether teachers consider it indispensable to use learning platforms as a means of support in teaching practice; the results are presented in this regard, in which it is stated that 40.7% of the teachers surveyed almost always use virtual environments as support and 28.8% always use them, stating that they are indispensable, 45.8% being in complete agreement and 40.7% agreeing with the use of Moodle and Classroom in their classes in the teaching-learning process at UTS. See table 7.

When returning to face-to-face teaching, do you use virtual environments to support your teaching practice?		He considers the use of platforms such as Moodle and Classroom indispensable to support his classes?	
Always	17(28.8%)	I fully agree	27(45.8%)
Almost always	24(40.7%)	Agree	24(40.7%)
Regularly	16(27.1%)	Neither agree nor disagree	6(10.2%)
Never	2(3.4%)	Strongly Disagree	2(3.4%)

Table 7 The need to use VAS in teaching practice during face-to-face classes
Source: Own Elaboration

Before concluding this section, it is important to mention that the virtual environment most used by the teaching staff surveyed is Google Classroom, with 55.9% in favour, due to its ease of use and adaptability in each of the subjects taught by the teacher. They also mention that it was easy to adapt again to the teaching practice in face-to-face mode, with 54.2% in favour, and the two most frequent communication tools used in the face-to-face mode are WhatsApp (88.1%) and e-mail (81.4%), the same as in the virtual mode, only with minimal percentages of difference in each.

To close this section, the main challenges faced by teachers are:

– Adaptation of face-to-face content for the virtual mode.
– Designing creative and innovative teaching strategies.
– Development of the level of expertise in computer and communication tools.
– Availability of infrastructure and equipment required given that they were at home in a pandemic.
– Adaptation to the digital work platform.

4. Acknowledgements

To the teachers of the Universidad Tecnológica del Sur de Sonora for their participation as subjects of study in this work and especially to the members of the Centro para el Desarrollo y Aplicación de Tecnologías de Información y Comunicación (CADTIC) and collaborators, for their support in the development of the project. We would also like to thank ECORFAN for their support in financing the publication.

5. Conclusions

The findings of this research allow us to take up some of the quotes mentioned in previous paragraphs and to answer some of the questions that triggered this study.

In Mexico and Latin America, according to Peña (2009), the following should be recognised as an object of study: a) the contribution of the virtual to educational innovation and b) assessing its impact on educational processes, with the aim of generating knowledge about the use and contribution of digital resources, which will enable the development of digital skills to be systematised.

It is also important to point out that behind a device and a platform there is a set of factors that give meaning to their use: study plans and programmes, the mission and vision of educational institutions, teacher planning, especially if we consider that "in Mexico, priority continues to be given to the distribution of equipment and software, but there are no documented profound changes in the forms of teaching" (Guerrero and Kalman, 2010, p. 214).

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Based on what these authors mention, while it is true that the education system in general, was in dire need of reinventing itself with extreme urgency, to remain constant despite the absence in the classroom, the teaching and administrative community of UTS also did so, strategies were designed in order to successfully complete the current school term. These strategies were directly related to the use of ICT and in order to continue the interactions between teacher and student.

With this research it was possible to affirm that teachers are trained to operate and face challenges in new study modalities, they consider it essential that virtual learning environments, specifically Moodle and Classroom, are also used in the face-to-face modality as a support to their teaching practice, age was not a determining factor to stop innovating in the teaching and learning process, it is shown that teachers continue to use means of communication such as WhatsApp and email to interact with students.

Likewise, it was found that student performance is good even with the presence of learning and knowledge retention problems, a situation that the Student Care and Services Centre continues to attend to all those who present one or both situations so that they can be channelled and attended to as has been the case up to now.

