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Virtual environments in education

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Editorial

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Dissemination and visibility in electronic scientific journals

In recent years, electronic scientific journals have not only become popular but they have also substantially increased, along with a scientific movement that promotes free information, accessible to everyone; motivated by the necessity to spread the episteme of any area, and make public the state of art and the findings that researchers are achieving in their different specialties of influence and lines of research. This ensures two aspects that have impacted on current science; first, the dissemination of science and second the greater influence that it must have in the scientific field itself.

From these two perspectives, electronic scientific journals play an important role; in terms of dissemination, they have allowed the spread of research in all fields and specialties ; they have made possible to know the state in which they are, what is being done, the theoretical and practical findings, which new aspects or niches of research are emerging, which of them have become obsolete or simply stopped being of practical interest to the community. All of these is possible thanks to the latest spread of electronic journals and their natural environment, that is the network, open to a globalized world, where geographic spaces do not exist, nor borders that may be an obstacle to disseminate what is happening in science, technology and education. These aspects are considered fundamental by our scientific journal Hamut'ay when disseminating multidisciplinary research of the diverse academic-research fields, since its inception to the present day.

The visibility on the web together with the repositories, libraries, virtual archives, databases, indexers and other scientific sources, along with the search engines, have allowed electronic journals

Divulgación y visibilidad en revistas científicas electrónicas

En los últimos años las revistas científicas electrónicas se han popularizado e incrementado sustancialmente, acompañadas de un movimiento científico orientado a la información libre al alcance de todos, motivado por la necesidad de masificar la episteme de cualquier área, así como hacer conocer el estado del arte y los hallazgos que los investigadores están logrando en sus distintas especialidades de influencia y líneas de investigación, cumpliendo así con dos aspectos que han impactado en la actualidad científica, por una parte, la divulgación que se quiere de ellos y por la otra el que tenga una mayor penetración en el propio ámbito científico.

Desde estas dos perspectivas las revistas científicas electrónicas juegan un papel importante; en cuanto a la divulgación, que ha permitido que se cristalice la difusión de la investigación en todos los campos y especialidades, en qué estado se encuentran, que es lo nuevo que se está realizando, los hallazgos teóricos y prácticos, que nuevas vertientes o nichos de investigación están apareciendo además, cuales se han vuelto obsoletas o simplemente dejaron de ser de interés practico a la comunidad, todo esto sustentado por la masificación que se ha gestado en los últimos años de las revistas electrónicas y su medio natural que es la red, abierta a un mundo globalizado, donde no existe el espacio geográfico, ni fronteras que puedan ser un obstáculo para propagar lo que está ocurriendo en la ciencia, tecnología y la educación, aspectos considerados fundamentales por nuestra revista científica Hamut´ay al momento de divulgar investigaciones multidisciplinarias de los diversos campos del quehacer académico e investigativo, desde sus inicios hasta la actualidad.

La visibilidad en la web junto a los repositorios,

to have a greater scope, not only in the scientific community but also in the business, commercial, political and economic spheres; fields that also accompany the human development conceived in the academy. The web has not only made possible the visibility of electronic scientific journals and therefore of researchers, but also the tendency to "Open Access" to full text in scientific dissemination allows us to be read and cited, such are the cases of the DOI and ORCID, tools that provide greater visibility to scientific publications and therefore to the academy, reaching in this way to a diverse public eager to know the scientific advances being made globally. Our scientific journal Hamut'ay is aware of this, making itself visible in a total of nineteen databases, repositories, indexers, virtual libraries, where you can download the articles to full text with open access to a wealth of information that the journal has in its multidisciplinary coverage.

bibliotecas, hemerotecas virtuales, base datos, indizadores y otras fuentes científicas, junto a los motores de búsqueda, ha permitido que las revistas electrónicas puedan tener un mayor alcance, no solo en la comunidad científica sino en la esfera empresarial, comercial, política, económica, quienes también acompañan al desarrollo humano gestado en la academia. Pero no solo la web ha permitido dar visibilidad a las revistas científicas electrónicas y por ende a los investigadores, la tendencia al "Open Access" a texto completo en la divulgación científica permite que se nos lea y se nos cite, tales son los casos de el DOI y ORCID, herramientas que brindan una mayor visibilidad a las publicaciones científicas y por ende a la academia, permitiendo así llegar a un público diverso, interesado en conocer los avances científicos que se están realizando a nivel global; y de esto está consciente nuestra revista científica Hamut´ay al hacerse visible en un total de diecinueve bases de datos, repositorios, indexadores, bibliotecas virtuales, donde se pueden descargar los artículos a texto completo con acceso abierto a todo el bagaje de información que tiene en su cobertura multidisciplinaria.

Dra. Cleofé Genoveva Alvites Huamaní
Editor in Chief of the Hamut'ay journal

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Sociodemographic aspects and self-regulation of incoming online psychology students

Aspectos sociodemográficos y autorregulación de estudiantes de nuevo ingreso a Psicología en línea

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Abstract

Analyzing the levels of self-regulated learning of incoming online psychology students and their relationship with sociodemographic variables in four consecutive generations was the objective that promoted all this work. The sample consisted of 896 students, of whom 242 were men and 654 women with an average age of 32.2 years. It is a quantitative study with a longitudinal tendency given that a measurement was made for each incoming group to the degree program during four semesters. The scope is correlational, since sociodemographic variables are used to establish the average differences and find the influence between these variables and self-regulation. For this purpose, the Motivation and Learning Strategies Questionnaire was used, which has the Motivation Scale and the Learning Strategies Scale, each one with sub scales. It was found that women reported higher levels of orientation to extrinsic goals and a higher level of Learning Strategies, along with the group of divorced students. Those students who are more than 36 years old reported higher levels of Learning Strategies; It was also found that the most current semester students refer a slight tendency

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to have better Learning Strategies.

Keywords: Self-regulated learning, higher education, online education.

Resumen

Analizar los niveles de Aprendizaje Autorregulado de estudiantes de psicología en línea de nuevo ingreso y su relación con variables sociodemográficas en cuatro generaciones consecutivas fue el objetivo que impulso todo este trabajo. La muestra estuvo conformada por 896 estudiantes, de los cuales 242 fueron hombres y 654 mujeres con una media de edad de 32.2 años. Se trata de un estudio cuantitativo, longitudinal de tendencia, dado que se realizó una medición por cada grupo de nuevo ingreso a la licenciatura durante cuatro semestres. El alcance es correlacional, ya que se emplean variables sociodemográficas para establecer diferencias de medias y encontrar la influencia entre estas variables y la autorregulación. Para ello se empleó el Cuestionario de Motivación y Estrategias de Aprendizaje, el cual cuenta con la Escala de Motivación y la Escala de Estrategias de Aprendizaje, cada una con sub escalas. Se encontró que son las mujeres quienes reportan mayores niveles de orientación a metas extrínsecas y un mayor nivel de Estrategias de Aprendizaje, al igual que el grupo de estudiantes divorciados. Aquellos estudiantes con más de 36 años reportan mayores niveles de Estrategias de Aprendizaje; también se encontró que los estudiantes de semestres más actuales refieren una ligera tendencia a contar con mejores Estrategias de Aprendizaje.

Palabras Clave: Aprendizaje autorregulado, educación superior, educación en línea.

Introduction

Distance education has provided opportunities to sectors of populations, which, for various reasons, do not have access to education. However, despite the new opportunities, there are high rates of desertion or lag associated with factors such as lack of educational or technological support, lack of institutional support, or the students themselves lacking proper study skills and methods (Escanés, Herrero, Merlino & Ayllón, 2014).

According to Torrano, Fuestes & Soria (2017), the emergence of this form of access to knowledge gave the student the need to generate autonomy. The driving idea behind this concept is that the student knows their cognitive processes and controls their own learning. In this way, their education is not limited to acquiring knowledge through others, but free to develop in a personal way, integrating personal experience. Through access to online education, the student can further develop their learning and cognitive skills in an individualized manner. From elementary to higher education, the inclusion of Communication and Information Technologies (ICT) in the educational process has shifted focus onto the strategies of self-regulated learning in virtual environments, as well as in different online tools, which teach cognitive strategies, metacognitive links, and collaborative learning.

In recent years, interest in researching self-regulation in the academic framework has skyrocketed. One-way self-regulation is defined is as the process in which students activate and maintain their cognition, affection, emotion and behavior to focus on achieving goals. Self-regulation and the skills developed translate from the school context into post-educational life (Brandmo & Berger, 2013).

In this regard, Cabero (2013) mentioned that self-regulation or self-regulated learning refers to the ability of the student to manage and regulate their learning, applying strategies and evaluating then improving the process to achieve goals. As the primary participant of their own training, the student establishes goals and objectives independently, and makes conscious decisions as to how

they will learn.

According to Hernández & Camargo (2017) self-regulation is the intentional and self-motivated organization of activities at the cognitive level, the process by which the student sets and organizes the environment to achieve objectives, whether self-imposed or assigned by a third party. Both behavioral and environmental influences can affect the student's learning success. Below are models based on a literature that analyze the theoretical components of self-regulation.

Models of Self-regulation

Several models of self-regulation have emerged in recent years. Each model shares similar elements but emphasizes different phases. Among the best-known models are the Three-phase Model, Zimmerman (2000), and the Model of Areas and Phases, Pintrich (2000). Both models propose similar phases concerning self-regulation and both Pintrich and Zimmerman designate the student as lead actor in their own learning process.

Pintrich (2000) mentions four components of these models. First, the participants (student) as a constructive and active agent of their own education. The student must derive their own meaning from material learned and balance their own objectives and internal strategies (mind) within their external influences (environment). Second, the student's immersion in active learning processes in order to monitor, control and potentially regulate their own reason, motivation, behavior, and environment. Third, the student's ability to establish and follow a goal path, adjusting as needed to meet standards. The fourth component is related to the activities that function as a mediator between the student and the environment. Besides the student's current goal, self-regulation of cognition, motivation, and behavior are the factors that mediate the relationship between student, environment, and success.

Pintrich's model (2000) examines different areas such as cognition, metacognition, behavior, and context, which typically focus on physical scenarios, such as the traditional face-to-face classroom, but also apply to virtual learning environments. A brief description of the phases is: 1. Planning: Set goals, objectives and activate cognitive resources to achieve them. 2. Monitoring: While performing a task, think about the execution; question whether help is needed, and the amount of time spent working. 3. Control: Select and adapt strategies, negotiating the amount of work needed to complete the task. Increase or decrease effort as needed. 4. Reflection: Make judgments about the strategies created and their implementation, then evaluate the task and context under which it was completed.

During each of these phases, the student organizes and manages various resources in different areas such as the cognitive, i.e. what students think about the task, including review and use of prior knowledge; the metacognitive area, which includes the judgments of self-efficacy, the interests of the student and the perception of the difficulty of the task; the behavioral area, which deals with the actions the student takes to carry out the task and involves planning, time management, effort, motivation and self-observation, etc., the contextual area, where elements of the task may be negotiated, the conditions under which the task is done are monitored, and changes may be made according to the emotional reaction to and overall success of learning strategies implemented.

These phases illustrate that different models of self-regulation share emphasis on motivation and the goals and objectives of the student, differentiating between intrinsic and extrinsic goals, which differentiates this self-regulation model from others (Winne, 2015).

In addition to the importance of sticking to a model of self-regulation, it is necessary to review how the chosen model has been evaluated in academic contexts. Traditionally and historically, Winne & Perry (2000, cited in Torrano & González, 2004) make a distinction between two ways to study self-regulation. First, to accept self-regulation as an ability and evaluate it through instruments—usually self-evaluation—describing any qualities or relatively stable attributes of the student in order to predict their behavior, cognition and motivation in other scenarios. Alternatively, to evaluate it through instruments that collect information

on conditions and processes that the auto-regulated student displays over time; for example, using vocal protocols or observatory measures. In this sense, Hernandez & Camargo (2017), with college students, conducted a meta-analysis of 43 empirical studies, finding agreement with the literature, which assumes self-regulation is an ability, and a strong interest in having reliable and valid instruments.

Self-regulation and Socio-demographic Aspects

Different students illustrate different elements of self-regulation. Dörrenbächer & Perels (2016) mentioned students who know that the meaning of "success" is to achieve one's goals have high levels of motivation and self-regulation. Additionally, the same students demonstrate low levels of anxiety and are more extroverted.

Regarding gender, Altun & Erden (2013) found that in metacognitive areas, components such as time and environmental management and regulation of effort were characteristics related to male students, while regulation of effort was the only element that might explain the women's success, possibly due to a cultural effect since most families in this region support self-efficacy of men from early ages.

On the other hand, Vives-Varela., Durán-Cardenas, Varela-Ruiz & Fortoul Van Der Goes (2014) mentioned that those students who have the ability to self-regulate tend to perform higher academically, as they're strategic when planning their goals, monitor their own progress, and evaluate their own performance. They are also aware of how they learn, enabling them to take advantage of their environment, regulating the context, for example, benefiting from the use of technology and collaborative work.

Analyzing these investigations led to finding aspects associated with the population that may have an impact on levels of motivation and learning strategies. For example, Torrano & Soria (2017) mentioned that women have better strategies and confidence in their performance because they know themselves as students. Cano-Garcia (2000) mentions that men are more motivated than women in social sciences careers and have better learning strategies. Regarding variables related to demographic aspects, Areth-Esteves, Castro-Martinez & Rodriguez - Granobles (2015) mentioned that when studying desertion, age is an important factor. Another aspect that Camacho, Gomez & Pintor added is the student's ability to manage technology. Ruiz-Palacios (2018) cites factors inherent to the lifestyle of adult learners as the main variable associated with desertion; travel, family, health, time, and other priorities of married students.

Once we reviewed the sociodemographic elements proposed by the literature, we developed the following objective: to relate the levels of self-regulation and the sociodemographic variables of four generations of incoming online psychology students.

Hypothesis:

- H1: The level of self-regulation is related to the sociodemographic variables such as gender, age and marital status of incoming online psychology students.
- H0: The level of self-regulation not related to the sociodemographic variables such as gender, age and marital status incoming online psychology students.

Materials and Methods

Participants

The selection of the sample was not random. 896 volunteer students signed informed consent. 73% of the sample was women and the age range of the full sample was 18 to 65 years, with an average of 32.2, residing in different States of the Mexican Republic and belonging to urban and rural areas. The sample was formed by first-semester students from semesters 2017-1, 2017-2, 2018-1, and 2018-2 in online psychology of the Faculty of Estudios Superiores Iztacala

Instrument

Motivated Strategies for Learning Questionnaire (MSLQ) assesses strategies of learning and motivation, variables related to self-regulation in the student.

Among the studies that have used this instrument we can mention Martinez & Galan (2000) and Ramirez, Canto, Bueno & Echazarreta (2013), both of Mexican samples. The first study was of the relationship between learning strategies and motivation, along with grades. The instrument indicated an alpha of .72 for the sub-scales of motivation, and an alpha of .65 for the sub-scales of learning strategies. The second study needed to be translation and adapted from the original version of the MSLQ to Mexican Spanish. This process is described in Ramirez et al.'s publication (2013), which is the guideline established in the Test International Committee. The results conclude that items were grouped correctly by principal axis factoring and levels of internal consistency obtained with the Spanish version were acceptable, reaching 0.90 Cronbach alpha values.

According to Curione & Huertas (2017), the MSLQ has a solid theoretical structure, which has been adapted to different populations while maintaining or strengthening its factorial structure. The MSLQ is sensitive to contextual variations in accordance with the type of disciplinary knowledge the students have. Crede & Phillips (2011) highlight the instrument MSLQ among others by its contextual adaptability in relation to motivation and self-regulated learning.

Regarding the reliability of the instrument, Feiz & Hooman (2013) mentioned that the reliability of studies employing the MSLQ varies between .52 and .80, with an alpha of .95 for the instrument. Saks, Leijen, Edovald, & Oun (2015) adapted the MSLQ for use in Estonia through the method of translation/retro-traduccion, obtaining coefficients of reliability that varied from .34 to .90 for the scale scores and .92 as a general score. Meanwhile, Valentin (2013) employed the MSLQ with college students and found an alpha coefficient of .80 for the motivation scale and .89 for the learning strategies scale but claims that it is necessary to review the psychometric properties of the sub-scales of the instrument.

After the information was collected, it was decided to revisit and adapt the MSLQ already adapted by Ramírez (2013) to an online context and apply it to incoming online psychology students.

The MSLQ consists of 81 questions to be answered on a Likert scale of 1 to 7, where 1 means "strongly disagree" and 7 means "strongly agree," divided into two scales: learning strategies, and motivation strategies. The reliability Alfa of Cronbach reported by Ramírez et al. (2013) was a .85 on the scale of learning strategies and .90 on the motivation strategies scale. This evaluation was done online, through Google forms. You can access a version of the instrument in the following link: https://goo.gl/forms/Hkb3FYY4HABNuvGB3.

Once adapted, we analyzed the internal consistency of both scales through Alpha of Cronbach. A coefficient of .61 was found for the motivation scale, so reliability is moderate. A coefficient of .84 was found for the scale of learning strategies, so the scale is reliable. This moderate reliability is consistent with some of the research mentioned above. It is necessary to take the results with some caution.

For the present investigation, some terms were modified to contextualize it in the study of online learning. The words that refer to the classroom were modified to online studies, and the references to printed material or printed text were changed to digital materials and resources as shown below.

Original:

81. I try to implement ideas of themes I have studied in other learning activities, such as, for example, debates.

Adapted:

81. I try to implement ideas of themes I have studied in other learning activities, such as, for example, debates or forums online.

Type and design

It is a non-experimental study because we observed pre-existing situations, while the design

type is longitudinal, because changes of certain variables are analyzed over time in context and a specific community (Hernandez, Fernandez & Baptista, 2010). In this design, the trend is analyzed over time. The interest within the population varies, and this is the main feature, since the participants in the study are not the same, but the population is.

Procedure

Incoming students who voluntarily consented were invited through institutional media such as e-mail. The instrument was applied through a system of surveys online (Google forms). Once the data was collected, it was analyzed using Excel, to subsequently perform statistical analyses using SPSS program version 20.

Confidentiality or Informed consent

Before answering the instrument via the Google form, each student accepted informed consent. Without this, they could not obtain the instrument (see annex 1).

Results

Descriptive analysis was performed on how the sample was formed, the number of students per semester, marital status, and age. Sociodemographic aspects were taken into account as well. These data are described in table 1.

Table 1
Displays aspects socio-demographic of the sample in relation to the evaluated half

Semester	N	Married	Single	Divorced	Average age	%
2017-1	250	106	129	15	31.77	27.9
2017-2	211	96	103	12	33.01	23.5
2018-1	207	74	121	12	32.58	23.1
2018-2	228	89	129	10	31.74	25.4
Total	896	365	482	49	32.24	100

We can observe in Table 1 that the semester with least number of married students was 2018-1 with 74, while the semester with the highest amount was 2017-1 with 106. The fewest singles arose in 2017-2 with 103 and the semesters with most singles were 2017-1 and 2018-2 with 129. The number of divorced students was relatively low in the four semesters, ranging between 10 to 15 per semester. Regarding the age of the students, the lowest average was found in the semester of 2017-1 with 31.77 years, while the semester 2018-1 had the highest average with 32.58 years.

To show the distribution of students according to gender and age the sample was divided into three quartiles taking into account the age, which is shown in Table 2.

Table 2
Gender and age of the sample

Age Group (years)	Men	Women	Total
18-27	76	258	334
28-36	91	189	280
37-63	75	207	282
Total	242	654	896

As we can see the group with the largest number of men was the range between 28 and 36, while the group with more women was the one between 18 and 27 years.

Once we did this analysis, we proceeded to divide the sample into ages according to marital status, it is shown in Table 3.

Table 3
Age and marital status of the sample

Age Group (years)	Married	Divorced	Single	Total
18-27	79	3	252	334
28-36	118	12	150	280
37-63	168	34	80	282
Total	365	49	482	896

In this Table, we found that the biggest group was singles between 18 to 27 years with 252 participants, followed by the group of married students aged between 37 and 63 with 168 participants.

The smaller group was divorced students with an age between 18-27 years with only 3 participants.

Table 4
Gender and marital status of the sample

Gender	Married	Divorced	Single	Total
Men	83	13	146	242
Women	282	36	336	654
Total	365	49	482	896

In this arrangement, the largest group is single women with 336 participants, followed by married women with 282. The larger male group is single men with 146, and the largest group of divorcees was the women with 36 participants. This is show in table 4.

We made a descriptive analysis of each scale of the instrument MSLQ taking into account the sub-scales, which compose them. Descriptive data on the motivation scale is found in table 5.

As you may notice, the sub-scale with a higher score was "Task Value" with a median of 6.41 and typical deviation of 0.67. The sub-scale with lowest score was "Test Anxiety" with a median of 3.98 and typical deviation of 1.44.

For the motivational scale we found a median of 5.41 and typical deviation of 0.62; it can be considered a medium-high score. Table 6 shows the descriptive analysis of the scale of learning strategies.

Table 5
Minimum, Maximum, Median and Typical Deviations of the motivation scale

	Minimum	Maximum	Median	Std. Dev.
Intrinsic Goal Orientation	2.00	7.00	5.39	.98
Extrinsic Goal Orientation	1.00	7.00	5.12	1.33
Task Value	2.33	7.00	6.41	.67
Control Beliefs	2.75	7.00	5.75	.87
Learning Self-efficacy	1.63	7.00	5.82	.89
Test Anxiety	1.00	7.00	3.98	1.44
Motivation Scale	2.20	7.00	5.41	.62

Table 6
Minimum, Maximum, Median and Typical Deviations of the learning strategies scale

	Minimum	Maximum	Median	Std. Dev.
Repetition	1.00	7.00	4.74	1.17
Elaboration	1.50	7.00	5.44	1.02
Organization	1.00	7.00	5.70	1.12
Critical thinking	1.00	7.00	5.23	1.10
Metacognitive Self-regulation	2.00	7.00	5.02	.87
Time and Environment Management	1.25	7.00	4.95	.91
Effort Regulation	1.00	7.00	4.78	1.13
Learning with Classmates	1.00	7.00	3.39	1.44
Help Seeking	1.00	7.00	3.76	1.32
Learning Strategies	1.69	7.00	4.78	.76

On this scale the highest average was in the subscale of "Organization" with 5.70 and typical deviation of 1.12, While the sub-scale with smallest median was "Help Seeking" with 3.76 typical deviation of 1.32. The median for the scale of learning strategies was 4.78 and a typical deviation of 0.76, which is considered a medium value.

To differentiate the demographic variables, we took into account gender, age, marital status and semester of admission to the major.

The next table shows the significant differences in the median within the sample, taking gender as a variable, analyzing median differences of independent samples from a student's t-distribution.

As you can see, in all these sub-scales the median favors the group of women, the most significant difference being test anxiety and effort regulation. All the differences obtained were significant (p = 00).

Below we show statistic differences based on the analysis of median differences using the ANOVA factor.

Table 8 shows the results by taking the semester of enrollment as a grouping variable.

Table 7
Significant results of the analysis of student's t-distribution of independent samples taking gender as a variable

Subscale	t(gl), sig.	Gender	Median	Std. Dev.
Extrinsic Goals Orientation	t(894)= -274, p=0.00	Men Women	4.92 5.19	1.39 1.30
Task Value	t(894)= -3.96, p=0.00	Men Women	6.26 6.46	0.80 0.61
Test Anxiety	t(894)= -4.11, p=0.00	Men Women	3.66 4.10	1.34 1.46
Motivation Scale	t(894)= -3.53, p=0.00	Men Women	5.29 5.45	0.69 0.59
Repetition	t(894)= -2.61, p=0.00	Men Women	4.57 4.81	1.12 1.18
Elaboration	t(894)= -2.61, p=0.00	Men Women	5.30 5.30	1.07 1.00
Organization	t(894)= -6.40, p=0.00	Men Women	5.31 5.84	1.25 1.04
Metacognitive Self-regulation	t(894)= -2.97, p=0.002.00	Men Women	4.88 5.07	0.83 0.87
Time and Environment Management	t(894)= -2.66, p=0.00	Men Women	4.81 5.00	0.94 0.90
Effort Regulation	t(894)= -3.04, p=0.00	Men Women	4.59 4.85	1.09 1.14
Help Seeking	t(894)= -2.65, p=0.00	Men Women	3.57 3.83	1.32 1.31
Learning Strategies	t(894)= -3.89, p=0.00	Men Women	4.62 4.84	0.79 0.74

Table 8
Results from the ANOVA factor taking the semester of enrollment as a variable

Subscale	F	Semester	Median	Std. Dev.
Test Anxiety	F(3,892)= 2.64, p=0.04	2017-1 2017-2 2018-1 2018-2	3.84 4.05 3.86 4.16	1.37 1.38 1.52 1.48
Organization	F(3,892)= 3.96, p=0.00	2017-1 2017-2 2018-1 2018-2	5.72 5.70 5.87 5.55	1.09 1.19 0.98 1.20
Metacognitive Self-regulation	F(3,892)= 4.26, p=0.00	2017-1 2017-2 2018-1 2018-2	4.92 4.94 5.18 5.06	0.93 0.95 0.73 0.81
Effort Regulation	F(3,892)= 29.83, p=0.00	2017-1 2017-2 2018-1 2018-2	5.09 5.13 4.35 4.50	1.29 1.22 0.86 0.85
Help Seeking	F(3,892)= 31.34, p=0.00	2017-1 2017-2 2018-1 2018-2	3.28 3.49 4.17 4.18	1.24 1.30 1.24 1.24
Time and Environment Management	F(3,892)= 2.84, p=0.03	2017-1 2017-2 2018-1 2018-2	4.88 4.84 5.04 5.05	0.93 1.22 0.61 0.76

As you can see in table 8, in most of the 2018-1 semester generation presented higher than median average, except for the sub-scale of effort regulation, while the lowest average generation was that of 2017-1.

The sample was divided into three quartiles by age, which generated three ranges: from 18 to 27 years, 28 to 36 years and 36 to 63 years. By grouping the sample for the analysis by age, we obtained the information in Table 9.

Table 9
Results from the ANOVA factor taking age ranges as the variable

Subscale	F	Group (Years)	Median	Std. Dev.
Intrinsic Goals Orientation	F(2,893)=4.76 p=0.00	18-27 28-36 37-63	5.26 5.43 5.50	1.02 0.98 0.93
Extrinsic Goals Orientation	F(2,893)=6.85 p=0.00	18-27 28-36 37-63	5.31 5.09 4.92	1.30 1.38 1.27
Test Value	F(2,893)=11.23 p=0.00	18-27 28-36 37-63	6.29 6.41 6.54	0.74 0.67 0.56
Test Anxiety	F(2,893)=8.09 p=0.00	18-27 28-36 37-63	4.21 3.93 3.75	1.40 1.46 1.43
laboration	F(2,893)=7.83 p=0.00	18-27 28-36 37-63	5.31 5.41 5.63	1.05 1.02 0.95
Organization	F(2,893)=7.58 p=0.00	18-27 28-36 37-63	5.54 5.68 5.89	1.13 1.12 1.09
Metacognitive Self-regulation	F(2,893)=10.35 p=0.00	18-27 28-36 37-63	4.90 4.97 5.21	0.92 0.81 0.83
Time and Environment Management	F(2,893)=16.15 p=0.00	18-27 28-36 37-63	4.76 4.94 5.18	0.95 0.90 0.82

Subscale	F	Group (Years)	Median	Std. Dev.
Effort Regulation	F(2,893)=4.54 p=0.01	18-27	4.67	1.09
		28-36	4.74	1.12
		37-63	4.94	1.18
Learning Strategies	F(2,893)=5.81 p=0.00	18-27	4.71	0.79
		28-36	4.73	0.75
		37-63	4.91	0.72

You may notice significant differences favoring the oldest group (37 to 63 years) reaching values considered high in sub-scales SUCH as task value (median = 6.54, typical deviation = 0.56), with the exception of extrinsic goals orientation where the participants between 18 and 27 years were higher than average (median = 5.31, typical deviation = 1.30) and test anxiety that also favors the group from 18 to 27 years (median = 4.21, typical deviation = 1.40). The group of 28 to 36 years did not get any higher results than the other groups.

Lastly an analysis of median differences taking marital status as grouping variable. The results are shown in table 10.

Table 10
Results from the ANOVA factor on the marital status variable

Subescale	F	Group	Median	Std. Dev.
Elaboration	F(2,893)=3.90 p=0.02	Married	5.54	0.94
		Divorced	5.56	0.91
		Singles	5.35	1.08
Organization	F(2,893)=7.21 p=0.00	Married	5.84	1.03
		Divorced	5.89	1.12
		Singles	5.56	1.18
Metacognitive self-regulation	F(2,893)=5.01 p=0.00	Married	5.12	0.81
		Divorced	5.13	0.89
		Singles	4.94	0.90
Time and environment management	F(2,893)=8.71 p=0.00	Married	5.05	0.89
		Divorced	5.27	0.90
		Singles	4.84	0.92
Effort regulation	F(2,893)=5.02 p=0.00	Married	4.89	1.15
		Divorced	4.99	1.23
		Singles	4.67	1.10
Learning stragegies	F(2,893)=4.62 p=0.01	Married	4.85	0.72
		Divorced	4.91	0.74
		Singles	4.71	0.78

As you can see in the table above, all significant differences favor the group of divorced students who reached high median values in sub-scales such as organization (median = 5.89, typical deviation = 1.12), while the group of singles presented in most of the sub-scales a medium-low rate, especially on the scale of learning strategies (median = 4.71, typical deviation = 0.78).

Discussion and Conclusions

The initial focus and purpose of this project was to analyze levels of self-regulation and sociodemographic variables that can affect it through four generations of incoming online psychology students. After analyzing the differences found statistically significant, we accepted our hypothesis as true; that the level of self-regulation is related to sociodemographic variables such as gender, age and marital status of the incoming online psychology students.

The findings of self-regulation and their components of motivation and learning strategies reveal an important panoramic of which aspects need to be influenced in order to increase these levels. Most findings show that students are highly intrinsic-goal-oriented, which is consistent with the findings of other authors such as Martin (2018); he stated that students are more concerned about their learning than extrinsic goals, or comparing their performance with other students, and that they assign high value to the tasks of their newly begun online education.

In terms of learning strategies, they showed high levels of organizational strategies, which refers to the ability to employ strategies like underlining and use of graphics and diagrams for studying relevant information.

In contrast to the findings of Martin (2018) where students in a traditional system obtained high values in time and environment management, learning with peers, and help seeking, in our case values considered median for these components were obtained. Broadbent & Poon (2015) claim it is important to increase peer-learning, especially in online education, so it is a finding to keep in consideration for future studies.

In terms of the findings, when comparing the sociodemographic characteristics of the population, it comes to our attention that there are median differences favoring the group of women when taking gender as a variable on the motivational scale and learning strategies scale. This confirms the findings of Torrano & Soria (2017), who found that women have better levels of learning strategies while the men showed higher levels of motivation. They explained that the differences in these scores is because women have a greater understanding of themselves, therefore they are able to make greater use of strategies.

