

# Management of a Virtual Learning Environment (AVA), For Students Who Have the First Semester of the Engineering Career in Business Management

Moreno Miguel Estefany Nalleli<sup>1\*</sup>, González Torres Arturo<sup>2</sup>, Rodríguez Cuellar Ruth<sup>3</sup>, Martínez Carrillo Eligio<sup>4</sup>, Ávila Pérez Tagle Alfonso<sup>5</sup>, Ramirez Castañeda Armando I.<sup>6</sup>

<sup>1-5</sup>Tecnológico Nacional de México / Instituto Tecnológico de Milpa Alta, Independencia Sur No. 36, Col. San Salvador Cuauhtenco, C.P. 12300, Alcaldía de Milpa Alta. Ciudad de México, México.

<sup>6</sup>Tecnológico Nacional de México / Instituto Tecnológico de Tláhuac II, Camino Real 625, Jardines del Llano, San Juan Ixtayopan, C.P. 13550, Alcaldía de Tláhuac. Ciudad de México, México.

\*Corresponding author: Moreno Miguel Estefany Nalleli | Received: 10.03.2019 | Accepted: 21.03.2019 | Published: 30.03.2019  
DOI: [10.21276/sb.2019.5.3.5](https://doi.org/10.21276/sb.2019.5.3.5)

## Abstract

The objective of this project is to implement a VPA that meets the minimum characteristics for quality distance education according to experts. To this end, the validation methodology of experts was used in order to achieve the objective of the investigation. The benefits of this project will be: a growth of the institution, have a greater number of enrolled and will provide education opportunity to more population.

**Keywords:** Management, virtual learning environment, engineering, business management.

**Copyright © 2019:** This is an open-access article distributed under the terms of the Creative Commons Attribution license which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use (NonCommercial, or CC-BY-NC) provided the original author and source are credited.

## INTRODUCTION

Thanks to the use of information and communication technologies, sharing information is easier, faster and more efficiently. As the use of audios and videos that are used to provide training in all fields, from this idea of grouping different methods to show information arose the Virtual Learning Objects that are a fundamental part of a Virtual Learning Environment as support for training face-to-face and can even be taken as a complete course to train in any field and at any level of education. A virtual learning is a form of distance learning that is supported by the network allowing communication between teacher and students, likewise seeks to reduce space-time and in turn results in greater knowledge generation and cost reduction.

The technology has allowed an important development in education with the implementation of the Virtual Learning Environments (AVA) and its continuous improvement. The virtual platforms nowadays play an important role in the educational field, since it allows not only the personal development of an individual, but the constant development of an institution that implements it and likewise of a country. The possibility of using a virtual platform aimed at education allows the improvement of teaching-learning as they return to the traditional learner in a self-taught

student, capable of developing in a different way through the use of technology.

Currently, even students who opt for face-to-face modality use technologies to improve their development. The Virtual Learning Environments are not intended to discredit face-to-face mode, but to give new learning opportunities to people who work or who, due to distance and mobility, find it difficult to complete a career.

This research was carried out through the application of the Delphi Method, Kendall's Correlation Coefficient and Cronbach's Alpha, each of these tools fulfills an important function within the research and at the same time the unification of results that allow to determine in a qualitative and quantitative way the characteristics of the proposal for a Virtual Learning Environment (AVA) focused on students who are enrolled in the first semester of the Business Management Engineering career.

The Delphi Method is a prospective study, which aims to achieve consensus among experts through questionnaires, the realization of this instrument should be under the following characteristics:

- Anonymity: No expert during the process knows the identity of others.

- Iteration and controlled feedback: The same questionnaire is presented several times, allowing to reduce the interquartile space and the experts comment and feedback on the responses of others in an appropriate and respectful manner until consensus is reached.
- Responses in a statistical way: It is not intended to know only the point of view of each, but the options that indicate the degree of agreement obtained.
- Heterogeneity: Experts may belong to different areas or activities, the important thing here is that each one of them has knowledge of the subject to be treated.

Kendall's W correlation is one of the non-parametric techniques to measure the degree of correlation between the variables in a sample. Measures the degree of association between several sets (M) of N entities. It is useful to determine the degree of agreement between several judges, or the association between three or more variables.