The main challenges they faced were;

a) The adaptation of face-to-face content for the virtual and they have already made progress in this for two years.

b) The design of creative and innovative teaching strategies, they have already received training on planning virtual sessions, design of virtual courses, use of resources in Moodle and Classroom platform, learning styles, teaching modalities.

c) The development of the level of expertise in computer and communication tools, according to the results of the research they say that their level of knowledge to be able to attend their virtual classes through platforms was intermediate, So this challenge is in favour of improving the quality and educational innovation in their teaching practice, and other challenges were the availability of infrastructure and equipment required, they had in their homes with the basic elements to carry out their classes, but they mention that regularly the institution provided them with the facilities, flexibility and resources necessary to carry out their classes virtually and the last challenge was the adaptation to the digital work platform, training was given in Moodle and Classroom, each teacher decided in which to design their courses if they did not already have it in Moodle which until today, is the institutional platform.

As for the difficulties presented by the students, what the university offers is the management of external and internal support so that they can solve economic situations and facilitate their access to education, as well as the availability of timetables in computer laboratories for the development of their face-to-face and virtual activities.

The position of 49 (83%) of the 59 teachers surveyed regarding the hybrid mode that had been operating until December 2022 is that it should continue, as the university has taken a great step forward in its processes and it would not be beneficial to return only to face-to-face education, which is favoured by 28.9% of the teachers surveyed.

By continuing with the hybrid modality, the university would have savings in services offered to students in general and could continue to innovate in the teaching-learning process. In general, with the results obtained, we proceed to generate new studies and a proposal for educational innovation to address each of the weaknesses found in this research and actions aimed at expanding coverage in order to increase enrolment.

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Finally, it is recommended:

- Establish mechanisms so that the opinion of teachers and students on improvements in the educational process is taken into account in decision-making, given that they are one of the main actors in the process.
- Promote innovative education that allows the institution to become one of the best in the state for its educational praxis.
- Establish alternative programmes to avoid the effects that students who work there could have by constantly changing their modality, as this generates instability for teachers and students.
- Improve teacher training programmes to continue with the updating in the use of ICT and creative and innovative pedagogical strategies.
- Grant financial resources to improve the optimisation of the institutional platform or, failing that, study the feasibility of others to facilitate the means of support in the educational process and even in the offering of continuing education courses or degree seminars.
- Expand coverage with the implementation of new study modalities, giving those who work the opportunity to professionalise in the career of their choice.
- To take full advantage of new educational trends in all areas.

In order to achieve success in teaching in virtual learning environments, academics need to acquire skills, abilities, knowledge and competences linked to pedagogical, communicational, technological and evaluative aspects that enable the implementation of good educational practices and, above all, the institutional support to achieve this.

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ISSN 2523-2509

Article **Journal Educational Theory**
June, 2022 Vol.6 No.15 21-29

Life-history in musical research. Leo Brouwer: A case study

Historia de vida en la investigación musical. Caso estudio: Leo Brouwer

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DOI: 10.35429/JET.2022.15.6.21.29 Received: March 25, 2022; Accepted June 19, 2022

Abstract

The life-history method as a scientific research method in music gains prominence in the twentieth century and grows even more in the present. Its usefulness is appreciated when writing about referent characters in artistic practices for the human being, cultural exchanges, study of personalities, and their effects in the training of new generations of musicians, among others. This method motivated this work, which had as an objective to elucidate the steps that constituted the methodological strategy of application of life-history in musical research, rooted in a study of the artistic output of Leo Brouwer. From a predominantly qualitative approach, interviews and an analysis of documents were combined, which made possible a reflection on the life-history method and its implementation in music research.

Life-history, Musical research, Leo Brouwer

Resumen

La historia de vida como método de investigación científica en la música toma auge en el siglo XX y se acrecienta en la actualidad. Su utilidad se aprecia en referentes sobre las prácticas artísticas para el ser humano, los intercambios culturales, el estudio de personalidades y su impacto en la formación de nuevas generaciones de músicos, entre otros. Este método motivó este trabajo que tuvo como objetivo mostrar las acciones que constituyeron una estrategia metodológica para la implementación de la historia de vida en la investigación musical, basado en el estudio sobre la producción artística de Leo Brouwer. Desde un enfoque predominantemente cualitativo se combinaron el análisis de documentos y la entrevista lo cual posibilitó la reflexión sobre la historia de vida y su aplicación en la investigación musical.