Also relating to motivation for women, we confirmed the findings of the study of Cano-Garcia (2000) where women outperformed men in terms of intrinsic motivation, interest in and attitude towards studying, time management, and use of learning strategies, while the extrinsic motivation and achievement favored males. Cano-Garcia (2000) attributed this to a higher level of anxiety of female students, favoring the use of strategies and intrinsic motivation. This did not occur in our study, since we found no gender differences in the levels of intrinsic goal orientation, but did find differences in the extrinsic goal orientation, which favored women. This may be related to the type of sample where 73% are women who may be seeking a better life by updating their academic status. Despite these findings in the literature there is not conclusive data regarding gender. In the study of Altun & Erden (2013) self-regulation median favors men, meanwhile in the findings of Zimmerman & Kitsantas (2014) found no differences between genders.

When we analyzed age ranges on the motivation scale, the sub-scales of intrinsic goals orientation and the task value favored the older group (37 to 63 years), while extrinsic goals orientation and test anxiety favored the younger group (18 to 27 years), demonstrating the possibility that young students pursue external benefits such as a better work or improved the quality of life. The younger students may have higher levels of anxiety because they are accustomed to rigorous testing in the traditional school environment. The older students, who have not been in contact with this situation, may have lower anxiety because of the unfamiliarity to test pressure.

In the sub-scales of learning strategies, the older students are the ones who had significantly higher levels in development strategies, organization, metacognitive self-regulation, time and environment management and effort regulation. If we take into account that the younger population had high levels of anxiety before tests, we confirm the findings from Furlan, Rosas, Heredia, Illbele & Martinez (2012), who mention that students with high anxiety before tests make more use of superficial learning strategies, while those who have low anxiety turn to critical and reflective strategies. Apparently, a high level of anxiety and lack of confidence is associated with behaviors of avoidance and reduction of learning strategies, while an appropriate level of concern for good performance promotes the mobilization of cognitive resources that prepare to the student to use strategies for managing effort, taking advantage of time, addressing problems, and having greater self-efficacy for the regulation of learning.

An apparent contradiction related to age and its impact on self-regulation is that in most of the related learning strategies sub-scale scores favored the older group (37 to 63 years). In this regard Rovai (2003), cited in Areth, Castro-martinez & Rodriguez (2015) mentioned that adults are at greater risk of dropping out given the labor and social context in which they operate as fathers and mothers of families, however, they are found to be good users of learning strategies.

In this regard Yuni (2018) mentions that adults of middle age and early old age tend to hold favorable beliefs about study, maintaining an individualistic view of learning and promoting the recognition of their abilities. Therefore, it is possible that they perceive themselves as students that had have good learning strategies throughout their life, which is consistent with the position of Vives-Varela (2014) who claims that students who are perceived as self-regulating are aware of how they learn strategically.

There are two important actions to carry out: first, emphasize and strengthen the beliefs of the older group on their own abilities in addition to promote collaborative learning and the use of te-

chnology; second, encourage young people to develop an optimal level of self-knowledge. This is relevant since it is likely that they are confronted with a scenario of online study for the first time.

Concerning variables influencing desertion of online education, Herrero, Merlino & Ayllon (2014) mentioned the difficulties of time management of individuals who have family obligations, such as parents. These personal factors tend to be deciding to choose online education to continue their studies, but they are also elements that affect academic performance. This is partially confirmed by the found data, since, despite being a small group, divorced students—mostly women—reported higher levels of learning strategies. This has called to our attention that they are good managers of their time and environment and therefore the dedication to study, while married and unmarried students showed levels below the divorced.

To make the comparison of averages by generation, we found that levels of self-regulated learning reported increased with each generation; the lowest average evaluated during the first semester (2017-1) and the highest during 2018-1, with similar values to the last evaluated semester (2018-2). The significant difference between these generations can be found especially in the area of learning strategies. Noting that the ages do not differ significantly between generations was discarded this as an influential variable. We also found a slight increase of unmarried students, while married students decreased; a slight difference of little significance. There has been speculation about the proximity of every generation to the use of internet tools for learning and everyday life; however, these factors are not input as part of our data to establish the correlation since instruments to measure them have not been implemented for the level of knowledge, management and use of technologies in this population. However, it may be relevant in a later evaluation since it is a variable that Camacho, Gomez & Pintor (2015) say stands out as crucial for achieving good performance of an online, adult undergraduate student, especially for the management of information, communication, time management and the basic use of the platform.

In conclusion, online students with an average age of 32 years, mostly women (70%), have high levels of motivation and learning strategies, which are important factors of self-regulated learning. Specifically, women have higher levels of self-regulated learning than men, whereas divorced students and students over the age of 37 reported higher levels of learning strategies. The most recent generations show higher levels of organization, seeking help and time and environment management, as part of learning strategies.

Among the contributions, we can highlight the use and adaptation of the Ramirez et al. MSLQ (2013) to a context of online study. Curione & Huertas (2012) cited online study as an area that had not yet been taken into account on the MSLQ. It was decided that rather than increasing scales, TIC-related items be slightly amended to correspond to digital materials, an online platform, and the asynchronous time to cover the scenarios facing the population that participated in this study so that the learning situation was contextualized. However, it is important to review some aspects of the instrument to improve its reliability on the motivation scale.

The results of this study can benefit new online students entering the system by providing the opportunity to influence those elements that benefit or restrict the student's levels of self-regulation. On these strategies Escanés, Herrero, Merlino & Ayllon (2014) suggest that university institutions take into consideration the implementation of the commitment of the teaching staff, a tutoring plan, content generation, and its professionalization and relevant curricula for students and motivation and social integration of the student population at the university. This is consistent with the proposal of De Smul, Heirweg, Van Keer, Devos & Vandevelde (2018), who suggest that it is important to evaluate and train teachers so that they can foster the development of self-regulation of students.

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Annex

Informed consent prior to entering the MSLQ instrument used in the online mode.

EVALUACIÓN PSICOLÓGICA 2018-2

Evaluación emocional para conocer el perfil psicológico de los participantes.

El objetivo de la evaluación es conocer su perfil emocional. La evaluación está compuesta por 4 instrumentos de autoinforme que están orientados a indagar aquellos aspectos que la investigación ha demostrado que son importantes abordar.
Le tomará entre 30 a 45 min.
Los participantes seleccionados se les invitará, en una segunda etapa del proyecto, a recibir consejería psicológica de forma gratuita.

Aspectos éticos y confidencialidad de los datos:
- Todos los participantes serán voluntarios que hayan dado su consentimiento informado para participar en el estudio.
A todos los participantes elegibles se les dará información oral y escrita sobre el estudio. Los participantes pueden abandonar el estudio en cualquier momento sin necesidad de dar ningún tipo de explicación y sin que sufran ningún tipo de perjuicio por ello.
La selección de los participantes se realizará de acuerdo a la evaluación clínica realizada por personal calificado.
El protocolo de evaluación se compone de instrumentos estandarizados que no suponen riesgos para los participantes.
No se realizarán informes para terceros ni se cederán los datos de la evaluación, del posible tratamiento ni de los seguimientos derivados de la intervención. Todos los datos permanecerán bajo el anonimato y serán tratados única y exclusivamente con fines de investigación. Los datos personales serán custodiados y protegidos

CONSENTIMIENTO INFORMADO*
A través de este documento, certifico que he sido informado/a con la claridad y veracidad debida, respecto a la evaluación psicológica perteneciente a la Facultad de Estudios Superiores Iztacala de la Universidad Nacional Autónoma de México, en el que se responderán seis escalas de autoinforme, con el objetivo de conocer tu perfil emocional y poder brindarte en mediano plazo un apoyo psicológico gratuito. Estoy de acuerdo en participar en la investigación, dejando claro que se respetará la buena fé, la confiabilidad y confidencialidad de la información por mí suministrada, sin mencionar mi nombre en cualquier reporte o presentación que se realice con los resultados obtenidos de la mencionada investigación. Para cualquier duda o aclaración, comunicarse con la responsable del proyecto, Dra. Anabel de la Rosa Gómez al correo anabel.delarosa@ired.unam.mx.

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Online tutor's knowledge in a Mexican public university: TPACK Model

Conocimientos del tutor en línea en una universidad pública mexicana: Modelo Tpack

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Abstract

The online tutor's perspective on their knowledge concerned with the subjects they teach in a fully online university education program was analyzed, from the Technological Pedagogical Content Knowledge (TPACK) model, which includes seven dimensions. A Likert TPACK scale was used, which was adapted to the activities of the tutor in a virtual classroom in a university training program. Two hypotheses were tested considering two predictors, the training received and the time dedicated to online tutoring activity (considered as the number of hours hired at the institution). It is a cross-sectional study with an intentional sample, in which 50 online tutors participated voluntarily. The results show acceptable reliability in all dimensions; the general average of the group was of 129, with a minimum score of 33 and a maximum of 155. In the Content Knowledge dimension: 70% of the tutors say they strongly agree to possess it. In the other dimensions, their answers oscillated between the options, strongly agree and agree. The statistical test indicates that the training (online or mixed) is not associated with the perceived knowledge, since the time dedicated to online tutoring is directly proportional associated to the perception of knowledge (Mann-Whitney z = -2.741, n = 34, p. = .006). This result is consistent with other studies. It was also identified that in the dimensions related to technological knowledge the differences are more significant.

Keywords: Online tutor, teaching knowledge, TPACK, Distance education.

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Resumen

Fue analizada la perspectiva del tutor en línea sobre sus conocimientos delimitados a las materias que imparten en una formación universitaria totalmente en línea, desde el modelo Conocimientos Tecnológicos Pedagógicos y de Contenido (TPACK) que contempla siete dimensiones. Se empleó una escala tipo Likert TPACK que fue adaptada a las actividades del tutor en un aula virtual en un programa de formación universitaria. Se probaron dos hipótesis considerando dos predictores, la formación recibida y el tiempo dedicado a la actividad de tutoría en línea (considerado como el número de horas contratadas en la institución). Es un estudio transversal con una muestra intencional, participaron voluntariamente 50 tutores en línea. Los resultados muestran una confiabilidad aceptable en todas las dimensiones; la media general del grupo fue de 129, con una puntuación mínima de 33 y una máxima de 155; en la dimensión Conocimiento de Contenido, el 70% de los tutores dice estar muy de acuerdo con poseerlo; en las demás dimensiones sus respuestas oscilaron entre las opciones muy de acuerdo y de acuerdo. La prueba estadística indica que la formación (en línea o mixta) no se asocia con el conocimiento percibido, en tanto que el tiempo dedicado a la tutoría en línea se asocia de manera directamente proporcional a la percepción del conocimiento (Mann-Whitney z=-2.741, n=34; p.= .006). Este resultado coincide con otros estudios. Así mismo se identificó que en las dimensiones relativas al conocimiento tecnológico las diferencias son más marcadas.

Palabras Clave: Tutor en línea, conocimientos docentes, TPACK, Educación a distancia.

Introduction

Online education is an increasingly important for university education, where the professor is often identified as a tutor, responsible for accompanying the student is learning through different activities. This process of accompaniment is to coordinate the learning activities, develop teaching activities, supervise the student's activities, develop didactic planning, and provide cognitive and socio-affective aid to the students in both group and individual settings.

To perform these activities, the tutors mobilize their knowledge about discipline, profession, the specific objectives of the subject, the variables that affect the learning of the student (cognitive, affective and social), teaching strategies, and the technological tools available (Chang, Shen & Liu, 2014) Cole, Shelley & Swartz, 2014; Goold, Coldwell & Craig, 2010; Kopp, Matteucci & Tomasetto, 2012; Matteucci et al., 2010; Barker, 2002; Berge, 1995; Garcia-Aretio, 2001; McPherson & Nunes, 2004; Goodyear, Salmon, Spector, Steeples & Tickner, 2001; Guasch, Alvarez & Espasa, 2010).

There are differing perspectives as to what it means to be an online tutor. Some studies address two important requirements of the online tutor: being experienced and knowing how to guide the student through online learning (Chang, Shen & Liu, 2014; Matteucci, et al., 2010; Kopp, Matteucci & Tomasetto, 2012; Gorsky & Blau, 2009).

Studies indicate that experience influences the performance of the online tutor. In general, it has been found that there is a direct relationship between this variable and the number and diversity of activities in the virtual classroom. We refer to "experience" in a general way; we have not analyzed specific qualities associated with the experience of the tutor, for example, their training, and their experiences as a student in a virtual classroom, time spent, etc.

Most studies are oriented to analyze online tutor performance to in a somewhat prescribed way, i.e., stating what has to be done according to the technological resources and institutional policies,

or discussing the tutor's performance, focusing on theoretically relevant variables such as cooperative learning or roles that the tutor must fill. However, the information provided by studying these factors in this way is an external and partial view, which does not consider the perspective of the tutor.

In contrast, other studies (Swinglehurst, Russell, & Greenhalgh, 2008;) McPherson & Nunes, 2008; Rodriguez-Hoyos & Calvo, 2011) have focused on analyzing what the tutor thinks about their online activity and have reported important findings. For the tutors, it is necessary to consider the existence of crucial aspects of online education: dedicating more time to plan and develop mentoring strategies, having an educational mode according to the model, and considering the characteristics of individual students rather than the idealistic student. It is important to them that they are involved in decisions about their training process and use the different educational technological resources available. They also value peer learning, and the possibility of experiencing being an online student themselves (Benson & Brack, 2009) Guasch, Alvarez & Espasa, 2010; Macdonald & Poniatowska, 2011; Gregory & Salmon, 2013).

Self-analyzation gives the tutor access to knowledge that would not be gained from an external look. We can understand their role as an educational agent who reflexively chooses their interaction style in the virtual classroom (to develop an educational design and propose the use of resources or provide feedback to students), rating their needs of training. In this regard, the Koehler & Mishra (2005) model about TPACK presents evidence of a systematic alternative to address the skills of online tutors from their perspective, and uses their experience as a variable, which affects their performance in the classroom.

Using the TPACK model, our objective was to analyze the relationship between the online tutor's experience and their perspective of their knowledge; specifically regarding subjects taught at an online university. "Experience" is defined as previous training and the amount of time they have been an online tutor. The hypothesis differs depending on the mode of the training they have had (online or mixed) and for time spent tutoring online (contracted time).

The TPACK Model

This section describes conceptual references of the TPACK model and different alternatives to assess the dimensions of the model. The TPACK was developed to describe the basis of the ability of teachers to teach effectively using technology. Various studies (Harris, Phillips, Koehler & Rosenberg, 2017; Voogt et al., 2013) have allowed researches to understand the differences between teaching in a face-to-face classroom and in virtual environments.

The TPACK is based on Shulman's proposal (1986) about the organization of the tutor's knowledge influencing decision-making in the classroom regarding what, with what, and how to teach. Shulman proposed to unterstand the teacher's thought process and knowledge and examine whether their methods were effective. His main concern was to make sure teachers were properly trained to translate knowledge within their domain into pedagogical contexts. In his model, he proposes to examine the interaction between teaching content and the teaching process. He defines various categories of knowledge, including the technology component, which are adopted and extended by the TPACK (see Figure 1).

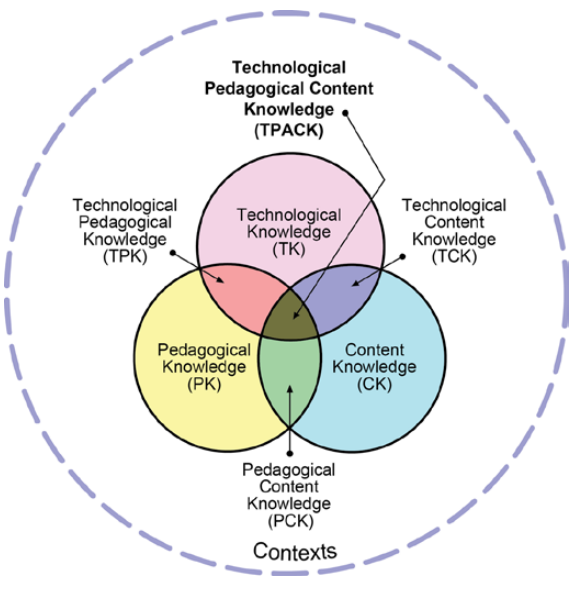

Figure 1. TPACK Model
Source: Mishra & Koehler (2011) www.tpack.org

The definitions of each of the components of the model of Schmidt et al., (2009, p.125) are the followings:

- Pedagogical Knowledge (PK): The methods and processes of education, including knowledge about classroom management, assessment, the development of the academic curriculum and student learning.
- Content Knowledge (CK): The knowledge about the specific topic that is learned and taught, and how it differs from others by its nature.
- Technological Knowledge (TK): Describes the knowledge about different technologies, from as basic as a pencil and paper to digital technologies like the internet, videos, interactive boards, and computer programs.
- Pedagogical Content Knowledge (PCK): Points to the relationship between the teacher's knowledge and best pedagogical technique; unique by nature.
- Technological Content Knowledge (TCK): Reference to the knowledge of how technology can create new representations for specific content. With a specific technology, the teacher can transform the students' understanding of a concept.
- Technological Pedagogical Knowledge (TPK): Considered the knowledge of how various technologies can be used to transform education.
- Technological Pedagogical and Content Knowledge (TPACK): Considered the knowledge required by teachers to integrate technology into their teaching. Teachers have an intuitive understanding of the complex interaction between the three basic components of knowledge (CK, PK, and TK) and teach the content properly using pedagogical methods and technologies.

Different work has been derived from this model, some specific to the online tutor and some related to teachers who adopt technology to teach. Schmidt et al., (2009) developed a scale of self-evaluation that derives from the belief that effective integration of technology in education depends on the content and pedagogy. The teacher's technological experience must be specific to the content. The purpose was to measure the self-assessment of teachers in training of the seven domains included in the TPACK model. The scale consists of 47 items, Likert-type with five response options. The sub-scales showed indexes of reliability Alpha in a range from .75 to .92. The correlations were statistically significant, leading the authors to conclude about the qualities and strength of the scale.

Cabero (2014) directs a project that adds empirical evidence to the TPACK model in the Spanish-speaking population, using a Spanish adaptation of the scale developed by Schmidt, et al. (2009). The results show that the knowledge of teachers is an important element to plan training and impact educational practice. The results also show that experience is an important element because it showed that teachers with experience performed better than teachers in training. The instrument is composed of 73 items; 58 of which collect information on the different dimensions of the TPACK model, individually and on interactions. Other items address different content with similar redaction, for example, in knowledge content dimension one item says, "I have enough knowledge about science," and added other similar items for math, social studies and literacy. The other 11 items are related to the value teachers assign to TPACK for its training abilities. The rest requests sociodemographic information. Reliability indexes of each of the dimensions that made the questionnaire were: TK Alpha = 0 906; CK Alpha = 0, 885; PK Alpha = 0 951; PKC Alpha = 0 787; TKC Alpha = 0 834; PCK Alpha = 0 912; TPACK Alpha = 0.899.

Research on the TPACK model focused specifically on the online tutor. Different approaches have been used including qualitative interviews, focus groups, and observations.

The work of Cowan, Neil & Winter (2013) shows how it is possible to get methodically closer to the educational practice of the tutor online from the tutor's view, but also through a theoretical perspective that allows researchers to explain that vision. They used focus groups and interviews. The basis of his research is connectivism, but they

categorized the knowledge, which emerged from their data with the TPACK mode. Online tutors indicate that the key elements to focus on when developing a curriculum that utilizes technology are: tutor, learning, history of the student and the technology to be used. In addition, they say that the way the learning process is facilitated is more important than the content of a course.

The study of Benson & Ward (2013) illustrated online tutors' profiles with graphic models that showed how their level of content knowledge, pedagogical knowledge, and technological knowledge were integrated in an idiosyncratic way and characterized their practice. They performed interviews and non-participant observation to create individual profiles of the skills of three online teachers, who were chosen for their focus on using technology to teach. Each teacher chosen had post-graduate studies in their subject area (content knowledge), at least three years of experience teaching online—showing mastery of the LMS (learning management system)—and focused on the use of technology to facilitate teaching and learning. A relevant result is that two of the three tutors, who had between five and seven years of experience, mentioned that their professional skills were related to the use of technology. They showed greater technological and content knowledge than pedagogical knowledge, and demonstrated low levels of integrated knowledge, for example, PCK and TPACK. The other teacher, who had four years of experience as an online tutor, had no actual training as an online tutor and had never been an online student, but also showed TPACK integration, with a greater presence of PK and CK than the other two teachers, but a lower level of TK. Benson & Ward (2013) concluded that the tutors who are able to explicitly express their understanding and application of pedagogical knowledge are more likely to demonstrate the integration of the TPACK.

Anderson, Barham & Northcote (2013) determined the degree to which the elements of different types of knowledge within the TPACK model is evident within the practices of teachers who participated in the study. The teachers selected were online tutors who had participated in training sessions at the University. The 15 teachers selected specialized in the following areas: music, communication and information technologies, marine biology, cultural studies, physiotherapy, nursing, architecture, pharmacy, and indigenous studies. They conducted semi-structured interviews; the results of which indicated that the three main components (TK, CK and PK) of the TPACK were represented in the participant's answers, the most frequent of which were TK and PK. The answers indicated that participants showed awareness that the content was not the main focus of the lessons, but instead focused on pedagogical aspects and significant use of technology. Another relevant result was the emergence of different combinations of TK with the other elements. Researchers reflect on how the online tutors' educational practice is fully linked with the use of technology.

Anderson, Barham & Northcote (2013); Benson & Ward (2013) analyzed interviews with online tutors using categories from the TPACK model. Through interaction with the participant, both studies showed the presence of their knowledge of each element. Anderson et al. found that TK and PK were more frequently observed than CK. For his part, Benson & Ward concluded that the tutors who are able to explicitly express their understanding and application of PK are more likely to demonstrate integration of TPACK. Anderson et al., (2013) as well as Cowan, Neil & Winter (2013) mentioned that, for online tutors, the content is not important, but the pedagogical methods for teaching the content are.

Materials and Methods

Participants

The sample type is intentional, not probabilistic (Harrison, 2013). 50 online tutors voluntarily participated. The sample constituted 35% of the population of tutors in a university training program of psychology, part of the Sistema de Universidad Abierta y Education a Distancia (SUAyED) (Open University System and Distance Education) in the Facultad de Estudios Superiores Iztacala (Superior Studies Iztacala Faculty)

belonging to the Universidad Nacional Autónoma de Mexico (UNAM) (National Independent University of Mexico). They were chosen because they have the authority to adjust the educative design of their courses, unlike other universities, and unlike other tutors of the same institution.

They were 37 women, 13 men, between 25 and 50 years old. They all have fourth-level studies such as specialty, master's degree or doctorate. They had been online tutors between one and 12 years within the SUAyED psychology department. They work different hours per week; less than ten contracted hours (24%), between ten and twenty hours (14%), between twenty-one and thirty hours (18%), and between thirty-one and forty hours (44%).

Participants who did not have any type of training in online education (6%); training in mixed mode (32%) or completely virtual (62%).

Instruments

An adaptation of the instrument published by Cabero (2014) was used. It is a questionnaire in Likert scale style with five response options: SD = strongly disagree, D = disagree; N = neither agree nor disagree, A = agree; SA = strongly agree. The steps for the adaptation of the instrument were the following:

1. Select the original test questions. Cabero's version of the test has 62 questions covering socio-demographic data, TPACK model knowledge, and questions designed to assess how students perceive the teacher's knowledge. For the present study, we used only TPACK-related questions.
2. Tailor the wording of the questions to the online tutor. The items were modified to relate to the online classroom. Questions related to a specific subject were modeled to pertain to that subject's content.
3. Prepare the questions related to the socio-demographic characteristics of online tutors. Questions used pertained to professional training, graduate and online education, the time of recruitment to SUAyED psychology, number of hours and type of modules managed (theoretical, applied, or mixed). Therefore, all the items about sociodemographic data of the instrument published by Cabero et al. (2014) were eliminated.
4. Apply the questionnaire to virtual media. The questions were put into a Google form for accessibility, so that the online tutors could answer and record their responses virtually.
5. Calculate reliability of the dimensions. Internal consistency was measured using Cronbach's Alpha coefficient in order to determine the behavior of the instrument in terms of variability of the questions, with respect to themselves and other questions (Reidl, Guillén, Sierra & Jewel, 2002).

The adapted questionnaire included questions specific to the objectives of the study (see the questionnaire in annex 1). It consisted of 31 questions, which assessed seven dimensions. The number of items and Cronbach's Alpha value are specified in table 1 for each dimension.

Table 1
Seven dimensions of the applied questionnaire, specifying number of reagents and Alpha calculated for each dimension

Dimension	Questions	Value
Technological Knowledge (TK)	7	α= .908
Content Knowledge (CK)	3	α= .949
Pedagogical Knowledge (PK)	7	α= .954
Technological Pedagogical Knowledge (TPK)	6	α= .938
Technological Pedagogical and Content Knowledge (TPACK)	6	α= .939
Content Technological Knowledge (CTK)	1	
Pedagogical Content Knowledge (PCK)	1	

Type and Design

The study was a transverse, non-experimental type (Garcia, Marquez & Avila, 2009). The hypothesis of the study considered the relationship between two variables and the perspective of the online tutor regarding how they implemented their knowledge in the educational practice within the online classroom, measured on the TPACK scale. The two variables present were: their training experience (online and mixed), and tutoring time

dedicated, defined by the amount of time employed by the institution.

Procedure

We presented the project to the management of SUAyED Psychology; the Coordinator and Manager of the teacher-monitoring program. We discussed the utility of the department's results for the institution.

Management agreed to invite their online tutors to participate in the study, specifying to the teachers that management in no way would benefit from their participation in the study and that their responses would not put their job in jeopardy. It was explicitly stated that their participation was completely voluntary and that the results be only used for research purposes.

The link to the questionnaire was included in the invitation message. In was sent on three occasions: May, August, and October 2017.

To analyze the data, we used the SPSS statistic package, version 21.

Results

We first showed the statistical analysis of the descriptive data related to central tendency, dispersion, and position (Vega, Garcia, Valencia & Hoover, 2009). Subsequently the inferential analysis proved the hypothesis true.

In general terms, the average score on the questionnaire was 129 points, with a minimum of 33 and a high of 155, which corresponds to the total score possible. The value of the first quartile was 121, of the second quartile was 134 and the third quartile was 145.

Table 2 presents the descriptive statistics for the seven dimensions. Answers lean toward the positive side of the scale. Tutors chose high percentages of the options "Strongly Agree," meaning that they agreed with the question's statement. A standout is the CK dimension, which presents a 71.3% response of "Strongly Agree."

Table 2
Descriptive statistical analysis for the seven dimensions

Dimensión	TK	CK	PK	PCK	TCK	TPK	TPACK
Average	27.84	13.74	29.74	4.02	3.96	25.52	24.7
Median	28.5	15	31	4	4	26.5	25
Mode	28	15	35	4	4	30	30
Standard deviation (SD)	5.41	2.48	5.78	1.02	1.00	4.92	4.91
Minimum	9	3	7	1	1	6	6
Maximum	35	15	35	5	5	30	30
Average (%)							
Strongly agree	33.7	71.3	48	48.5	35.6	34	36
Agree	41.2	23.3	36.2	39.4	43.6	40	42
Neither agree or disagree	16.5	1.3	11.7	7.1	14.8	16	14
Disagree	5.4	0	0.5	0.8	2.8	8	4
Strongly disagree	2.8	4	3.4	4	3.2	2	4

Note: The average percentage row shows percentages of responses to each of the dimensions by type of response. TK = technological knowledge, CK = content knowledge, PK = pedagogical knowledge, PCK= pedagogical content knowledge, TCK = technological content knowledge, TPK = technological pedagogical knowledge, TPACK = technological pedagogical content knowledge

The percentage of participants who chose the option "neither agree nor disagree" fluctuates between 7% and 16% chose and a very small percentage chose the "disagree" or "strongly disagree" response. The categories that demonstrate the highest amount of those options are related to TK.

The data obtained from the hypothesis test always displayed a significance level of .05. The population who exclusively had: online training (N = 16), joint training (online and face to face) (N = 31). The overall score was used as the main display.

HO: Online tutors who have had exclusively online training are not perceived to have different knowledge than tutors who trained in mixed mode.

H1: Online tutors who have had exclusively online training are perceived to have different knowledge from tutors who trained in mixed mode.

The Mann-Whitney U test for independent samples indicates that the null hypothesis is accepted, since a value of z = 28.500 with an associated significance of .088 was obtained. The overall score for the questionnaire does not differ according to the type of training experience. For this reason, we did not do the dimension comparison.

On the differences in the knowledge perceived according to the time dedicated to online tutoring: we considered the overall score on the instrument and compared four groups: less than ten contracted hours (N = 12), between ten and twenty hours (N = 7), between twenty-one and thirty hours (N = 9) and between thirty-one and forty hours (N = 22).

HO: Online tutors are not perceived to have different knowledge based on how many contracted hours they work.

H1: Online tutors are perceived to have different knowledge based on how many contracted hours they work.

The Kruskal-Wallis test for more than two independent samples indicates that the research hypothesis is statistically significant; therefore, accepted. Differences were found in the overall score depending on the time dedicated to online tutoring (Kruskal-Wallis ji2 = 7.912, n = 50; P = .048). Based on this data, it was decided to do a different analysis that would identify between which groups exist statistically significant differences.

Factors within each group were compared to each other. Statistically significant differences in the overall scores between tutors were specifically found between those with more than 30 hours and less than 10 hours (Mann-Whitney z = - 2.741, n = 34;) P = .006). For the group of 30 hours [M = 135.95, SD = 12.71], for the Group of 10 hours [M = 110.25 & SD = 36.05]. Next, the dimensions analyzed yielded statistically significant differences, mainly in technological knowledge concerning dimensions: TK [Mann-Whitney z = - 2.332, n = 34;] [P =. 018], TCK [Mann-Whitney z = - 2.437, n = 34;] [P =. 018], TPACK [Mann-Whitney z = - 2.811, n = 34;] [P =. 004] and PK [Mann-Whitney z = - 2.484, n = 34;] [P =. 012]. The means and standard deviations for groups with less than 10 contracted hours and the group with more than 30 hours contracted for each of the dimensions are shown in table 3.

Table 3
Comparison of means and standard deviations in seven dimensions into two groups

Counted hours	Less than 10		Between 30 - 40	
Dimensions	M	SD	M	SD
Technological knowledge	23.58	7.78	29.31	3.87
Content knowledge	11.91	4.35	14.13	1.12
Pedagogical knowledge	25.08	8.49	31.27	3.62
Pedagogical content knowledge	3.41	1.24	4.22	.92
Technological content knowledge	3.2	1.05	4.13	.94
Technological pedagogical knowledge	22.33	7.83	26.72	2.60
Technological pedagogical content knowledge	20.66	6.91	26.13	3.07

Note: Shows the nomenclature for the average with M and standard deviation with SD

Discussion and Conclusions

The objective of the present study was to analyze the perspective of the online tutor about their knowledge within the subjects they teach at an online university, using the TPACK model. In general, the findings identify that tutors perceive their technological knowledge, pedagogical knowledge, and content knowledge in a highly positive manner, however, the findings also identified that the longer they spend tutoring online, the greater their perceived knowledge is. This result is similar to that reported by Cabero et al. (2014). CK, PK and TK were present such as in studies of Benson & Ward (2013); Anderson, Barham & Northcote (2013). However, there is more commonality with the study of Benson & Ward (2013) regarding PK and its manifestation in the articulation of each of the integrated knowledge of TPACK components.