The Cronbach's alpha is a mean of the correlations between the variables that are part of the scale. It can be calculated in two ways: from the variances (Cronbach's alpha) or from the item correlations (Cronbach's standardized alpha).

The uses of these methods met in order to develop a survey that allows the person who makes an AVA, to know the criteria and essential characteristics that the platform must contain for its success. The research shows six basis points for the formulation of the proposal, which are:

- Features
- Virtual Learning Objects
- Communication
- Pedagogical Content
- Evaluation
- Feedback

Each of these factors was analyzed by the experts, which allowed selecting the tools and resources for the proposal.

The present project is designed a proposal for a Virtual Learning Environment in terms of content in tools and essential resources for students of the first semester of the aforementioned career at the Technological Institute of Milpa Alta located in San Salvador Cuahutenco, Mayor Milpa Alta in the Mexico City.

## BACKGROUND

### What is a Virtual Learning Environment?

Currently technology has facilitated and improved life, in the workplace, communication and education. In the companies it has allowed the reduction

of the costs since it improves the production and the services by means of the introduction of new technologies, the communication; through Web applications that allow communication over long distances, and in education has generated great opportunities for obtaining knowledge. The use of technology and new methods of education pave the way for their combination and results in virtual education also known as distance education that are the Virtual Learning Environments or Virtual Learning Environment. Gallego [1] mentions that a Virtual Learning Environment is a web environment that is available all the time, allowing the teacher and the student to use it in a way that fits their time and place. López [2] points out that an AVA is the set of synchronous and asynchronous interaction environments where, based on a curricular program, the Teaching-Learning process is carried out through a Learning Management System in which all the information management tools and OVAS that facilitate the acquisition of contents are hosted.

### Antecedents of the Virtual Learning Environments

Information and communication technologies (ICT) are being inserted in all areas of society, causing different impacts. Education is one of these areas, where the possibilities that these technologies provide, can favor the introduction of innovative aspects in the methodological aspects, related to teaching and learning processes. Castro, Guzmán & Casado [3] point out why it is so important to incorporate ICT into the curricula of the teaching career, as a content, transversal axis and use of ICT. A Virtual Learning Environment is considered when certain minimum conditions are met, these are: interaction spaces considered as those where direct communication between peers and between teachers and students is favored, the interaction spaces have synchronous and asynchronous characteristics, their function is dimensioned by the ability to facilitate communication processes between the student with his group and his tutor [4].

Online education arose from the need to provide education to students who can not attend a classroom. This type of study is not only used as an auxiliary tool, but as an effective learning that helps people of any age and gender. Created to satisfy the educational demand of certain groups, the antecedents of this educational model are correspondence courses, used by students who were in isolated places and had no opportunity to attend a conventional school [5].

### Benefits of Virtual Environments

Internet stands out as a fundamental tool in the present for both personal and work relationships. It has become fundamental in the lives of millions of people, from young students to executives of large companies. Its utilities are multiple and diverse, and the increase in the quality of life of those fortunate enough to have access to it has been favored in many ways [6]. Given

the distances, the TICs allow to achieve savings in time and money taking advantage of the capacities of members of an organization or different organizations in distant geographical points. Teamwork under these conditions can be done even without the need to coincide at the same time [7]. The company EADBOX is a portal that allows the creation and design of online courses, on its website Hurtado [8] mentions that VPAs favor the democratization of information, thus giving the opportunity to develop skills. Each person can decide which courses to take, depending on their tastes and interests and to be able to organize their times to participate in them, that is to say without impositions, this reflects a great benefit for the new generations since they look for development opportunities without they can become boring and everyday.

### Characteristics of the Virtual Learning Environment

Cerón, Coiduras and Guazmayan [9] conducted an assessment in which they described four categories: the Ethical Vision, Aesthetic Vision, Visibility of Vision and Sensibility Vision. The Aesthetic Vision is one of the categories of Cerón, Coiduras and Guazmayan [9] that we will take in relation to the design of the Virtual Learning Environments.

