

Construction of an RTD as Didactic Support for Non-Face-To-Face Lessons Due to COVID-19

Josefina Hernández Jaime
Instituto Politécnico Nacional

Eduardo Rodríguez Flores
Instituto Politécnico Nacional

Yasmín Ivette Jiménez Galán
Instituto Politécnico Nacional

As a result of the COVID-19 pandemic, there have been momentous changes in working in all sectors of the economy, including the education sector. The educational institutions where face-to-face lessons are taught overnight were forced to continue with distance classes (virtual and online). It is a reality that most schools and their communities were not prepared to deal with this atypical situation. Therefore, the objective was the development of a digital teaching resource (DTR) as pedagogical support, in online classes, of the Business Finance learning unit that is taught at the Escuela Superior de Cómputo (ESCOM) of the National Polytechnic Institute (IPN). Documentary analysis was carried out based on applied research, and the DTR was later built. This construction obeys the criteria considered for the elaboration of digital didactic resources proposed by the authors consulted, particularly in those required and evaluated by the Polytechnic Unit for Virtual Education (UPEV) of the National Polytechnic Institute (IPN), which focuses specifically on pedagogical, editorial, graphic and technical aspects.

Keywords: teaching-learning process, remote classes due to COVID-19 pandemic, digital teaching resource, criteria for the evaluation of digital teaching resources

INTRODUCTION

The rapid use of information and communication technology (ICT) is increasingly present in all areas of human life; it has become a reality in the classroom, in many cases a reality untapped mainly by obstacles such as inflexible school organizations, lack of culture and digital literacy, or even by a scarce or inadequate teacher training for the implementation of ICT in the classroom (Mirete, 2010).

Currently, as of March 2020, as a result of the COVID-19 pandemic, the changes mentioned above have been accentuated even more. Specifically in the educational field, overnight, the educational institutions in which face-to-face classes are taught were forced to continue with their classes, but now in a non-face-to-face way. It is a fact that most schools and their communities (authorities, teachers, pupils,

administrative and support staff) were not prepared to deal with this atypical situation, which has led to a drastic change in the ways of working and, of course, of carrying out the teaching-learning process.

Within this context, the actors involved were given the task of undertaking the necessary actions that would allow them to provide continuity with the classes, which has undoubtedly represented significant challenges. As far as teachers are concerned, once they started teaching technology-mediated classes, they saw the need to redesign the teaching-learning strategies they had been using. This redesign could contemplate, among many other aspects, the development of digital teaching resources (DTR). Therefore, it was decided to carry out applied research that aimed to build a digital teaching resource (DTR) of the thematic unit II of the Business Finance learning unit to support the teaching-learning process in the non-face-to-face modality.

THEORETICAL & CONTEXTUAL FRAMEWORK

The Teaching-Learning Process

The main aim of educational institutions is to achieve student learning. To achieve this, planned teaching must be promoted, among other aspects, with timely and relevant didactic interventions; that is, intentional teaching. Teaching and learning are closely related activities; according to the most recent educational approaches, learning should be understood as a process of construction of knowledge of reality, which develops in the mind of each person (Oliver, 2007; Ruiz, 2012); while teaching should be conceived as an adjusted and necessary aid to the construction processes carried out by students on the programmed contents (Díaz Barriga and Hernández 2010). As mentioned by Meneses (2007), "teaching can only be understood in relation to learning; and this reality relates not only to the processes linked to teaching, but also to those linked to learning" (p.32), and it is then that the teaching-learning process becomes relevant, which is conceived as the space of dynamic interaction, where the main protagonist is the student, and the teacher is the facilitator of the learning processes (Abreu, Barrera, Breijo and Bonilla, 2018).

Authors studying the subject agree that the main didactic components of the teaching-learning process are: the teacher, the students, the educational objectives, the contents, the context, the didactic strategy, the evaluation, the evaluation means, materials, and didactic resources (Marqués, 2011; Abreu *et al.*, 2018).

Digital Teaching Resources

Educational resources are necessary for the construction of learning; in this sense, Zapata (2016) argues that each learning requires specific conditions that are determined through planning and evaluation processes; the author emphasizes that "such learning conditions are determined by two elements: educational resources and teaching strategies, and by the interaction of both" (p. 3).