Online tutors expressed proportionally greater disagreement in dimensions that involve technology, specifically in TK and TPK. This data does not match the claim of Anderson et al., (2013) about

the obvious presence of the TK due to the nature of the educational environment. In the present study, the data on knowledge linked to the use of technology could be understood as the need for greater training; however, we should consider that the ability to use a variety of technologies does not necessarily result in their effective use to affect teaching and learning (Benson & Ward, 2013). The educational use of a technological tool inside or outside of the virtual classroom responds to the educational need of the didactic online tutor who is interested in their students' education. This point will be analyzed more extensively in future research.

Tutors with more time dedicated to online tutoring are perceived to have more knowledge in comparison with the tutors who have fewer hours in the institution. This study's results concur with other studies that indicate that the dedication to mentoring online influences educational practice (Chang, Shen & Liu, 2014;) Gorsky & Blau, 2009; Kopp, Matteucci & Tomasetto, 2012; Matteucci et al., 2010), which suggests that the benefits offered to the tutor by the institution can influence their dedication to education.

To examine pedagogical knowledge, technological knowledge, and content knowledge of the online tutor, using the TPACK model is a way to begin to identify and recognize their perspective on knowledge, and their level of knowledge in different areas, in order to detect which areas are their strengths and which areas could use more training.

The TPACK model enables researchers to understand these skills separately (PK, CK, TC) but also in an integrated way (TPK, TCK, PCK and TPACK), coinciding with the conclusions of Harris et al. (2017), who believe that the TPACK model is a powerful tool for educators and researchers, since it helps to better understand the nature of knowledge, reasoning, decision making and teaching processes.

In future work we must know how online tutors build such knowledge in the light of their experiences and reflections. It is desirable and pertinent that we from approach online education from the perspective of online tutors, using qualitative tools to delve into the manifestation of the knowledge of the tutors. The goal is to understand how to develop the ability to teach the content of their subject, with the mediation of the technological resources available in and out of the virtual classroom so that the student will achieve the expected learning.

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Annex

Instructions:

In the following questions, choose answer that most closely applies to you. Remember that there are no right or wrong answers.

1. I solve my own technical problems on the SUAyED Moodle platform.
2. I assimilate to technological knowledge easily.
3. I stay up to date on important new technologies.
4. I often experiment with the technological tools of the SUAyED Moodle platform.
5. I know how to use many different kinds of technology (tools, applications, platforms, software.
6. In the module that I chose:
7. I have the necessary technical knowledge to use the SUAyED Moodle platform.
8. I have had sufficient opportunities to work with different technologies.
9. I have enough knowledge about the content of my module.
10. I know how to apply versatile ways of thinking in accordance with the contents of my module.
11. I have various methods to develop my knowledge about the contents of my module.
12. I know how to evaluate the performance of students on the platform.
13. I know how to adapt my teaching to what students understand or don't understand at all times.
14. I know how to adapt my teaching style to accommodate students of different learning styles.
15. I know how to assess students' knowledge in different ways.
16. I know how to use a variety of teaching strategies in the classroom.
17. I'm aware of the most common successes and errors that students do in relation to their comprehension of the content.
18. I know how to organize and maintain the classroom dynamics.
19. I can select effective teaching approaches to guide the thinking and learning of the students in my module.
20. I am familiar with technologies (on and off the platform) that I can use to understand and develop content on my module.
21. I know how to select (on and off the platform) technologies that support the strategies of teaching for a specific topic.
22. I know how to select (on and off the platform) technologies that improve the learning of students in a certain subject.
23. My training as a teacher has made me reflect more carefully about the ways in which technology can influence teaching approaches employed in the classroom.
24. My training as an online tutor has made me think more carefully about the ways in which technology can influence teaching approaches employed in the classroom.
25. I think critically about how to use technology (on and off the platform) in the classroom.
26. I can adapt the use of technologies (off the shelf) on which I am learning to different teaching activities.
27. I can adapt the use of the technologies on which I'm learning (Google drive, Google Hangouts, Skype and other applications outside of the platform) to different teaching and learning activities.
28. I master topics related to my module content, technologies, and teaching focus.
29. I know how to select technologies for use in the classroom (on and off the platform) that enhances how I teach and what students learn.
30. I know how to use teaching strategies to combine content, technologies, and teaching approaches that I've learned.
31. I can guide and help other tutors to coordinate the use of content, technologies and teaching approaches in the same module.
32. I can select (off the platform) technologies that improve lesson content.

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Active participation and evaluation of the didactic materials in success / failure academic in Distance Education

Participación activa y valoración de los materiales didácticos en el éxito/fracaso académico en educación a distancia

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Abstract

Quality professional training at the level a distance program demands having a report on the influence of active participation and the students' perception of the didactic materials on the academic success / failure of students at Alas Peruanas University. Therefore, the objective was to analyze such influence in the final grades of a subject, while the hypothesis was that these variables positively influence the academic success / failure. This is a basic correlational research with a non-experimental, cross-sectional design. The method is hypothetic-deductive. The sample consisted of 153 students of the 2016-II semester. The logistic model applied in the hypothesis testing has the capacity to correctly classify 68,6% of the analyzed cases. Cut-off value 0,5. The Hosmer and Lemeshow test for the model has a chi square = 0,159, gl = 1 and p-value of 0,690. For $\alpha = 0,05$, it is evident that the model has a good data adjustment. The obtained results confirm a significant influence on the final grades of the subject in terms of the active participation variable, with CI for Exp (B) from 1,460 to 32,962; as well as the positive perception of the digital material available on the Blackboard platform and the printed materials received, with CI for Exp (B) from 1,772 to 82,55.

Keywords: Active participation, assessment of didactics materials, academic performance, distance education.

Resumen

La formación profesional de calidad en el nivel de educación a distancia requiere tener un reporte de la influencia de la Participación Activa y la Valoración de los materiales didácticos en el éxito/fracaso

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académico de los estudiantes de la Universidad Alas Peruanas. Por ello, el objetivo fue analizar dicha influencia en las calificaciones finales de asignatura, siendo la Hipótesis que dichas variables influyen positivamente en el éxito/fracaso académico. La investigación es de tipo básica, de nivel correlacional. El diseño es no experimental, transversal. El método es hipotético-deductivo. La muestra estuvo compuesta por 153 estudiantes del semestre 2016-II. El modelo logístico aplicado en el contraste de hipótesis tiene una capacidad de clasificar correctamente al 68,6% de los casos analizados. Valor de corte 0,5. La prueba de Hosmer y Lemeshow para el modelo tiene chicuadrado = 0,159, gl = 1 y p-valor de 0,690. Para $\alpha = 0,05$, se evidencia que el modelo tiene un buen ajuste de datos. Los resultados obtenidos corroboran una influencia significativa en las calificaciones finales de asignatura por parte de las variables participación activa, con IC para Exp(B) de 1,460 a 32,962; así como de la valoración positiva del material digital disponible en la plataforma Blackboard y los materiales impresos recibidos, con IC para Exp(B) de 1,772 a 82,55.

Palabras Clave: Participación activa, valoración de material didáctico, Rendimiento académico, Educación a distancia.

Introduction

In education, the measurement of learning is a key element for the quality of the education service. (Zambrano, 2016). In this regard, there are studies on measurement of learning outcomes and their associated factors, as referred to by Arribas, 2014; Vergel-Ortega, Martinez-Lozano & Zafra-Tristancho, 2016. Expectations, skills and performance of students in distance education were studied by Herrador & Hernández, (2013); Ramos, Rodrigues, Gomes & Silva, (2014); Aucandela & Eugenia, (2016). On the other hand, Gomez (2016) studied the essential actions that must be deployed to learn and the experiences of students with the technological platforms and their relationship with academic achievement in the first year of study in university systems of virtual education.

For Davila, Garcia-Artiles, Perez-Sanchez & Gómez-Déniz (2015), the positive assessment of available material that the student may have is one of the variables, which could determine academic performance. For this, they used an asymmetric logistic regression model to explain that the probability of passing a course increases if the student believes that the available material is adequate for supplementing the subject. However, these studies did not address, for example, the student's participation in tutoring or in a virtual classroom.

On the other hand, low attendance at tutoring sessions, a small number of queries, and little participation in the forums and blog have been observed in the teaching practice of administration and international business students in Distance Education (DE) and the operative subject Investigation. However, the students do watch the telematics tutoring videos. They also print supports and carry their text.

On the other hand, they have low grades in exams. This allows the presumption that the academic success or failure in (DE) could be related to the interaction that students develop with their tutor and teaching materials. This is why the situation to improve administration and International Business (AIN) in the Dirección Universitaria de Educación a Distancia (DUED) at Universidad de Alas Peruanas (UAP) consists in the lack of reports about how the participation of the students in tutoring or the virtual classroom relate and enable satisfactory academic performance (AP), in particular on the subject of Operative Investigation. Also, are the lack of relevant information in relation to the assessment of the teaching materials from the student, and the current state of these materials (both printed and

digital), adequate for their autonomous learning? Is the student's interaction with the text sufficient to develop their academic work with support of readings available in in virtual classroom? These aspects are considered important in academic performance in DE.

Thus, the following problem arose: How does active participation and assessment of the teaching materials influence the academic performance of students of the subject of Operative Investigation (OI) in the major of Administration and International Business in the distance education mode in the Universidad Alas Peruanas?

The objective is to determine the influence that active participation and assessment of teaching materials had on academic performance in distance education mode, the hypothesis being: Active participation and assessment of teaching materials have a positive influence on the academic performance of the students of Operative Investigation, in the major of Administration and International Business in the mode of distance education in the Universidad Alas Peruanas.

Active participation in tutoring

Active participation as a process develops within the framework of a set of activities, which constitute an academic work. The participation level of a student depends on their characteristics and motivation to learn. Therefore, to support the learning process in DE the teacher-tutors have an important role (Fernandez-Jimenez, Mena-Rodriguez & Tovar - Hurtado, 2017), since they assume the responsibility of planning and designing learning activities that generate active participation of the students, through the development of works to be discussed in groups, group work, participation in face-to-face sessions, etc., in the context of student-centered learning.

The tutor must control the content of the subject and evaluation strategies; necessary technological skills and sufficient respect to the virtual environment develop their role. In addition, they must be counselor and guide in order to avoid the isolation and loneliness of the student in this mode so that it promotes self-regulated learning. (Fernandez-Jimenez et al. 2017, Garcia-Barrera 2016, p.4).

Tutors promote a collaborative environment and have the ability to motivate and educate the student. In addition, permanent interaction between tutor and student motivation powers the learning process, even more if in practice the tutor makes evident their accompaniment and monitoring of the activities of the subject, through the resources of the Virtual Classroom. (Mora & Bejarano, 2016).

Thus, to efficiently perform their role, the tutor must undergo a training process in the theoretical foundations of distance education. In this way, the skillset and teaching competencies are put into practice in the didactic, technical and psych affective domains during virtual or face-to-face tutoring, allowing students to identify additional information required for a complete understanding of the contents and good development of the academic work (Ruiz & Davila 2016).

On the other hand, the tutor provides pedagogical support to complete unclear areas in the development of content. Therefore, aspects that should be considered are conceptual, procedural, attitudinal, and values aspects that allow the knowledge to be delved into, using deductive and inductive reasoning that helps them to solve problems, make decisions, be critical, and be creative. That is to say, the pedagogical practices of the tutor complemented by the use of the technological competencies are an important component that will help the student's achievement in learning, as agreed upon by Ruiz & Dávila (2016).

In addition, the tutorial action is a relevant strategy (teaching, guiding and training) to help allow the student adapt to University life (Sánchez & Rosales, 2016); and, consequently, to work on their professional project. That is to say, it is an element that helps to avoid University failure and/or desertion, which is high in DE, according to Fernandez-Jimenez et al. (2017).

The tutorial dynamics generates spaces not only for collaboration, but also encourages social relations where students show their affections, emotions, expose common problems in the academic

and personal life, and support each other by searching for solutions which makes them involved protagonists of their learning.

The experience of student in the DE is distinctive according to advances in their formative process. That is to say, at first it was perceived that tutoring and interaction are for support, coexistence, and companionship; while the latest perception is that communication and mentoring is a medium, and they report negative aspects such as absence and authority, among others (Sanchez & Rosales, 2016).

In that line, we understand that in DE, participation in tutoring occurs when students pose questions about the subject to be discussed, exchange information between them, or engage with issues of common interest in the tutorial telematics or face-to-face session.

Active participation in virtual classroom

DE has led to teachers being obligated to use and apply as educational resources all the technological tools that are available on the platform that is part of the virtual classroom, with the purpose of making the offer to students to actively participate in all of their professional training, so these tools will be described in detail.

Blackboard Collaborate provides Virtual Classroom (VC), understood as the space where contents and activities are customized, student progress is tracked, and the tutor adapts tutorial sessions to different levels of learning; that is to say, an environment similar to conventional forms of communication can be created. The VC has advantages and disadvantages (Aguilar, 2014). It also stands out because it incorporates the key informational, educational, experiential, and communicative dimensions of the teaching-learning processes (Flores, 2012, p.122 cited by Aguilar 2014).

Thus, In Blackboard Collaborate the communicative interaction between students and teachers from DE occurs through the technological resources that are had during a web conference. Through this, real-time communication through audio, video, and data between the parties can be done from anywhere, in addition to alerts to ask for participation in the virtual classroom, interactive digital whiteboard, and a stopwatch tool for quizzes. In addition, in the Chat as a form of synchronized written communication between the tutor and the student or students, allowing them to exchange opinions, ask questions, and discuss concepts. This creates interaction between the participants, which enhances the importance of communicative interaction that occurs in the teaching-learning process in virtual environments (Montenegro, 2016).

The Blog. Tool of open communication where graphics, audiovisual, or multimedia resources on any topic in particular can be inserted. Larreal (2015) discusses various definitions of this asynchronous tool. The aim is that students share their opinions and argue points of view on a hub topic. That is to say, it is an element of learning support not only for the videos that are published (usually YouTube) but rather contributes to the development of digital skills and greater effectiveness in the work of tutoring, according to Rodriguez & Fernandez (2017), basically it is a space to promote the active participation of the students and the interaction with the tutor and fellow students, promoting the achievement of the proposed objectives and especially the construction of knowledge on a subject (Jenaro-Rio, Castano-Calle, Martin-pastor & flowers-Robaina, 2018; Ruiz & Davila 2016). Finally, the blog/ "has a positive impact on learning supporting constructivist educational activities in a manner which is cognitive and socially interactive." (Chavez, Del Toro & Lopez, 2017, p.48).

The Forum. It is defined as a shared, virtual or physical space, in which several people meet to exchange and gather ideas and experiences on one or several subjects (Chavez, Del Toro & Lopez, 2017, p.49). In addition, which has the purpose of maintaining an asynchronous or deferred participation time around a common and specific theme in common or any topical theme geared to contribute to the objectives of the profile of the graduate in a professional career. The minimum condition to open the forum is participation (production and reproduction).

The types of Forums used in DE: Welcoming, which allows the personal presentation of the tutor and invites the student to express their expectations on the subject, of whose purpose is to resolve specific issues of content and discussion focused on the discussion of a hub topic. That is to say, when the teacher-tutor plans forums, they take into account aspects to the resolution of problems, to the contrast of ideas to the collective thinking, to disseminate and communicate ideas of interest of the group.

Among the benefits of the discussion forums are: increase student participation and the development of critical thinking in higher education according to Kutugata (2016). Being so, tutors properly choose the subject to discuss, guide, give feedback, and filter negative responses that threaten the climate of learning; they stimulate the cohesion of the group (Carrasco, Carrillo, Bazley, Vergara & Contreras, 2017); and they encourage reflective, collaborative participation favoring interaction between participants (From Lucas-Santos, 2017). The main concern is to know how knowledge is constructed through the discussion, i.e., what are the social and educational factors in the process of learning in online forums. (Torres-Gordillo & Perera-Rodriguez, 2015).

To promote interaction, the teacher must plan and structure the forums of discussion with instructional activities, projects, or reports that contribute to collaborative learning according to the objectives and competences of the subject, Kutugata (2016). Therefore, active participation in forums implies that the student analyzes and expresses his point of view or proposes topics of discussion.

Active participation in virtual classroom is understood as that of the person (teacher or student) who watches the video of the conference room, access the forum, opens or reads a message and sends a reply or a new one at the minimum. Otherwise, it is important to plan activities that encourage such participation.

Assessment of the teaching materials

In DE, the teacher adapts their teaching strategies based on new technologies that provide platforms like Blackboard Collaborate. Therefore, in the case of DUED-UAP, they combine the uses of two types of materials: Digital (new technologies) and print (conventional) according to Aguilar, Ayala, Lugo & Zarco (2014). These materials help self-learning without support of a tutor, to be used autonomously with the support of the tutor and auxiliary or supplementation of other materials, facilitating their learning to develop skills and the formation of attitudes and values (Barcelo & Ruano, 2014).

Likewise, teaching material attends to different styles of learning through positive redundancy including videos, web readings, and links, among others. In other words, for the message to be understood, different channels are used to present the information in a different way (Poveda, 2016).

Thus, when the teacher-tutor selects the digital resources, they must ensure their relevance and that they meet minimum quality requirements. This implicates their contribution to the quality teaching-learning processes (Garcia-Barrera, 2016).

Regarding the printed material, it presents some weaknesses as, for example, it cannot help students understand the content by itself, it is difficult to promote feedback to questions; however, it has the advantage of being self-sufficient, easily accessible, and portable. As for the tutorial, this contributes by motivating, guiding, and facilitating the student's approach to knowledge and to interaction with the tutor.

In DE, digital materials are available, such as aids, web graphics, readings, other multimedia formats, etc., that support learning, to create copies of documents, texts, (properly referenced) articles that are not necessarily easily accessed by students or information that is scarce. In addition, as support for the study to transmit and share examples, applications or casuistry that arises in each subject. Finally, the student uses and leverages them in order to complement and reinforce the themes of the teaching units. According to Trangay & Ruiz de la Torre (2018), teaching material enables "that students have the opportunity to develop their capacity for analysis and reflection,

and that, supported educational platforms, promote their active participation in discussion spaces and debate" (p.102). This highlights the important work of teaching tutors in the selection and conduction of digital materials. They design, operationalize, and develop educational strategies based on the use of digital materials, as well as assessing learning. Teaching tutors are supported in the use of these materials as a means to promote interactivity and creativity (Gallardo et al., 2017). Digital materials and available web graphics must stay active in a given period.

On the other hand, in the context of distance education, the appreciation of materials by students has to do with the satisfaction or lack thereof of their real learning needs on a subject. That is to say, if the utility and support that should be given to the materials matches their learning objectives, the student is involved in the proposed activities and their autonomous learning.

Thus, the value that students give to the material might be affected by the ease or difficulty as an element of support in their academic work; as well as wanting to look good with the institution. For this reason, it is important to know the factors predictive of the satisfaction of students according to Zambrano (2016).

For Garita-Gonzalez, Gutierrez-Duran & Godoy-Sandoval (2018), "… should evaluate the importance that the written material continues having in this technological age, and as new emerging technologies provide more usability and motivation" (p.144).

The direct experience the student has with the materials, compliance or lack thereof of previous expectations, offered by the institution, as opposed to the real role played in their self-learning, and how it is reflected in their grades is vital in their assessment. They could therefore be satisfied and assess in a positive way or feel dissatisfied and issue a negative assessment to relate the difficulties and shortcomings in the teaching materials with the fact that it interfered with the construction of their knowledge and their learning (Garita-Gonzalez, et al., 2018, p.145).

As a result, this assessment helps to detect difficulties in material that the institution must amend in a subsequent edition.

Academic performance (AP) in distance education

It is understood that learning happens from the outside in, through interaction with others in a dynamic of appropriation of the culture, but above all in relation with the environment and the support from others. Learning is a process of knowledge construction from intersubjective activity (mutual social interactions) and subjective restructuring (as a process of internalization) (Pomajambo, 2015, p.9).

Thus, in the context of distance education, students strive to develop general and specific skills needed to successfully conclude university studies and for his later professional career. However, the effort does not only guarantee success, but also skills such as teamwork, problem solving, effective communication, data analysis, order, ethics, self-esteem, and skills and attitudes that are forever more demanded by the labor market (Garita-Gonzalez, et al., 2018). For this reason, an indicator approaches the knowledge of the results of the performance and level of learning in students: academic performance (AP).

AP as construct entails a limitation because it responds to the educational model of each university and in general to the university system. Therefore, the assessment of AP depends on these aspects mentioned.

This research considers the final grades as a criterion of AP, linking summative evaluation and certification of the evaluation. Of interest is the immediate performance related to success or failure, in one academic period and in a subject. Immediate performance refers to skills that the student achieves their academic and/or tests that allows them to pass a subject, remain in the subject, or fail to enroll (Abarca, Gomez & Venegas, 2015).

In DUED-UAP, AP is understood as a result of the curricular learning content in conceptual, procedural aspects and attitude, expressed in subject scores. Thus, final qualification is obtained with the qualification of two exams: a partial and

a final. Each test has a weight of 30%; and qualification of the academic work has a weight of 40%. The measuring scale is from 0 to 20. Thus, the grades obtained represent more than just performance on tests, they are also evidence of achievements within educational experiences and in a context that is mediated by technology (Vergel-Ortega et al., 2016).

Materials and Methods

Participants

The population is 1040 students enrolled in the major of Administrative and International Business in DUED-UAP in the 2016-II semester. The calculation of the sample size was:

$$n = \frac{Z^2 p \bullet q \bullet N}{E^2 (N-1) + Z^2 p \bullet q}$$

Where: N = population size, p = probability of success or completion, q = probability of mistakes or failure, E = level of precision = 0.05 and Z = 1.96 (95% confidence level)

Inclusion criteria: students of Administration and International Business at DUED-UAP, who enrolled in operative investigation and stay until the end of the course.

Exclusion criteria: students who do not attend the survey application or who do not adequately fill the survey.

Initial sample: 281 students, 153 after applying the exclusion criteria (45% men and 55% women). These students already exceeded half of the time spent in the major in DUED-UAP and their ages are on average 33 years for men and 30 years for women.

Instruments

The instruments used were three for data collection: the first, a (01) questionnaire of performance of the student tutoring and virtual classroom in the LMS (Blackboard Collaborate), composed of six (06) dichotomous pre-coded closed questions.

In tables 1 and 2, the description of the items is shown by each dimension of active participation.

Table 1
Description of the items by dimension active participation in tutoring.

Dimension: Active participation in tutoring	
1. In the weekly tutoring, according to you, what is your performance or that of your classmates?	a) I have communicated actively since the beginning of the tutoring. b) My colleagues pay attention to the tutor. c) I ask questions to clarify the topic or to motivate reflection. d) I participate in the activities proposed by the tutor, involving myself with them, contributing my ideas and opinions and seeking to carry them out in the best possible way. e) My companions provide a pleasant climate (tolerance, respect and good treatment). f) I have attended prepared for the tutoring; that is, having reviewed the topics. g) I contribute to the tutoring with additional material and information.

Table 2
Description of the items by dimension active participation in the virtual classroom

Dimension: Active participation in the virtual classroom	
2. Through the virtual classroom, you usually, often participate in:	Visualize the weekly video of the Conference Room? If your answer is Yes ? Indicate: • How many times do you see a video of the Conference Room? • How many scheduled videos have you visualized?
3. Through the virtual classroom, you usually, often participate in:	Blog? If your answer is Yes ? go to the next question.
4. During your stay on the blog:	a) Do you analyze the entries published by the tutor, to explore contributions and contributions for your learning? b) Do you leave your comments on the publication? c) Do you review any video that the tutor recommends for your learning?
5. Through the virtual classroom, you tend to, often participate in:	Forum of the course? If your answer is Yes ? go to the next question.
6. During your stay in the forum:	a) Do you analyze the debates in the forum, to explore contributions and contributions for your learning? b) Express your point of view on the subject? c) Do you propose discussion topics that contribute to answering questions or giving feedback on the issues?

The second, a (01) questionnaire for the evaluation of the student with the digital teaching materials such as printed, consisting of five (05) questions: 02 dichotomous and 03 with a rating of (1) Excellent, (2) Good, (3) Average and (4) Not suitable. Tables 3 and 4 show the description of the items for each dimension of the evaluation of teaching materials.

Table 3
Description of the items by dimension estimation of digital teaching materials

Dimension: assessment of digital teaching material	
1. For the development of your academic work, you tend to often resort to	a) Consult with your tutor? b) Virtual library? c) Didactics help? d) Exchange of information with your classmates?
2. During your weekly study hours, you usually, often resort to:	a) Didactic help for a better understanding of the information? b) Visit the webgraphic; that is, the electronic addresses reference? c) Readings to strengthen your knowledge?

Table 4
Description of the items by dimension estimation of printed teaching materials

Dimension: evaluation of printed didactic material	
3. Do you consider that the text book and its didactic guide is an element that:	a) Does it contain current issues that were considered in the exams? b) Does it show the prerequisites that are relevant to your learning? c) Does its design allow you to handle it easily and take it everywhere you do your activities? d) Does it present different examples and situations that help to understand the contents? e) Does it facilitate the construction of knowledge? f) What motivates you to continue in the Professional career?
4. Do you consider the text book and its didactic guide to facilitate:	a) Self-learning without the support of a Tutor? b) Do I study autonomously with the support of a Tutor? c) Relate the Material with other complementary materials? d) Self-evaluation activities that help you in your learning and prepare you for the exams?
5. What is your general assessment of the teaching material?	a) Suitable for your learning b) It is motivating and self-instructive c) Facilitates communication with colleagues d) It is updated e) Its wording is clear

The third one (01) notes with 153 final grades of operative research record in the 2016-II semester.

On the other hand, the relationship between item and the dimensions of each predictor variable are shown in table 5.

Table 5
Dimensions, indicators and instrument items

Dimensions	Indicators	Items
Active participation in Tutoring	Level of interaction in tutoring	1. a), b), c), d), e), f), g)
Active participation in the virtual classroom	Level of interaction in the virtual classroom	2, 3, 4, 5 6. a), b), c)
Assessment of digital teaching materials	Degree of assessment	1. a), b), c), d) 2. a), b), c)
Evaluation of printed teaching material	Degree of assessment	3. a), b), c), d), e), f) 4. a), b), c), d) 5. a), b), c), d), e)

Questionnaires were subjected to expert opinions and the quantification of the AIKEN V validity coefficient is 0.92 (See table 6). In addition, the Cronbach's alpha of whose total value is considered good 0.810 was used to verify the reliability of the questionnaire.

The instruments were implemented physically, at a national level, during the 2016-II semester. Each student responds to the instrument, following the directions on the questionnaire.

Type and Design

This research is basic, since "it seeks production of theoretical knowledge. It focuses on the generation of models of reality in order to explain it and to predict it . . ." (Fontainez, 2012, p.126). The level is correlational predictive, according to Hernandez, Fernandez & Baptista (2014) "Associated variables using a predictable pattern for a group or population" (p.93). The method is hypothetical deductive. The design is not cross experimental, since they are "Studies that are carried out without the deliberate manipulation of variables and on those who only observed phenomena in their natural environment for analysis". Cross because data are collected in a single moment, in a unique time, Hernández et al., (2014, p.153-154)

Table 6
Validity of AIKEN V coefficient

N°	Indicators	Qualitative / quantitative criteria	Judges				Item Value	Average	V de Aiken
			1	2	3	4			
1	Clarity	It is formulated with appropriate language	90	80	90	60			
2	Objetivity	It is expressed in observable behaviors	100	90	95	80	365	91,25	0,92
3	Present	Appropriate science and technology	95	95	95	95	380	95,00	0,96
4	Organization	There is a logical organization	100	90	95	80	365	91,25	0,92
5	Sufficiency	It includes aspects of quantity and quality	90	100	90	100	380	95,00	0,96
6	Intentionality	Suitable to assess aspects of the study	90	90	95	60	335	83,75	0,85
7	Consistency	Based on theoretical-scientific aspects and the subject of study	95	90	90	70	345	86,25	0,87
8	Coherence	Among the indices, indicators, dimensions and variables	100	100	95	100	395	98,75	1,00
9	Methodology	The strategy responds to the purpose of the study	90	100	100	100	390	97,50	0,98
10	Convenience	It generates new guidelines in the research and construction of theories	95	90	90	80	355	88,75	0,90
	Subtotal		946	927	938	829	3640		9,17
	Average		94,60	92,70	93,80	82,90			0,92

Procedure

This research was developed in two phases:

First. Initially, a group of students of management and international business was gradually observed in communicative interaction during telematic tutoring sessions of operational research. This allowed the formation of the theoretical framework of research. Then, permission and support were requested from DUED-UAP for the implementation of the instruments. With the permission of the fieldwork, surveys were applied to the sample in a single moment, at the end of the academic term 2016-II.

Second. The survey was debugged, encoded, and the data obtained was processed. Contingency tables were made. The binomial logistic regression test was used to test the hypothesis given that the variable of interest follows a Bernoulli distribution. The SPSS software was used v.22.

Confidentiality or informed consent

The research development was authorized and supported by DUED-UAP for the implementation of the instruments. The objectives of the study were explained to the students, and the teacher was in charge of the teaching operative investigation, the questionnaire and the types of answers were explained, it was explained that the survey was anonymous and a volunteer-basis, and that if they took the questionnaire, they were giving consent for the data to be analyzed.

Results

The sample mean is 10.94 score slightly below the passing minimum which is eleven (11), possibly because the average is affected by extreme values. However, the median is twelve (12).

The quantitative variable academic achievement was aimed at success, if the final grade is between 12 and 20, and failure, if the final score is between 0 and 11. Therefore, follow the median ratings of end-of-course as a reference item to dichotomize. Therefore, academic performance is a Bernoulli distribution with parameter p>0.

Thus, 51 women passed the course with a final average greater than or equal to 12 as opposed to 33 of them who obtained a lower average. Simi-

larly, 37 men passed the course with an average finish greater than or equal to 12 against 32 of them who obtained a lower average.

Table 7
Final average for active participation

		Active participation		Total
		No	Yes	
PROMF_MED	PROMF < 12	63	2	65
		46,3%	11,8%	42,5%
	PROMF >= 12	73	15	88
		53,7%	88,2%	57,5%
Total		136	17	153
		100,0%	100,0%	100,0%

In the contingency table (Table 7) 42.5% of the students obtained a final average of less than 12. This percentage is higher, 46.3%, among those who did not participate actively while at 11.8% among those who participated. Likewise, 57.5% of the students obtained a final average equal to or greater than 12, the greater percentage, 88.2%, of who participated actively as opposed to the 53.7% of those who did not participate.

Chi squared testing was applied for variables in table 7, where the value of the statistic of the contrast (bilateral) obtained was 7.386. The p-value is 0.007. It can be seen that, at a significance level of 0.05, active participation exerts influence on academic performance.