Aesthetic Vision: Relating what Barbero [10] mentions, aesthetics is conceived as the space where a new paradigm of the relationship between the logic of discourse and the visible (the form), of intelligibility and sensitivity is constructed. The aesthetics of virtual education is like this, the abstract representation through the person-computer-society relationship, of a reality constructed from the image and for the image, languages and scriptures different from thought, learning and teaching.

The VPA must have certain characteristics that allow users to facilitate their understanding and participation, according to Boneu [11] are four basic characteristics that a virtual education platform should have:

- **Interactivity** The interactive process in a virtual world begins with the generation or creation of an avatar. This process needs a time of dedication to generate our identity. This identity can be improved, simplified, maximized, degraded, etc; through the time of habitability in the virtual world [12]. The interactivity is to get the person who is using the platform aware that he is the protagonist of his training [11].
- **Flexibility.** The flexibility in distance education offers benefits not only to the student, but its focus goes beyond personal development in an individual. Penalva [13] mentions that flexibility in a constructivist teaching seeks consensus among educational actors. Flexibility includes meanings from students, institutions and teachers; in addition,

factors such as autonomy, dedication of time, institutional regulatory processes, curricular management and the ability to make decisions regarding basic training aspects [14]. For Boneu [11] are functionalities that allow easy adaptation in the organization where you want to implement, in relation to the institutional structure, curricula, content and pedagogical styles.

- **Scalability** The scalability according to Boneu [11] in a virtual platform is responsible for allowing its correct functionality regardless of the number of participating users, whether large or small. Normally the scalability is done upwards, that is, increased the size and power of the system; but it can also be downward, using only the necessary resources in situations of low demand [15].
- **Standardization.** It is the possibility to import and export courses in standard formats such as SCORM [11]. SCORM is a set of standards in the form of specifications that explain to developers how to create a code so that it can be played on any learning management platform [16].

## MATERIAL AND METHODS

The methodology used in this research involves the participation of knowledgeable people in the matter in order to agree on their opinions.

### Phase 1: Formulation of the problem

Instituto Tecnológico de Milpa Alta I, belonging to the TECNM (Tecnológico Nacional de México), has three face-to-face courses, which are: Engineering in Business Management, Biochemical Engineering and Computer Systems Engineering.

The problem currently facing the institution, is the disadvantage with other educational institutions, the low academic credibility and the location of it that leads to mobility, time and distance of students and teachers to perform educational activities - labor. Another notorious problem is the dropout rate of students, due to economic problems that unfortunately interrupt their studies, to cover family and personal expenses.

### Phase 2: Selection of experts

The experts were selected in two roles, experts in Virtual Learning Environments and experts in Teaching with Economic-Administrative Area Training.

Characteristics considered in the selection of Experts in Virtual Learning Environments:

- a) Teaching experience
- b) Knowledge in:
  - Virtual content
  - Virtual tools
  - Knowledge in virtual platforms
- c) Distance education experience:

- Development of virtual content
- Platform management
- Teacher in distance mode

Table-1 represents the coefficient of competence of the 4 experts in the subject: AVA.

**Table-1: Competence Coefficient AVA experts**

<b>Expert 1</b>	$K = 0.5 (1+1.00) = 1.00$
<b>Expert 2</b>	$K = 0.5 (0.8+0.95) = 0.875$
<b>Expert 3</b>	$K = 0.5 (1+1.05) = 1.025$
<b>Expert 4</b>	$K = 0.5 (0.8+0.85) = 0.825$

Source: Own elaboration (2019)

The previous table shows that the people obtained very good results, therefore, they will be taken into account for the development of the project.

Table-2 represents the coefficient of competence of the 4 experts in teaching with training in the Economic-Administrative area.

**Table-2: Competency Coefficient experts in teaching and Economic-Administrative training**

<b>Expert 1:</b>	$K = 0.5 (0.8+1.05) = 0.925$
<b>Expert 2:</b>	$K = 0.5 (0.9+1.05) = 0.975$
<b>Expert 3:</b>	$K = 0.5 (0.9+1.05) = 0.975$
<b>Expert 4:</b>	$K = 0.5 (0.9+0.85) = 0.875$

Source: Own elaboration (2019)

The previous table shows that the people obtained very good results, therefore, they will be taken into account for the development of the project.