In recent decades, the insertion of ICT in education has made it possible to develop and use digital teaching materials and resources. According to Fernández, Domínguez, and de Armas (2013), digital teaching material is a resource in the digital format used in the teaching-learning process. For the National Polytechnic Institute, a digital teaching resource (DTR) is defined as all educational content presented in digital format, which serves as support and/or pedagogical support to promote learning in its different modalities: schooled (face-to-face), unschooled (open, distance, virtual) and mixed. (UPEV, IPN, 2021).

In short, didactic resources are elements that can contribute to providing students with information, techniques, and motivation that facilitate their learning processes. The effectiveness of these resources will depend to a large extent on how the teacher orients their use within the framework of the didactic strategy they are using (Marquès, 2011).

According to Abud 2005 (cited by Aguilar *et al.*, 2014), in the computer field, there are no specific international standards for the evaluation of educational software, so the author proposes a set of metrics based on the ISO-9126 standard. On the other hand, Cepeda, Gallardo, and Rodríguez (2017) highlight that some recent research seems to highlight the remarkable degree of ignorance that exists about the models and guides for the evaluation of printed and digital materials; In this regard, they state that in order to analyze digital didactic materials, the following dimensions must be considered: technological, design, pedagogical, content and evaluation and monitoring.

Likewise, Fernández, *et al.*, (2013) propose a quality model with ten criteria grouped into standards of didactic quality (didactic documentation; quality of the contents: reflection, criticism, and innovation; interactivity, adaptability; and motivation) and technological quality (format and design, usability, accessibility, reusability, and interoperability).

As far as digital teaching resources are concerned, the IPN through the UPEV is responsible for establishing the quality and evaluation criteria weighing four fundamental aspects: pedagogical, editorial, technical, and graphic; for each of these aspects, the aforementioned author has developed a series of indicators contained in an evaluation guide.

RESULTS (DESCRIPTION OF THE DIGITAL TEACHING RESOURCE)

The structure is made up of different elements respecting the format of an html file with cascading Style Sheets (css), and with sequences programmed in javascript, on a web server using the Django framework on Python.

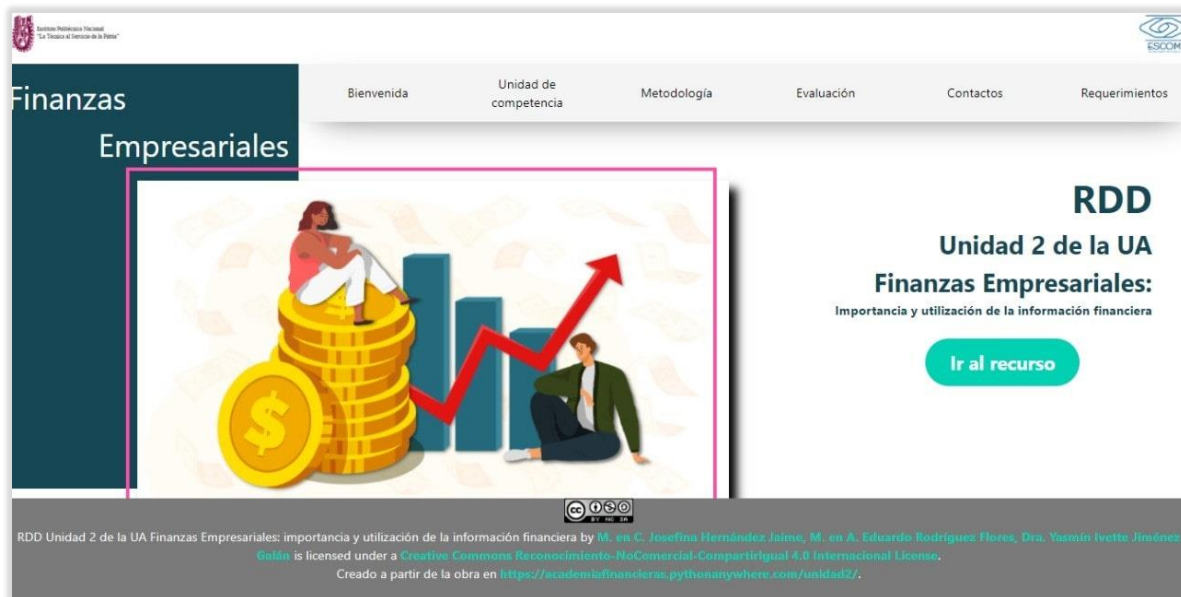
The DTR has two pages:

- a. a home page
- b. a content page

Home Page

It has a start menu with navigation buttons: welcome, competence unit, methodology, evaluation, contacts, and requirements (Figure 1).

