Importance of instructional design for the implementation of Flipped Learning Model in the modality of distance education

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Abstract

By using the ADDIE methodology as a basis for instructional design and implementation of various techno-pedagogical tools by teachers of distance education for the development of teaching and learning activities, it seeks the implementation of the model called "flipped classroom", in a population of enrolled students in educational programs of Industrial Engineering, Computer Systems Engineering and Degree in Administration at the Technological Institute of Pachuca, in order to contribute with the student in acquiring autonomous competencies and with the teacher in time optimization intended to develop techno-pedagogical tools to support learning. It is concluded that efficiency in implementing the flipped classroom depends largely on the quality of the instructional design, the appropriate use of technological teaching resources that motivate and promote student autonomy, the professional provision of teachers and student responsibility for their learning.

Instructional design, ADDIE Model, flipped classroom, distance education.

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1. Introduction

Given the new scenarios in which the knowledge society is contextualized, Educational Institutions of Higher Education are obliged to offer society greater coverage in education and alternatives to access to it. The Model of Distance Education in TecNM emerges as a strategy to ease the curriculum and thus meet the needs of those who for some reason cannot attend schooled education. Under this modality, the use of various teaching strategies, design of techno-pedagogical tools and the use of Information and Communication Technologies (ICT) are inherent in teaching activity, and indispensable today for the development of generic competencies in students.

Through the ADDIE model used for instructional design, the implementation of the teaching strategy called flipped classroom, and with the support of techno-pedagogical strategies and use of ICT, the intention is to create learning environments that change the vision of the traditional model of "magisterial" teaching type, through a teaching model that seeks to promote the development of the autonomy competency in students.

Since 2011, the Technological Institute of Pachuca expands its educational border through the modality of Distance Education (DE), initially relying on pedagogical models such as e-learning and b-learning.

Subsequently incorporating the "flipped classroom" which means as its name suggests, "invest" the traditional teaching and learning process, and focus the student as the main actor responsible for the process and pace of learning, through the study and analysis of techno-pedagogical materials used by teachers and promoted by platforms such as YouTube, the Kahn Academy Initiative or TED-ED.

Allowing that scheduled academic sessions and time the teacher spends in professorship, being used for the discussion, feedback and reinforcement of knowledge as well as for the design of educational resources to support teaching and learning processes [Raad, 2015].

Under a scheme of traditional teaching, the student is used to be a mere recipient of knowledge, resulting among other factors, the loss of autonomy and initiative, plus it is severely undermined their creativity. In the distance modality, by own model characteristics, it is impossible to continue with the dynamics of teaching mentioned.

However, it has been found that the student who enters this modality brings the traditional rhythm of teaching and expects the performance of the teacher be in the same context. This has led the teacher to invest much of his time in maintaining synchronous communication with the student, hoping the complete professorship of thematic content of the curriculum, resulting in an excess of work-hours that teachers used to develop fully the functions inherent in his position.

Impacting productivity and causing a mental wear by overwork. Therefore, the model of "flipped classroom" is implemented in order to achieve autonomy in the learning process and invest with quality the time devoted to teaching in developing techno-pedagogical tools and activities of instructional design, both tools indispensable for the operation of the model; without the teacher ceases to perform his duties as moderator, adviser and guide in the teaching process.

This document consists of three sections. In the first, a literature review showing the theoretical foundations of instructional design, the ADDIE model and strategy flipped classroom is done. In the second section is detailed the used methodology of quantitative type with descriptive cut, as well as the description of the implementation process of models.

Finally, the findings from the results derived from the application of four instruments for gathering information, describing teachers and student experiences.

2. Instructional Design: a background check

Regardless of the method under the educational process is guided (classroom, distance, virtual or mixed), an instruction is designed with the aim of generating competencies development (skills, abilities, knowledge, aptitudes and attitudes) to facilitate the acquisition of knowledge.

This requires a methodology used to guide instruction and allow the organization of a learning session and complete development of a curriculum.

Under the modality of Distance Education, it is considered even greater this need for teacher-student separation in time and space; and the development of virtual environments is a much larger task than face teaching, there are made activities related to the teaching-learning process required by the educational model of the XXI century based on competencies plus the use of information technologies and communication technologies. In this process, instructional design, known by the acronym ID, and defined by Berger and Kam authors [1996] cited by Belloch, C. [2013] as:

"The science of creating detailed specifications for the development, implementation, evaluation, and maintenance of situations that facilitate learning of small and large units of content, at different levels of complexity "[p. 2]; plays a key role as a guide for teachers in the didactical process development and of quality formative activities.