**Phase 3: Preparation and launch of the questionnaires**

For the elaboration of the encuetas a previous interview and a questionnaire was made to each one of the experts of both Virtual Environments of Learning as well as those of the subject of Teaching with formation in Economic-Administrative Sciences, using in the same way the research before realized for complement and strengthen the viability of the survey.

For the creation of the survey questionnaires of approach to both subjects were made, which allowed to analyze fundamental criteria of a Virtual Learning Environment in terms of tools, virtual objects and pedagogical content.

**Phase 4: Practical development and exploitation of results**

In this phase you will find the results of the surveys applied to the eight experts. The objective of the questionnaires is to reduce the dispersion of opinions and to specify the consensus opinion. The evaluation carried out is measured in Clarity and Consistency of the question. In this section, three rounds of questions were conducted, which allowed the experts to analyze and reflect on their responses. At the end of each round, the responses of the other experts

were made known, so that the evaluation scale was broadened. That in the first rounds the results did not meet the criteria established in the methods that continued.

- Clarity: The item is easily understood, that is, its syntactic and semantics are adequate.
- Coherence: The item has a logical relationship with the dimension or indicator it is measuring.
- N. E: Expert Number I: Item.

**W coefficient of Kendall**

The Kendall concordance coefficient, which most authors symbolize by the letter W, is a statistical analysis technique widely used in the science of health and sociology [17]. Measures the degree of agreement between a group of elements and a group of characteristics. If the agreement is the maximum possible,  $W = 1$ , the maximum value that the coefficient W can have is unity: on the contrary, if the agreement is the minimum possible, that is, there is no agreement  $W = 0$ . Therefore, the coefficient can oscillate between 0 and 1 [17]. The application of the Kendall W Coefficient allows obtaining the validity and agreement of a group of experts that will allow the validation of measurement instruments for the proposal of a Virtual Learning Environment that is aimed at the students of the first semester of the career of Bussines management's engineering. Table-3 represents the results of the Kendall parameter.

**Table-3: Results with a high value of AVA Concordance in coherence with Kendall W application**

	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10		S= 12844.8
E1	10	10	10	5	5	10	10	3	8	6		Den.= 15840
E2	10	10	8	5	5	10	10	1	8	5		
E3	9	9	8	4	4	10	9	4	9	4		W 0.811
E4	7	9	8	3	2	8	8	2	5	3	Promedio	
Σ	36	38	34	17	16	38	37	10	30	18	27.4	
Σ-x̄	8.6	10.6	6.6	-10.4	-11.4	10.6	9.6	-17.4	2.6	-9.4		
(Σ-x̄) <sup>2</sup>	73.96	112	43.56	108.2	130	112.4	92.16	302.8	6.76	88.36		
	n=	10										
	m=	4										

Source: Own elaboration (2019)

The previous table shows that the study carried out, the coefficient obtained a good result, and therefore, the VPA Concordance in Coherence has a

credible result. Table-4 represents the results of the Kendall parameter.

**Table-4: Results with a high value of Clarity Teaching Concordance with Kendall W application**

	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10		S= 12337.2
E1	10	6	10	4	5	10	10	4	9	4		Den.= 15840
E2	9	10	8	3	4	8	9	3	8	4		
E3	10	9	8	2	4	10	8	3	8	4		W 0.7789
E4	6	8	4	3	2	10	7	1	5	3	Promedio	
Σ	35	33	30	12	15	38	34	11	30	15	25.3	
Σ-x̄	9.7	7.7	4.7	-13.3	-10.3	12.7	8.7	-14.3	4.7	-10.3		
(Σ-x̄) <sup>2</sup>	94.09	59.29	22.1	176.9	106.1	161.3	75.69	204.5	22.09	106.1		
	n=	10										
	m=	4										

Source: Own elaboration (2019)

The previous table shows that the study performed, the coefficient obtained a good result, and therefore, the Clarity Teaching Concordance has a credible result.

coefficient can also be conceived as the measure in which some construct, concept or measured factor is present in each item. Generally, a group of items that explores a common factor shows a high value of Cronbach's alpha [18]. The validity of an instrument refers to the degree to which the instrument measures what it intends to measure. And the reliability of the internal consistency of the instrument can be estimated with Cronbach's alpha. The measure of reliability using Cronbach's alpha assumes that the items (measured on a Likert scale) measure the same construct and are highly correlated [19]. Table-5 represents the results of the Cronbach's Alpha parameter.