**FIGURE 1
DTR HOME PAGE**



Source: own elaboration

The previous sections are briefly described below:

- Welcome. In a few lines, students are welcomed, and expectations about the performance of the participating actors (students and teachers) are announced.
- Competence unit. Specifies the purpose of the thematic unit, which is explicit in the synthetic program of the learning unit.

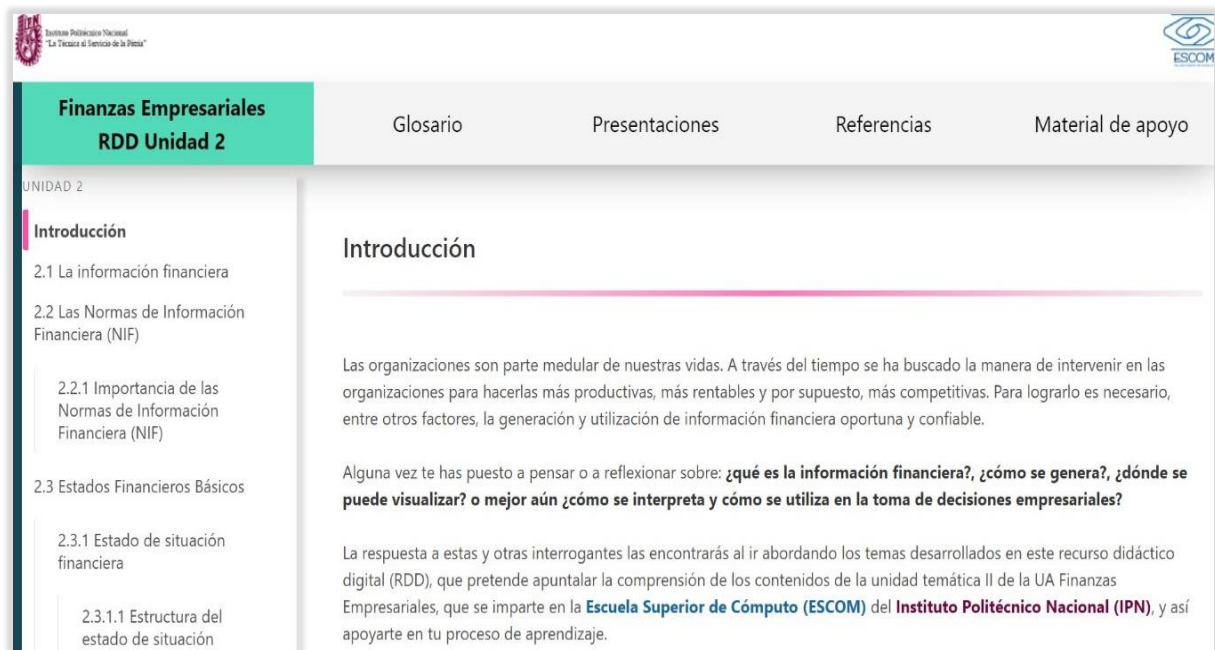
- **Methodology.** The use and function of the didactic resource are specified. It describes in broad strokes the method to be followed to address the contents, explains how the resource will be used to develop the proposed competencies, and gives the student an overview of what they will find and what is expected of them in terms of their performance.
- **Evaluation.** The type of activities that will be carried out to evaluate learning is announced.
- **Contacts.** For questions or comments about the DTR and its content, the institutional emails of the team of teachers who participated in the construction of this resource are provided.
- **Requirements.** The technical requirements to access and make use of the DTR are specified.

To access the content page, click on the **go to the resource** button located in the center-right (figure 1).