Instructional design has its historical basis in various learning theories, emphasizing among them: behaviorism, cognitivism, constructivism and connectivism.

The following diagram shows the approach that each theory has on the conceptualization of learning and the main contributions of each one to the study model, with reference to the cited by the author Benitez, M [2010] and Siemens [2006b]:
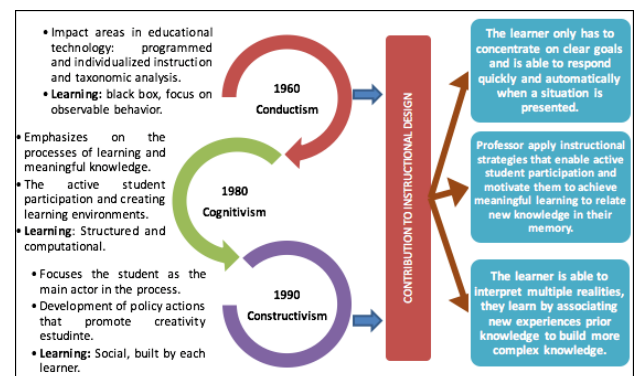

Figure 1 *Models of Learning and its contribution to Instructional Design.* Developed by Gonzalez, M [2016] with information of authors Benitez, M [2010] and Schuman [1996].

Behaviorism, cognitivism and constructivism are most commonly used theories for creating instructional environments and try to show how people learn; they conceive learning defined by Driscoll [2000] cited by Siemens, G. [2004] as "a persistent change in human performance or in potential performance which should occur as a result of the experience of the learner and their interaction with the world" [p.11].

However, these theories were developed in an era where the technological impact not permeated in the field of education.

Siemens, G. [2004] explains that when the theories of classical learning were added to the "technology" factor, result in the emergence of a new context that can hardly be treated under the traditional foundations of them, are not enough to understand the learning and is hardly feasible to adapt. In this situation, it requires a completely new approach, an alternative theory which technology is adopted to and guide learning activities towards the digital age.

Based on the above (with greater influence of cognitive theory), instructional design clothes on elements of a new concept called "Educational Technology" which is defined by the Association for Educational Communications and Technology [AECT, 2004]

As "the study and ethical practice of facilitating learning and improving performance through the creation, use, and management of appropriate technological processes and resources", and whose precursor is Johann Amos Comenius.

From these conceptions emerges Connectivism, the youngest of learning models that drives the importance of instructional design from use of technologies to support the teaching and learning processes. Also called "Learning theory for the digital age" coined by Stephen Downes and George Siemens, and defined as:

"That which directs the individual processes, not in an individualistic way, but as a result of the connections established on social networks.

The information is displayed in digital environments from technology and are fed by representatives of society, organizations and institutions, forming a flow of information and constituting individual learning ". [Reno L; 2014, p.200]

In the publication of Siemens, G. [2006b] explains characteristics of social networks of connective knowledge, same as mentioned in the following diagram:

Figure 2 *Characteristics of knowledge networks in the theory of connectivity.* Developed by Gonzalez, M. [2016] with information of Siemens, G. (2006b)

Connectivism is a contemporary theory of learning that requires students to develop various competencies, mainly related to the synthesis capacity, to recognize patterns of information and connections within the huge volume of resources that provide social networks while allowing the creation of new knowledge, acquired through the experiences of other members of the learning community. [Perez, 2010, p.8]

Based on the theories mentioned above and systemic approach to instruction, can be established that the methodology used for the design of instructions lies in four important pillars. The first related to the assessment and analysis of the needs of the student context; the second towards the establishment of learning objectives; third related with development of strategies and evaluation criteria; and last but not least, with regard to the design, implementation, evaluation and maintenance of techno-pedagogical materials tending to contribute to the implementation of the curriculum and competencies development in students.