Historia de vida, Investigación musical, Leo Brouwer

Citation: JUAN-CARVAJAL, Mara Lioba, JUAN-CARVAJAL, Dargen Tania, VDOVINA, María. Life-history in musical research. Leo Brouwer: A case study. Journal Educational Theory. 2022. 6-15: 21-29

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Introduction

It is common to find Life History in the scientific literature as a method, technique or strategy that helps to facilitate research, especially in art, particularly in its less tangible manifestations such as music, performance and/or musical composition; however, it has been more visible for a long time in Psychology and Sociology, disciplines from which researchers explore aspects related to human beings and their environment. Its use can be seen as a result of research with different purposes: explorations of community and/or age groups, their customs, ways of life, experiences in conflicts, traditions or culture (Ferrarotti, 2007; Leite, 2011; Pérez, 2017); or on the essence of everyday life in social structures and biographical constructions (Camacho and Campos, 2011; Madrid, 2021).

Likewise, this method can explore a wide range of topics that describe problematic or emerging spaces from different areas of knowledge: experiences, identities and developments (Cornejo, Mendoza and Rojas, 2008; Veras, 2010); body of knowledge and its interaction with physical, symbolic and emotional environments; facing educational changes (Hernández, 2011; Hernández, Sancho and Creus, 2011); understanding people's vision of the world and reality (Vidanovic and Osorio, 2018).

Explaining the debate on life history as a method or technique would entail a theoretical analysis that exceeds the limits of this paper. Although these terms are specified in numerous articles, there are also assertions that characterise life history as an approach, methodology, story or memoir, in which its use can be appreciated from the research process itself or as a result of it. From the documentary analysis it can be inferred that there is no consensus in this respect; however, acceptance as a method is recorded in a majority of articles. In this sense, the method can be used with a multidisciplinary vision based on the perception of the subject who reports, the position and decision-making of the researcher and the context experienced in both cases.

As has been expressed, such a multiplicity of uses favours its application in music-related research.

This method motivated this work, which aimed to show the actions that constituted a methodological strategy for the implementation of life history in musical research, based on the study of Leo Brouwer's artistic production.

The work was developed from a predominantly qualitative approach in which the analysis of documents, interviews and systematisation were combined to arrive at results on life history, its use in musical research and its application in the study of the figure of Leo Brouwer. In order to characterise the method, 45 sources were analysed, including articles in scientific journals and books; of these, 33.3% were directly related to their etymology, structure or methodology, and 44.4% to their application in musical research. The main themes identified were life history, contexts of realisation, structure and methodology.

In the systematisation of the life history during the study of Brouwer's work, a sample of people involved in his work were interviewed. These informants provided arguments about the development and characteristics of the composer's musical production based on experiential connections (62.5% of the interviews); in addition, three interviews conducted directly with Brouwer by third parties were used (37.5%). Books, book chapters, articles in serial publications, essays, theses, recordings, catalogues and scores were also accessed. All of this made it possible to establish priority criteria in relation to artistic characteristics and movements, taking into account the reasoning of instrumentalists, composers, orchestra conductors, musicologists and writers.

Life history. Reflections on method

In qualitative research, life history is recognised in many ways, the range of references identifies it as a method, technique or approach. Method reflects the way in which the researcher relates to the object, which indicates that, although a set of general rules must be followed, the researcher's creativity and the conditions for its application are evident. Techniques are more specific (particular, specific) aids; a combination of several techniques can also be found in the structure of the method. The approach is perceived as the most general and constitutes the theoretical-methodological orientation of the research.

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During the exploration carried out, authors were found who recognise the Life History method within the biographical method and also refer to it indistinctly as a life story (Cornejo, Mendoza and Rojas, 2008; Longa, 2010; Miguel and Castillo, 2013); based on this idea, a part or the life of the person is studied on which the story is constructed or an interpretation is made based on categories of a conceptual, temporal, thematic or areas of knowledge nature. Other authors include it in the narrative and highlight the relationship between the story and social structures, context and/or historical conditions (Veras, 2010; Hernández, 2011; Hernández, Sancho and Creus, 2011).