Content Page

To facilitate navigation and consultation, the content page is based on views; it is dynamic in maintaining the link, which allows the content of the topic that is displayed to vary depending on the selected case (i.e., the content is constantly changing); in addition to the contents, there is a menu with the following navigation buttons: glossary, presentations, references and support material (figure 2).

**FIGURE 2
DTR CONTENT PAGE**



Source: own elaboration

The following are the elements of the content page:


- **Introduction.** An overview of the structure and organization of the contents is given; some questions are asked to awaken interest in the thematic unit's contents. And at the same time, there is an overview of the value and application of business finance in organizations.
- **Contents.** In this section, you will find the explanation of each of the topics; Additionally, at the end of some of these, you can see buttons in which, when you click, you can consult or download complementary readings, learning activities, other support resources and links to internet videos (figures 4 and 5).

- Glossary. In this section, when typing an accounting or financial term (included in the DTR), its meaning will be shown to enrich the contents.
- References. The sources of consultation based on which the contents of the thematic unit were developed are listed.
- Presentations. A PowerPoint presentation with the contents of the thematic unit is included.
- Support material. In this section are available some formats, graphic organizers, readings, and learning activities to be developed in the thematic unit.

It is important to note that the content section was developed based on thematic unit II of the synthetic program of the Business Finance learning unit, which is taught at the ESCOM of the IPN. An attempt was made to write the text clearly and simply, with a language like the one used when teaching a class in the classroom (addressing the students).




The content (topics and subtopics) is located on the left side of the DTR; at all times, it remains complete and visible to the user. To consult a topic or subtopic, simply locate it and when you click on it, the respective information and explanation is displayed (Figure 3); immediately afterwards, at the end of the explanation, the student will be able to find complementary readings, support materials, videos on the subject and the learning activity(s) to be developed (figures 4 and 5).

FIGURE 3
EXPLANATION OF THE SELECTED TOPIC OR SUBTOPIC

Finanzas Empresariales RDD Unidad 2	Glosario	Presentaciones	Referencias	Material de apoyo
UNIDAD 2 Introducción 2.1 La información financiera 2.2 Las Normas de Información Financiera (NIF) 2.2.1 Importancia de las Normas de Información Financiera (NIF) 2.3 Estados Financieros Básicos 2.3.1 Estado de situación financiera 2.3.1.1 Estructura del estado de situación financiera 2.3.1.2 Formas de	<h3 style="text-align: center;">2.1 La información financiera</h3> <hr/> <p>La información financiera que se obtiene de la contabilidad tiene las siguientes características:</p> <p>A. Es cuantitativa porque se expresa en unidades monetarias B. Es descriptiva en razón de que muestra la posición y el desempeño financiero de la entidad</p> <p>El objetivo primordial de la información financiera radica en la utilidad que ésta tiene para los usuarios en la toma de decisiones económicas (figura 2.1). Dicha información se ve reflejada en los estados financieros, mismos que muestran cómo va el negocio, permitiendo evaluar su desempeño en función de los objetivos propuestos; adicionalmente, dichos estados proporcionan información con la que se puede estimar el comportamiento futuro de algunos aspectos, por ejemplo del flujo de efectivo.</p>			<p>Figura 2.1 Importancia de la información financiera</p>  <p>Hernández, J., Rodríguez, E. & Jiménez, Y. (2020).</p>

Source: own elaboration

**FIGURE 4
READINGS AND SUPPORTING MATERIAL**

<p>2.2 Las Normas de Información Financiera (NIF)</p> <p>2.2.1 Importancia de las Normas de Información Financiera (NIF)</p> <p>2.3 Estados Financieros Básicos</p> <p>2.3.1 Estado de situación financiera</p> <p>2.3.1.1 Estructura del estado de situación financiera</p> <p>2.3.1.2 Formas de presentar el estado de situación financiera</p> <p>2.3.2 Estado de resultados</p>	<p>En la siguiente lectura se abordan a detalle las principales cuentas que conforman al estado de situación financiera.</p> <div data-bbox="727 394 906 457" style="border: 1px solid black; padding: 5px; display: inline-block;">  Lectura </div> <p>Principales cuentas del estado de situación financiera, estado de posición financiera o balance general</p> <p>A continuación, encontrarás un organizador gráfico, como material de apoyo, que contiene la clasificación de las principales cuentas del estado de situación financiera.</p> <div data-bbox="748 638 984 688" style="border: 1px solid black; padding: 5px; display: inline-block;">  Material de apoyo </div> <p>Organizador gráfico. Cuentas del estado de situación financiera</p> <p>Ya cuentas con los elementos suficientes para realizar las siguientes actividades de aprendizaje:</p> <div data-bbox="873 856 1081 907" style="border: 1px solid black; padding: 5px; display: inline-block;">  Actividad 2.2 </div>
--	--