For Yukavetsky, G. (2003), the instructional design phases constitute the skeleton upon which the instruction is designed, which are summarized in the following scheme:
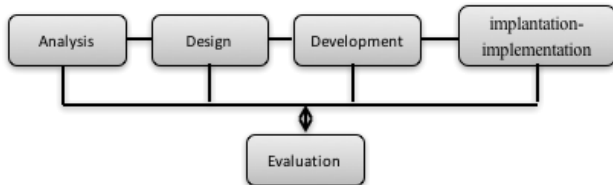

Figure 3 *Phases of Instructional Design.* Yukavetsky, G. (2003)

The contributions made by the various theories (mentioned above) on how people learn and the inclusion of technology as necessarily binding factor in the teaching and learning processes due to the new educational context, have laid the foundation for the generation of various methodologies applied to instructional design, considered the latter as the pillar of educational technology.

A. Instructional Design through the ADDIE Model

For Muñoz Carril [2015] instructional design methodologies applicable to the context of distance education under the model of Gagné, has an integrative approach which are considered aspects of the theories of stimulus-response and information processing models; Belloch, C. [2013] mentions these are:

- ADDIE (Analysis, Design, Development, Implementation and Evaluation)
- Performance-Based Training (PBT)
- Criterion Referenced Instruction (CRI)
- ASSURE (Analyze, Set, Select, Use, Require, Evaluate)
- Dick and Carey

The National Technological of Mexico (Largest institution of technological higher education in our country and to which belongs the Technological Institute of Pachuca).

Adopts the ADDIE model, and consider it as one that covers the essential steps for instructional design as claimed by Morales, B. [2014] and for the development of digital distance education materials commonly used in electronic medium and adaptable to teaching modalities of Blended Learning.

Just this model follows the basic structure requested by the instructional design (analysis, design, development, implementation and evaluation) mentioned by Yukavetsky, G. [2003], wherein the step of evaluation is presented as a constant at the end of development of each one of the initial stages, ensuring the opportunity for feedback (review, reflection and change) at any stage of the process.

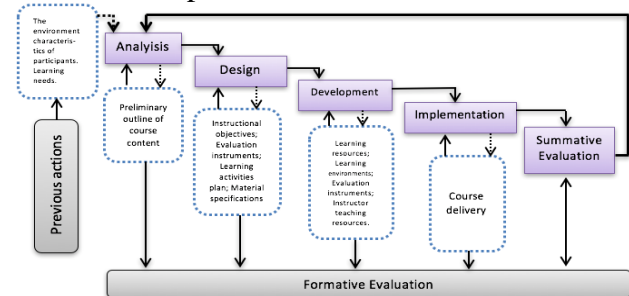In the following figure, show the results obtained with the application of ADDIE model in each of its phases.

Figure 4 *Outline of each phase of the ADDIE model.* Taken from Gonzales, S., & Mauricio, D. [2006, p.7)]

Each of the stages of the model provides a dynamic and flexible guide to develop an efficient and effective instruction. As seen in the chart above, a phase of pre analysis proposed by Cookson quoted by Gongora, P. et.al. [2012], indicated by double-headed arrows interrelating the different stages of the model, this means that there are relationships of mutual reciprocity and even when they are rational and chronologically sorted, occur the possibility of variations in sequence, without this alter the efficiency of the process.

The following table indicates the purpose of each stage of the ADDIE model and some elements of analysis.

Stages of the ADDIE methodology	Purpose	Sub-Variables
Analysis	In this the problem is defined, the source of the problem is identified and possible solutions are determined. Analysis of needs.	Define the characteristics of the student. Technological resources and media to teach in the technological platforms.
Design	Interface design, sequences, lesson design and control student is described.	Presentation, content and tools available for effective communication. Marking of the instructional objectives. Selection of teaching strategies. Design of course content considering electronic interactive media. Calendar of learning activities and synchronous and asynchronous meetings. Approach of the activities and tasks to be developed by the student.
Development	The materials to be used are produced.	Teaching and learning techno-pedagogical resources (Learning Resources - course materials) Assessment instruments: rubrics design
Implantation - Implementation	With the defined learning material, and having completed the development of the program, the learning platform and developed materials, the instructor must be available to start teaching.	Administer the management plan through monitoring by the Platform Manager
Evaluation	The effectiveness and efficiency of instruction in each of the phases of the model will be evaluated.	Design of mechanisms for diagnosis, monitoring and certification of competence objectives achieved.