**Cronbach's Alpha**

The alpha coefficient was described in 1951 by Lee J. Cronbach. It is an index used to measure the reliability of the internal consistency type of a scale, that is, to evaluate the magnitude in which the items of an instrument are correlated. In other words, the Cronbach's alpha is the average of the correlations between the items that are part of an instrument. This

**Table-5: Results of the Cronbach's Alpha parameter.**

Alfa de Cronbach		
	Clarity	Coherence
AVA	0.76	0.78
DOCENTE	0.76	0.71

Source: Own elaboration (2019)

The previous table shows that the study performed, the coefficient obtained an acceptable result,

and therefore, the value of Cronbach's Alpha has a credible result.

## RESULTS AND DISCUSSION

The application of the questionnaire was quantified, which allowed obtaining the reliability of

the survey, through the participation of the experts. Table-6 represents a summary of the results obtained during the rounds with the experts.

**Table-6: Results of Applied Statistical Methods**

W Kendall			Alfa de Cronbach		
	Clarity	Coherence		Clarity	Coherence
AVA	0.76	0.81	AVA	0.76	0.78
TEACHAR	0.77	0.82	DOCENTE	0.76	0.71

Source: Own elaboration (2019)

The previous table shows that the study performed, the parameters used had an acceptable result, therefore, the research has a creditable result.

Thus, the basic topics for the investigation were the following:

- Features
- Virtual Learning Objects
- Communication
- Pedagogical Content
- Evaluation
- Feedback

Based on the topics studied above, a proposal was developed for the following subjects, which belong

to the first semester of the Engineering Degree in Business Management.

The subjects involved were the following:

- Research foundations
- Differential calculus
- Human development
- Fundamentals of Management
- Fundamentals of Physics
- Fundamentals of Chemistry

Table-7 represents the proposal must contain the VPA.

**Table-7: Proposal Characteristics of the proposal**

Subject	Platform	Characteristic	Tools
Research Foundations	Web	HTML5, CCS, FRAMEWORK	WEBINAR, WIKI, BLOGS, EDMODO, CLOUD
Diferential calculus	Web	HTML5, CCS, FRAMEWORK	WEBINAR, CLOUD, GOOGLE FORMS, QUESST BASE
Human development	Web	HTML5, CCS, FRAMEWORK	WEBINAR, WIKI, BLOGS, EDMODO, CLOUD
Fundamentals of Management	Web	HTML5, CCS, FRAMEWORK	WEBINAR, WIKI, BLOGS, EDMODO, CLOUD
Fundamentals of Physics	Web	HTML5, CCS, FRAMEWORK	WEBINAR, CLOUD, GOOGLE FORMS, QUESST BASE
Fundamentals of Chemistry	Web	HTML5, CCS, FRAMEWORK	WEBINAR, CLOUD, GOOGLE FORMS, QUESST BASE

Source: Own elaboration (2019)

Figure-8 represents the estimates of launch and maintenance of the AVA.

**Table-8: Estimated costs of launching and maintaining the VPA**

Human resource	Amount of people	Monthly cost
Senior analyst	1	\$30,000.00
Database Developer	1	\$22,000.00
Support Assistant	1	\$16,000.00
Teachers	6	\$7,280.00

Source: Own elaboration (2019)

Table-9 represents the breakdown of costs for each subject corresponding to the first semester.

**Table-9: Cost breakdown by subject**

Subject	Hourly	Hours per week	Weekly cost	Monthly cost
Research Foundations	\$130.00	2	\$260.00	\$1,040.00
Diferential calculus	\$130.00	3	\$390.00	\$1,560.00
Human development	\$130.00	2	\$260.00	\$1,040.00
Fundamentals of Management	\$130.00	2	\$260.00	\$1,040.00
Fundamentals of Physics	\$130.00	3	\$390.00	\$1,560.00
Fundamentals of Chemistry	\$130.00	2	\$390.00	\$1,560.00

Source: Own elaboration (2019)

Table-10 represents a breakdown of the project totals.