Source: own elaboration

**FIGURE 5
EXPLANATORY VIDEOS**

<p>2.3 Estados Financieros Básicos</p> <p>2.3.1 Estado de situación financiera</p> <p>2.3.1.1 Estructura del estado de situación financiera</p> <p>2.3.1.2 Formas de presentar el estado de situación financiera</p> <p>2.3.2 Estado de resultados</p> <p>2.3.2.1 Estructura del estado de resultados</p> <p>2.3.2.2 Cuentas del estado de resultados</p> <p>Cierre de la unidad temática</p>	<p>En el siguiente video, encontrarás información complementaria acerca de los estados financieros.</p> <div data-bbox="797 1178 1273 1591" style="border: 1px solid black; padding: 10px;">  </div> <p>Fuente: https://www.youtube.com/watch?v=CR8mILg0SIg&t=4s</p>
--	---

Source: own elaboration

As far as learning activities are concerned, it is essential to note that some are designed to carry out a formative assessment and others for the summative evaluation. As for its structure, each activity has several activities; title; data (student name, date, and group); the specification of whether or not it has value in the evaluation; detailed instructions, and, if applicable, the evaluation criteria are set out (Figures 6 and 7).

It is worth mentioning that an attempt was made to design contextualized learning activities of interest to students; some represent a challenge in leading students to put into practice and articulate, in real-life situations, what they have learned, thereby promoting meaningful learning.

FIGURE 6
LEARNING ACTIVITY WORTHLESS FOR ASSESSMENT

FINANZAS EMPRESARIALES

ACTIVIDAD: 2.3 Clasificación de las cuentas del estado de situación financiera

DATOS

Nombre: _____

Fecha: _____

Grupo: _____

Valor en la evaluación: **Evaluación formativa**

Instrucciones

- Lee cuidadosamente y en cada caso realiza lo que se solicita
- Guarda tu documento con la siguiente nomenclatura: apellidonombre_Act2.3
- Sube tu actividad en el espacio designado para ello en la plataforma indicada por tu profesor(a)

De la siguiente lista de cuentas (partidas) de activo, pasivos y capital contable, especifica en cada caso, a qué clasificación corresponden: activo circulante (AC), activo no circulante (ANC), pasivo a corto plazo (PCP), pasivo a largo plazo (PLP) y capital contable (CC).

CUENTA	CLASIFICACIÓN				
	AC	ANC	PCP	PLP	CC
1. Renta pagada por anticipado					
2. Papelería y artículos de escritorio pagados por anticipado					
3. Franquicia					
4. Edificio					
5. Patente					
6. Terreno					
7. Cuentas por pagar a proveedores (24 meses)					
8. Anticipo de clientes					
9. Equipo de cómputo					
10. Seguros y fianzas					