Table 1 *Stages of ADDIE model and study variables.* Prepared by Gonzalez, M. [2016] with reference to the quoted by Chambers, D. [2007] and Cacheiro, M [2011].

B. Instructional Design in Distance Education

Distance education defined by Schlosser and Simonson [2002], cited by Martinez, A. [2009] is that: "Based on a formal institution where the learning group is separated, and systems of communication and interaction are used to connect students, resources and instructors" (p.109).

It is evident that the instructional design under this type of education is more complex, because it requires detailed planning of the course, where are defined: objectives, strategies, ways and resources to guide student learning.

It is therefore essential to incorporate various technological resources in the design of instruction; although this should not be exclusive to this modality.

The break of the traditional pattern of looking at teacher daily in front of the classroom and students to interact with it in space and time under direct instruction, forced to change the traditional perception that people have of the teacher as mere transmitter of knowledge, now becoming facilitator of learning and the student acquires greater commitment as an active entity and self-directed in the process, where two-way communication remains a key element to reach the aim and instruction design the greatest of the challenges to achieve significant processing of information and learning.

With greater emphasis on communication, online modality engages teachers to maintain a direct tutorial action with the student, as this largely depends on the interest and motivation of the student, and their permanence or abandonment of the project.

Consequently, a good instructional design facilitates not only the effective conduct of students, but speed up the development of activities that teachers should perform, inherent in their function.

For it the design of instructional materials and the use of techno-pedagogical tools become essential to help in improving educational quality in the context of distance education.

The flipped classroom

Use of Information and Communication Technology (ICT) has helped to streamline the process of teaching and learning by designing scenarios in which the main actor is the student, who develops knowledge and skills from the guide and application by the teacher-facilitator of methodological strategies mediated by technology and designed to create a more personalized learning.

Customize learning involves, according to Davies, R. et.al. [2013], "identifying the characteristics and needs of each student to provide relevant and meaningful instruction, which allows flexibility in scheduling, tasks and learning pace."

A pedagogical model that uses technological tools to implement methodological strategies to facilitate and make flexible the process of teaching and learning, and thus allow students to progress at their own pace and according to their personal and contextual needs, is the called "Flipped Classroom".

Flipped classroom means that the activities traditionally carried out in the classroom, now are done outside of it and vice versa.

Ambriz, M. [2015] states that the teacher "before teaching class produces, seeks, cure digital material or designs it using Web 2.0 tools"; and through such material it presents the content to students. According to Paz, A. et. al. [2015], when students review the content at home, have more time to apply in classroom theories and concepts learned, with the advice of the teacher who is responsible for verifying the understanding of the issues.

Based on the above, the flipped classroom can be conceived, with reference to the cited by Martinez, P. et.al. [2015] as "a model that favors active learning, peer instruction and attention to different learning styles" [p.15].

In addition, according to Horn, M.B. [2013] gives students more control over their learning, because they decide when it is necessary to review again the content they have not understood or move faster to which they already dominate.

A. Background on the implementation of the Flipped Classroom

According to various investigations, Lage, M.J., Platt, G.J., & Treglia, M. [2000], were the first to implement the inverted classroom as a teaching method in a course of Introduction to economics at the University of Miami. Trying to attract students with different learning styles.

They used resources such as lectures, PowerPoint presentations and videos to introduce students to the contents and that they could study outside the classroom, such resources were available in the computer labs of the School of Business. Students occupied the class time to analyze and apply learning through exhibits, experiments, group discussions, among other strategies. Ambriz, M. [2015].

Crouch, C.H., & Mazur, E. [2001] are other precursors of the flipped classroom, they developed a strategy called "peer instruction" and applied it in two courses of Introduction to Physics at Harvard University. With peer instruction involving students in the classroom through activities to apply the basic concepts, they learned prior way by reading the topics, for later explain it to their peers.

In 2004 Salman Khan, an American professor, a graduate of Massachusetts Institute of Technology (MIT) and the University of Harvard, offered his cousin Nadia of 13 years old, give math lessons at distance, for which he used a drawing software for write equations, then recorded video lessons and shared them with her over the Internet.

Over time, many other people began to use, noticing the scope of its work, he decided to create in 2006 an educational non-profit organization, thus resulting in the Khan Academy, a platform with micro classes on various areas of knowledge, presented through video tutorials. [Thompson, C., 2011].