**Table-10: Breakdown of total costs**

Development Costs	Hosting and Domain	Human resource (maintenance)
\$30,000.00	\$25.00 anual	\$75,280.00

Source: Own elaboration (2019)

Table-11 represents the cost of the platform, launch and annual maintenance.

**Table-11: Cost of the platform, launch and annual maintenance**

Development Costs	\$30,000.00
Hosting and Domain	\$25.00
Human resource (maintenance)	\$903,360.00
Annual cost	\$906,385.00

Source: Own elaboration (2019)

## CONCLUSION

The main objective of this project is to address one of the problems faced by people who, due to mobility, time and even economic problems, should abandon their studies. The education offered in a Virtual Learning Environment through a quality study platform that allows students to obtain better information and opportunity within the labor world and also to the institution to offer an adequate development and reaffirm further the importance of incorporating information and communication technologies in teaching-learning processes.

The main contribution of this work is the research that allows to develop a quality Virtual Learning Environment, although the computer and technological tools are not addressed in their entirety, it was investigated in order to detect those that best apply to the students of the Technological Institute of Milpa Alta new entry into the career of Engineering in Business Management.

The conclusions of the research work presented with the Delphi method to qualitatively detect which are the needs that must be covered when implementing a VPA not only in the technological part, but also in the pedagogical part, that although we name

it is the pillar for quality education, the use of this method with respect to the consensual and representative opinions of a group of individuals, achievement of the guidelines for the analysis of characteristics, selection of virtual learning objects, media, content pedagogical and types of evaluation and feedback. As well as the interpretation of the data with the use Kendall and Alfa de Cronbach quantify the information and allow to identify and evaluate the results obtained.

The Delphi methodology is a versatile technique that allows us to filter information for the purpose of extracting information when there are no historical data that statistical models can be developed.

With the study of the results obtained, phase two and three are reduced and improved, where the parameter of quantifying the filtering of the experts and interpretation of the parameters obtained for the exploitation of phase four of the coefficient of agreement of Kendall and Cronbach's alpha, which allows obtaining the validity and reliability, to obtain the metrics that will help the group of experts to interpret the information.

## ACKNOWLEDGEMENTS

- Marrón Ramos Domingo Noé for his tutoring and advice on the project
- Dominguez Mendoza Omar Uriel for his tutoring and advice on the project.
- Academic Body ITLAG-CA-5 and its leader Eduardo Rafael Poblano Ojinaga for his advice and tutelage in the project.