Source: own elaboration

FIGURE 7
LEARNING ACTIVITY WITH VALUE FOR ASSESSMENT

Source: own elaboration

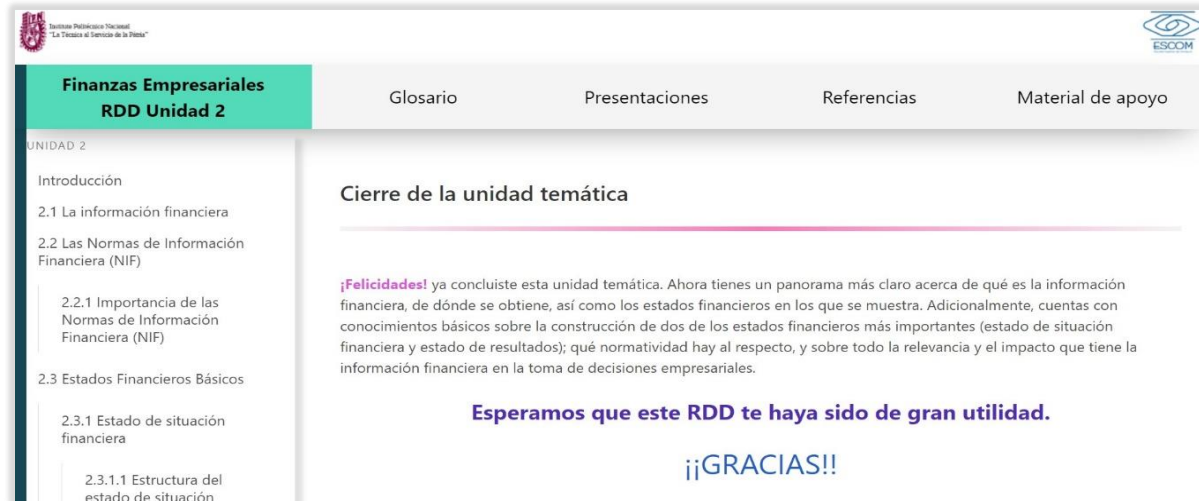
The function of the DTR developed, regardless of the educational modality in which it is used, is to support and facilitate the teaching-learning process; to promote autonomous learning so that the student knows how to learn, directs, controls, regulates, and evaluates their knowledge. Evaluation is a very complex activity; in this resource, only a small evaluation was included (Figure 8) with multiple choice reagents that appear randomly; at the end of the evaluation, the student will obtain his result and feedback that evidences successes and errors.

FIGURE 8
EVALUATION

Source: own elaboration

The last item of the DTR is the closure of the thematic unit, which can be seen in Figure 9.

**FIGURE 9
CLOSURE OF THE THEMATIC UNIT**



Source: own elaboration

METHODOLOGY

The methodology followed in the development of this DTR (of Thematic Unit II of the Business Finance Learning Unit) is based on applied research considering the criteria for the elaboration and evaluation of digital teaching resources proposed by the authors consulted, and specifically in those provided by the Polytechnic Unit for Virtual Education UPEV of the IPN (2021). According to this organization, digital teaching resources must have relevant pedagogical, editorial, technical, and graphic design foundations that support the teaching-learning process to raise educational quality. These fundamentals are contained in Figure 10.

**FIGURE 10
ASSESSMENTS AND ASPECTS CONTEMPLATED IN THE EVALUATION OF DTRS**

Criterios de evaluación			
Pedagógicos	Editoriales	Técnicos	Diseño gráfico
Introducción			
Competencias			
Metodología			
Agenda de actividades	Bibliografía		
Guía del estudiante	Glosario	Agenda de actividades	
Tabla de evaluación	Citas textuales	Recursos de apoyo	Criterios generales
Glosario	Políticas de inclusión	Criterios generales	
Recursos de apoyo	Licencia y derechos de autor		
Contenidos	Criterios generales		
Recursos multimedia			
Actividades y evaluación			
Criterios generales			
25 puntos	25 puntos	25 puntos	25 puntos

Source: <https://www.ipn.mx/assets/files/dev/docs/DII/02GuiaEvaRDD.pdf>

CONCLUSIONS

The COVID-19 pandemic has impacted the way of living, doing, working, and carrying out the teaching-learning process. Within this context, the use of technology has made it possible, in many cases, to continue with classes in a distance modality, offering new and varied possibilities to both teachers and students. One of these possibilities is precisely the construction of digital teaching resources, which are elaborated and used with relevance, and can have great potential by facilitating, strengthening, and enriching the teaching-learning process.

The DTR central theme of this work was built to support the student in his learning process: to be able to access, with an internet connection, the development and explanation of the contents and thus not only favor autonomy but also learn at his own pace.

It should be noted that this DTR was developed in the period May-December 2020; is in the evaluation process by the UPEV of the IPN; meanwhile, in the February-June 2021 semester, it is being piloted in seven ESCOM groups (approximately two hundred and fifty students).

Once the semester is over, it would be interesting to inquire about the perception and assessment of both students and teachers about using this DTR to detect areas of opportunity and, as far as possible, attend to them.