In 2007 Bergmann, J., & Sams, A. [2012] began using video and screen casting applications to record demos and presentations for their students to not lose classes when they had to attend contests, sports activities or other academic events. They discovered a low - cost software to record PowerPoint presentations and published lessons on the internet.

Bergmann, J., & Sams, A. [2012] argue that the inverted classroom allows offer to students personalized education, relevant to their learning needs, allowing them to move at their own pace and develop competencies for self-directed learning.

In 2010 Stone, B. [2012] applied the flipped classroom in a course of genetic diseases at the University of Missouri. Students were reviewing short videos before class about the contents and demonstrated have completed this activity by solving a questionnaire online or doing some thinking about it.

In class, working in teams to develop activities such as concept mapping, role-playing, case studies, problem-based learning, among others.

Through a talk at TED (Let's use video to reinvent education) conducted by Salman Khan in 2011, the flipped classroom model achieved greater popularity.

Gaughan, J.E. [2014] applied this model for the first time in 2013, in Pueblo University at Colorado State for a world history course. Provided students with links to videos on the topics of study and resources that wanted to analyze further. The result were students more involved with the content and with the enthusiasm and knowledge necessary to participate actively in class discussions.

The flipped classroom model has been implemented by many members of the teaching community of the United States in higher education, mainly in the area of Medicine. In Mexico, it is until 2014 when started with the first practices of its implementation in institutions of higher midlevel.

It is a widely accepted and relatively new model, which is still conducting research to determine its benefits and advantages for learning, compared to traditional models.

Network, F.L. [2014] states that the flipped classroom is not only to pass the "group learning to custom, it is necessary to create a dynamic and interactive environment where teachers will guide students and promote their creative participation in the course".

To succeed in implementing the flipped classroom model is essential: The well - structured programming made by the teacher about educational experiences, which take into account access to material support inside and outside the classroom, the practice of active pedagogy in small teams to permit verification of acquired knowledge, facilitate evaluation and allow a working fluid rhythm.

And, adjusting successful strategies that ultimately will improve the academic performance coupled with the satisfaction in using the model. [Martinez-Olvera et. al., 2014]

Methodology

Technological Institute of Pachuca currently provides an educational service under the face and distance modality. In the state of Hidalgo, the latter, is offered in three academic units located in: Jacala of Ledezma, Sahagún City and Social Reinsertion Center of Pachuca (the latter unit is not part of the study population).

Section of development of this research was conducted through two stages: implementation of instructional design (ADDIE model) and application of the flipped classroom model; then are detailed the results derived from the experiences, with the participation of 28 teachers and 57 students, attached to three educational programs in the modality of distance education, distributed as follows:

Academic unit	Educational programs			
	Degree in administration	Computer Systems Engineer	Industrial Engineer	**Total**
Sahagún	0	0	26	26
Jacala	7	24	0	31
Total Students	**7**	**24**	**26**	**57**

Table 2 *Distance education students.*

The academic unit of Jacala of Ledezma takes an educational distance modality, where time academic load is used by teachers to give his professorship (from 3 to 5 hours a week depending on the number of credits); while the Sahagún City unit maintains a virtual style, allowing the teacher to monitor and provide advice on specific issues within hours of the academic load.

The assignment of students to each of them was not performed at random due to own registration procedures of institutional dynamics.

It is important to mention that students who participated in the research belong to different semesters (on various subjects) and were organized to carry out research in two groups of analysis considering the characteristics of each academic unit: Group 1: Jacala of Ledezma and Group 2: Sahagún City.

Quantitative study was raised with descriptive cutting, using to obtain information the following support tools:

Instruments	Applied to
Checklist 1: Monitoring implementation processes of ADDIE model Checklist 2: Monitoring the teaching regarding the implementation of the flipped classroom strategy.	28 Teachers
Questionnaire 1: Student satisfaction regarding the quality of instructional design and experience with the flipped classroom strategy.	57 Students
Interview: Teaching experience regarding the implementation of the ADDIE model for instructional design and their perception of the dynamics of learning and student autonomy with the flipped classroom.	28 Teachers

Table 3 *Data collection tools*

Tracking and monitoring through checklists 1 and 2 were carried out for three periodic revisions made to the structures of the courses in the Moodle platform in the presence of teacher-designer-instructor (design phases, development and implementation of the ADDIE methodology).