The research shares the position of Borboa-Quintero (2012); Naranjo and Soto (2018); and Vidanovic and Osorio (2018) who do define life history as a method. From these referents, the actions of the protagonist are synthesised from the account of the reality lived by him or her or in coexistence with others, which involves achievements, failures, emotions, events and experiences that he or she considers significant. The interviewee also offers information about collective memory, tradition, practices, beliefs, historical conditions and context.

For Vidanovic and Osorio (2018) this method enables the description of the everyday in the human being; they argue that it is aimed at the human experience. They use the term method "because life history requires an orderly way of interpreting a whole reality of life with structures, made up of connections between various elements, which represent human complexity" (p. 171).

When applying the life history method, the interview is identified as a recurrent technique for obtaining information, motivating the accounts of the subject under study; however, in many investigations, other techniques are used, such as the analysis of documents (including letters, reports, photos, videos, audios, etc.), narratives, observation, and genograms.

Its characterisation comprises accounts of a life based on interviews, conversations and reflections; association of consequences with the context (both at the time when they happened and when they are told); meaningful relationship between the researchers and the subjects who tell the story; repeated and calm reading in search of constrictions weighing on the individual or determining conditioning; and construction as a version of the story told to a researcher at a particular time or in the life of the subject being studied (Hernández, Sancho and Creus, 2011; Borboa-Quintero; 2012; Charries, 2012; Vidanovic and Osorio, 2018; Martinez and Albuquerque, 2020). One possibility offered by the Life History method is the continuity and updating of the research by taking preceding references.

In its structure, actions were identified that could be grouped into three stages: the preparatory stage, the information collection stage, and the analysis and elaboration stage, which are formed as a methodological strategy for the application of the method in music research.

The preparatory stage includes the definition of the objective; it is the theoretical preparation of the researcher; where the precision of the categories for the search for information is established; the selection of the sources; the design of the procedures and instruments; the determination of the logic of the possible encounters (including the projection of the information to be given to the subject who relates or explains how to proceed); as well as the consent of the participants, in which their commitment and motivation is sought from the slogan for carrying out the interview.

At this stage, it is important to establish a relationship of trust and respect between the interviewer and the interviewee. "No one would tell a tape recorder about their Erlebnisse, their "lived experiences". This means that the research is conceived as a co-research and that each researcher, far from being able to entrench himself behind a pre-constituted methodological armoury, is himself a "researched"" (Ferrarotti, 2007, p. 26).

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The information gathering stage concentrates on conducting interviews, analysing documents or other techniques that make it possible to obtain information. In this process, consideration should be given to the context in which the event being recounted took place, as well as the time and conditions in which it took place, the characteristics of the person (age, occupation, relationship with the event or the subject under investigation, cultural level, among others) or of the document (typology, date and format of production, its objective, the type of information it contains, etc.). Likewise, the transcription of the interviews will be taken care of, which is exchanged with the interviewee in order to favour the clarification and correction of the account.

During the interview or document analysis, other aspects are usually raised that are of interest to the researcher but which are not related to the proposed objective, which is why it is important to bear in mind the categories identified for the design of the instruments, which will maintain the direction of the research,, however, if deemed necessary, the designed instrument can be improved.

In the analysis and elaboration stage, the results are obtained. It is important that during the study of the interviews (of their recordings) attention is paid to the emotional reaction, the tone of voice, the words. During the review of the information, look for significant elements in each sentence or in material that may be uneven or disjointed. Nothing that is recounted is considered insignificant, as it may link events or moments in the development of the personality under study.

Life history in music research

Due to its methodological structure, life history is considered a method within the qualitative approach whose function is directed towards the understanding and interpretation of phenomena, processes and/or events. This is the approach most commonly used in musical research because of the ease with which it recreates, clarifies or describes phenomena. Its rigour is discovered in the meticulous collection of information, the fidelity during its recording, the clarity and transparency of the methodological strategy developed and the presentation of evidence that gives value to the results achieved.