Factorial analysis was applied to the items of the questionnaire for the evaluation of printed material. The maximum likelihood method was used for the extraction of factors by prefixing them in four (04) that account for 69% of the total variance. The KMO test (Kaiser, Meyer & Olkin) test is 0.885 > 0.8 for which the model is notable. Bartlett's sphericity chi squared test scored 1225.656 with gl = 105 and p-value = 0.000 for which the model of factor analysis is adequate. The matrix of the solicited rotated factor applied to factors and the data was ordered from greatest to least where values of less than 0.60 absolute value were discarded.

Table 8
Final average valuation of teaching material

		VALOR_MDTG		Total
		VNEG	VPOS	
PROMF_MED	PROMF < 12	28	37	65
		65,1%	33,6%	42,5%
	PROMF >= 12	15	73	88
		34,9%	66,4%	57,5%
Total		43	110	153
		100,0%	100,0%	100,0%

In the contingency table (Table 8), 65.1% of the students who negatively valued the didactic materials obtained a final average lower than 12. This percentage is 33.6% lower than the percentage of those who positively valued said materials. Likewise, 66.4% of those who positively valued materials obtained a final average equal to or greater than 12, with the lowest percentage being 34.9% of those who gave a negative rating having a final average of less than 12.2.

Contrast of hypotheses. The estimate of the logistic regression model was performed with SPSS software. In table 9, the explanatory variables "PART_ACT" active participation and evaluation of teaching material "VAL_MDTG" are significant at 5%.

Table 9
Active participation and evaluation of teaching materials in the logistic model

	B	Standard Error	Wald	gl	Sig.	Exp(B)	95% C.I. to EXP(B Up	Down
PART_ACT(1)							1,460	32,962
VAL_MDTG(1)	1,341	0,393	11,672	1	0,001	3,824	1,772	8,255
Constant	-0,813	0,339	5,758	1	0,016	0,443		

The equation of the logistic model is as:

$$Ln\left(\frac{p}{1-p}\right) = -0{,}813 + 1{,}937 * PART\_ACT + 1{,}341 * VAL\_MDTG$$

Table 9 shows the confidence intervals of Exp (B), with greater than 1 limits, so we are confident that effectively the positive coefficients of the variables "PART_ACT" and "VAL_MDTG" increase the likelihood that a student finally

achieved an average greater than 12. Being so, it is observed that: a) Because of the marginal increase in the variable "PART_ACT", the rate of advantages of getting a satisfactory AP for a student who participates in tutoring or interacting in a virtual classroom contrasted with another who does not, increases by more than 5.93 times; and (b) By the marginal increase in the variable "VAL_MDTG", the rate of advantages of achieving a satisfactory AP for a student who appreciates the teaching materials, both digital and printed, contrasted with a student who does not value them, increases on average more than 2.82 times. The model has the capacity of correctly classifying 68.6% of the analyzed cases, see the table 10. The cutoff value is 0.5.

Table 10
Classification table for the variables in the table 9

Observed		Predicted		
		PROMF_MED		% Correcction
		PROMF< 12	PROMF>= 12	
PROMF_MED	PROMF < 12	28	37	43,1
	PROMF >= 12	11	77	87,5
			Percentage Overall	68,6

Table 10 shows that the sensitivity (S) is 87.5% and specificity (E) is 43.1%. The Hosmer and Lemeshow test for the model has chi squared value = 0.159, gl = 1 and p-value of 0.690. For α = 0.05, there is no statistical evidence that the model does not conform to the data. Therefore, we assume that the model has a good fit.

Table 11
Active participation in tutoring and virtual classroom in the linear model

Model	Non standarized coefficients		standarized coefficients		
	B	standar Error	Beta	t	Sig.
(Constant)	-0,160	0,030		-5,350	0,000
PART_ AVIRTUAL	0,514	0,041	0,694	12,606	0,000
PART TUTOR	0,250	0,035	0,389	7,070	0,000

Active Participation "PART_ACT," has as good predicted variables regarding mentoring "PART TUTOR" and active participation in the virtual classroom "AVIRTUAL PART". This is confirmed by a multiple linear regression.

The equation of the linear model is as follows:

$$PART\_ACT = -0{,}160 + 0{,}250 * Part\ Tutor + 0{,}514 * Part\ AVirtual$$

In table 11, the participation in the virtual classroom has greater impact on the variable for active participation than participation in tutoring. R2 = 0.555; that is to say, 55.5% of the total variance of the values of the active participation in the sample is explained by the regression. Variance Analysis and hypothesis Test of the adequacy of the model are shown in table 12, where we accept that at least one of the two predictive variables contributes significantly to active participation.

Table 12
ANOVA for the coefficients of the variables in table 7

Model	Sum of squares	*df*	Mean square	F	Sig.
Regresion	8,382	2	4,191	93,411	0,000b
Residual	6,730	150	0,045		
Total	15,111	152			

The assessment of the teaching material "VALOR_MDTG," has a Valuation of the digital material "VALOR_MDIGITAL" and valuation of the text and guide "VALOR_TEXTOGUIA" as good predictors.

Table 13
Evaluation of text and guide and digital material in the linear model

Model	Non standardized coefficients		Standardized coefficients		
	B	Standar error	Beta	t	Sig.
(Constant)	1,217	0,034		36,168	0,000
VALOR_MDIGITAL	0,567	0,040	0,629	14,003	0,000
VALOR_TEXTOGUIA	0,462	0,041	0,510	11,348	0,000

The equation of the linear model is as follows:

$$VALOR\_MDTG = 1{,}217 + 0{,}567 * VALOR\_MDIG + 0{,}462 * VALOR\_TEXTOGUIA$$

From table 13, it can be deduced that the assessment of the digital material has greater impact in the variable for evaluation of teaching material

than for the assessment of the text and teaching guide. R2 = 0.699; That is to say, 69.9% of the total variance of the values in the evaluation of teaching material in the sample is explained by the regression. The variance analysis and test of hypothesis of the adequacy of the model gives us the information:

Table 14
Analysis of variance for the model of table 9

Model	Sum of squares	*df*	Mean square	F	Sig.
Regresion	21,596	2	10,798	173,812	0,000b
Residual	9,319	150	0,062		
Total	30,915	152			

From Table 14, it is accepted that at least one of the two predictor variables contributes significantly to the assessment of the didactic material.

Discussion and Conclusions

In this research, the application of logistic regression gives us a model for academic achievement with the predictive variables: "PART_ACT" active participation with Wald index = 5.932 and p = 0.015; as well as assessment of teaching material "VALOR_MDTG" with Wald = 11.672 index and p = 0.001. The model has a capacity of correctly classifying 68.6% of the analyzed cases, with cut-off point 0.50. Likewise, the percentage of students correctly classified as passing with greater than or equal to 12 average is 87.5% while the percentage of students correctly classified who have an average of less than 12 is 43.1%. Therefore, it is concluded that the model best predicts whether a student will pass with greater than or equal to 12 than average than to predict whether a student will have one average of less than 12.

The results obtained show that employment of active teaching and learning strategies is associated with better academic results coinciding with Herrador & Hernández (2013); Jenaro-Río et al. (2018).

It is confirmed that the assessment of learning materials, positively influences academic performance of students in DE. It is confirmed that a student who interacts in the tutorial, communicates and exchanges information with his companions; as well as downloads their virtual classroom materials, reviews the forum and blog, and whose assessment of their study materials is positive, has greater advantage to achieve a final average greater than or equal to 12 (successful) than a student who does not do activities or only partially does. In this regard, this study agrees with Carrasco, Carrillo, Bazley, Vergara & Contreras (2017) about the implication of the forum, Aucancela & Eugenia (2016) in the sense that the Virtual learning System helps the learning process in approximately 85%, and De Souza, Franco & Costa (2016) about the advantage of the text to be self-sufficient, easily accessible, and portable.

On the other hand, by means of multiple regression, participation in the virtual classroom has greater impact on the variable of active participation to participation in mentoring by R2 = 0.555; That is to say, 55.5% of the total variance of the values of the active participation in the sample is explained by the regression. Also, assessment of the digital material has greater impact in the variable evaluation of teaching material to the assessment of the text and teaching guide with R2 = 0.699; That is to say, 69.9% of the total variance of the values in the evaluation of teaching material in the sample is explained by the regression. In this part, it confirms the results of Prats & Ojando (2015) in their study on academic performance enhancement using ICT they concluded that students who have used the didactic digital contents gain a significant improvement of their learning and academic performance, with an average of 20.4%.

As suggestions, these findings should lead to activities that enhance the interaction of the students both in tutoring the virtual classroom; as well as, update teaching materials—both digital (aid, readings, etc.) and DE (didactic units and Guide) printed with the aim of contributing to increasing the level of academic performance considered as satisfactory.

For future implications, further investigations should include other variables such as the studies

of higher level, digital literacy, educational practices, etc., that will expand the results obtained in this research.

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Multiple intelligences and learning styles in psychology students of a course in virtual education modality

Inteligencias Múltiples y Estilos de Aprendizaje en Estudiantes de Psicología de un Curso en Modalidad de Educación Virtual

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Abstract

We aim to describe the profile of students based on Multiple Intelligences and learning styles. The study is framed within a quantitative research, with a descriptive design, in which two questionnaires were applied (Multiple Intelligences Inventory, adapted by Walter McKenzie and the Integral Diagnosis of Cerebral Dominance (DIDC) adapted by Omar Gardié), which were applied through the Google Forms platform. 107 psychology students enrolled in a course of first registration in virtual education in the UNAD Psychology program participated. 89.7% of the participants were women, the average age was 26.72 years (SD 9.06) and the academic performance was between 0.02 and 4.9, being 5.0 the highest. The null hypothesis states that there is no statistically significant difference between the students learning styles and multiple intelligences.

The results suggest that the predominant learning style according to Hermann's whole brain theory, corresponds to quadrant B with an average of = 66. It was found that the predominant intelligence was the intrapersonal with an average of = 79.21. Finally, when performing the variance analysis of the study variables, we found statistically significant relationships between Quadrant C and age ($p < .009$), visual-spatial intelligence with quadrant AF (24.82) = 1.78, $p < .029$, bodily-kinesthetic intelligence with quadrant BF (25,81) = 1.69, $p < .040$, Linguistic intelligence with the average grade F (57,45) = 1.68, p = .036.

Keywords: Multiple intelligences, learning styles, virtual education.

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Resumen

Se pretende describir el perfil de estudiantes basado en las Inteligencias Múltiples y los estilos de aprendizaje. El estudio se encuentra enmarcado dentro de una investigación cuantitativa, con un diseño de carácter descriptivo, en el cual se aplicaron dos cuestionarios (Cuestionario de Detección de las Inteligencias Múltiples, adaptado por Walter Mckenzie y el Diagnóstico Integral de Dominancia Cerebral (DIDC) adaptado por Omar Gardié), los cuales fueron aplicados por medio de la plataforma Google forms. Participaron 107 estudiantes de psicología inscritos en un curso de primera matrícula en modalidad de educación virtual del programa de Psicología de la UNAD con 89.7% mujeres, el promedio de edad fue de 26.72 años (DE 9.06) y rendimiento académico entre 0.02 y 4.9 siendo 5.0 el más alto. Como hipótesis nula se plantea la no existencia de diferencia estadísticamente significativa entre las inteligencias múltiples y los estilos de aprendizaje en los estudiantes.

Los resultados sugieren que el estilo de aprendizaje predominante? según la teoría del cerebro total de Hermann, corresponde al cuadrante B con una media de = 66. Se encontró que la inteligencia predominante fue la intrapersonal con una media de = 79.21. Finalmente, al realizar el análisis de varianzas las variables del estudio, se encontró relaciones estadísticamente significativas entre el Cuadrante C y la edad (p<.009), la inteligencia visoespacial con el cuadrante A F(24,82)=1.78,p<.029, Inteligencia física cenestésica con el cuadrante B F(25,81)=1.69,p<.040, Inteligencia lingüística con el promedio de calificaciones F(57,45)=1.68,p=.036.

Palabras Clave: Inteligencias múltiples, estilos de aprendizaje, educación virtual.

Introduction

The constant evolution of the educational processes and understanding of the various factors related to learning have the expansion of educational proposals in the university context, for strategies consistent with the diversity and specificity of the educational needs of the students.

From this perspective, the UNAD adopted A Universal Design for learning which is conceived as "an educational approach that aims to apply its principles to the design of the curriculum for different levels of education" (Yunda, 2016). This model recognizes the diversity of the students, especially regarding learning styles, to facilitate this process in every student.

For this reason, it is essential to inquire about dominant learning styles as well as multiple intelligences that excel in students, since investigations reflect that, in the first year of university studies, the largest number of desertions occur, which are associated with poor performance, but also to familial economic situations and vocational problems. (Centro de Microdatos [CMD], 2008;) Olani, 2009; Rodriguez, Fita & Torrado, 2004; Donoso & Schiefelbein, 2007, cited in Esguerra, 2009). This is why that, to arrive at these strategies, it is necessary to inquire about how students learn and resources they may have, in order to address in an appropriate manner, any academic difficulties that may arise throughout the process of adaptation, and thus, can give tools allowing them to maintain and be successful within the educational system. Therefore, this research poses the following question:

What is the profile of psychology first-time registered students enrolled in a course of the UNAD psychology program from multiple intelligences and learning styles?

To enrich the understanding of the formation of this group of students, this study will take into account variables to be explored such as academic achievement, age, and geographic location, taking into account that the students are natio-

nally distributed with cultural diversity, gender, and occupation due to the fact that of the student population, the vast majority are adults who belatedly began their university education.

The general objective is to describe the profile of the students of the introductory psychology course in virtual education in the program of psychology of the UNAD from multiple intelligences and learning styles. Specific objectives are: i. identify principal multiple intelligences of newly registered psychology students. ii. recognize the dominant learning styles of the newly registered psychology students. iii. describe significant relationships between the variables proposed in the study. The null hypothesis states that all the means of the population (means of the factory levels) are the same while the alternative hypothesis states that at least one is different.

Finally, note that, in the bibliographic review on the psychology students' profiles, in terms of intelligence and learning styles, specific literature with this population is limited. However, it was found that for Carrasco & González (2018) students do not have a predominant learning style but have a moderate preference towards each of the learning styles. For their part, Escobar & Llumiquinga (2018) conclude in their research that the learning style selected by the students is the reflective

E-learning styles

Each individual through their uniqueness creates a learning style to interact with their environment and create knowledge. From this perspective, it is important to highlight that each person brings with them a "style" or personal mechanism for the acquisition of knowledge and consolidation of learning that makes up just part of their personal characteristics, through which they recognize and interacts with the environment that surrounds them and in which they develop.

Learning style is understood as the cognitive style that each individual manifests when confronted with a learning task in which each person shows his or her favorite, usual, and strategies en the moment of learning (Vásquez, 2011, p. 162).

Learning style is one of the more stable and defined concepts in each human being, as well as being one of the most used in their constant interaction with the environment and through which they relate to it, learn from it, discover it, and significantly explore it (Sachún, 2017).

Reviewing the learning styles in psychology training, we have found in Carrasco & Gonzalez's study, 2018, who evaluated the profile of psychology students in the Universidad Autónoma de Chile (Independent University of Chile), that they do not possess a distinctive learning style, but have a moderate preference in toward each of the learning styles, highlight the importance of generating appropriate methodologies for the best academic performance in students.

In the same way in another exploration carried out by Escobar & Llumiquinga, (2018) with psychology students of the University Central de Ecuador in Quito, it was concluded that the learning style selected by the students of first, fourth, and ninth semester is the reflective, the evaluation is developed by the institution from the early years of training to the professional field, on the basis of observation and research.

The chosen theoretical proposal of this research on learning styles is oriented towards understanding the interaction between the brain and some aspects related to learning from the contribution given by neuroscience, for this the proposal taken is called the Model of the Whole-Brain or Brain Quadrants of Ned Herrmann. The author develops the model based on brain structure. He proposes the learning styles from cerebral dominance.

This model is based on the fact that each hemisphere processes information differently, so there are different ways of thinking associated with the operation of each hemisphere (Montes & Gutierrez, 2017).

The whole-brain model contains two proposals: made by Sperry (1961), posed by the split-brain theory of the right brain and left brain that proposes that the two hemispheres are associated with different forms of thinking, due to which each hemisphere process information in particular way, favoring different styles of thought.

Precisely, the left hemisphere dominates digital, linear sequential processing, it is logical, rational, think in words and numbers, learns from the part to the whole and quickly absorbs details, facts, rules, and analyzes the information step by step, contrary to the right hemisphere which specializes in management of analogous, holistic, simultaneous information, prefers to find patterns, and processes information in a comprehensive manner, starting with a full understanding in order to understand the various parts. In addition, it is memorial, spatial, sensory, intuitive, synthetic and subjective.

Another theory proposed by MacLean, (1990) called the "Triune Brain" that complements Sperry's theory, since it considers that there are three brains in one: the basic, related to automatic behaviors that are based on the survival of the individual; then the affective or emotional brain and lastly; the neocortex, formed by the left and right hemispheres where higher intellectual processes are conducted.

In this way, Herrmann sought to articulate the functioning neocortex with its right and left hemispheres of the cerebral cortex and the limbic system and fractionated them into four quadrants which are related and which at the same time keep their particularity in the operation of processing information and they can act either individually or combined, both sequentially or simultaneously, in the different processes of brain function.

He found that each quadrant displays its functions as well:

- Left Cerebral Hemisphere (quadrant A), expert, thinking, logical, analytical, critical, logical, quantitative and based on facts.
- Left Limbic System (quadrant B), the organizer, sequential thinking, organized, planned, detailed and controlled.
- Right Cerebral Hemisphere (quadrant C) strategist, style of emotional, sensory, humanistic, interpersonal, musical, symbolic and spiritual thought; holistic-intuitive, synthesizer-integrator, idealistic.
- Right Limbic System (quadrant D) Communicator, conceptual thinking style, holistic, integrative, global, synthetic, creative, artistic, spatial, visual, metaphoric, interpersonal, feelings, emotional aesthetic.

This theory poses that each person has one or several forms of cerebral dominance, therefore processes the information that comes with this dominance and to this extent would use functions of one or another hemisphere for this purpose and to interact with its environment.

An instrument of psychometric assessment was created to identify cerebral dominance, and was applied validly and reliably to diverse populations and from this is derived a profile that offers four modes of thought:

a. Realistic and common sense of the left hemisphere (Quadrants A and B);
b. Idealist and kinesthetic, characteristic of the right hemisphere (quadrant C and D);
c. Pragmatic (Quadrants A and D);
d. Instinctive (Quadrants B and C) (Segarra, Estrada & Monferrer, 2015).

This theory proposes that each individual displays one or more dominances and that this form of operation influences personality, skills, and creates pathways for the learning of each individual (Montes & Gutierrez, 2017).

Multiple intelligences

For Gardner, and cited in Villamizar & Donoso (2013), intelligence is considered a potential biopsychology that allows you to process information, which can be activated within a cultural framework facilitating the resolution of problems or in the generation of products that have significance within a culture. Similarly, it sees intelligence as a cognitive competence covering a number of talents, skills and mental abilities, which are regulated and differentiated according to individual interests and the context (Orozco, 2010).

Gardner presents the theory of multiple intelligences (MI), which is based on this study, and questions the validity of the concept of intelligence as a dependent skill exclusively consisting of unique factors and research has contributed

significantly to advances in understanding the operation of the brain based on the acquisition of new knowledge and its relation with creativity, attention and memory. Therefore, the MI theory is an analysis of intelligence, which offers a wide range of resources and tools, from the particularity of each subject, using different brain mechanisms, which operate according to external and internal agents of the individual (Prieto, 2014). In this sense, this theory is considered an alternative to the traditional classroom design taking into account that it considers the diversity of how people learn and understand a subject. Similarly, when the author recognizes more than two intelligences, they make a significant contribution to cognitive science where a philosophy is constructed that is based on the student and also, to be more assertive in the understanding of individual differences and their approaches and in the teaching-learning environment (Sener & Cokcalıskan, 2018).

A definition of each intelligence proposed by Garner cited in Prieto (2014):

Linguistic intelligence

This type of intelligence is related to the use of the written and spoken word, to communicate and connect with the surrounding world. People who develop this intelligence use language as a tool for interaction with the environment and develop the competence to carry out activities such as to describe, narrate, observe, compare, relate, value and summarize.

Bodily-kinesthetic intelligence

Related to the capacities and abilities to recognize and manage the body itself, such as the practice of sport, as well as the ease of creating new things. It stands out mainly for specific skills of coordination, balance, strength, speed, etc., which are the cognitive characteristics use of the body.

Logical-mathematical intelligence

This intelligence is known for the ability to carry out calculations, complex mathematical operations, and establish and test hypotheses. It facilitates the ability to establish logical relationships, manage propositions and has the facility to classify, categorize and solve problems.

Interpersonal intelligence

Considered the fundamental basis for the establishment of human relations and involves the ability to interact and relate to the outside world, through assertive strategies, empathy, solidarity, and excellent communication. It brings with it the ability to listen to and understand others. People with this kind of intelligence tend to have a high self-esteem and self-knowledge.

Musical intelligence

Related to the ability to appreciate and produce different musical tones and rhythms and with the ability to play instruments, some of its symbolic systems are the musical notations and Morse code, handles different ways to of manifesting musical expressions.

Intrapersonal intelligence

People who normally live in their inner world and develop an important inner wisdom, Gardner recognized this as an important source of knowledge. They tend to be very self-motivated, with great capacity to recognize themselves; reflective.

Visual spatial intelligence

People who have this kind of intelligence demonstrate great skill with the handling of images, as well as the ability to perceive the spacial world and represent an abstract and visual experience. This intelligence also involves a very sensitive sense of colors, lines, shapes and space analysis.

Naturalistic intelligence

It is the manifestation of a high sensitivity to the natural world, interest in research and exploration of the environment. People who have this kind of intelligence expressed great interest in the natural environment, its observation and recognition of species that are part of it.

After defining each of the multiple intelligences, it is important to highlight that these may or may not be seen in meaningful activities, depending

on various cultural and environmental factors. At the same time, may also be related to experience, age and the formation of each person (Armstrong, Kennedy & Coggins, 2002;) Furnham, 2014, cited in García, 2018).

For an effective functioning, another essential feature present in all types of intelligence is the "memory", without which every act would lead to a new problem. The different types of memory are present in each intelligence in a specific way and enhance its development. For example, the sensory memory present in the musical, visual, and kinesthetic intelligence uses peripheral sensory receptors: sight, hearing, taste, touch, and smell, to receive stimulation from the environment; and for the processing of the information in each different level of memory some of the structures involved are: the hippocampus, the amygdala, entorhinal cortex, and the frontal lobes, among others (García, 2018).

Verbal and linguistic intelligence are articulated with language function to enable their comprehension and expression, some of the neuroanatomical structures that sustain it are: the left hemisphere of the brain where: structures as the Broca's area, Wernicke's area, arcuate fasciculus, angular gyrus, supramarginal gyrus, supplementary motor area, prefrontal lobe (mountain & Brigard, 2005).

In the base of musical, Visual-spatial, and bodily-kinesthetic intelligences are also executive functions, which are related to the organization of reeducate processes, i.e., the gnosis and praxis, since these cognitive functions that are established to perceive and recognize the shape and physical properties — Visual, auditory, olfactory, gustatory, somesthetic — of people and objects in the environment. These functions are the result of a physiological learning, depend on the social environment for their development, and are essential to learning processes. These functions are biological in nature and social by genesis. The brain regions involved in the recognition of stimuli derived by the sensory channels -Gnosis - are the limbic cortex, lingual gyrus, fusiform gyrus, anterior temporal cortex, parietal, and occipital lobes. Motor activities are organized through a process of learning, given by the interaction of the senses and muscle activity (Géromini, 2000).

In a student-centered learning process, it is important to explore the skills that each person has to resolve situations or to create knowledge. The above refers to intelligence, a term which has a breadth of meanings given by authors such as Binet, 1908; Jensen, 1980; Sternberg, 1985; Wechsler, 1944 and who have submitted different proposals to understand this concept. For example, Wechsler cited in Ardila (2018) defines intelligence as the overall capacity of an individual to act deliberately, think rationally and effectively manage in their environment. Other definitions were limited to refer to this construct as the ability to provide a single, correct answer to a precise question as proof of a theorem (Simon, 1973, cited in Jaarsveld & Lachmann, 2018).

Taking into account the above, it can be stated that intelligence combines factors typical of the mental faculty and capacity of people, in conjunction with all the stories of interaction, resulting in skills of reasoning, comprehension, understanding, planning, and communication within the surrounding environment and which are needed to enrich the learning styles and therefore the construction of new knowledge.

With regard to the measurement of multiple intelligences, it is suggested to not only assess the person, but to collect the perceptions about the capabilities and skills of a student. This information may be provided by other colleagues, parents, teachers and relatives (Pfeiffer, 2015). However, it could be that the information supplied does not reflect the student's reality, and could be influenced or biased (García, 2018).

Finally, reflection upon the measure of the multiple intelligences in educational settings suggests that curricula integrate the teaching-learning processes and assessment with the development of intelligences, as a result of an integrated and significative process (Fogarty & Stoehr, 2008, cited in Diaz-posada, Varela-Londoño & Rodriguez-Burgos, 2017).

Materials and Methods

Participants

The participants were students enrolled throughout the nation, in the course of Epistemology of Psychology of the two first academic periods of 2018, who belong to the UNAD Psychology program reaching a total of N = 2423 students, distributed in the eight regional zones of the UNAD organization in the national territory.

The sample used was intentionally non-probabilistic as Hurtado expresses (2007). As inclusion criteria for this study, it was taken into account that the selected participants were starting their academic process and were enrolled in the introductory course to the program. As exclusion criteria, students not taken into account were those with more than 25 credits passed, since they wouldn't be first-time registered students from. In this way, we achieved a participation of n = 107, with students from all eight zones.

Confidentiality

The population was contacted online, the purpose of the investigation was shared with them, as well as the confidentiality of the information provided by the students, the handling of the data, the voluntary nature, which were specified in the instruments published online.

Instrument

In order to optimize time and broaden the geographical spectrum according to Amat (2017), the two instruments used in this study were digitized, facilitating the national implementation. Each is described:

Questionnaire for the detection of the multiple intelligences, adapted by Walter Mckenzie in 1999.

This test in its eight phases, aims to assess each of the intelligences proposed by Gardner (Naturalist, Musical, Linguistic, Intrapersonal, Viso-spatial, mathematical, interpersonal, physical and kinesthetic) which are made of ten phrases that describe situations related to the intelligence in particular.

The instrument is adapted to the population in elementary, middle and high school for both male and female genders. It is recognized as a tool for easy application and adjusted to measure the types of intelligences of students (Hajhashemi & Bee, 2010). The various adaptations for high school students raise different questions, each participant responding according to their level of identification, in every one of the contexts for each intelligence (Athanassopoulos & Lopez, 2017).

Regarding the validity and reliability of the instrument, Morales (2013) considered it an instrument of analysis near the theoretical base of multiple intelligences which descriptively enunciates situations that are related or in the context of the intelligence in focus, the subject must then answer according to the perception obtained at the moment in which the test is developed and in correspondence with their personal interests. However, consider that the individual may vary their perception, and that their preferences may be modified over time, causing a reduction in the reliability of the instrument.

For his part, Garcia (2014) in his research has identified that the instrument adapted by Walter McKenzie, has a level of reliability between 77 and 85%. However, to make the method of reliability, Cronbach's alpha, for this sample, a score of 0.773 was obtained. In the following link you can see the applied questionnaire. https://docs.google.com/forms/d/e/1FAIpQLSdTpILLMSjgMVuy6WJsbCMeG4qiXXbbPBNoPk2pL137i-4MW7w/viewform

Comprehensive diagnosis of cerebral dominance (DIDC)

This survey, carried out by Omar Gardié (2000), is an adaptation for the Latin American population of the Herrmann Brain Dominance Instrument (HBDI) from the model of the cerebral areas of Ned Herrmann (whole-brain). Its objective is to quantify the degree of preference of a person through specific modes of thought: an indicator of cerebral dominance. It is worth noting that Ruiz Bolivar et to the. (1994) began the adaptation and validation of the Venezuelan population, a study that was completed by

Gardie (1995). This adaptation retains the same theoretical support of the whole-brain of Herrmann (1989) and assesses the profile of hemispheres and quadrants casting the application of the HBDI determining the degree of preference which is assigned to the quadrants A, B, C and D of the brain, according to a particular score for each item and a numbering also determined for each quadrant, in every part of the instrument.

The instrument is composed of 48 items divided into four parts. The first, evaluate expressions relating to work and everyday activities. The second refers to behaviors, attitudes and beliefs of the personality. The third represents themes or issues of interest to social life. In addition, the fourth, the participant selects the adjectives that best describe their personality.

For the interpretation and assessment of each quadrant the following categories are assigned, in which the term Dominance is used to refer to Primary Preference, Secondary Preference or Indecision and Tertiary Preference or Rejection. Profiles of the quadrants are represented by the numbers 1, 2 and 3, in accordance with the score obtained by each in the sequence A, B, C, D.

Regarding the validity and reliability, Gardié (2000) ensures that the instrument has been subjected to a validation process, since it was applied to approximately two-thousand subjects in several samples from different regions of Venezuela.

For their part, Rojas, Salas & Jiménez (2006) applied the instrument two times in a group of students from University Mayor, in Temuco, Chile, with an interval of one month between applications and on average obtained a Cronbach's Alpha of .8130.

This reliability coincides with the one carried out by Torres & Lajo (2009) in their study, where the Cronbach's alpha fluctuated between 0.74 and 0.87, considering the test as dependable and furthermore valid based on the exploratory factor analysis carried out. It presented adequate evidence of construct validity. For this study, the Cronbach's alpha was 0.603, slightly lower the acceptable minimum of 0.7 considered in this article. In the following link, you can see the instrument applied. https://docs.google.com/forms/d/e/1FAIpQLSeHFc-XYtaCB_Je-QuoqWQluglGR-7TojiFCThtA_Y0awDYc-w/viewform

Type and Design

This research is quantitative, extrapolating the data related to the profile through 2 psychometric instruments: multiple intelligences (adaptation Mc Kenzie, 1999) and Cerebral dominance (Gradíe, 2000), applied to a sample made up of 107 students of an introductory course in the virtual psychology program at UNAD — National Distance Open University. Large amounts of data were provided and measured in an objective and neutral manner (Amat, 2017).

The design of the study was descriptive and sought to explore and recognize the characteristics of the student population related to the learning styles from the Ned Hermann's Cerebral dominance and multiple intelligences; furthermore, to discover the extent of existing association or lack thereof between these categories and some socio-demographic variables of the population without finding a causal relationship. The null hypothesis considers the nonexistence of a statistically significant difference between students' learning styles and multiple intelligences. It does not intervene or manipulate the factor of study, but observes what happens under real conditions. (García, 2004).

Procedure

- In the first phase, we identified the problem of study which showed the need to identify the learning style and predominant multiple intelligences in the first period students of the psychology program at the UNAD.
- In the second phase, study variables were picked, as well as the categories and scales of measurement of the variables. Instruments were selected in order to collect the information about the object of the study categories, which were digitized in a Google form. The questionnaire link was sent to students via e-mail, in which informed consent was also obtained, since it explained that participation was volun-

tary and that the information was only going to be manipulated by the researchers, which characterized it as confidential and exclusively for research purposes.