Due to the urgency and to be able to be used by students during the pandemic, the DTR was only developed for a thematic unit II because it is the most extensive of the learning unit and because from the experience of the teachers who instruct the learning unit, we know that it is the thematic unit that is most difficult for students; however, work is underway to scale the DTR and contemplate the five thematic units that make up the learning unit.

ACKNOWLEDGEMENT

Translated & edited by American Publishing Services (<https://americanpublishingservices.com/>).

REFERENCES

- Abreu, Y., Barrera, A.D., Breijo, T., & Bonilla, I. (2018). El proceso de enseñanza-aprendizaje de los Estudios Lingüísticos: Su impacto en la motivación hacia el estudio de la lengua. *MENDIVE. Revista de Educación*, 16(4), 610–623. Retrieved from <http://mendive.upr.edu.cu/index.php/MendiveUPR/article/view/1462/pdf>
- Aguilar, I., Ayala, J., Lugo, O., & Zarco, A. (2014). Análisis de criterios de evaluación para la calidad de los materiales didácticos digitales. *Revista Iberoamericana de Ciencia, Tecnología y Sociedad – CTS*, 9(25), 73–89. Retrieved from <https://www.redalyc.org/pdf/924/92429919005.pdf>
- Cepeda, O., Gallardo, I., & Rodríguez, J. (2017). La evaluación de los materiales didácticos digitales. *RELATEC. Revista Latinoamericana de Tecnología Educativa*, 16(2), 79–95. Retrieved from <https://relatec.unex.es/article/view/3055/2117>
- Díaz Barriga, F., & Hernández, G. (2010). *Estrategias docentes para un aprendizaje significativo*. Una interpretación constructivista. Mexico: McGraw-Hill.
- Fernández, A., Domínguez, E., & de Armas, I. (2013). *Diez criterios para mejorar la calidad de los materiales didácticos digitales*. Ponencia presentada en la VII Jornadas de Campus Virtual UCM. Madrid. Retrieved from https://eprints.ucm.es/20297/1/25-34_Fern%C3%A1ndez-Pampill%C3%B3n.pdf
- Instituto Politécnico Nacional [IPN]. (2010). Reglamento de Promoción Docente del Instituto Politécnico Nacional. *Gaceta Politécnica*, 13(828). Retrieved from <http://www.aplicaciones.abogadogeneral.ipn.mx/reglamentos/EXT828.pdf>
- Marquès, P. (2011, August 07). *La enseñanza. Buenas prácticas*. Motivación. Retrieved from <http://www.peremarques.net/actodid3.htm>

- Meneses, G. (2007). *El proceso enseñanza-aprendizaje: El acto didáctico*. Retrieved from <https://www.tdx.cat/bitstream/handle/10803/8929/Elprocesodeensenanza.pdf>
- Mirete, A. (2010). Formación docente en TICS. ¿Están los docentes preparados para la r(evolución) TIC? *INFAD Revista de Psicología*, 4(1), 35–44. Retrieved from <https://www.redalyc.org/pdf/3498/349832327003.pdf>
- Oliver, C. (2007). *La evaluación desde la complejidad. Una nueva forma de evaluar*. España, Barcelona: Departamento de Didáctica y Organización Educativa de la Universidad de Barcelona. Retrieved from <http://www.encuentros-multidisciplinares.org/Revistan%BA25/Carmen%20Oliver%20Vera.pdf>
- Ruíz, M. (2012). *Enseñar en términos de competencias*. Mexico: Trillas.
- Unidad Politécnica para la Educación Virtual (UPEV), IPN. (n.d.). *Clasificación de recursos didácticos digitales*. Retrieved from https://www.ipn.mx/assets/files/dev/docs/DII/01Clasificacion_RDD%2003.pdf
- Unidad Politécnica para la Educación Virtual (UPEV), IPN. (n.d.). *Valoración y aspectos contemplados en la evaluación de los RDD*. Retrieved from <https://www.ipn.mx/assets/files/dev/docs/DII/02GuiaEvaRDD.pdf>
- Zapata, M. (2016). Secuenciación de contenidos y objetos de aprendizaje. *Revista de Educación a Distancia (RED)*. Retrieved from <https://www.redalyc.org/pdf/547/54746291012.pdf>