The second instrument, Questionnaire 1 was applied online to the two focus groups (mentioned above), once the first half (January-June 2016) concluded.

Finally, the result of experiences is derived from an interview with teachers at the end of the semester school cycle. The findings cast by the instruments are mentioned in the results section.

Development

A. Stage 1: ADDIE Instructional Design

The teaching methodology used for the instructional design of the themes of each of the subjects was guided through the steps indicated by the ADDIE Model, allowing the teacher manage as a contextualized way the teaching, learning and assessment activities. TecNM [2015].

Prior to the analysis phase, teachers were trained on the model and the way in which they should implement, providing the guide "Structure format" (Table 4) showing the elements to consider for course design in Moodle platform. With reference to Table 1 (Steps of ADDIE model and study variables), the following describes each of the activities in the project:

Analysis Phase

Activities	Description
Characteristics of the study population	Students of this modality have very particular characteristics, ranging from academic unit to another. In the Academic Unit of Jacala is offered college career in Business Administration and Computer Systems Engineering. Students are between 19 and 55 years, 14 men and 17 women from the location or nearby communities. A total of 31 students. Most of them work, either in municipal institutions or private businesses. Some are already married and with children; others still live with their parents, but they have to contribute to household spending. His interest in further study is due to the desire they have to be placed in superior positions of work to improve their living conditions and contribute to the development of their locality through the implementation of innovative projects. They are students who had not worked with the educational distance learning, however, they are easily adapted to the use of own technological tools of the modality. Courses are taught through online sessions either by chat, video call or video conference on a schedule of 16 to 21 hours; however, not all students can attend them, because of their different activities. In the Academic Unit of Sahagún City the Industrial Engineering is taught. During the period January-June 2016 the number of students enrolled was 26. His age is in the range of 19 to 41 years. Of these only five are women. All are employees of a company in the region, who want to finish a college career for promotion to higher positions within it. Most of them already have family responsibilities. In this unit courses are taught virtually, because students work in different shifts in the company and may not coincide in the same time to take their classes. Therefore, communication they can establish with teachers is totally asynchronous.
Technological resources available	Students from both units have access to an educational platform from which they can download the resources available in each course and upload their assignments and take exams. There are in Jacala academic unit classrooms with computers, speakers, cannon, videoconferencing equipment and Internet access. In the Sahagún academic unit does not have a classroom set, so students must work with computer equipment and personal Internet connection. For communication through video calls, it offers free software like Skype or Zoom.

Table 4 *Characteristics of the study population and technological resources available*

Design Phase

For the design of teaching and learning activities each of the courses, special attention was paid in the form of sequence and organize the contents of each subject, for which a section indicating the elements to be integrated was used during the course design:

No.	Elements in the structure	No.	Elements in the structure
1	Name of the subject	12	Official program of the course
2	Image or animation allusive to the subject	13	Teaching instrumentation of the subject (tutorial)
3	Subject data (two - column table)		**For each unit of learning:**
4	Name of the teacher who teaches the subject	14	Abstract title
5	Teacher photography	15	Study period
6	Presentation of the subject (according to current program)	16	Specific topic competency
7	Assessment and Accreditation of the subject	17	Description Table to evaluate activities: activity, weighting, delivery date, evidence and generated competency
8	Specific competencies of the subject	18	Learning activities design
9	Previous competencies	19	Design or use of techno-pedagogical resources
10	Scheduling dates of beginning and end of each learning unit and evaluation periods.	20	Self - Assessment Test / Evaluation
11	Diagnostic evaluation		

Table 5 *Elements of format for subject review in platform.* Developed by Gonzalez, M. [2016] with reference information of TecNM [2015]

The structure was used by each teacher to design courses set in the Moodle platform, some of them developed before starting the semester and others during the course of it, ensuring that every unit of learning and was completely finished respecting the scheduled startup and shutdown dates of units.