- In the third phase, the collected data was analyzed using the Statistical Package for the Social Sciences (SPSS). Parametric analyses were performed and took into account the normal distribution of the data. Variance analysis (ANOVA) Snedecor's F: a method to test the equality of two or more population means analyzing sample variances, (Amat & Rocafort, 2017, Hurtado, 2007). Pearson correlation: a method to reveal if one variable is related to another.

Results

Descriptive statistics of two of the socio-demographic variables were then related (see table 1). There is evidence that the average age of the students was of = 26.72 with a standard deviation of 9.06 years and academic average of 3.7 on a scale where 5.0 is the highest rating.

Table 1.
Statistical description of the variables of age and grade point average

	N	Average		Standard deviation
	Statistical	Statistical	Standard error	Statistical
Age	107	26.72	.876	9.058
Average	103	3.7423	.12710	1.28991
N valid (per list)	103			

These results show that the majority of participants are women who are found beginnig the course of Epistemology of Psychology. Other variables considered in this research were the level of studies, taking into account; the population entering college is heterogeneous and not only students who had recently graduated high school. Similarly, the UNAD students are nationally distributed, so this study looked at this category as an element of analysis given the diversity of each of the regions. In this category, it was evident, that 28.24% of students are in the zone Centro Bogotá-Cundinamarca (downtown Bogotá-Cundinamarca), an area in which a greater concentration of the student population of the UNAD is found. However, all areas of the country were represented in the sample. In addition, as reflected in the values according to the quadrants A, B, C, D related to the location of the participant, a statistically significant difference is not reflected, that is to say:

- Quadrant is F (7.99) =. 85, p =. 545
- Quadrant B is F (7.99) =. 88, p =. 528
- Quadrant C is F (7.99) = 1.00, p =. 435
- Quadrant D is F (7.99) =. 86, p =. 538

After exploring multiple intelligences from the proposal of Gardner, the predominant intelligence was intrapersonal with an average = 79.21, which is associated with self-knowledge, realistic self-image, handling of feelings, the capacity for introspection and personal acceptance, and the ability to make decisions about their own lives, characteristics of people with preferences towards occupations engaged in mental health, education or spiritual development, deploy this type of skill or intelligence. Likewise, a comparative analysis was conducted between men and women regarding the multiple intelligences, finding similar gender results, although there is evidence that men score higher than women in intrapersonal intelligence with $\bar{x}$ = 82.73 and women $\bar{x}$ = 78.8, and intelligence in visuospatial in which men score $\bar{x}$ = 77.27 and women $\bar{x}$ = 70.47. In turn, the study identified the difference through the statistical analysis of variance (ANOVA) Snedecor's F for the genre with the types of intelligences from Gardner's approach (see table 2).

On the other hand, a second instrument (DIDC) was applied to participants, which was intended to identify the brain dominance of each student on the basis of Ned Hermann's theory of the model of the cerebral areas, where you could see that the dominant quadrant in the sample is quadrant B: with an average $\bar{x}$ = 66, related to the left hemisphere characterized by processing the information, planning, prioritizing the shape, structure, method, organized, detailed, a bit innovative; However, the other quadrants had close scores. Likewise, a comparative analysis was con-

ducted between men and women regarding cerebral dominance, finding that women have no dominance, while men have two dominances: in the B quadrant with an average of $\bar{x}$ = 68 and C with a quadrant average of $\bar{x}$ 66. Similarly, the results of the statistical variance analysis (ANOVA) between cerebral dominance and gender, did not identify any value less than 0.05, demonstrating that statistically significant differences in this group do not exist (see table 3).

Table 2.
Distribution of means according to Gardner's Multiple Intelligences

Intelligence	$\bar{x}$			F	Sig.
	Complete sample	Female	Male		
Naturalist	75.5	75.47	71.36	0.659	0.419
Musical	66.68	66.61	67.27	0.012	0.915
Mathematical logic	72.66	72.92	70.45	0.275	0.601
Interpersonal	71.4	70.68	77.73	1.283	0.26
Physical and kinesthetic	67.94	67.97	67.73	0.002	0.966
Linguistic	72.78	72.45	72.73	0.003	0.959
Intrapersonal	79.21	78.8	82.73	0.836	0.363
Visuospatial	71.17	70.47	77.27	1.556	0.215

Table 3.
Distribution of means according to the Ned Hermann's model of the cerebral areas

Brain quadrant	$\bar{x}$			F	Sig.
	Complete sample	Female	Male		
A	62	63	61	.074	.786
B	66	65	68	.583	.447
C	65	65	66	.080	.777
D	54	53	55	.286	.594

The Kolmogorov-Smirnov test performedfor normality of functions discovered the behaviorof the variables (See table 4).

Table 4.
Kolmogorov-Smirnov test with correction for normal distribution

Brain		Quadrant A	Quadrant B	Quadrant C	Quadrant D
N		107	107	107	107
Normal Parameters	Mean	62.41	65.61	65.01	53.68
	SD	12.28	11.79	12.18	11.57
Most Extreme Differences	Absolute	0.07	0.08	0.12	0.09
	Positive	0.07	0.05	0.07	0.07
	Negative	-0.07	-0.08	-0.12	-0.09
Kolmogorov-Smirnov Z		0.77	0.78	1.21	0.98
Asymp. Sig. (2-tailed)		0.589	0.58	0.088	0.294

To expand the analysis of the various categories, we sought to identify possible relationships between variables and the Pearson correlation statistic considering the results (see table 4) was used to perform the normality test. Direct and significant correlations were found between:

- Quadrant B and Musical intelligence (p<.039 *)
- Quadrant B with Physical intelligence, and Kinesthetic (p<. 013 *)
- Quadrant A and age (p =. 229 *)
- Quadrant D with age (p =. 219)

On the other hand, it was found that the correlations between all the intelligences are much more powerful and significant, considering that it approaches + 1 and a bilateral significance of (p<.01). Similarly, a Pearson Correlation was found between:

- Academic average and geographical location (p =. 204 *)
- Age and logical mathematical intelligence (p =. 252 *)

Additionally, a statistically significant difference was not found in relation to multiple intelligences and the variables of age, gender, or location, in terms of average scores also failed to reveal a significant difference statistic in relation to the quadrants however in terms of multiple intelligences (see table 5) a statistically significant difference was unveiled between the linguistic intelligence and average, F (57.45) =1.68, p =.036. .

Table 5.
Relationship between average and multiple intelligences

Intelligence		Sum of Squares	df	Mean Square	F	Sig.
Naturalist	Between Groups	13134.48	57	230.43	0.84	0.739
	Within Groups	12388.33	45	275.3		
	Total	25522.82	102			
Musical	Between Groups	20091.83	57	352.49	0.88	0.672
	Within Groups	17941.67	45	398.7		
	Total	38033.5	102			
Mathematical logic	Between Groups	13897.88	57	243.82	1.38	0.13
	Within Groups	7928.33	45	176.19		
	Total	21826.21	102			
Interpersonal	Between Groups	21756.9	57	381.7	1	0.504
	Within Groups	17177.08	45	381.71		
	Total	38933.98	102			
Physical and kinesthetic	Between Groups	20119.74	57	352.98	1.38	0.133
	Within Groups	11516.67	45	255.93		
	Total	31636.41	102			
Linguistic	Between Groups	20339.74	57	356.84	1.68	0.036
	Within Groups	9546.67	45	212.15		
	Total	29886.41	102			
Intrapersonal	Between Groups	8810.92	57	154.58	0.71	0.888
	Within Groups	9775	45	217.22		
	Total	18585.92	102			
Visuospatial	Between Groups	17794.46	57	312.18	1.08	0.396
	Within Groups	12992.92	45	288.73		
	Total	30787.38	102			

Table 6.
Multiple intelligences relationship with Quadrant A

Intelligence		Sum of Squares	df	Mean Square	F	Sig.
Naturalist	Between Groups	4218.45	24	175.77	0.64	0.89
	Within Groups	22456.32	82	273.86		
	Total	26674.77	106			
Musical	Between Groups	8985.35	24	374.39	1.03	0.445
	Within Groups	29911.85	82	364.78		
	Total	38897.2	106			
Mathematical logic	Between Groups	5374.01	24	223.92	1.05	0.418
	Within Groups	17491.87	82	213.32		
	Total	22865.89	106			
Interpersonal	Between Groups	10265.78	24	427.74	1.15	0.308
	Within Groups	30373.94	82	370.41		
	Total	40639.72	106			
Physical and kinesthetic	Between Groups	6260.15	24	260.84	0.83	0.694
	Within Groups	25887.51	82	315.7		
	Total	32147.66	106			
Linguistic	Between Groups	8718.96	24	363.29	1.38	0.144
	Within Groups	21599.73	82	263.41		
	Total	30318.69	106			
Intrapersonal	Between Groups	3716.62	24	154.86	0.82	0.706
	Within Groups	15540.85	82	189.52		
	Total	19257.48	106			
Visuospatial	Between Groups	10733.15	24	447.21	1.78	0.029
	Within Groups	20545.82	82	250.56		
	Total	31278.97	106			

The following table shows the relationship between the B quadrant and multiple intelligences noticing (See table 6) that there is a statistically significant difference between the quadrant and physical and kinesthetic intelligence.

We found that there is a significant difference between visuospatial intelligence andquadrant A with p =. 029 (See table 7).

Table 7.
Multiple intelligences relationship with Quadrant B

Intelligence		Sum of Squares	df	Mean Square	F	Sig.
Naturalist	Between Groups	6600.94	25	264.04	1.07	0.4
	Within Groups	20073.83	81	247.83		
	Total	26674.77	106			
Musical	Between Groups	6229.05	25	249.16	0.62	0.913
	Within Groups	32668.14	81	403.31		
	Total	38897.2	106			
Mathematical logic	Between Groups	5069.62	25	202.78	0.92	0.574
	Within Groups	17796.27	81	219.71		
	Total	22865.89	106			
Interpersonal	Between Groups	9281.59	25	371.26	0.96	0.528
	Within Groups	31358.12	81	387.14		
	Total	40639.72	106			
Physical and kinesthetic	Between Groups	11036.16	25	441.45	1.69	0.04
	Within Groups	21111.51	81	260.64		
	Total	32147.66	106			
Linguistic	Between Groups	7668.52	25	306.74	1.1	0.365
	Within Groups	22650.17	81	279.63		
	Total	30318.69	106			
Intrapersonal	Between Groups	4830.27	25	193.21	1.08	0.379
	Within Groups	14427.2	81	178.11		
	Total	19257.48	106			
Visuospatial	Between Groups	8229.31	25	329.17	1.16	0.305
	Within Groups	23049.66	81	284.56		
	Total	31278.97	106			

Discussion and Conclusions

Given the results above, it can be inferred that the intelligences and dominance present in this group, correspond from the neuropsychological base where linguistic intelligences and the quadrant B and C dominance involve interaction between the left hemisphere and the limbic areas. This means that students who possess a dominance in quadrant B are left hemisphere based with characteristics related to the proper use of language and their rational management of information processes, they take the distinctive characteristics of quadrant B which are organizing, logical, planned practices and simultaneously integrate in the processing of information, particularly of their location in the kinesthetic-limbic-emotional quadrant. This sample has elements of other related intelligences, like musical intelligence, which favors the emotion management, serves as a way to capture feelings, knowledge about feelings and gives ways to communicate them to the listener. At the same time physical and kinesthetic intelligence provides elements related to the use of one's own body, to know and take actions upon the world. For this reason, these people have skills to express themselves through communication, the use of language, being empathetic, and having the ability to connect with other people. In other words, the different types of intelligences work together, interact, and although some dominate over others in an individual to provide a solution to the problems facing at a given time or to create products, different abilities are required of each one and therefore could not be developed in isolation. In addition, that relate directly to the values, culture and habits of the people.

It could be recognized that learning styles are the strategies that an individual has developed to address learning tasks in a manner more or less consistent over time, resulting from a triple influence, their heritage, the own experiences and demands of the context and that they should now it is part of all educational planning that seeks to promote the learning of students. According to this idea, it is suggested to incorporate in the pedagogical proposal, experiences that connect students with the context, and works that promote all types of intelligence and thought. In this sense, optimal

learning must be comprehensive, competencies to be developed should not only be related to the professional aspects, but it must also promote others that facilitate and adapt to changes, social skills, individual emotional management and teamwork.

Therefore, the intention is to integrate educational strategies that encourage the development of the different quadrants of the brain. In addition, to encourage less preferred thinking styles, as well as the preferred route. The contribution of different disciplines such as psychology, education, neuroscience, and information technologies, allows clear recognition and understanding of the processes required to enhance the pedagogical action centered on "student learning."

It is necessary to recognize and work the variables involved in this process, that is to say, those related to the student, teacher, pedagogy and didactics and the environmental variables, so that it refers to a process that promotes customized learning, to study every aspect in the planning of the educative act.

Thus, it is considered primordial learning focused on the student, which entails the need to explore alternatives to customize the virtual learning environments, based on the concept of adaptability (Mejía, 2013); as well as the reflection of the human being that is emerging in this new paradigm that is the virtuality and which is present in a new, forceful manner in all facets of human life, it is a new challenge to approach from the perspective of education and psychology.

Part of the reflections about elements that promote student-centered learning implies that to consider the processes of evaluation, regarding this research suggests those actions that can be done in the real-ecological context, which involve activities in context, addressing real problems, projects, looking for the student to benefit from the contribution of other people (Gargallo-Lopez, Pérez-Pérez, Green-Peleato & Garcia-Felix, 2017). In this context, it is sought that the educative act promotes the development of people with greater resources to deal with the real and everyday context.

Complementing this reflection, Costa & Kallick cited in Bisquerra, (2003) propose to integrate new skills into the learning process, required in the new labor context, which involves leaning on the intelligences that each individual has in order to cope with everyday lifecs omplexity in a creative way and develop other skills of emotional intelligence like perseverance; learn skills for a proper management of the emotions, on the intrapersonal and interpersonal level. In the same way metacognitive skills; create, imagine and innovate; take risks, apply the sense of humor, think independently; be open to continuous learning. In this sense, Lucas & Claxton (2014) provide an open model, with four main components: research, experience, thought, and reason. Another avenue of development implies an intelligence that includes the ethical element, looking to make the individual and collective well-being compatible (Pfeiffer, 2015)

By way of conclusion, it is further enhanced that it is important, in education, to create pedagogical conditions that facilitate the care of diversity to promote inclusion, with proposed educational routes that enable expression options of the various learning styles, ways of thinking, and development of multiple intelligences. It is suggested that the teacher has the possibility of recognizing their learning style so that in addition to generate related proposals, they enrich their pedagogical and didactic proposals to improve the educative act, providing initiatives that favor other learning styles and thought to comprehensively promote the training processes in their students. It is noteworthy that Information Technologies combined with an educational model that includes all the variables that are present in the educative act, joined to constitute a fundamental variable for virtual and face-to-face training proposals, are essential tools that favor the development of the learning styles and enhance learning.

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Evaluation strategy for the continuous improvement of courses of a Visual Arts program in virtual and distance modality: Case study

Estrategia de evaluación para el mejoramiento continuo de cursos de un programa de Artes Visuales en modalidad virtual y a distancia: Estudio de caso

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Abstract

This research was developed with a qualitative methodological design, specifically a case study, with a focus group data collection technique in active students and teachers of the visual arts program of a public university in Colombia with virtual and distance modality. Its main objective was to develop a strategy of evaluation for the academic program in visual arts offered in virtual learning environments. In 2016, the visual arts program starts with an enrollment of 50 active students, for the following year the number increases to 278. The student population is heterogeneous, between 16 to 45 years old and socio-economic conditions with presence in 63 open and distance education centers in Colombia. The results are concentrated in three analytical categories: expectations regarding the program and its methodology, teacher support and new didactic and pedagogical resources. Its impact is reflected in the following findings: a. Establishment of an academic program as an object of study; b. Design of theoretical-methodological contents with relevant and innovative digital educational resources, which encourage autonomous and meaningful learning; c. Identification of

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expectations and needs of teachers and active students as part of the teaching and learning process of the arts, research methodologies and creation of work; d. Implementation of a methodological route for constant evaluation, establishing academic management practices within the program characterized by quality, decision-making based on research and oriented towards academic excellence.

Keywords: Arts, educational resources, evaluation, academic management, virtual learning environments.

Resumen

La presente investigación se desarrolló con un diseño metodológico de tipo cualitativo, específicamente estudio de caso, con técnica de recolección de datos grupo focal en estudiantes activos y docentes del programa de artes visuales de una universidad pública de Colombia con modalidad virtual y a distancia. Su objetivo principal fue desarrollar una estrategia de evaluación del programa académico en artes visuales ofertado en ambientes virtuales de aprendizaje. En el año 2016, inicia el programa de artes visuales con una matrícula de 50 estudiantes activos, para el siguiente año el número se incrementa a 278. La población de estudiantes, es heterogénea, entre los 16 a los 45 años y condiciones socio-económicas con presencia en 63 centros de educación abierta y a distancia en Colombia. Los resultados concentrados en tres categorías analíticas, siendo: expectativas frente al programa y su metodología, acompañamiento docente y nuevos recursos didácticos y pedagógicos. Su impacto se refleja en los siguientes hallazgos: a. Establecimiento de un programa académico como objeto de estudio; b. Diseño de contenidos teórico-metodológicos con recursos educativos digitales pertinentes e innovadores, que propician el aprendizaje autónomo y significativo; c. Identificación de expectativas y necesidades de docentes y estudiantes activos como parte del proceso de enseñanza y aprendizaje de las artes, metodologías de investigación y creación de obra; d. Implementación de una ruta metodologíca para la evaluación constante, estableciendo prácticas de gestión académica al interior del programa caracterizadas por la calidad, toma de decisiones basadas en investigación y orientadas a la excelencia académica.

Palabras Clave: Artes, recursos educativos, evaluación, gestión académica, entornos virtuales de aprendizaje.

Introduction

The training of artists in a virtual mode not only problematizes the art/technology relationship, but also addresses important aspects of life from different dimensions (emotional, cognitive, and expressive). In this sense, questioned in the scope of "aesthetic behavior" as stated in Barbosa (2017), it is relevant for the purposes of training and research in the Arts: "Like a tool that enables expression, that does not disassociate itself from life or from human effort, art calls upon human being to share emotions, sensations and ideas. Thanks to the collective impulse, in art two types of fulfillment within the experience are achieved: the unification of components of life, and the union of intersubjective experiences between groups human" (p.4).

Virtual mode favors access to training in crafts, with national and international coverage and a flexible structure for development of the pro-

posed content. The features proposed in this program which distinguish it from others are as follows: the virtualization of curricular content, active use of Information and Communication Technologies (ICT) in the teacher-student relationship, and research mediated through use of technologies for the formation of investigational research, using methodologies unique to the arts, such as the art of investigation/creation and qualitative or mixed research.

The teaching of the arts fosters a close relationship between the teacher and students through face-to-face interaction, however, thanks to ICT, is possible to maintain this relationship virtually. Because this is the first program of a virtual modality offered in Colombia, it is necessary to inquire into meaningful learning in theoretical-practical courses, since the courses in have traditionally been developed for the face-to-face environment.

The questions are; is it possible to learn how to draw virtually? Can artists be taught through a virtual mode? The answers to these questions cannot derive from a prejudiced or enthusiastic place, but through research. This is an exercise for the review of the significant learning of the students in the program. Using these ideas, we can propose the development of a tool for continuous improvement of the design and didactic components of online art programs, which teach drawing, photography, and basic design.

Developing evaluation strategies allows the constant identification of standards for success or failure of the pedagogical strategy and didactic implementation for the appropriation of theoretical-practical concepts of Visual Arts. For this, four phases were created: the methodological design, the subsequent application of evaluative techniques, analysis of results and finally the formulation of guidelines.

Virtual education arose as a solution that encompasses the needs of the population, granting access to education to people from contexts. Due to disability, mobility, space, and time, not everyone can access education in person. This mode of learning in virtual environments has evolved as permitted by information technologies. At this time the growth of online courses has been increasing and supplementing spaces where education and the spreading of knowledge was not possible, therefore, ICT provided various tools and possibilities for students to gain, process, and execute knowledge. The distance higher education environment is not only seeking the success use of technologies, but also educational tools offered within the course. How the Plan Nacional de Tecnologías de la Información y las Comunicaciones 2008-2019 del Ministerio de Educación (Information and Communication Technologies National plan 2008-2019 of the Education Ministry) shows it: The use of these technologies has changed the social customs and the ways in which people interact. ICTs have improved opportunities for large groups of the population traditionally excluded by increasing mobility within society. These technologies have additionally revolutionized learning, changing the way people learn and the role of pupils and teachers. It has also become clearer that the learning period may not be a time-limited process, but occurs throughout life. (Ministry of Communications, 2008, p. 65).

In connection with the above information, the importance of constant evaluation of the online courses is stressed, since distance education not only seeks to provide an opportunity to a population or provide easy access to knowledge, but also seeks to use certified high-quality educational learning.

> "The existence of media as an instrument of communication and exchange does not guarantee nor determine a methodology or a particular concrete learning since it requires the processes of construction and socialization where the media come to contribute but are not crucial to achieving learning outcomes. The simple presence of technologies does not guarantee optimal results, every proposed application demands the active, creative and critical participation of the agents involved, each one of whom are generators of messages and have the power to exchange knowledge and ideas with others to enrich their knowledge"(Avila & Bosco, 2001, p.34).

So what impacts and effectiveness does the learning process have in students who participate in

methodological Visual Arts courses offered by a public University with online and distance learning? What pedagogical tools should be taken into account for the continuous improvement in a virtual course high quality craft?

As Avila & Bosco (2001) assert, educative practice is not sufficient with the incorporation of ICT since in itself it does not educationally significant. Because of this insight, the use of technology and communication tools must be accompanied by a creative and innovative pedagogical model that allows constant transformation for meaningful learning. From this perspective, a high-quality education in which students learn in a positive and effective manner must be guaranteed.

Research explores methodological aspects of the teaching of Arts in virtual environments from the theoretical approach of certain theoretical-practical courses. Analytical categories explored are expectations about the program and its methodology, teacher accompaniment, and new didactic and pedagogical resources.

Its main objective is to develop an evaluation strategy for the continuous improvement of four methodological courses of the online Visual Arts program: drawing, photography and basic design.

Programs of Arts in Colombia: a view of the teaching-learning processes

The programs of Arts in Colombia

Currently, programs of Arts offered in Colombia are insufficient in relation to other professions and fields of knowledge. According to the SNIES-Ministry of national education (2013), there are 37 programs of Arts, which represent only 5% of the programs of higher education offered in Colombia, meaning that only 469 programs out of the 9,824 that exist correspond to this area of knowledge. Areas of economics, mainly business administration and engineering programs, make up more than half of the programs offered at the national level, holding 55% of the total (see Figure 1).

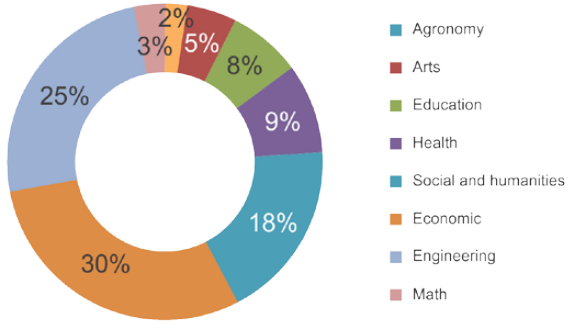

Figure 1
Registered, quality programs by subject. Analysis based on information from the SNIES, Ministry of national education (2013).

The area of the arts consists of seven basic core knowledges: plastic, visual and related arts, representative arts, history, design, music, advertising and related arts, and other unclassified disciplines. However, the range of Visual Arts is significantly smaller than the total number of programs available within the area. Within the arts programs, design and music are occupied by larger proportion of students and academic offerings. As stated above, only 5% of higher education programs offered at the national level are within the area of Arts; of these, 469 programs cover the seven basic nuclei outlined. Only 69 programs of the 469-cover plastic, visual, and related arts, the others correspond to the other programs that constitute the arts, representing 19.7% within the area and only 0.69% of the total number of programs offered in different areas of knowledge in Colombia (information gathered from the SNIES-Ministry of national education, 2013 and can be observed in table 1).

Table 1.
Number of programs offered by subject. MEN - SACES. Information from July 2013. * Does not include national university programs; includes only the SENA registered, qualified programs.

Area	Number of programs	%
Agronomy	243	2
Arts	469	5
Education	769	8
Health	939	9
Human and Social Sciences	1742	18
Economics	2936	30
Engineering	2413	25
Math	313	3
Strongly disagree	9824	100

Analysis based on information from the SNIES, Ministry of National Education, 2013.

Teaching the arts in virtual learning environments

The development and evolution of information technologies has created virtual spaces and environments in order to make education accessible to all. Likewise, we seek to create different areas within online higher education with new opportunities of knowledge (Avila & Bosco, 2001).

When we refer to the virtual learning environment, it is contextualized as the use of software or a platform, the purpose of which is to transmit information to build new knowledge. The virtual learning environment is characterized by the use of an intuitive visual interface, where modules are used for step-by-step information mediation. There are tools such as calendars, agendas, student management, evaluation, and tracking, allowing a real meaningful learning; In addition to these tools, there are people who enable such mediation; the administrator, the tutor, and the student. A virtual learning environment must allow communication between the teacher and the student to develop skills and mediate the educational process, as well as have the capacity to work with large and small groups without affecting the usability of prepared resources (Belloch, 2012; Zapata-Ros, 2015).

According to Avila & Bosco (2001) perceive learning environments as neither subscribed to formal education nor to a particular educational modality. On the contrary, they try to create spaces in which to recreate the conditions under which the individual gains new knowledge, new experiences, and new elements that generate processes of analysis, reflection and appropriation without mandatory on-site attendance. From this perspective, it is understood that distance education considers that people in areas, which do not have access to educational tools, also have a need for learning and specific knowledge of different subjects. This is where ICT plays a key role; in the generation of tools that afford the opportunity of a high-quality education through online and distance learning.

In Colombia, in online and distance learning has evolved in three stages. At first, student-teacher interaction was very limited and most correspondence was through mail. Then, ICT played an indispensable role by closing the space between the student and the tutor by means of remote learning and cyberspace, in order to further enable the exchange of information. The third part of this evolution occurred through technologies that offer continuous communication over networks which allow access to education anywhere at any time, allowing close student-teacher contact. Likewise, it is important that the pedagogical model is planned while taking into account advancements towards high-quality education process.

Many advantages within the virtual mode allow it to be a successful learning alternative for students. According to Mendoza & Galvis (1999, p. 34) there is a long list of advantages for both the tutor and students. Highlights among them are: 1, reduced sense of isolation; 2, increased flexibility, and 3, increased variety.

In this sense, it highlights that an educational system should constantly be evaluated and reflected upon. The use of ICT must encourage continuous improvement within the learning environment to promote high-quality education. For this purpose, there are enforcement instruments of qualitative and quantitative form that enable foster constructive criticism and improvement of online courses. Likewise, it demonstrates the importance of online higher education, where the objective is to provide an effective, relevant, and full knowledge.

Evaluation in virtual learning environments

In the virtual mode, it is essential to raise a number of guidelines in order to develop a quality education system. For the creation of a virtual learning environment, it is necessary to take into account the following elements: analysis, design, development, and evaluation. The dynamics of each of these tools lead to successful student learning. Instruments have been created that allow the continuous application of these elements in online courses, as well as reflection about changes and dynamics that must be configured in the courses to be evaluated. For this type of evaluation, it is important to select areas and subareas, define standards, and define indicators in order to

adopt a system of improvement within an online course. As Rubio (2005, 2003) says when referring to quality standards and indicators, to be included within a model they adopt the intrinsic characteristics of the course to be evaluated, like those that contributed to its organization and management; and in some ways, they can affect student perception. In addition, Rubio mentions that although the established indicators attempt to represent the entire context, even though they have tried to be representative of the whole of the context, it is convenient that each institution selects those most appropriate to their needs and their reality.

Methodological courses

The online and distance learning Visual Arts program of a public university in Colombia has a curricular design with core problems, which seeks to integrate in a coherent manner the environment, mediation, mediators, learning strategies, and evaluation proposal, which, thanks to methodological order, is composed of a set of procedures, strategies and pedagogic-didactic techniques. These strategies and techniques are viable through the resources and tools of the online learning environment, enabling the exercise of certain professional practices, trades, or occupations, the recognition of regional problems and feasible solutions, as well as the identification of new training requirements (PAP solidarity-UNAD, 2011, p.16).

Regarding classification, three types of courses are offered in the arts program: theoretical, methodological (theoretical/practical), and practical. The theoretical courses of the program respond to the declarative knowledge of knowledge, i.e., concepts, fundamentals and problems of knowledge and knowledge discipline. The methodological courses emphasize procedural, very relevant knowledge for the methodological strategy workshop and requires the application of knowledge to practice solving problems in which student must enhance the implementation of the theoretical contents (know-how). The practical courses (workshops) are those in which production and action may develop; they are structured from the processes of creation and research of each student after they have knowledge and expertise gained in the theoretical and practical courses. In coherence, the following were determined as methodological courses of the Visual Arts program: drawing, artistic photography, and basic drawing.

Context and scope of research mediated by technologies of information and communication for the evaluation of an academic program

According to Romero (2014) at the end of the 1960s, the emergence of Internet conceived societal transformations, now shaped by subjects and hyper-connected subjectivities; citizens of the world exist in delimited territories and have new requirements regarding technological consumption (p.28). For Garces, Ruiz & Martínez (2014, p.219) societies recognize the Internet's social impact. Transformations in dynamics, ways of interpreting realities, the individual's relationship to their self, others, and the environment, has put on the agenda the discussion today's university's commitment to meeting the challenge of top education in digital societies and culture. Within the impact of transformation, ICT has begun to play a fundamental role in the educational process as a contribution to the construction of knowledge, for the purpose of solving problems and fixing the situations of an environment or context.

According to UNESCO, the university's social responsibility and substantive functions are teaching, research, and extension. This has enabled the leap from traditional to distance education, while recognizing other models of teaching and learning and maintaining standards of quality, relevance, social inclusion, integration, internationalization, and mobility (Estrada, Fernández, & Zambrano, 2017). From teaching and extension expands the design and offer of training and MOOC courses (massive, online, open, and free courses). From research, new knowledge about virtual environments has been developed for the mediation of processes of University research. As mentioned previously, research is an important factor for the development of new knowledge products that may contribute to the different fields of action required; in this case, the explo-

ration topics within the Humanities which were previously unknown are now uncovered, due to technologies that contribute to research improvement, strengthening, and shed light on the practices of social sciences and humanities researchers (Romero, 2014, p. 20).

Nowadays, not only the research but also the education itself is constantly challenged to achieve significant learning and achieve an evolution of the transmission of information; It is there where technologies, virtualization, and the same distance education contribute to the construction of a social development through virtual spaces, which foster independent learning. Using the technologies to independently look for information leads to building individual knowledge, simultaneously mediated with collaborative learning for the development of skills in online environments. These spaces generate discussion and a search for transformation in forms of education, to reach an end point at the construction of knowledge. Here, technology is a necessity for the evolution of information (Navarro, 2017, p.38).