Life history has been used for different purposes in music research since the last century; in the last five years we have found research whose objectives cover a heterogeneous range of problems in different areas; among them: formation, impact, regional configurations, generic complexes in music, contextualisation, socialisation, temporal or socio-cultural conditioning factors, social studies, professional trajectory, contributions of recognised personalities to musical development and heritage, structuring and compilation of repertoires, and interdisciplinarity (Juan-Carvajal and Juan-Carvajal, 2014; Suárez and Escudero, 2016, Vásquez, 2020; Spencer, 2021).

One can also distinguish reflections that feed on the life stories of social actors linked to musical practices (García, 2020), or the positioning of the method as part of the Biographical, where uncritical works have been developed that tend to become "propaganda tools in relation to certain composers, certain aesthetic ideologies and certain schools of composition" (Madrid, 2021, p.22).

Other fairly widespread dimensions are the impact of context on the musician's creative development and the study of traditions based on a regional musical structure or instrumentation, which "accounts for an ethnomusicological praxis based on the formal analysis of music" (Campos, 2019, p.233).

Why Leo Brouwer?

Juan Leovigildo Brouwer Mesquida "Leo Brouwer" (Havana, 1939), is an integral and avant-garde musician in the broadest conceptual sense. He is also a concert guitarist, orchestra conductor, pedagogue, researcher, music theorist and critic, artistic-cultural promoter and one of the most prolific composers of the so-called academic music. He holds the title of Doctor Honoris Causa awarded by the Universidad de las Artes de Cuba and the Universidad de Chile and is an honorary member of UNESCO, among many other honours.

His long and creative life, sharpness, perseverance and intelligence have allowed him to experiment with music, leaving a compositional legacy of folk, experimental, national and universal compositions.

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In his global work, modernity, plurality and artistic and aesthetic multidisciplinarity are recreated in the most varied and unlikely forms of artistic expression. He has skilfully employed the techniques, stylistics and knowledge of the traditions of a national and cosmopolitan culture, which keeps him active and predominant in the compositional, research and academic context. He is a reference of great impact among his contemporaries, but above all among young performers, composers and musicologists.

He has an extensive catalogue, heterogeneous in styles, formats and genres, as well as customised arrangements and transcriptions for many different types of ensembles, both of his own work and of international music, including popular genres. His creation can be classified as a free, recurrent and experimental style in constant development, in which national and universal values of contemporary and modern art can be appreciated in a dialectic relationship with other artistic manifestations, particularly the visual arts and cinema, but also in direct interrelation with other areas of knowledge, mainly mathematics and geometry. His still growing musical production renews conceptions and perceptions of compositional and interpretative art and reveals basic concepts of his capacity for synthesis and abstraction, as the main exponents of his language and philosophy: tradition, avant-garde, experimentation, Cubanness and universality.

As a pedagogue, he has a dossier of didactic materials for instrumentation, interpretation and composition, he revolutionised the musician's curriculum by introducing new subjects in the teaching of composition and he stood out in the exercise of specialised conferences of a didactic nature. His theoretical, methodological and musical production constitutes a valuable source for the study of avant-garde techniques in general and the knowledge of the characteristics of this and other movements of the 20th century and the present.

In short, Leo Brouwer is a universally recognised artistic personality. His study offers an insight into the surrounding reality in the field of performance, composition and music pedagogy.

In his creation there are many works that have been commissioned, for competitions, festivals, or by outstanding performers and even international orchestras of great prestige, however, the majority of his creation was made from the Cuban reality.

Our professional and continuous training as instrumentalists and pedagogues motivated the study of Leo Brouwer's contributions to culture, music and musical pedagogy. Based on the criteria of interviewees and the analysis of documents, visits were made to libraries, information centres and museums that treasure the maestro's musical production, theoretical studies, essays, memories of events, biographical studies, among others, to reveal the contributions in the musical, aesthetic and pedagogical fields, as well as the musical composition for those formats in which the bowed strings played a leading role. The search was carried out through the composer's own experiences and those of his main performers and scholars, based on the categories of compositional-evolutionary development, music for fretted strings, catalogue of works and discography. From the exploration it is evident that Brouwer's compositional and interpretative development is influenced by the context, the different personalities of music and universal art, as well as the multidisciplinary as a consequence of the cultural exchange, the communicational openness and the visualisation of his musical production at an international level.