## REFERENCES

- Gallego, J. E. (2009). Ambientes Virtuales de Aprendizaje (AVA) e investigación como proceso formativo. Obtenido de: <https://www.google.com.mx/search?q=Itinerario+Educativo+E2%80%A2+A%C3%B1o+xxiii%2C+n.%C2%B0+54+E2%80%A2+109-122+E2%80%A2+julio-diciembre+de+2009&oq=Itinerario+Educativo+E2%80%A2+A%C3%B1o+xxiii%2C+n.%C2%B0+54+E2%80%A2+109-122+E2%80%A2+julio-diciembre>
- López-López, J. H. (2015). Diseño de un ambiente virtual de aprendizaje como estrategia para la enseñanza de las ciencias naturales. XVI Encuentro Internacional Virtual Educa. Guadalajara. México.
- Castro, S., Guzmán, B., & Casado, D. (2007). Las Tic en los procesos de enseñanza y aprendizaje. *Laurus*, 13(23), 213-234.
- Gómez, A. R. (2010). Aprendizaje Basado en Problemas (ABP) y Ambiente Virtual de Aprendizaje (AVA). *Magistro*, 4(7), 81-94.
- UTEL, U. T. (2013). UTEL BLOG. Obtenido de Historia de la educación en línea: <http://www.utel.edu.mx/blog/estudia-en-linea/historia-de-la-educacion-en-linea/#prettyPhoto>
- Puyol-Pérez, A. (2017). Nuevas tecnologías y de educación. México: Agencia Promotora de Publicaciones.
- Rincón, Y., & Zambrano, E. (2008). Revista Científica Electrónica Ciencias Gerenciales (Redalyc). Obtenido de Equipos de trabajo virtual: los desafíos del trabajo compartido a distancia: <http://www.revistanegotium.org.ve/pdf/11/Art5.pdf>
- Hurtado, S. (2017). EADBOX. Obtenido de <http://es.eadbox.com/ava-entiende-sus-beneficios/>
- Cerón Mónica, P., Coiduras, J. L., & Guazmayan R. (2015). Valoración del Ambiente Virtual de Aprendizaje de la Universidad de Nariño Virtual. Vol. 16. Obtenido de [http://www.scielo.org.co/scielo.php?script=sci\\_arttext&pid=S0124-86932015000100002](http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0124-86932015000100002).
- Barbero, J. M. (1996). Heredando el futuro. Pensar la educación desde la comunicación. Nómadas (Col), núm. 5. Universidad Central. Bogotá, Colombia. Obtenido de: <http://www.redalyc.org/pdf/1051/105118998002.pdf>
- Boneu, J. M. (2007). Plataformas abiertas de e-learning para el soporte de contenidos educativos abiertos. (Vol. 4). Obtenido de: <http://www.uoc.edu/resc/4/1/dt/esp/boneu.pdf>
- Revuelta, D., & Pérez-Sánchez, L. (2009). Interactividad en los Entornos de Formación ONLINE. Barcelona: UOC. Obtenido de <http://revistas.usal.es/index.php/1130-3743/article/view/8306>
- Penalva, B. J. (2008). Análisis crítico de los aspectos teóricos del currículum flexible y abierto. Consecuencias educativas. Profesorado. Revista de currículum y formación del profesorado. Obtenido de: <https://www.ugr.es/~recfpro/rev113COL2.pdf>
- Díaz, J. (2002). La evaluación formativa como instrumento de aprendizaje en Educación Física. Obtenido de: [https://books.google.com.mx/books?id=PJCD3HcgxjYC&pg=PA138&dq=evaluaci%C3%B3n+sumativa&hl=es&sa=X&ved=0ahUKEwj-96b4ko\\_eAhVGIqwKHXaYCT4Q6AEILjAB#v=onepage&q&f=false](https://books.google.com.mx/books?id=PJCD3HcgxjYC&pg=PA138&dq=evaluaci%C3%B3n+sumativa&hl=es&sa=X&ved=0ahUKEwj-96b4ko_eAhVGIqwKHXaYCT4Q6AEILjAB#v=onepage&q&f=false)
- Godino, F. G., & López, G. G. (2013) Diseño de una arquitectura escalable y de alta disponibilidad para un sistema middleware. Universidad Politécnica de Madrid. Obtenido de: [http://oa.upm.es/32647/1/PFC\\_FERNANDO\\_GODINO\\_GONZALEZ.pdf](http://oa.upm.es/32647/1/PFC_FERNANDO_GODINO_GONZALEZ.pdf)
- Salido, S. R. (2018). Desarrollo de software de red MANET (Mobile Ad-hoc Network). Univesidad de Jaén. Obtenido de: <http://tauja.ujaen.es/bitstream/10953.1/8378/1/MemoriaTFG.pdf>
- Álvarez, C. R. (2007). Estadística aplicada a las ciencias de la salud. España: Díaz de Santos. Obtenido de <https://books.google.com.mx/books?id=V2ZosgPYI0kC&pg=PA815&dq=w+de+kendall&hl=es&sa=X&ved=0ahUKEwjB3veKx6vfAhXxi60KHTAEAy0Q6AEIKTAA#v=onepage&q&f=false>
- Oviedo, H. C., & Campo, A. A. (2005). Metodología de investigación y lectura crítica de estudios. Aproximación al uso del coeficiente alfa de Cronbach. Obtenido de <http://www.redalyc.org/html/806/80634409/>
- Welch, S., & Comer, J. (1988). Quantitative Methods for Public Administration. Brooks/Cole Publishing Co., Pacific Grove, California, 168-296.