In this sense, it has been developed like in the evolution of these technologies that allowed the transmission and transformation of spaces, in this case, education, which is where ICT has generated parameters of evolution in education within virtual environments. Three important aspects are highlighted here, to be taken into account for the construction of virtual spaces where information will be given. First, communication is sought, and is where it is mentioned to transmit information about the subject determined. Second is cooperation, in which collaborative work is encouraged for the collective construction of knowledge. The third is sharing, which is where the mediator of processes furthers the stimulus to enhance initial learning. (Real, 2011, p.54).

Taking into account the above information highlights how research mediated technologies allow for the design of strategies to evaluate methodological courses in a program of Arts in virtual learning environments; in one hand, the focus of this text in the design of methodological courses and their pedagogical and didactic strategies as a field of study; on the other, Internet and ICT as a mediator of processes of collaborative research.

From the strategic component of research, the academic program of Visual Arts is structured from the formulation of research. The arts in the digital era, whose purpose is to develop different research parameters within the Arts for the approach of contemporary contexts, with the purpose of achieving comprehension of the use and treatment of the production of work in different social and cultural environments.

Considering these aspects, this study had as general objective: develop an evaluation strategy for the continuous improvement of four methodological courses of the Visual Arts program in virtual learning environments: drawing, Photography and basic design.

In addition, as specific objectives:

1. Formulate evaluative parameters for the continuous improvement of the courses to work.
2. Identify strategies for the improvement of the courses of the Visual Arts program with teachers and students.
3. Design of a tool for the continuous improvement of the courses within the program.

Materials and Methods

Participants

In the year 2016, the Visual Arts program began with 50 active students enrolled. The following year the number is increased to 278. The student population is heterogeneous, of different ages ranging from 16 to 45 years and socio-economic conditions since the University's teaching model is characterized by social inclusion and is present in 63 open and distance educational institutions across all regions of Colombia. Participants do not report any disability status. Research includes students from the arts program distributed over 63 municipalities of Colombia, as shown in table 2.

Table 2
Geographic location of the students.

Number of Students	Region	Number of Students	Region
135	Bogotá	1	La Dorada
16	Medellín	2	La Plata
8	Acacias	1	Málaga
5	Barrancabermeja	2	Ocaña
6	Barranquilla	12	Palmira
10	Bucaramanga	5	Pasto
8	Cali	4	Pitalito
3	Cartagena	1	Sahagún
1	Corozal	1	San José del Guaviare
3	Cúcuta	4	Santa Martha
1	Cumaral	1	Santander de Quilichao
6	Dosquebradas	2	Sogamoso
5	Duitama	1	Valle de Guamuez
10	Facatativá	1	Tumaco
5	Florencia	3	Valledupar
1	Garagoa	2	Yopal
2	Girardot	5	Zipaquirá
5	Ibagué		
		Total	278

Analysis based on information from the SNIES, Ministry of National Education, 2013.

The sampling was voluntary, according to the definition proposed by Hernandez, Fernandez & Baptista (2014, p.156) who define the voluntary sample as ". . . in volunteer sample the selection of participants depends on varied circumstances. This kind of sample can also be called auto-selected, since persons proposed themselves as participants in the study or responded to an invitation."

From the universal population described, we called for voluntary participation in the process of assessing courses, by sending invitation to students enrolled in methodological courses (theoretical/practical) and which yielded the following distribution of participants according to active academic registration period, which is shown in Table 3.

Table 3
Sample distribution.

Application period (16 weeks)	Sample (participants)
January - June 2016	39
January - June 2017	20
August - December 2017	29

In relation to teachers who direct the methodological (theoretical/practical) courses, the development of a focus group was proposed. Highlighted is the participation of four (4) teachers, young adults aged between 25 and 35 years of age, of whom three (3) feature a profile of master's in visual and plastic arts and the other one (1) has the profile of a specialist in photography. In addition, they have additional training in the specific field of teaching in virtual environments (AVA).

Instrument

Understanding the process of data collection as a systematic process that ensures, on one hand, the capture of the most determinant information about reality, and on the other, checks the validity of tentative observations from the various observation sources or the various sources to examine a reality (Bonilla-Castro & Rodriguez-Sehk, 2005, p. 141). In this sense, mainly two instruments were used to collect the data:

1. An online survey composed of 13 questions aimed at addressing the following categories of analysis:
   a. Expectations about the program and methodology
   b. Didactic material
   c. Teaching accompaniment
   d. New resources: communication strategy.

   The purpose of the instrument is concentrated on measuring the scope of learning of methodological courses of Visual Arts in virtual methodology. Students registered as being enrolled for the first time in the courses for drawing and artistic photography as part of the visual arts program were used in the implementation of the survey. The database

of the program of Visual Arts enrolled in the courses of drawing and artistic photography. Participation in the survey was voluntary and anonymous aspects were communicated in the online form's header and part of the informed consent.

The survey was validated through a pilot test in which adjustments were made on the analytical categories of: a. environment; b. teaching strategies and c. methodological approach of the courses.

2. Target Group: Since their exercise is built in a group meeting, it is guided by a collective conversation in which participants share their experiences, views, and perceptions on a specific topic. For their application, 100% of teacher's visual arts, teachers who had the role of methodological course director were summoned

   It was held in two sessions in order to inquire about materials and supplies, as well as perceptions and expectations in the design of courses, taking into account the activities of the course and the actions of the program to facilitate the realization of such activities. The target for each of their group sessions, with the participation of 5 teachers, concentrated developing the investigation of the following analytical categories: a. Course design: techno-pedagogy and discipline; b. Didactic and c. Teaching accompaniment. (See Table 4).

It is necessary to highlight that the two data collection techniques mentioned above have a central reference that, in the qualitative research, comes from the subjective interpretation proposed by Max Weber (Castillo-Guzmán, 2003), which does not prevent the objectivity of its results in terms of the validity of the significance, i.e. the ability to verify data in virtue of what are really results of a person's understanding, placing interpretations in the context of the "reality lived and the perspective of a more valid understanding of the social world"(Poutois & Desnet, 1992, p.68, quoted by Castillo-Guzmán, 2003).

Table 4
Instruments and scope.

Instrument Type	Scope
Question guide for the focal group	Approaching the experience of the student of arts in the virtual modality, allowed researchers to know firsthand the experience of an artist in training in the distance mode.
Online survey	Identification of the learning scope of methodological courses of visual arts in virtual methodology:: 1. Expectations regarding the program and methodology 2. Teaching materials 3. Teacher accompaniment 4. New resources: Communication strategy

Type and design of study

The research was developed from a qualitative methodological design, type case study, which, according to Hernandez, Fernandez & Baptista (2014) is characterized by:

1. Performed in natural areas of the participants or units of analysis.
2. The variables are not controlled or manipulated.
3. The meanings are taken from the participants themselves.
4. Data is not reduced to solely numeric values.

The procedure for the methodological development of the study allows the following structure phases indicated in Figure 2.

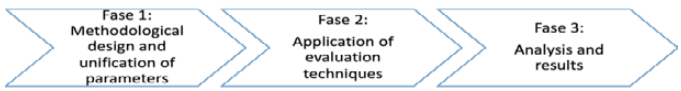

Figure 2. Phases of the study.

Through systematic development of each of the phases, three unified categories were developed. Their descriptor and code (Table 5) are established for the analysis of the consolidated results, which allowed the construction of the tools to evaluate methodological courses of the program.

Table 5
Categories, descriptor and code.

Category	Description	Code
Expectations regarding the program and methodology	t expresses the fulfillment or lack thereof of the expectations of the student about the methodological courses.	EFP
Teacher accompaniment	The favorability or not of the quality of the accompaniment made by the teachers of the methodological courses is expressed.	AD
New resources: Communication strategy	Participation or lack thereof of students is expressed in the communication strategy of the visual arts program - UNAD.	EC

Later, the qualitative analysis of the data from the coding is performed and categorized, which allows the establishment of recurrences and omissions and generates knowledge of the perceptions, expectations, and needs of students and teachers facing the teaching-learning process of the visual arts in an online and distance learning mode.

Results

The findings found in this research are focused on:

Expectations about the program and methodology

87% of new students consider that the methodology is adequate for learning in methodological courses of visual arts.

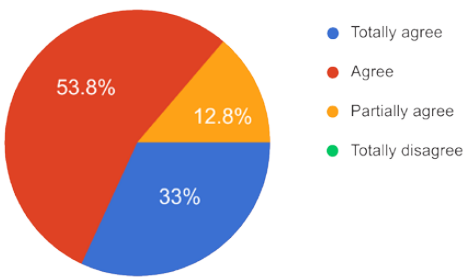

Figure 3. Expectations about the methodology of the courses.

The same way, expectations have been met at the time of enrollment into the program. Within this, category students state that one of the factors that most influences success in the courses is the response and appropriate accompaniment by the teacher. Another category is of didactic material, which seeks to support a better understanding of developing products for methodological courses. Taking into account the expectations within the first category, we find in the second category about teaching materials that students show that although the visual product is relevant, the quality of the audio does not enhance each learning resources for the course.

Accompanying teacher

41% of the students consider teachers generate an appropriate accompaniment for the development of methodological courses and that the course is addressed properly, allowing advancement in the development of visual arts skills. Likewise, they considered that the teaching materials and the development of courses has promoted significant learning in methodological courses of visual arts, where, through step-by-step explanation, the video allows the application of concepts which seek to reach the process of higher education.

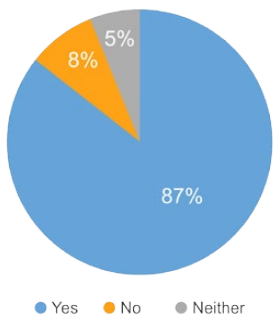

Figure 4. Comprehension of course content

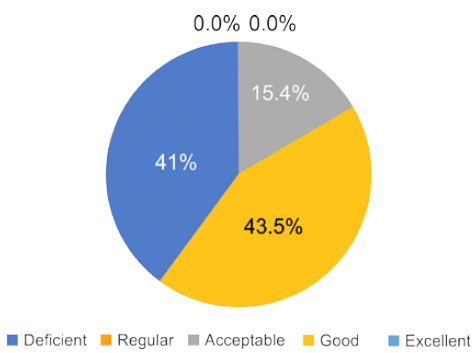

Figure 5. Quality of teacher accompaniment.

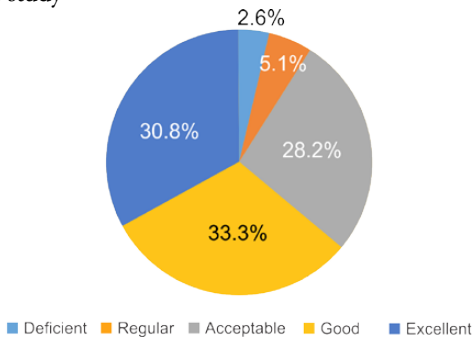

Figure 6. Comprehension of activities and content.

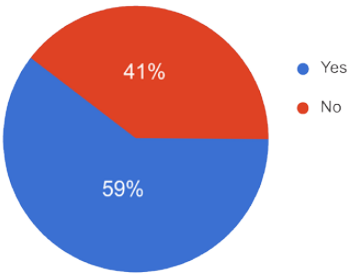

Figure 7. Participation in "Arts in Context"

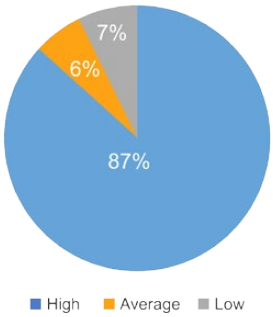

Figure 8. Relevance of the themes of Arts in Context

Figures 5 and 6 represent that 87% considered that the course contents of the methodological courses of visual arts are understandable and 30.8% considered the activities understandable. However, 28% of participating students expressed an acceptable understanding of activities in conjunction with 15.4% who indicate an acceptable quality of teaching accompaniment. The above reflects the need for rethinking structural aspects in the context of the design of courses and digital educational resources that facilitate clarity and innovation of contents of theoretical-methodological courses and teaching accompaniment, from its propitious spaces and mediations that allow the realization of said process.

New resources

Communication strategy: Figures 7 and 8 show that 87% of students perceived high thematic relevance in the space of academic life called "Arts in Context" in contrast with the 41% who reported no participation in the space. The program of Visual Arts from the mode should promote and raise awareness and understand the importance of these complementary resources for updating and academic university life that is not always on-site, but are developed through transmissions from web-conference rooms, since the virtual "Arts in Context" radio program production and open new spaces of circulation and dissemination of products derived from the theoretical-methodological courses such as journals of formative investigation, national academic character event, academic networks, research groups, and research hubs. In addition, to articulate from the curricular of the University Museum of digital arts—MUNAD—as a fundamental pillar for the entire process of dissemination of work.

As a result of the analysis, the team of teachers of the academic program designed the following tool to collect and identify of aspects to improve the design of the Visual Arts courses and educational resources in the virtual learning environment (Annex 1). Within this recollection form, a new category was included, which was based on the analysis of results that are available for general improvement of aspects of the program from their curricular design.

Consequently, from the academic program of the National Coordination have provided the updated space of academic life "Arts in context" as a communication strategy for science, technology, and innovation—CteI (annex 2). As well as the design and implementation of formative research magazine Back Projection and the national academic event MEDIÁTICA (Anexo 2) as a first meeting of digital arts in Colombia allowing the combination of joint efforts between 3 Columbian universities for the creation of the academic network AVI—art, virtuality, and research. These actions have allowed the results obtained from the research process for the evaluation of the program to result in strategic decisions for continuous improvement of the approach to high-quality standards, as well as the best digital educational resources considering their relevance and innovation.

Discussion and Conclusions

The teaching of the arts in virtual mode involves the development and implementation of a culture of evaluation and continuous improvement of pedagogical and didactic resources used by the students to develop different academic activities in the courses. The research allowed the formulation of evaluative parameters through the instruments applied to teachers and students of the visual arts program. It also allowed the consideration of the visual arts program in virtual mode to be an object of research, involving effectiveness and academic possibilities of the modality, which are reviewed in the light of the evidence of the instruments, results and analysis.

In this order of ideas, research constitutes an input for subsequent exercises of high quality and accreditation registered quality for the status of research and curriculum improvement.

Consistent with the above, the instruments and strategy that were formulated in this research have enabled the curriculum committee of the program to make strategic decisions of didactic, pedagogical or communicative order based on the information of the results and observations.

The impact of the interpretation of the results promotes micro-curriculum order (academic) actions that result in permanent adjustments for the continuous improvement of the program, allowing appropriation of methodologies, in particular, of courses like photography and drawing. Every time, the quality of teaching materials and teaching accompaniment is an essential criterion for compliance with the learning objectives of the courses in function.

Following the order of the above, authors such as Avila & Bosco, 2001; Belloch, 2002; Mendoza, 1999, conclude that the processes of teaching learning mediated, by the use of ICT simultaneously, provide access to educational content and teacher accompaniment, making the experience, perception and learning processes of the visual arts student become a fundamental axis for the formulation of research and improvement in curriculum design. It is then as posing constant exercises of inquiry about the needs and requirements of student within the virtual modality, and the development of the strategic actions of improvement cannot be delayed. The student experience is crucial for the design of future course content; the permanent review of the content and strategies ensures that the effectiveness of the actions on the course can be measured between periods.

As designated by UNESCO (2004; 2016) the relevance of the pedagogical, didactical, methodological and evaluative dimensions, within a transformative educational model lie in the understanding by fine-tuning the learning processes starting from the characteristics, needs and changes in the social, political and productive environment that permeates the participants. Also working on the strengthening of an educational culture that ensures the rights and fundamental duties from formation for the expertise to be, expertise, expertise to learn, and expertise to coexistence.

In parallel, research in collaboration allows the combination of efforts to develop high-impact educational, social, and academic research projects. As well as other scenarios that allow the development of strategies for the social appropriation of knowledge, academic and research networks, national and international co-authorship, and scientific events spaces conducive to the collaborative work. Likewise, research allows the identification of objects of study related to the academic program in itself, converting them to objects of study oriented to academic courses, pedagogical and didactic strategies and instruments to the significant contribution of contributions that allow a real pedagogical transformation and that will have an impact on the educational paradigms of virtual education. As Salinas (2012) says, the research agenda aims to achieve real impact in educational and institutional policies, knowledge of how learning occurs in these scenarios, and how that change occurs in educational practices.

To future investigators interested in this thematic line, approaching the teaching of the methodological theoretical-practical courses from the virtual modality, the establishment of methodologies that decant continuous improvement models applied

in other virtual and distance modality programs.

As recommendations for the future, it could influence that the challenges and bets of the academic and investigative scenarios will be: 1. academic life as a scenario in situ of the recognition and appropriation of the sense of institutional belonging and relevance in the academic program that develops. 2. Increase the production of digital educational resources through conferences, strategic B-learning face-to-face meetings strategie and virtual learning objects in order to facilitate spaces for the strengthening of the autonomy in the process of learning in virtual environments. 3. Establish educational strategies that promote the teacher-student interaction from the constant use of audiovisual educational resources. 4. Strengthening of the scenarios of academic and university life that the program has, specifically in actions for dissemination among the student community.

Every time, these scenarios provide the possibility of supplementing the knowledge provided from the methodological courses of the visual arts program and show, how to design methodological tools that enable the assessment of the appropriation of ICT as a mediator in processes of vocational training; promote the creation and consolidation of academic networks and research for collaborative work between institutions that deal with artistic practices with emphasis on the production, circulation and exhibition of digital arts in Colombia and Latin America.

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Visualization of indicators of teaching activity in online education as support for formative evaluation

Visualización de Indicadores de actividad docente en educación en línea como apoyo a la evaluación formativa

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Abstract

Online education has had a significant growth and evaluation of learning, the system and the teaching activity to assess its success is particularly relevant. The latter has been evaluated in the literature based on indicators of teaching activity that come from the face-to-face modality, which restricts its scope. Therefore, indicators of teaching activity that respond to the characteristics of the modality are required, indicators that consider the data stored in the databases of the used digital environments and, simultaneously that these are presented to the teachers in a comprehensive way to contribute to his training regarding his execution. Thus, the present work has the objective to determine the use of the visualization of formative indicators describing two indicators, the estimated working time in the platform and the dialogical teacher-student interaction in the platform. We analyzed data on the activity of 146 teachers and 3,556 students in a period of 18 weeks with 18,592,774 records on the platform. Heat map visualization techniques and network analysis were used. They allowed us to observe the time the teacher works in the platform with respect to their hired time, as well as their interaction in an understandable way regarding their position compared to others. Finally, it is considered pertinent to use visualizations of the indicators in the platform as formative feedback for teachers. It was found that teachers can have among one and nine subjects, with an average of 4.77; between four and fifty-six curricular hours. The percentage of the dedicated time during the semester was 38%. Also, the percentages of time in the virtual environment were classified into four ranges, "very low", "below expected", "good" and "very good". Four teachers stood out from these ranges, with 113%, 134%, 267% and 473%.

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When mapping the network in three degrees of separation we found 2,103 nodes (63% of the nodes) and 16,438 edges (80% of the relations); with four degrees of separation we found 2,863 nodes (85% of the nodes) and 20,297 edges (99% of the relations).

Keywords: Evaluation, online teaching, activity indicators, visualization indicators, visualization techniques

Resumen

La educación en línea ha tenido un auge significativo y cobra especial relevancia la evaluación de los aprendizajes, del sistema y de la actividad docente para valorar su éxito. Este último ha sido evaluado en la literatura a partir de indicadores de actividad docente que provienen de la modalidad presencial lo cual restringe su alcance. Por ello, se requiere de indicadores de actividad docente que respondan a las características de la modalidad, que aprovechen los datos almacenados en las bases de datos de los entornos digitales utilizados y, simultáneamente que estos puedan ser presentados a los docentes de forma comprensiva para contribuir a su formación respecto a su ejecución. Así, el presente trabajo tiene como objetivo determinar el uso de la visualización de indicadores formativos describiendo dos indicadores, tiempo estimado de trabajo plataforma e interacción dialógica en plataforma docente-alumno. Se analizaron los datos de la actividad de 146 docentes y 3,556 alumnos en un periodo de 18 semanas con 18,592,774 registros en plataforma. Para el análisis se utilizaron técnicas de visualización de mapa de calor y el análisis de redes que permitieron observar el tiempo que trabaja el docente en la plataforma respecto a su tiempo contratado, así como su interacción de manera comprensible respecto a su posición frente a los demás. Finalmente se considera pertinente el uso de visualizaciones de los indicadores en la plataforma como retroalimentación formativa para los docentes. Se encontró que los profesores pueden tener a su cargo entre uno a nueve asignaturas, con media 4.77; entre cuatro y cincuenta y seis horas curriculares. El porcentaje de tiempo a lo largo del semestre dedicado fue de 38%. Asimismo, los porcentajes de tiempo en el entorno virtual fueron clasificados en cuatro rangos, "muy bajo", "abajo de los esperado", "bueno" y "muy bueno". Cuatro docentes sobresalieron de estos rangos, con 113%, 134%, 267% y 473%. Al graficar la red en tres grados de separación encontramos 2,103 nodos (63% de los nodos) y 16,438 aristas (80 % de las relaciones), con cuatro grados de separación se encontraron 2,863 (85 % nodos) y 20,297 aristas (99 % de las relaciones).

Palabras Clave: Evaluación, docencia en línea, indicadores de actividad y visualización, técnicas de visualización

Introduction

In recent years, there has been a growing number of educational modalities mediated by technology, such as blended learning education, mobile education. This fact has not only transformed the way in which the teaching and learning processes occur, but also transforms the roles of the people involved and the ways in which both parties' performance can be tested. The teacher becomes especially relevant in online education, since many questions have been raised regarding the role of the teacher in the online classroom. Solutions

from other educational modes cannot compete with the possibilities provided by a digital classroom. In the opinion of Zapata-Ros (2013, 2014 and 2015), the problem with the teaching activities is that they are not visual elements. This is a main political concern, because it makes it difficult to set a standard.

On the other hand, when trying to respond to these concerns about the online teaching activity, it becomes evident that the imported proposals of the teaching evaluation in the face-to-face mode are not enough to explain the activity of these actors. and therefore, make decisions regarding its execution.

Faculty of online education should respond to requests for changes so its functions and roles are transformed to fit the modality. It is very important to identify the online teacher's performance level, because they must have specific characteristics (Goodwin, 2010).

Because of the requests for change, alternative methods are presented to ensure the academic quality of online education. Elements questioned include student opinions, course instructional quality, or academic achievement tests (Rubio, 2003;) Belt, 2004; Abdous, 2009; Fields, 2009; Jung, 2011; De la Garza, Vinuesa & Zermeño, 2015; Martinez, Cegarra & Cepeda, 2015; Mengual, Roig & Català, 2015; Mejía & Lopez, 2016; Melendez, Roman, Pérez & Maldonado, 2017; Stracke, 2017). In this context, organizations responsible for rating higher-education institutions propose and offer models, criteria, indicators, and standards of quality for online education (Rice, Pace & Mellard, 2017).

This wide variety of proposals is, of course, aimed at improving evaluation, as it is a substantive element that optimizes the way online classes function, as well as the relationship between the students and teacher. As a result, the proposals become a source of information for decision making and intervention for the improvement.

Within the aspects of quality evaluation, teaching attributes and associated activities are considered fundamental (Van Duzer, 2002; Branch, 2007; Kebritchi, 2014; Guitert, Ornellas, Rodríguez, Pérez Romero & Romeu, 2015; Boettche & Conrad, 2016; Cabero, Llorente & Morales, 2018). The quality of the information and decision-making depends on the instrument and sources of information, the most common of which are teachers, students, institutional authorities, peers, and experts, although there has been discussion about what they measured and how the data was collected and interpreted (Fernandez & Coppola, 2010; Reyes & Rueda, 2016; Tejedor, 2016).

Due to the objectivity of these scenarios, it is crucial that the activity indicators utilize the masses of data generated, stored, and supported by Information and Communication Technology (ICT). These indicators also support the scale of growth of online systems' automatic processes.

It's deemed appropriate to make use of visual techniques that help users decode simple analyzed information. "Data visualization" is the area that lies between mathematics, computer science, and cognitive science and has a series of algorithms ranging from the simple to the complex (Telea, 2014) which seek to facilitate the representation of the analysis of one or more variables.

Roles of the teacher in online education

In online education, the role of the teacher has been redefined. The teacher is presented as a facilitator who acts as mediator between the students and their ability to achieve the proposed objectives. The teacher guides the usage of available resources and promotes the learning of module content to do well on evaluations. Thus, the role of academic staff is reconceptualized through alternative educational positions online.

Through feedback, mentoring, and advice, the teacher promotes and maintains the necessary processes to encourage the improvement of the educational system. The teacher is also in charge of designing highly interactive learning activities to increase the quality of their knowledge in their professional environment, as well as the personal development of pupils (Garrison, 2011).

Even though the teacher is very important, they do not play the main role in online education; they are in charge of facilitating the learning process.

Depending on the activities that the teacher creates for the class, they are able to identify a group of desirable attributes and different ways they can function for the class. In this regard, several authors who have made proposals regarding ways the online teacher should function. These functions are closely related to the characteristics of a scenario in which they promote collaboration; meaning that the scenario is interrelated with other scenarios and saturated with information (lawns, Brenes & Solano, 2010). Also, to be considered are the characteristics of the educational modality, which is directed toward the student population.

Therefore, teachers must possess clear and defined functions to carry out their activities considering pedagogical and technological aspects. In addition, the teacher must take into account that when the teaching/learning process is being developed, they must promote an environment in which to interact, communicate, share, and of course, build knowledge.

Shown in table 1 are the main functions carried out by teachers, recognized by various theorists.

Table 1.
Roles of the teacher in online education

	Author								
Function/ Role	Paulsen (1992)	Berge y Collins (1996)	Adell (1999)	Gisbert (2002)	Jonassen (2000)	Llorente (2006)	Urdaneta, Aguirre y Guanipa (2010)	Garrison (2011)	Quiroz (2011)
Social	X	X				X	X	X	X
Pedagogical		X	X	X	X	X	X	X	X
Organizational	X	X	X	X		X	X	X	
Technical		X	X			X	X		
Tutoring			X		X	X		X	X
Evaluation			X						X
Motivation	X				X				
Materials design			X	X					

As seen in table 1, there are coincidences within the proposals of authors who have tackled the subject of teaching in online education, which affects the educational and organizational functions, since both are essential to enable students to develop their activities. Other functions include tutoring, social and technical. Functions such as assessment and materials design appear less frequently, possibly because they are already included within the previously referred pedagogical and organizational functions, respectively. In addition, other theoretical proposals presented the role of moderator as a more specific function directly related to the teaching/learning process (see table 2).

Table 2.
Main actions of teachers in its role as moderator

Author	Role of the moderator
Ryan & Hall (2001)	• Pedagogical • Technical
Barberá (2001)	• Preparing the discussion • Articulating the discussion, the transitions, and giving feedback • Closing the discussion
Salmon (2000)	• Access and motivation • Socialization • Sharing information • Knowledge building • Development

Table 2 specifically shows the role of the teacher as a moderator of the discussions on the themes of the course. Therefore, it highlights that constant interaction between the teacher and students is especially important, since that's what creates a sense of motivation. Feedback from the teacher

helps to improve aspects of students' learning, creating an atmosphere and language of friendly conversation that is closer to a personal relationship (covers, 2014).

According to Alvarado (2014), the constant presence of the teacher in the learning environment is essential because it allows interaction with students, as well as the feeling of not being abandoned. Such presence is not only beneficial for students, but also for the teacher, who can be made aware of questions that students pose, evaluate tasks, moderate conversations, and perform other functions.

This in turn creates the opportunity for teachers to reflect on their practice, allowing them to project into the future and thus anticipate situations that may occur.

Therefore, it is considered that, to make the process of teaching and learning from the technological mediation, it can be a new alternative of evaluation for the teacher, from the creation of tools and techniques that analyze large datasets of data that have registered. In this regard, it is pertinent to develop research on new forms of assessment deemed functions performed by teachers in this mode (Zapata, 2013). In addition, these techniques should systematize so that the analysis of data and information are carried out in an automated manner.

In this same line, Buckingham & Ferguson (2012) argue that assessment process must collect, measure, analyze and present data on teachers and its activity, with the purpose of, first understand and then try to optimize your practice.

Evaluation of the educational online activity

To redefine the role of the online teacher also transforms the way in which their activity and other functions are monitored. In this case, the evaluation should not be conceived as an institutional surveillance strategy to control the activity of the teachers; rather, it is intended as a way to promote and encourage their practice.

This way, we create the evaluation of online teacher's activities as a way to review and follow their functions with the purpose of improving their practice. It is necessary to bear in mind that, due to the characteristics of this educational modality, monitoring online teacher's functions is more complex than monitoring face-to-face teachers.

In the literature, we often see the use of evaluation indicators for traditional teaching, applied to online teaching. This does not favor the online teachers or allow for objective observation of productivity in online scenarios mediated by technology; for example, self-reports or the use of portfolio. Because of this, it's considered necessary to identify and create techniques and procedures based on the data generated at the teacher's workplace; i.e., in virtual environments to address the functions performed (Silva & Figueira, 2012; Alvarado, 2014).

Some analysis techniques commonly used to study the online teacher's functions emerged from analysis of face-to-face interactions, the availability of media and resources, and asynchronicity of the registration of non-verbal interactions and multiple temporary scales (Suthers, Vatrapu, Joseph & Dwyer, 2006). This makes evident the need for methodological techniques that take advantage of large amounts of information produced in the digital media within which the educational activity is carried out.

During learning processes mediated by technology, many actions associated with chosen activities are registered. Authority figures and teachers typically miss these data, which could be used to encourage a formative evaluation. The problem is that the volume of data accumulated on the platform is difficult to treat with standard techniques, so teachers and authority figures are limited due to the lack of experience for the treatment of the data and therefore cannot monitor or make decisions about the educational process with the wisdom of accumulated records (Ellis & Mansmann, 2010).

In this sense, they require techniques and procedures that allow the analysis of large amounts of data, as well as better and more effective ways to understand and analyze it. At the time, they are allowed to act on their findings immediately, in real time, with respect to the activity of the online

teacher. Gašević, Dawson, & Siemens (2015) report advances relevant to this topic, although they warn that there is a disconnect between research and educational applications in the classroom.

Display of training indicators of online educational activity

Databases are the record of teaching, but they are usually disregarded. At first glance, they do not offer information that can immediately be understood by all viewers. The 2013 Horizon report synthesizes interactive data sources (e.g. forums) data, navigation data, relational data (social network analysis techniques) and context data (Johnson et al., 2013), and in 2017 voiced the need for change in the teaching role (Becker, 2017).

In addition, authors such as Persian, Pozzi & Sartri (2009), Papamitsiou & Economides, (2014); Hernandez, Martinez, Pardo, Muñoz & Rodriguez, (2018) have reported research in technology-mediated learning environments and show that computer systems offer advantages for research and management of these environments and record the events and actions of people involved in order to monitor, evaluate and understand the processes of learning in online education.