Application of the life history method. Case study: Leo Brouwer

From the point of view of Vidanovic and Osorio (2018), with life history the totality of an experience in time and space can be captured. "The life story is constituted by a network of social relations woven by the life of the human group itself, in which the researcher is interested and belongs in some way to that fabric" (p.171).

As Angulo and Noriega (2014) note, with this method it is possible to describe the changes that a person goes through, obtaining the subjective vision with which one sees oneself and others; in addition, it favours the understanding of the impact of the context on their development, "...it discovers the keys to the interpretation of many social phenomena of general and historical scope that only find an adequate explanation through the experience of specific individuals" (p.15).

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These authors relate life history to the case study by arguing that the latter constitutes a system with which the individual, event or community is investigated. They emphasise that the result must be credible, so that it leaves the impression of what was experienced; that the story told stimulates curiosity, analysis, and motivates research to find out the reasons for their actions.

The combination of the two methods led to the contextualisation of Brouwer's cultural contribution and creative work, the clarification of his catalogue for bowed strings (which is of particular interest to us) and the elaboration of compilations and texts that constitute references for new research in this area of knowledge. These results were reanalysed on the basis of the categories constituted in transversal axes from which they were obtained:

- A compilation with a historical-cultural assessment of the works written for bowed strings.
- A historical-logical analysis of the compositional-evolutionary development for bowed string instruments in Cuba and its historical assessment.
- Compilation and dissemination of information on the works written mainly for the violin, viola and cello (individually or as a whole) with evaluative commentaries that facilitate their dissemination in a panoramic way or by means of recordings and their interpretative appreciation.
- A basic bibliographical source for the string instrumentalist in Cuban creation after the sixties of the last century.
- The recognition of the composer's imprint on the basis of his experience as a musician, universal performer and of his works or as an orchestra conductor.
- The conception of modernity and contemporaneity represented in Leo Brouwer's work, as well as the influence of technological development on his musical production.
- The impact of the universal artistic movements in force at a given time on the compositional development and the expression of a national culture with universal features as an identifying element in his work.
- A compilation of the discography in which the intervention of at least one stringed instrument can be distinguished.

Leo Brouwer has positioned himself and continues to advance as one of the most transcendent composers in Latin America in terms of the place occupied by his prolific production, fundamentally his compositions. His creation is representative of the 20th and 21st centuries in Cuba and internationally recognised in all its value. His merits have earned him numerous decorations and distinctions worldwide.

Among the characteristics that distinguish his creative imprint are the compositional development; the methodological expression of works for guitar recognised by music schools in Paris, Brussels, Tokyo and Toronto, among others. The technical-sound contributions are included in the world classical repertoire, whose functional sense is described by the master himself in three types: incidental music (works written for cinema and theatre), practical music (grouping creations for choirs, piano and soloists) and avant-garde music (of interest as concert music); as well as changes in compositional patterns that he enunciates as analogies to geometric forms, architectural or novelistic structures, and biological forms.

Brouwer's work describes the compositional model of his time; it embraces universal stylistic processes in a free and conscious manner, thus creating a novel and attractive artistic product. The principles of his work are a Cuban-universal style, contemporary language, social communicative intention or meaning and aesthetic value.

His technical and expressive contributions to the development of the guitar, for example, include the use of the thumb of the left hand in search of greater extension; the use of pizzicato, of percussive blows on the strings and the tops that broaden the sound and resonance possibilities of the instrument; he also experimented with the use of non-traditional tunings, the use of objects that are not proper to the instrument such as the bow or other metallic objects, etc. This consequently has repercussions on the fingering technique, on the way of bringing out the sounds and expressing sonorities, timbres and diversity of colours with an orchestral sense.

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He promoted the inclusion of experimental techniques and languages in his compositions and created exchanges and spaces to disseminate the work of other Cuban composers, especially those who initially shared with him the aesthetics of the experimental avant-garde that took place in the middle of the 20th century, and the study and analysis of their main interpretations.

The result of all this was that Brouwer revolutionised views and aesthetic ideas about modernity, contemporaneity, the avant-garde, post-modernism and all the stylistic and compositional concepts present in this process. In his work, changes in aesthetic values can be appreciated, tempered to the identity characteristics of the Cuban-universal, which expressed materially could be appreciated in the use of popular rhythms and cadences that are used together with advanced and own techniques combined with some traditional elements according to the needs of expression that the works acquire.

In the pedagogical field, Brouwer made innovations to the musician's curriculum, mainly related to the teaching of the guitar and composition, as can be seen in the analysis of his work, but he has also contributed with his instructions and master classes to the universal definition of study methodologies for the resolution of technical passages, to the way of approaching and breaking down the study of a score for its learning, as well as to the understanding of the intrinsic relationship between the material and the spiritual of the work, in accordance with the visions of the performer and the composer as key figures in the interpretative process, above all, when it comes to living composers as in his case.

Brouwer has also been a professor of harmony, counterpoint and composition, a music advisor and instructor, and his pedagogical mastery has met wide recognition on several continents, in universities in Cuba, Canada, Mexico, Australia, Japan, Sweden, Brazil, the United States and Finland, among others. He has been part of or presided over juries in national and international competitions; he also stood out as a trainer of generations of laureates who dignify the cultural progress of his country and promoted the development of a basic literature for the teaching of the guitar.

The influence of the context in his training is present since his birth in a family of renowned musicians that provided a favourable environment for his inclination towards music and his first incursions into this sphere. The possibility of taking some courses and systematic exchanges in the international sphere had an impact on his musical creation where one can visualise the development of an individualisation in the aesthetic conception; the use of hybrid techniques; a practical approach that is shown in his own expressive, communicative and reflexive language; two fundamental tendencies in the general expression where one can appreciate a writing with a futuristic look (cosmic-spatial) and another where the everyday and general feelings such as joy, mockery, sadness, love, passion, etc., are identified, as well as the exploitation of timbres and the use of timbres to express the music, as well as the exploitation of more related timbres and sonorities in the conformation of the ensembles.

Conclusions

The study of various sources related to musical research and the use of general methods applicable to qualitative research revealed the stages for the use of the life history method in musical research: preparatory, collection of information, and analysis and elaboration.

The combination of life history and case study as methods for musical research favoured the constant alignment of the research with the objectives where, taking into consideration the categories compositional-evolutionary development, music for bowed strings and catalogue of works and discography, the characteristic aspects of Leo Brouwer's composition and the impact of the context on his work stand out.

Life history as a method is feasible to apply in musical research. From the instruments designed for its implementation, results are obtained that favour the understanding of the development of a subject or phenomenon in this area of knowledge. In its application, the direction of the research should be watched over carefully, avoiding propaganda. For this purpose, a new reading is recommended, taking into account the categories identified during the preparatory stage.

ISSN 2523-2509

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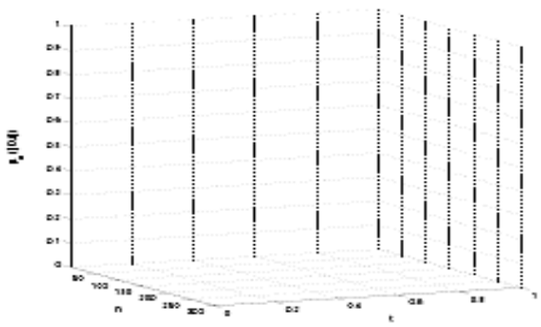

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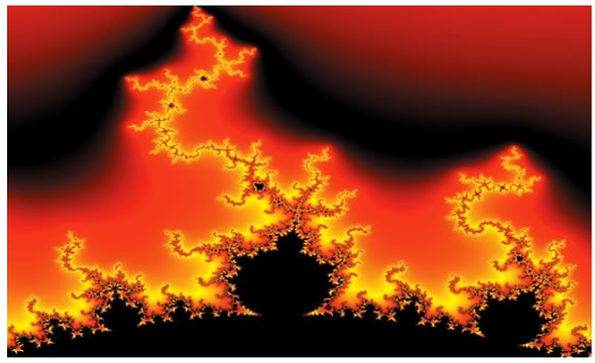

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