However, this supports the thesis of Gašević, Dawson & Siemens (2015), regarding the relevance of the creation of analysis methods to identify patterns about the participants' activity, not only to help assess and understand the dynamics performance of proposals of education online (Hrastinski, 2008) but also to track and plan strategies for improvement.

For example, the techniques and methods are used to analyze large datasets learning and academic analytics (Gomez, Garcia & Theron, 2014), with the goal of monitoring online teachers and students, which makes it possible for their lesson schemes to meet performance standards with respect to the analysis of the teaching/learning processes. Previously recorded data can be used to enable the identification of patterns, as well as the creation of predictive models.

From the analysis of data recorded from online academic scenarios, we can identify the type of interaction that occurs between the teacher and each student and the time taken to evaluate assignments, and the amount of time spent on the scenario, which together become fundamental indicators of other scenarios that can be carried out.

The adoption of these techniques allows educational institutions to develop the ability to act appropriately based on data and methodologies together as visual analytics. In this sense, the visualization of data and the corresponding analytics is an emerging field and its implementation makes use of visually appealing interactive interfaces, which stimulate the analytical approach (Thomas & Cook, 2006). Analytical data is combined with visual representations, interaction techniques, and content, allowing the user to access a resource that simplifies huge amounts of information (Gomez, Garcia & Theron, 2014).

Visual analytics integrates both the analytical capabilities of the computer and the capacities of the individual. This makes it possible to make novel discoveries and empowers people to take control of the analysis process. Thus, this technique sheds light on hidden and unexpected information, which can lead to a beneficial and profitable innovation (Ellis & Mansmann, 2010).

Visual analytics makes use specific techniques such as the spiral timeline, word clouds, heat maps, social network analysis, curriculum mapping and customization, adaptation, and prediction and adaptation of educational designs over short periods of time (Siemens, 2010; Gomez, Garcia & Theron, 2014). They offer clear and understandable information about the interactions between students and teachers, the use of tools arranged in the virtual learning environment, temporary presence, abandonment, and dropout, among many other elements (Johnson et al., 2013).

If the elements proposed by Johnson et al. hold true, they are attractive due to the wide range of data they generate in an online system. These procedures and calculations are of little use if they are not used as a form of feedback to the people immersed in the context analyzed. Although the institution develops assessment methodologies to calculate indicators of online teaching activities, the effectiveness of these begins with deci-

sion-making and direct institutional feedback to the teacher regarding their job performance. This is an invaluable formative training for teachers.

In this sense, Gomez, Garcia & Theron (2014) argue that advances in the creation of techniques and procedures for visual representation of data are closely related to the complexity of the data used. Visual representations are used to understand events that are not observable to the naked eye, in this case the records generated by the actions of users since its abstract form is transformed in such a way that the managers of the institutions, as well as students and teachers, can observe and understand the information represented.

Examples of this are the works of Heer & Agrawala (2008); Silva & Figueira (2012); Muñoz, Delgado, Rubio, Grilo & Basto (2017) and Liu et al., (2018) about the graphic representation of the interactions between teachers and students in virtual forums based on the analysis of social networks and established relationships.

In this sense, and for this work, use as technology-based visualization of networks for the tie-in Dialogic interaction indicator, from technique the sociometry and in particular the analysis of social networks; which focuses on the analysis of the structure of human groups, organizations and any other kind of system that can be represented as a cohesive grouping by connections of some kind (Han, 2015).

In this project, we used a technological base to visualize the network showing the indicators of dialogical teacher/student interaction.

Network analysis is considered a data visualization technique because it emphasizes structural pattern recognition and simplifies the understanding of the phenomena analyzed using a graph that functions as a condensed product topology set apart from any previously defined pattern

Considering these arguments, the objective of the present study is to describe indicators of educational online activity studied through visualization techniques. The goal of this is to contribute to a formative evaluation that meets the target described within two indicators of teaching activity: the estimated amount of time spent working on the platform and teacher-student dialogic interaction on the platform. The present study was conducted using records observed regarding a population of online Bachelor's degree teachers who carry out their activities on an institutional platform.

The indicators come from a proposal of formative assessment to for online teaching. They form part of a group of five indicators created ad hoc based on the selection of data such as time, identification of participants, groups to which they belong, who writes and receives messages, and types of activities done within the environment. These indicators can be calculated by selecting and combining variables.

These indicators are based on the data recorded in the online environment where teachers perform their main functions. Said data is analyzed using learning analysis. It is essential that the teacher can access the results, so viewing techniques allow easy-to-read representation. In this way, the teacher obtains a formative evaluation which does not seek to reward or punish, but provides elements that empower teachers to reflect upon and improve their activities.

Materials and Methods

Participants

Institutional authorization was given to access records regarding 18,592,774 instances of online activity of an online bachelor's degree program. These records are composed of the participation of 3,556 students and 159 teachers in 756 classrooms (distributed over nine semesters). 621 are regular classes and 135 apply specifically to the degree sought.

Online degree enrolls in a school form online, i.e., their activities are mediated by an educational platform and this requires the student's rhythm and regular deliveries distributed throughout the school range.

Due to the nature of an online bachelor's degree,

all of the activities are mediated by an educational platform that requires the student to maintain a consistent rhythm.

This study uses a sample as used all records generated on the platform by the participant population, when of was calculate each indicator analysis variables were selected. That is, while they were used for the first indicator (time) times reported between one and the other activity; to the second indicator used records with respect to messages between students and teachers.

This study does not use a sample of a population; rather, it uses all records generated on the platform. Variables to analyze were selected for each indicator; time spent on the platform and teacher-student interaction. Results were then calculated.

Study design

The design is longitudinal and covers 18 weeks of work, corresponding to the duration of the school semester. The first week corresponds to academic planning, the following 16 are devoted to coursework, and the last week is used to conclude the course.
The study design has an exploratory scope, which presents displays from two indicators of educational activity. These indicators were developed from an extensive documentary research on the quality of online education.

Instruments

The two visualizations that are described here are based on the two indicators presented and are part of the instrument that forms the "List of indicators of teaching activity" deriving from the conceptual delimitation of 1188 documents on educational quality online from 2006 to 2016 in the Web of Science database, which validates the content and construct. Finally, indicators are manufactured from records automatically used by the servers of the analysis community, which has ecological validity.

Therefore, the following indicators were used:

1. The amount of time estimated working on platform (calculated using the teacher's actions, with a buffer time of 30 minutes between one action and the next).
2. The amount of teacher-student dialogical action, which refers to the percentage of received messages and the percentage of messages sent by the teacher in a dialogic scenario such as, but not limited to, platform forums.

For the calculations, the learning analysis technique was used, meaning that the measurement, collection, analysis and presentation of data about the participants, their environment, and interactions were generated on the platform.

Activity logs were automatically stored in MySQL, an open-source database management system. Every participant interaction that occurred in the learning environment (Moodle) was recorded there.

Activity logs were analyzed initially by SQL (Structured Query Language) and later put into a spreadsheet (OpenOffice Calc) and an open-source social network analysis program (Touchgraph).

Informed consent

Consent was obtained in two ways:

1. Accepting the conditions of use of the educational platform. Conditions of use included (among other things) acknowledging the unique software design and that all interaction in the program is recorded, and consenting that interactions are susceptible to analysis for educational research and improvement purposes.
2. The Bachelor Program academic administration authorization to use, analyze, and publicize results, provided any allusion to the participants' identity be omitted.

Procedure

Two visualization techniques were used to implement formative activity for the two indicators (estimated time spent on platform and teacher-student interaction records). These indicators are part of a four-indicator general proposal, in

which is given the time elapsed between activity completion and feedback. Results were obtained from arbitrary periods such as a week, month, or semester.

To make the visualization of the indicators, the analysis was divided into three steps:

Stage 1. Selection of records

The records were extracted with MySQL SQL spreadsheets, from which the records necessary to develop the two indicators (time spent on platform and teacher-student interaction) were selected.

For the first indicator we considered the teacher's identification records, the date, and the subject. The records corresponding to the teacher's identity, the module, the student's identity, and the date were considered for the second indicator.

Stage 2. Calculation of indicators

Visualization of the indicator for time spent on the platform

For the display of this indicator only data from 146/159 online teachers was considered, because the remaining 13 presented inconsistencies in the records of the platform. Additionally, the calculation took into account the number of contracted hours each teacher had. A buffer time of 30 minutes between action (between one click and the next) was given for each teacher. The hours the teacher spent in the classroom, not the number of subjects they taught, was considered.

Visualization of the indicator for teacher-student interaction

To create a topological representation of teacher-student interaction, the total number of registered users (teachers and students) on the platform (3734) and the number of logins into the platform were entered into a table.

Stage 3. Visualization of indicators

At this stage, we created the visualization of the indicators using the data obtained. A spreadsheet and the tool, which visualizes social networks, were used.

Results

Below are results and a visualization of the "estimated time spent on the platform" and "teacher-student communication rate" indicators, coordinating respectively to the visualization techniques of heat maps and social network representation.

Indicator visualization for "estimated time spend on platform"

We found that teachers may have a minimum of 1 class and a maximum of 9, with an average of 4.77; This means that the minimum time worked per week is 4 hours the maximum 56 hours.

The time each individual teacher spent in the virtual classroom during the week was compared to his or her contracted time. The average time worked each week for all teachers was also calculated, and finally the general average was calculated, with the result that only 38% of all contracted time was spent in the virtual classroom.

The visualization of these percentages based on data obtained is presented on a heat map (see Figure 1).

Figure 1 represents the calculated values of the indicator for time spent by teachers in the virtual environment. The periods of the semester are shown in the first row. These correspond to the weeks of: a) Inter-semester, which is made up of the first week of work and the last week of the semester; b) Active Semester, consisting of sixteen weeks; and c) test period, consisting of two weeks.

Below this row is the overall average percentage of time spent by all teachers on platform during the week. On the right side is the semester average per professor, calculated from the mean time per week.

The percentage of time spent in the virtual environment is measured on a scale from 0 to 100%, so this was divided into 4 ranges; "very low" ranging from 0 - 24%, "lower than expected" ranging from 25-49%, "meets expectations" ranging from 50-74%, and "exceeds expectations" ranging from 75-100%. In the same column, the semester average is displayed, allowing the user

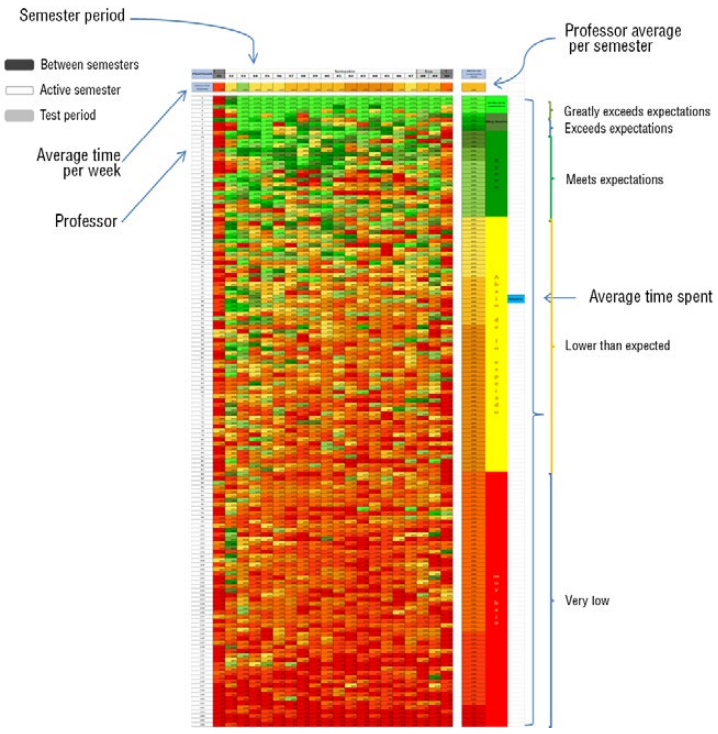

Figure 1. Visualization of time spent on platform (heat map); percentage of time calculated per week and the average of all teachers on the platform.

to identify their position in relation to other teachers. It should be noted that teachers know their position compared to the rest, but does not know to whom each of the other scores belong. This data allows the professor to take actions to improve their time indicator, since it is considered a fundamental element of the teacher's function.

The positioning of "meets expectations" at 50% is an arbitrary cut-off point. The principle of this thought is that not all online teaching activities are done directly on the platform, for example, reading and taking notes on the text. From this point of view, the administrative academic executives and researchers conclude that teachers spending half of the contracted time on the platform and the other half performing academic activities offline seems an acceptable use of time.

In the visual, different tones are intended to show the teacher which time percentage range they are in for both the short and long term; i.e., at the end of the week and the completion of the semester.

In this case, red implies "very low," yellow shows "lower than expected," green represents "meets expectations," and dark green signifies "exceeds expectations." This figure also shows cases of teachers who exceeded the 100% scale in a light green range called "greatly exceeds expectations." The different shades of each color imply its proximity to the next rank.

Also shown is that for the majority of the weeks, teachers spent a "very low" percentage of time in the virtual classroom performing activities. During the inter-semester period, some teachers fell within the "meets expectations" range, which would be a desirable range for time spent working with students during the rest of the semester as well. Within the second rank were 58 teachers of which only 17 (38%) were found to have exceeded the overall mean time, and only two teachers had exactly the average time.

The heat map shows that most often the percentage of time spent on the platform is low, but also shows a high number of cases in which teachers had greater than expected presence on the platform throughout the week, even during the semester.

19 teachers fall within the third range, "meets expectations," and only 4 teachers fall within the fourth rank. The green color, (exceeds expectations), has greater predominance during the weeks of the regular semester.4 teachers exceeded expectations so greatly that they did not fall on the scale, so a fifth range, "greatly exceeds expectations," was created for them. Their percentages were 113%, 134%, 267%, and 473%.

Within the results, you can see that the average total weekly percentage was low, with the exception of week 3, which presented a high percentage. From this data, the evaluations show that the total percentage of time spent in the online classroom by the teacher is low.

Visualization of the "teacher-student interaction" indicator

In a network analysis platform, the following records obtained from 567 class forums were combined: 63,876 messages, and 2,521 discussions,

with 113 messages on average.

The result is a graph with 3,734 nodes (users), 3,332 of which are connected by 28054 edges (see Figure 2).

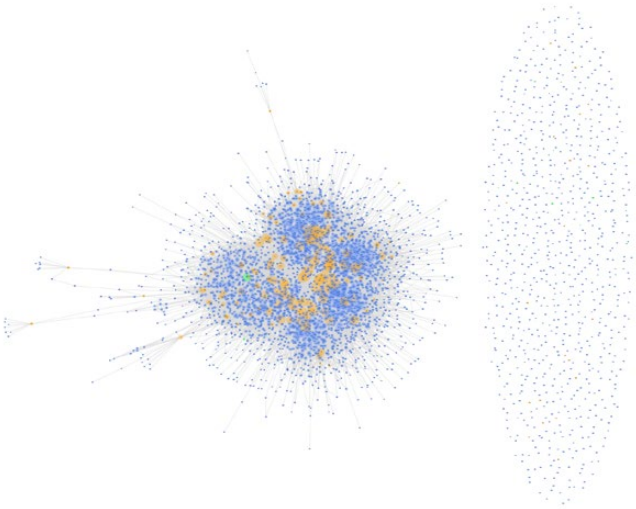

Figure 2. 63,876 messages, 2,521 discussions, 3,734 nodes (users)—concerning educational platform forums.

Figure 2 shows 159 teacher nodes (brown), 3,556 student nodes (blue), 19 administrative staff nodes (green). 402 nodes are disconnected, and the remaining 3,332 nodes are connected to more distant network nodes by 12 jumps; i.e., the most distant people in the online discussion platform network are 12 connections away. Finally, we observed an average of 19 outgoing messages per node and 17 incoming messages.

One element that stands out is that the network is densely populated in the central area. For example; to graph the network in three degrees of separation (from central persons and up to three dialogical connections), we found 2,103 (63% of total) nodes and 16,438 edges—80% of the relationships. At four degrees of separation, the figures were respectively 85% and 20,297 edges—99% of relationships. The remnants of the nodes and connections are distributed between 5 and 12 degrees of separation and 11% of nodes did not participate in discussions in the online forums.

In regard to the distribution of the discussions in online forums per professor, we found that out of 142 valid teacher profiles, there was an average of 71 outgoing messages, with a minimum of 1 message and a maximum of 415. The mode was 31 messages and the median 51, while the standard deviation was 71 messages. Professors received an average of 134 incoming messages, with 1 minimum, 1040 maximum, mode 28, median 91, with a standard deviation of 148.

In the context of the creation of indicators for online teaching, the visualization of the network serves as a comparative parameter of the contribution of the professor and his discussion group during the semester. The graph shows varying degrees of connectivity within this social network. For example, teacher number 100 displays an egocentric network analysis featuring 28 student connections. (see Figure 3).

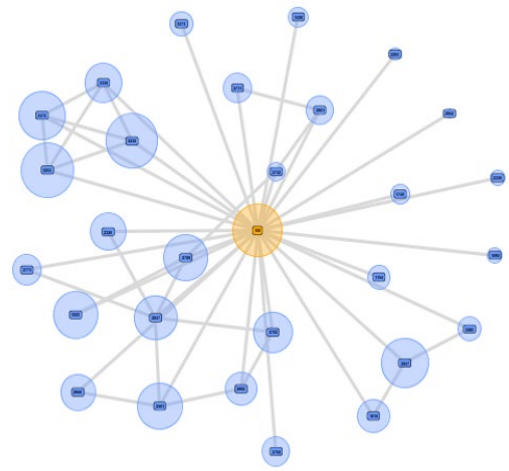

Figure 3. Egocentric network of first-grade of teacher number 100

The teacher who has an average dialogical connection is located in the central part of the network and if we visualize the egocentric network of the teacher in the second grade, we will see that they maintain a relationship with 28 teachers and 314 students, an average of 11 students per teacher (see Figure 4).

The proposed visualizations are designed to show the intensity of the discussion in the forums and have a parameter of comparison with the other classrooms. While it is true that the examples presented are restricted to a single variable, you can see other variables such as module type, cloister, modality, etc. Colors help contrast between

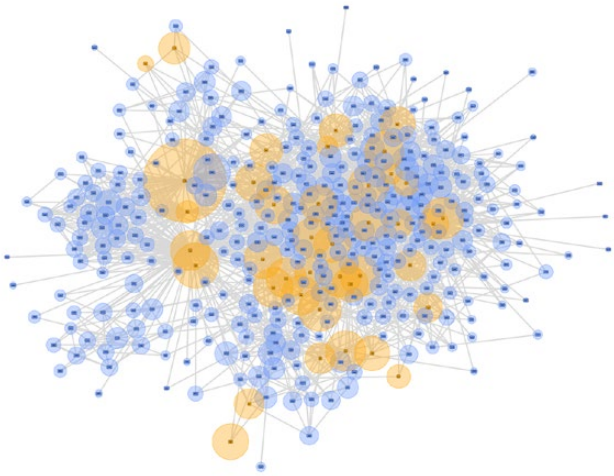

Figure 4. The egocentric network in the second grade of user number 100.

variables and facilitate the comparison between teachers.

It is thus that this indicator makes it possible to visualize the dialogic interaction established between teachers and their students, which is only one of the functions that online teachers perform.

Discussion and Conclusions

The transformation of the role of teachers in an online environment has raised several questions regarding their functions, constraints, and how alternatives for improvement can be evaluated. Thus, it is not enough to provide a series of values or data that are difficult to understand. Visualizations should be developed to represent the large amounts of complex data in these kinds of analytics complex data (Vieira, Parsons and Byrd (2018).

The heat map and network maps presented allow people to objectively observe, which is a key factor for the development of the online teacher's functions, like how much time is spent in the virtual environment that is their work area. Thus, this technique helps the visual representation of the information sourced from the records of the platform, which could be considered abstract and worthless. In this case, the potentialities of academic analytics allow the information to be analyzed and used in the development of systemic improvements, the monitoring and evaluation of teachers, and decisions regarding the regulation of educational systems.

In addition, the use of this information requires that it be presented in a way that is understandable for users (in this case the teachers), so that, with this type of visualization (which can be calculated in real time) it is possible to give the teacher a reference element about their execution. This could be considered a way to help the self-regulation teaching execution and, in the future, could improve the entire education system.

As found in the literature, visualization techniques allow the representation of principal data about the aspect of interest. In the case of online education, diverse works, such as those developed by Heer & Agrawala (2008) argue that visual analytics support the social interaction that occurs in virtual forums. In this way, the teacher-student relationships become visible, which subsequently allows teachers to make decisions regarding the design of the interactions that are part of their educational and social role, which ultimately contributes to the learning of their students.

In the same sense Duval Verbert, Klerkx, Wolpers, Pardo, Govaerts & Parra (2015) indicate the use of visualization techniques to provide relevant information relevant to teachers and students in order for them to understand their progress in online environments. El-Assady, Sevastjanova, Sperrle, Keim, & Collins (2018) take it one step further, indicating that it is possible to use automatic visualization modeling to further facilitate decision-making by the people involved.

This indicates that visualizing data in a pleasant way makes it easier for people on the platform to understand, enables the teacher to carry out the processes of meta-reflection, and provides the institution a panorama of the online system.

In addition, a correlational analysis could be done for the other indicators mentioned in this work in order to identify the closeness of the relationship between their presence in the online classroom, the degree of communication they establish with students, how much time it takes them to give students feedback, and the time it takes them to

respond to messages, among other factors.

In this work, although it is true that percentages of time spent on the platform were low, it is important to note that not all the teacher's work is done online, since they also make use of other tools. Although, as mentioned in the introduction, the teacher's presence triggers aspects such as interaction, motivation and student communication.

On the other hand, it is important to consider that when searching the literature, it is difficult to find information regarding measurement of a teacher's time spent in the online classroom, and in some cases, the indicators are provided by the face-to-face classroom, the questions of which do not fit the characteristics of online education. Thus, we consider that it is a fundamental aspect to identify this indicator, as it provides clarity regarding the time the teacher spends in the online classroom, and therefore can relate to other functions performed, like dialogic interaction and the amount of time it takes the teacher to provide feedback on student work, among other functions.

It is important to keep in mind that the teacher's presence on the platform, makes it likely that they will complete tasks, which is an element that impact the performance of students and success.

In this way, we should remember that the techniques are an auxiliary in the visual representation of the indicators that should be delimited according to the functions of online teaching and resources available in the platform database.

The use of visualization techniques to represent indicators is a way of giving users feedback, specifically to teachers about their activity. This allows the teacher to determine the compliance level of their main functions, to identify strengths and areas of opportunity, and plan improvement strategies according to their needs.

The indicator for the time it takes teachers to provide feedback on activities and the amount of feedback given at the end of a period are not included in this project. However, the techniques used for their presentation are illustrated heat maps with the indicator for time spent working on the platform.

Finally, we consider that the performance of the online teacher's activity has a fundamental role in promoting the learning of students, therefore, it can be said that the teacher's presence in both individual and group activities is essential. Teaching activity is summarized in commitment and discipline, since their presence in the course must be constant, and feedback must be delivered to students according to the institution's policies regarding response times. For this reason, we consider that these last indicators are worth studying more deeply in a future work that surpasses the objective of this paper.

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Analysis of digital signature based on the public key infrastructure

Análisis de la Firma con base en la Información de Clave Pública

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Abstract

The descriptive analysis of the functioning of the digital signature architecture based on public key infrastructure determined the central objective of all the investigation, for this reason the responsibilities that each Certification Authority exercises in its creation and verification process were explained, to guarantee the authenticity, integrity and non-repudiation of the transmitted information. The methodology used is documentary through the bibliographic review of the main concepts of digital signature, cryptography and PKI obtained from repositories, digital libraries, free access database and Google Academic.

From the study carried out it can be concluded that the digital signature based on the public key infrastructure is a transparent process that generates reliability both to the sender and the receiver that the keys generated correspond to their legitimate owners, but it is necessary that it is protected by an adequate legislative framework, sophisticated hardware and software is used, and each user is aware of the responsibilities acquired when implementing it.

Keywords: PKI, digital signature, cryptography, public key.

Resumen

El análisis descriptivo del funcionamiento de la arquitectura de firma digital con base en infraestructura de clave pública determinó el objetivo central de toda la investigación, por ello se expusieron las responsabilidades, que cada Autoridad de Certificación ejerce en su proceso de creación y verificación, para garantizar la autenticidad, integridad y no repudio de la información transmitida. La metodología utilizada es la documental a través de la revisión bibliográfica de los principales conceptos de firma digital, criptografía y PKI obtenida de repositorios, bibliotecas digitales, base de datos de libre acceso y Google Académico.

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A partir del estudio realizado se puede concluir que la firma digital con base en la infraestructura de clave pública es un proceso transparente que genera fiabilidad tanto al emisor como al receptor de que las claves generadas corresponden a sus legítimos propietarios, pero es necesario que esté amparada por un marco legislativo adecuado, se emplee un hardware y software sofisticado.

Palabras Clave: PKI, firma digital, criptografía, clave pública.

Introduction

Communications networks have evolved vertiginously allowing connectivity in the transmission of images, voice and data that transcends borders; for this reason every day different business models incorporate digital platforms as the main mechanism of their financial activities, which has led to a greater exchange of information and a raised awareness of the level of security of the data and messages transferred, which are prone to threats of interception and analysis of traffic, identity theft, reenactment, modification of messages, and fraudulent degradation of service, among others (Martin, 2015).

Taking into account these aspects, companies and academies related to Information and

Communication Technology (ICT) have implemented methodologies that can guarantee robust security of the information based on four principles: I. Confidentiality, the information is hidden from unauthorized third parties; II. Integrity, the data are genuine and have not been modified since their creation; III. Availability, information is accessible at any time requested; and IV. Non-repudiation, to prove that a message is from the sender and avoid the recipient denying having received the message (Sánchez & González, 2016). Urbina (2016) points out that one of the methodologies that has provided high efficiency guarding the data is cryptography that satisfies these pillars through encryption techniques.

According to Joshi & Karkade (2015) the process of encryption and decryption have particular characteristics according to their nature, asymmetric cryptography being one of the more reliable ones, especially for the incorporation of digital signature algorithms (current and not colliding up to date) that guarantee the identity of the signer and the integrity of a message. However, Espinoza (2018) says that given the possibility that an issuer or recipient is unknown the authenticity of a digitally signed document joined the public key infrastructure (PKI) as a mechanism that implements authorities of Certification to legitimize correspondence from the keys to their authentic owners, certify the origin of a message, and guard to ensure compliance with guidelines and policies in their format, among other aspects.

Considering that the digital signature based on public key infrastructure possesses cryptographic operations that generate greater robustness than a signature generated by traditional methods, which is currently used in banking, commercial applications, and E-government; and that its fundamental principles are very similar to those of a handwritten signature (only its owner can create it, it may be verified by its transmitter and receiver, it cannot be repudiated by the sender) (Lojan, 2016); It is necessary to know how this architecture in real time guarantees the legitimacy of a sent message.

Is in that sense, the objective is making a description of the architecture and functionalities that certification authorities exercise in the process of creation and verification of a digital signature based on the public key infrastructure, and thus know its reliability in the identification and authentication of the signer and integrity of transmitted data.

Methods

This article is an investigation of documentary review, which analyzes various sources of literature on public key infrastructure and its application in the digital signature in order to sustain, that this type of signature offers greater reliability and robustness than other systems of electronic identity, being created by asymmetric cryptographic mechanisms and backed by certification authorities.

For the selection of bibliographic material, on which rests the theoretical framework, included: printed and virtual books, obtained from Google Books; journal articles indexed in Google Scholar, repositories, digital libraries and open access database (SciElo, Wos, Dialnet, Redalyc). In addition, the following were used as descriptors: Cryptography, PKI, digital signature and public key infrastructure trusted authorities.

Within the inclusion criteria it was defined that articles, books and analyzed documents correspond to the last five years of the issue; resulting in major publications of magazines.

On the other hand, presented literature was qualitatively analyzed, helping the distribution of this document in sections that include a logical sequential structure form in relation to the public key infrastructure. It should be noted, that this document uses indirect quotations, which are presented without quotation marks and include the respective bibliographical reference.

Digital signature

In 1976 American investigators, Whitfield Diffie and Martin Hellman explained the structure of a digital signature theory, giving the pattern to Ronald Rivest, Adi Shamir and Len Adleman to develop the RSA algorithm a year after (Saravanan & Kumar, 2015). This algorithm allowed the creation of the first digital signatures, which obeyed the same principles of the autograph signature, but insecurity prevailed, so it was necessary to add a cryptographic hash function to the original message (Thangavel, 2014). In 1984, Shafi Goldwasser, Silvio Micali, and Ronald Rivest proposed the first safety guidelines in a digital signature; and at the same time, other cryptographic schemes were created as: Lamport, Merkle and Rabin; which did not acquire greater relevance (Thangavel, 2014). Later (1988), the first software with commercial purposes for digital signatures was born called Lotus Notes 1.0, it was based on RSA (Thangavel, 2014). Three years later, the National Institute of Standards and Technology of the United States developed the DSA algorithm oriented to the Digital Standard Signature (DSS) with disadvantages compared to RSA, which had a longer computer processing time (Nabarjun, 2017). Later (1999), the PDF format acquired the ability to embed digital signatures to documents, however, it was in the year 2008 when the International Standardization Organization (ISO) made this format an open standard that included digital signatures as an integral part of their scheme, originating that the implementation of digital signatures had greater acceptance in the world (Nabarjun, 2017).

Rocha, Castello & Bollo (2014) point out that the digital signature is a cryptographic method that allows you to verify the original source of a message to subsequently verify that it has not been altered. For his part, Gaona, Montenegro & Wiesner (2014) established that a digital signature is the result of encrypting a message using one-way hash functions that guarantee that the only one who can decrypt the message is the recipient with its corresponding private key. In the same way, Lojan (2016) defines digital signature as a variant of the electronic signature, which is built, based on asymmetric cryptography allowing the association of the identity of the signer with a digital document.

Consequently, a digital signature involves a process of encryption (Gallo, 2015), and therefore it is necessary to distinguish the term cryptography which, according to Zhou, Gong, Fu, & Jin (2016) is a discipline that studies the techniques to transform a plain text into ciphertext using cryptographic keys (parameter that allows a user to encrypt or decrypt data) and that in addition, it enables the prevention of security flaws in a computerized system ensuring the confidentiality, integrity, authenticity, and non-repudiation of information (Wadhwa, Hussain & Rizvi, 2013).

Medina & Miranda (2015) point out that Cryptography is classified into: symmetrical, which uses the same key to encrypt and decrypt the data; and asymmetrical, which uses a pair of keys (one is published and the other is securely stored) but, Boneh & Shoup (2017) demonstrate that there is hybrid cryptography, which combines the safety of a public key with the efficiency of a symmetric key algorithm. In this context, Joshi & Karkade (2015) show that asymmetric cryptography is mostly used in the creation of a digital signature because its methodology provides greater robustness.

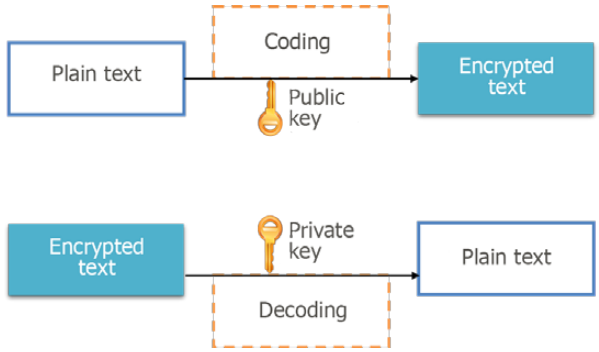

Figure 1: Process of encryption and decryption in Cryptography
Source: Medina & Miranda (2015, p.16)

In this regard, a digital signature built with asymmetric cryptography uses two different keys with a mathematical relationship among themselves: the public key is responsible for coding and the private key allows the decryption (Malhotra, 2015). In the same way, Joshi & Karkade (2015) show that when creating a digital signature with asymmetric cryptography, algorithms are implemented which generate a pair of complementary keys, which performs the process of encryption and decryption of a message. In addition, Pramendra & Vijay (2014) point out that the public key is freely available, while the user owner only knows the private key. Figure 1 shows an outline of this process.

Peña (2015) indicates that in an ideal context a digital signature has the same properties of a handwritten signature, because it is authentic, unforgeable, unalterable, non-reusable and cannot be repudiated; it is important that technology, which generates it, provide a secure scheme to meet these attributes otherwise could be altered/corrupted. According to Rocha, Castello & Bollo (2014) a digital signature may be built with different techniques, but the standard public key infrastructure provides greater robustness since the owner has sole control of the signature, the verification process is performed for any entity who knows the signer's public key, and the certification authorities recognize the sender identity.

Public Key Infrastructure (PKI)

With the birth of asymmetric cryptography, the problem of key management arose and was mitigated with the creation of a directory called Public Archive that contained the name, number and public key of the recipient (Albarqi, Alzaid, Ghamdi, Asiri & Kar, 2015). When the sender wanted to send a message, they should look for the recipient by name to find the public key, which did not offer the necessary guarantees to demonstrate that this key belonged to the desired recipient (Afshar, 2015). In 1980 this context led the International Telecommunications Union (ITU) to build a directory that could store the keys of all persons and devices in the world, which gave origin to the X.500 standard that completely defined the characteristics of that directory (Albarqi, Alzaid, Ghamdi, Asiri & Kar, 2015). However, given the need to ensure authentication, the X.509 was born, and pinned down the format for digital certificates and incorporated to a trusted third party to verify the correspondence of a title to a public key, leading to the moment in which the concept of PKI arose (Afshar, 2015).

Abobeah, Ezz & Harb (2015) defined public key infrastructure as a combination of software, hardware, policies and people that have objectives to manage (create, issue, modify, store and delete) digital certificates, authenticate the identity of the sender and the receiver, and provide data integrity. For their part, Cantero, Baran & Stuardo (2014) indicated that it is an architectural model that allows you to manipulate the public keys and ensure correspondence to their legitimate owners. According to Ramos (2015) a PKI is a set of security policies, procedures, and technologies to create, issue and manage digital certificates based on public key cryptography.

Consequently, the public key infrastructure is used to establish robust authentication services and security protocols based on asymmetric cryptography such as IPSec, SSL/TLS; allowing the associate of an entity with its pair of generated keys, performing the encryption and decryption of a message, and ensuring non-repudiation of a shipment (Sumalatha & Sathyanarayana, 2015).

Cantero, Baran & Stuardo (2014) assert that the objective of a PKI is to create a document that verifies the authenticity of a public key, which is called a Digital Certificate. Ramos (2015) defines a digital certificate as a data structure linking a public key to an entity, which has been recognized by a Certification Authority, which has a specific validity period and includes the digital signature of the Authority to validate its legitimacy. Angle & Henao (2017) established that a digital certificate is generally uses usually the X.509 standard to define the structure and the corresponding fields, and actually said standards were found in version 3. Figure 2 details the format of the standard X.509 v3.

Gutierrez (2014) says that running a cryptographic operation that uses PKI involved at least three elements: i. User, which starts the process; ii. Authorities, which validate the certificates; iii. Recipient, who receives the encrypted data. In addition, Albarqi, et al. (2015) establishe that the primary components of a PKI are: i. Registration Authority (RA), ii. Certification Authority (CA), iii. Security Policies, iv. Trusted applications for PKI, v. Distribution Systems and vi. Repository of Certificates

According to WebTrust (2017) the registration authority (RA) has as function to authenticate the identity of the user or device that requires a digital certificate but may not issue or sign a certificate. Similarly, Ormaza, Barrios & Fernandez (2017) assert that a RA unequivocally recognizes the applicant of a certificate and performs the registration process for their issuance.

WebTrust (2017) evidences that the certification authority (CA) is a trusted third party that guarantees the relationship between the public key and the user data registered within a digital certificate. Moreover, Cutanda (2013) says that when the

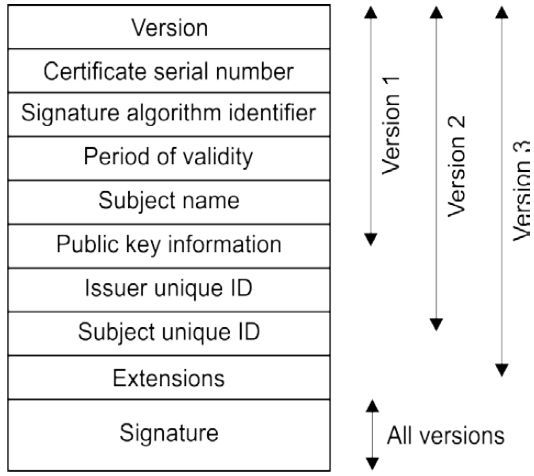

Figure 2: Format of certificate X.509 version 3
Source: Hawanna, Kulkarni, Rane, Mestri, & Panchal (2016, p. 2)(2016, p. 2)

CA issues a certificate it generates in the format X.509 v3 by adding their digital signature which allows a third party to verify its authenticity using the public key of the CA. Likewise, the functions of the certifying authority are: issue certificates, maintain and generate certificates revocation lists (CRL) and retain information regarding the expiration dates of certificates (Afshar, 2015).

Nelson & Nordenberg (2016) determined that security policies are operating procedures that govern the operations of the PKI and have technical and legal validity, for example: criteria that ensure that the method to validate the identity of the holder of the certificate is reliable, rules to establish who can revoke certificates, measures of how to distribute reversa lists, and guidelines that determine the frequency for filing certificates, among others.

Albarqi et al. (2015) outlined that the PKI-enabled applications are programs/software suitable for handling digital certificates, so, for example: web browsers, e-mail clients, and operating systems, among others.

Nelson & Nordenberg (2016) set up a distribution system that is intended to automate the management of digital certificates.

According to MICITT (2018) a Certificates Repository stores valid certificates for entities/applications, which require it to download them. These repositories used directories like the X.500

which are accessible via open protocols that allow the consultation of centrally saved information through the network, the most used being the Light Weight Directory Access Protocol (LDAP)) Abobeah, Ezz & Harb, 2015).

Nelson & Nordenberg (2016) show that the elements of the PKI described above present a process interrelated through phases, which begins when the applicant appears to the Registration Authority (responsible for the capture of registration information and key generation), and the entity communicates with Certification Authority to transmit the data of the applicant. After registration, the applicant can access the Certification Authority to obtain a digital certificate signed by this entity, but custody of the private key will be the responsibility of the Recipient during the valid time of the certificate. It should be noted that the applicant (using a cryptographic software) or the certification authority (Gallo, 2015) could perform the asymmetric key generation process. Figure 3 shows the operation of a PKI architecture.

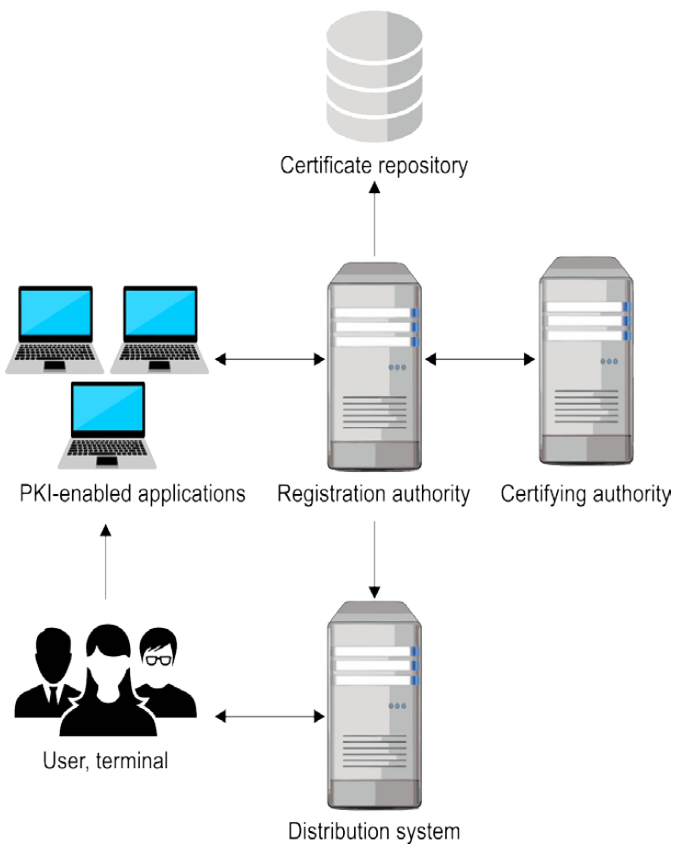

Figure 3: A PKI architecture
Source: Albarqi, Alzaid, Ghamdi, Asiri & Kar (2015, p. 33)

On the other hand, Cuno (2015) evidences that given the possibility that a user requires to verify the legitimacy of a digital certificate they can appeal to a Validation Authority (VA), which will determine the validity of the document based on the CRL or OCSP (Protocol that allows you to request the status of a certificate to a server). In addition, if necessary, it will include a time stamp issued by the Time Stamp Authority, which unequivocally recognizes the truth of the certificate even if it has expired (Sánchez, 2016).

Digital Signature based on the Infrastructure of Public Key

Peña (2015) defines the digital signature based on public key infrastructure as a procedure using cryptographic techniques that requires the participation of a trusted third party to prove the identity of the issuer. In this sense, Ramos (2015) says that PKI-based digital signature plays an important and irreplaceable role in the security of electronic transactions, authentication of identity, digital integrity and non-repudiation; for this reason, they are used in software distribution, financial transactions and in environments where it is important to detect the falsification and manipulation of data.

Gaona, Montenegro & Wiesner (2014) show that to build a digital signature based on public key infrastructure requires a function hash (SHA-2, SHA-3, RIPEMD-160) which converts a variable-length text in a block of length set in the summary form that is irreversible (cannot retrieve a text from your summary); and an asymmetric algorithm (RSA, DSS, ECDSA) that generates two keys, being the public key and the private key that allows you to sign and authenticate the signature.

Rocha, Castello & Bollo (2014) indicate when the process of signing is in progress; first, the sender creates a message, then applies the hash function and then encrypts it with their private key. A Certification Authority that will validate its origin and content shall review each message signed by the issuer, and only if it is correct will it be sent to the receiver attached to the Digital Certificate. Finally, the recipient receives the mes-

sage with two elements: the message (plaintext or encrypted with the public key of the receiver) and digital signatures (formed by the hash with the private key of the issuer and encrypted with the private digital key certificate of the Certification Authority).

According to Gallo (2015) to verify the validity of a digital signature, the receiver must decrypt the digital certificate of the issuer using the public key issued by the Certification Authority (having accessed the key through the web page of the CA). After decoding the certificate, the receiver will know the public key of the issuer, which will allow them to decrypt the received hash; and if the message was encoded, they can decrypt it with their private key. Finally, the receiver compares the hash received from the issuer with their hash retrieved, if both are equal it is considered that the message is authentic, the digital signature corresponding to the sender and that the message has been decrypted with a public key and encrypted with a private key. Figure 4 details the Signing and Verifying Process of a digital signature based in PKI and figure 5 is the frame of reference.

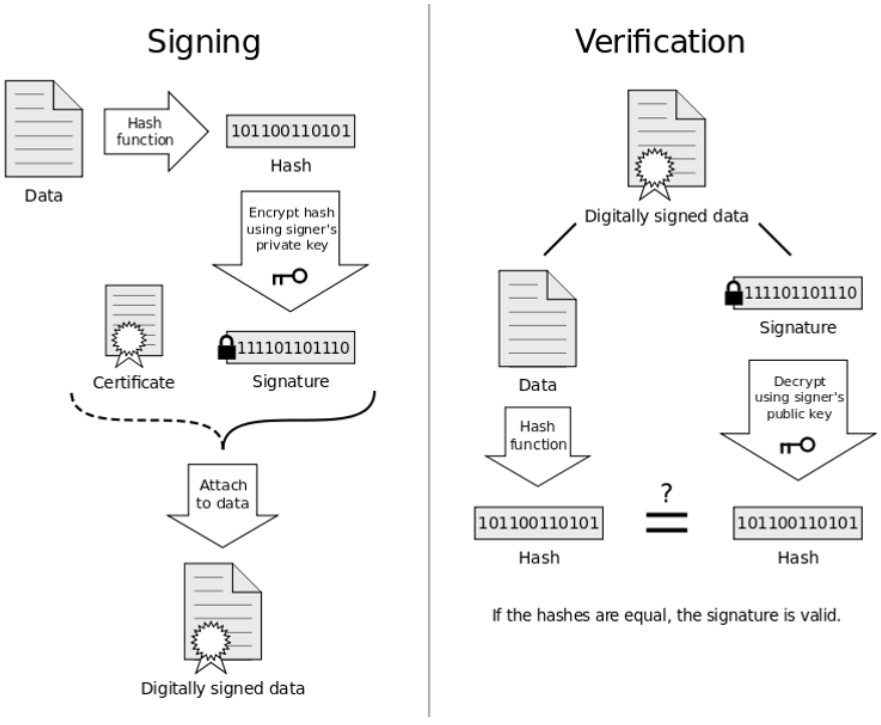

Figure 4: The process of signing and verifying a digital signature based on PKI
Source: Ramos (2015, p. 3)

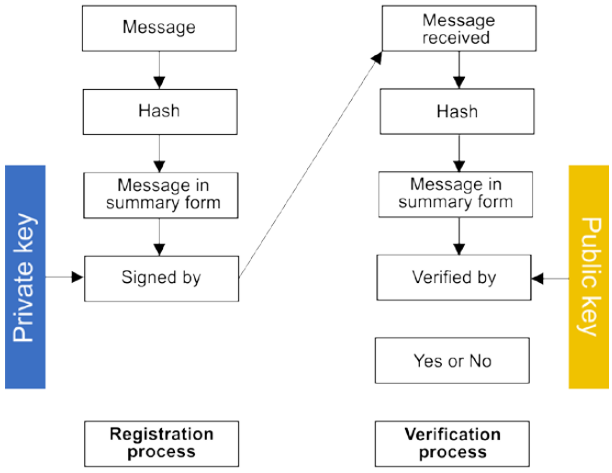

Figura 5: Reference framework to register and verify a digital signature based on PKI
Source: Ramos (2015, p. 4)

Cuno (2015) designates that the process of generating and verifying a digital signature based on PKI is based on two entities: i. Certification Authority, which provides confidence to both the transmitter and the receiver that the distribution of the key is secure; and ii. Revocation List of Certificates, which must be constantly updated by the corresponding Certification Authority; but it, is necessary that the public key infrastructure is supported by an appropriate legal framework, each authority that is equipped with a secure computer system, and that the signer relies on the transparency of this process.

On the other hand, Schaettgen, Levy, Schelnast & Socol (2014) distinguish two types of digital signatures, which are differentiated by the security that is based on authentication, and are: i. Recognized digital signature (RDS), created with a unique device, that is to say, distinguished from the one used to sign the document (which gives more safety); and ii. Advanced Digital Signature (ADS), developed with the same device that was used to sign the docu-

ment, and therefore, is less robust than the RDS. In this context, Saavedra & Astolfi (2015) point out that cryptographic devices that are implemented for the creation of digital signatures are governed to standards such as: FIPS 140-2 level 3 or Common Criteria ISO 15408 EAL 4 +; and one of the most widely used devices is the HSM (Hardware Security Module), which generates, stores and protects cryptographic keys; Therefore, it provides greater security and performance in operations of Cryptography.

In another area, Vigil, Buchmanna, Cabarcasb, Weinerta & Wiesmaierc (2015) manifest that digitally signed documents are retained for some years but if it is required to preserve them by decades or longer time technological problems may arise, such as: cryptographic obsolescence, the algorithms can be corrupted in this interval; loss of integrity, flaws in the physical devices due to the migration of new formats; obsolescence of software, evolutionary changes that meet the requirements of the time; obsolescence of hardware, physical impairment or technological evolution.

Finally, it is necessary to annotate that the digital signature technology based on PKI, in addition to being used in the identification and authentication of an entity, can also be implemented in electronic commerce, to safeguard a transaction; On the network, to identify the authenticity of a web site; in software, to prevent their manipulation, among others (Saavedra & Astolfi, 2015).

Conclusions

The development of communications networks and the global trend pf mainly implementing online trade has aroused increasing interest in safeguarding data and information transmitted from threats and vulnerabilities that destroy the reliability of any web process, therefore the encryption techniques have become a fundamental pillar that strengthens the principles of computer security (Urbina, 2016).

Asymmetric cryptography enabled the development of the digital signature as a mechanism to support that the information exchanged has not been altered, through this it is being implemented with greater consent in transactions where a traditional signature is powerless (Joshi & Karkade, 2015).

Coincidentally mentioned by Rocha, Castello & Bollo (2014), public key infrastructure constitutes a rigorous architecture, in which each element (Authority) has defined roles that guarantee the transparency of the process of generation and delivery of keys and unambiguously identifies an entity, therefore it is the standard most used to create safe digital signatures; However, barriers such as: the cost of implementation, few specialists in the country and interoperability have limited its use.

A digital signature based on public key infrastructure is a technology that ensures through asymmetric algorithms, hash function and digital certificates, authentication, integrity and non-repudiation of a message; and in this sense Espinoza (2018) highlights that its correct establishment should be covered by an adequate legislative framework, use a hardware and sophisticated software, and each user must be aware of the responsibilities (cannot disown the authenticity of a digitally signed document) that are acquired when they implement it. It is important to highlight that the validity of a digital signature is not imperishable, various requirements must be met (arising in accordance with technological evolution) to ensure its validity in both the long and short term. In addition, its scope can be global or limited to a territory specific (Vigil et al. 2015).

It is necessary to increase efforts so that the operation of the PKI-based digital signature as an instrument of public domain, encourages confidence in economic, administrative and governmental activities so that they increasingly incorporate this technology in their processes (Lojan, 2016).

On the other hand, we agree with Saavedra & Astolfi (2015), who distinguish that the security of an environment is the result of the combination of various processes and technologies; consequently, a PKI-based digital signature is not the solution to all the possible security problems in an organization.

Here we have shown only performance, architecture and advantages offered by the digital signature based on the public key infrastructure to authenticate a sender and integrity of a message based on the exploratory analysis of previous works. Therefore, future continuations of this investigative line could explore which formats, packaging and levels ensure greater interoperability and effectiveness, exposing current regulations in Ecuador that protect its legal validity and define a model of digital signatures implementation (zero papers project) for small and medium-sized businesses that have not yet migrated to this technology.

In addition, in a following moment, a comparison could be made about the performance characteristics of the traditional digital signature algorithms like RSA as opposed to elliptic curve based on those latest-used keys, which are much smaller and provide an equivalent level of security.

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Hamut'ay
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PEER REVIEWS

Hamut'ay 5(2). July-december 2018

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INSTRUCTIONS FOR AUTHORS

The electronic journal "HAMUT´AY" is a biannual scientific publication of the Coordination of Research and Scientific and Technological Extension of the University Direction of Distance Education of the Alas Peruanas University. Its objective is to disseminate scientific articles in full text about technologies and virtuality in the different professional and academic fields, aimed at the entire university community at the national and international pre-graduate and postgraduate levels.

Periodicity

The journal publishes one volume per year, which includes two issues, the first in June and the second in December (biannually).

Types of articles to publish

The scientific journal HAMUT´AY accepts two categories of articles to be published:

Scientific and technological research articles (López, 2013, Publindex, 2010): are original researches, which present the results of academic and or technological research projects concluded or in process.

Review article (Fernández-Ríos and Buela-Casal 2009): it is the synthesis of bibliographic studies of a specific topic, in which is analyzed, synthesized, and discussed the review of the literature and/or analyze the information published in an integrated manner..

Structure of the types of articles

All articles must be written with the Microsoft Word program, following the APA style guidelines (American Psychological Association) Sixth edition, as described A4 paper size, with margins 2.5 cm; font Times New Roman, size 12 and double-spaced interline.

The title of the article and the full names of the authors must be in the header, according to the Participation an abstract that does not exceed 250 words and a maximum of 5 key words.

Each page of the article must be numbered consecutively.

Composition of the types of articles

Articles on scientific and technological research (López, 2013; Bobenrieth, 2002): are composed of title, author (s), abstract (abstract), keywords (keywords), introduction (background, objectives), review of the literature (theoretical foundations of the study) materials and method (participants, instrument, design, procedure) results (interpretation of tables and figures), discussion and conclusions, bibliographical references, acknowledgments (optional) and annexes. Outline and format of the original Scientific and/or Technological article (EFACYT). 30 pages and maximum 4 authors.

The review articles (Fernández-Ríos & Buela-Casal 2009, p.332): are composed of the title, author (s), summary (abstract), keywords (keywords), introduction, method (criteria of literature selection) review of the literature (theoretical framework of the review topic), conclusions, (relevant aspects of the review of the literature and future suggestions or recommendations) bibliographic references, acknowledgments (optional) and annexes. Outline and Revision Article Format (EFAR) 25 pages, a single author.

Originality of manuscripts

Being that originality is one of the editorial policies of Hamut´ay magazine, it is done the following way:

1. A first review by the editorial committee, which complies with quoting and referencing all the sources mentioned in the manuscript, as well as verifying that there is no self-plagiarism.

2. Subsequently, to verify that there is no plagiarism, it is analyzed with specialized anti-plagiarism software (Turnitìn).
3. Once the analysis is done, the software issues a report, in which it is described in detail, whether plagiarism exists or not, showing a percentage of 0-100%. If there was plagiarism, it indicates the percentage and the original citations and references from where the contents or data were taken, which is reported to the author in the first phase of the article's arbitration system.

Ethical responsibility

The author or authors who submit their manuscripts for publication in the journal Hamut´ay, (COPE, 2011), should consider the following:

1. Guarantee that the article is an original and unpublished document and has not been published, totally or partially, in another journal and is not being considered simultaneously for publication and undertakes not to present this work to another journal for publication, until receiving the editorial decision of the Hamut´ay Scientific journal about its publication.
2. Certify that they have contributed directly to the intellectual content of the manuscript, to the genesis and analysis of the data, holding themselves responsible for it.
3. Record that the ethical criteria in the research have been respected and that the informed consent of the participants and/or institutions subject to research has been obtained.
4. Guarantee not to copy without citing or referring or without requesting permission from other researches; plagiarize or self-plagiarize, or the create false data.

The four criteria described are endorsed by the author or authors with their signature on the Affidavit of Authorship and Authorization for publication of scientific work in the Magazine Hamut´ay, (DEJA), which is sent together with the article accepted for publication.

Arbitration system for articles

The articles sent to the journal Hamut´ay are submitted to an evaluation process, considered the established standards and norms

First phase: The editorial committee verifies the fulfillment of the following criteria:

1. Those of structure and form according to the instructions for authors, written in the scheme and format regulated by the journal according to type of article (EFACYT or EFAR).
2. Consistency and clarity in the writing of contents and sequenticity with what is proposed in the manuscript, spelling rules, adequate citation according to APA style regulations Sixth edition, among other aspects.
3. It is evaluated whether it complies with the ethical norms established by the journal.
4. Verification of originality of the manuscript, through the review of specialized antiplagiarism software, (Turnitín).

In the case that the manuscript in this first phase meets the four criteria described, it will be accepted to follow the review and evaluation in the second phase with the external evaluating peers.

For the second phase, the journal has a staff of peer evaluators at international and national level, with a master's and doctor's degree, experts in the topic to be reviewed, members of research groups, and experience in scientific publications.

Second phase: The review and evaluation of the manuscripts are under the double-blind system, neither the peer reviewers nor the authors know their identities, the process being the following:

1. The pairs evaluators determine the value of the content of the article and its methodological aspects, evaluating the scientific quality of the article, for which the manuscripts will be delivered anonymously to the mail assigned by them, when they accepted the invitation to be part of the manuscript staff of evaluating peers of the journal.
2. For the evaluation and qualification of the manuscript, the original Article Protocol (PEAO) or the protocol of review article (PEAR) will

be delivered, including in it a sheet with suggestions and/or observations to be raised by its author(s).

3. The peer reviewers' issue one of the following criteria: Not published, published conditionally, and published.
4. If the criterion of Published conditionally is given, the author(s) will be anonymously sent the grade, so that he/she can raise the observations, then he/she will return the corrected manuscript to the editor, so that it is sent back to peer reviewers for their final decision.
5. In the case that a manuscript has the acceptance of a peer evaluator and not the other, it will be sent to a third evaluator for resoluteion, who will define one of the three publication criteria for .

The editor and editorial board considering the qualification of "published" of the peer reviewers and the manuscript meets the objective of the journal, will proceed to notify via email the acceptance to publication of the manuscript, which is sent in its final version with the correction of style and translation, for the verification of the author, who will return the manuscript and the signed publication consent (DEJA) to the journal.

Submission of manuscripts

The authors should send the manuscript to be submitted to the editor, Dr. Cleofé Alvites Huamaní, to be submitted by e-mail to revistahamutay@uap.edu.pe. Upon receipt of the letter, the receipt of the manuscript will be confirmed. The reception is open throughout the year.

Copyright policies

To preserve the copyright, the following has been considered:

1. Authors grant permission for their manuscript to have been accepted for publication to be Din the magazine Hamut´ay and under the Creative Commons License Attribution (CC BY-NC-ND: https: // creativecommons. Org / licenses / by-nc-nd / 4.0 /)
2. The economic rights of the accepted articles are transferred to the magazine Hamut´ay, the authors retaining their moral rights according to the Law.
3. The authors accept that, since the journal Hamut´ay is open-access to scientific knowledge, they understand that no royalties or other monetary compensation will be granted.
4. They accept allowing the copying and distribution of their manuscript by any means, as long as the recognition of the authors is maintained and no modifications are made.
5. The archives of manuscripts, accepted or not, will not be shared with third parties either during or after the completion of the editorial process, unless written authorization is obtained by the author.

The five criteria described are endorsed by the authors with their signature on the Authentication and Authorization Affidavit for publication of scientific work in the journal Hamut´ay, (DEJA), which is sent together with the article accepted for publication and with the Creative Commons Attribution license.

Bibliographic References

References and citations should consider the APA Style Rules, sixth edition.

Books:

Cabello, R. & Levis, D. (2007), Medios informáticos en la educación a principios del siglo XXI, [Computer media in education at the beginning of the 21st century] (pp.107) 1era. Edición. Argentina: Publicaciones Prometeo Libros.

Chapters of books:

García, A., Cocero, D., Velázquez, J., Blanco, E., Grande, M., Núñez, M.V. & Tejera, R. (2006) Aplicación de la teledetección a la gestión silvopastoral. En Camacho Olmedo, M., Cañete, J. & Lara, J. (ed.) El acceso a la información espacial y las tecnologías geográficas. (pp.831-842). España Granada: Editorial universidad de Granada.

Articles published in magazines:

Padilla, J., Rincón, D., & Buitrago, L. (2015) La investigación formativa desde la teoría de las representaciones sociales en la Facultad de Estudios a Distancia de la Universidad Militar Nueva Granada. Journal Academia y Virtualidad, 8 (1), 21-34.

Articles published in journals with DOI:

Alcalde-Alvites, M.A. (2016) Software libre enfocados en diversos campos de las ciencias biológicas. [Free software focused on various fields of biological sciences] Journal Hamut`ay, 3 (1) 59-70. https://doi. org/10.21503/hamu.v3i1.1000

Thesis:

Carmona, J. (2012) Aplicaciones de la simulación tridimensional para la detección precoz de consumo de sustancias y violencia escolar en ámbitos educativos entre los años 2011 y 2012. [Applications of three-dimensional simulation for the early detection of substance abuse and school violence in educational settings between 2011 and 2012] (Thesis doctoral). University of Almería, España.

Tables:

The title will be clear, concise and descriptive of the contents of the table. Only the initial word is capitalized, and no point is placed at the end of the title. See following model:

Tabla X.
Proportion of errors in groups of young people and adults

Difficulty level	Youth			Adults		
	n	M(DE)	95% CI	n	M(DE)	95% CI
Low	12	.05 (.08)	[.02, .11]	18	.01 (.15)	[.08, .22]
Moderate	15	.05 (.07)	[.02, .10]	12	.17 (.15)	[.08, .28]
High	16	.11 (.10)	[.07, .17]	14	.26 (.21)	[.15, .39]

Note: CI = Confidence interval
Source: APA (2010, p.157)

Figures:

They are graphics, photographs, diagrams and drawings in high quality JPG format. The title will be brief and concise.

See the following example.

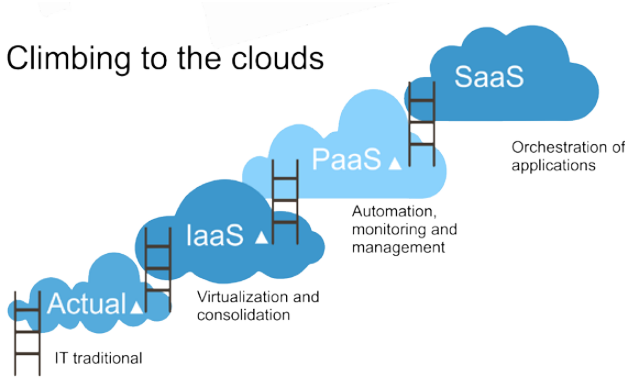

Figure X. Proportion of errors in groups of young people and adults (According to Baron & Kenny, 1996) Adapted from "Preschool Home Literacy Practices and Children's Literacy Department: A Longitudinal Analysis" by M. Hood, E. Conlon & G. Andrews, 2008, Journal of Education Psychology, 100, p.259. Copyright 2008 by the American Psychological Association.
Source: APA (2010, p.170)

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Bobenrieth, M. (2002) Normas para revisión de artículos originales en Ciencias de la Salud. Revista Internacional de Psicología Clínica y de la Salud, 2 (4) 509-523.

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López, S. (2013) El proceso de escritura y publicación de un artículo científico. Revista Electrónica Educare, 17 (1), 5-27. Recuperado de http://www.revistas.una.ac.cr/index.php/EDUCARE/issue/current

Publindex (2010) Documento Guía, servicio permanente de indexación de Revistas de Ciencia, Tecnología e innovación colombianas, Base Bibliográfica Nacional-BBN, Índice bibliográfico nacional Publindex-IBN.