Development and implementation phase

To support the design of teaching and learning activities, teachers employed and/or built various techno-pedagogical materials, used as teaching resources in the educational process in the development phase, also students generated some other derivatives of learning activities requested by the teacher during the implementation process. As result, the generated resources are mentioned:

Techno-pedagogical materials	Used	Designed	Teacher	Student
Videos	X		X	X
Podcast		X	X	X
Documents	X	X	X	X
Electronic presentations in PowerPoint	X	X	X	X
Electronic presentations in Prezi		X		X
Cognitive maps		X		X
Digital books	X		X	X
Web page	X	X	X	X
Blog		X		X
Infographic		X	X	X
Digital billboards		X		X
Google Forms		X	X	X
Interactive activities		X		X
Skype	X		X	X
Zoom	X		X	X
Messaging platform	X		X	X
Email	X		X	X
Google Drive	X		X	X

Table 6 *Techno-pedagogical materials and mass media.* Developed by Martínez, K. [2016]

Based on the importance of quality in instructional design, during the course of the semester three revisions to the structures of the subjects were performed.

The first one, for diagnostic purposes to detect those elements that require adjustments in their development and/or that may have been missed by the teacher during design; in which were asked corrections and/or adjustments to the teacher. In the second revision main attention was paid to the design of learning activities, where he was asked to fulfill the instruction with the following requirements:

Elements	Description
What?	Specify clearly the product or evidence requested to the student.
For what?	The objective of the activity, indicating how and how impacts on the acquisition of skills is established. That is, the raison of the activity.
With what?	Teaching resources (used or designed) teacher provide to the student as a guide for the development of learning activities, clearly defining the resource name and the exact location thereof are defined. Minimum must provide one resource for requested activity. It is important that teachers, if necessary, provide links to resources located on the Web (e.g. tutorials) that help in the development of activities.
How and how much?	Here are defined the criteria to be considered for making the product or evidence, specifying the elements that will cause evaluation in three stages: structure, content and complements. The rubric is made and should detail all the criteria to assess, the weightings of each of them and their performance levels acquired.
When?	Finally, should specify how the document should be named containing the product or evidence and the requested format. The date and time of opening and delivery of the activity are established.
Who?	It is important to place the full name of the teacher who design instruction learning activity requested.

Table 7 *Elements in instructional design for learning activities.* Proposed and developed by González, M. & Martínez, K. [2016]

Finally, the last review was conducted in order to provide timely follow-up regarding the teacher-student dynamic, derived from the flipped classroom strategy, used in developing learning activities, monitoring:

- The compliance of scheduled days of start and end of learning units and activities delivery; avoiding lag of more than a week without justification.
- The teaching and learning strategies employed and the dynamics of the same.
- Advice and feedback that teachers performed, considering not only the on time delivery and the grade the student got in each learning activity (diagnostic, formative and summative) but equally the comments and/or observations that are resulting therefrom.
- Timely care through electronic means of communication, of student academic needs.
- Follow up to the evaluation of learning units and publication of results.

Evaluation phase

As explained above, this step is not presented at the end of the model, but as a flashing element in each of the previous stages. This was implemented during the design of each of the instructions of the learning activities (formative and summative), same that answer the question of: how and how much? mentioned in Table 5.

B. Stage 2: Implementation of Flipped Classroom

The strategy was applied in both groups inverting activities traditionally performed in the classroom. Students undertook experience through the use of educational materials designed or previously selected by the teacher at the stage of "instructional design - development phase" for each of the subjects. The characteristics of the focus groups are:

Implementing "*Flipped Classroom*"	
Group 1: Jacala of Ledezma Unit	**Group 2:** Sahagún City Unit
Participants: A group of 31 students.	**Participants**: A group of 26 students.
Modality: Distance Education	**Modality**: Virtual Education
Teacher participation: He served as guide and facilitator in the process, using their academic load (hours - assigned class) to develop each of the issues addressed in the curriculum through collaborative activities with the student; under the three stages of a training session: openness, development and closing.	**Teacher participation**: He served as guide and facilitator in the process, using their academic load (hours - assigned class) to advise or discuss specific derivatives points of the study and preliminary analysis of techno-pedagogical materials and / or those arising during the development of learning activities by the student.
Student participation: Review, analyzes and studies the techno-pedagogical materials prior to class. Develops learning activities (diagnostic, formative and summative) during and after the learning sessions.	**Student participation**: Review, analyzes and studies the techno-pedagogical materials prior to the counseling session. Develops learning activities (diagnostic, formative and summative) outside learning sessions.

Table 8 *Characteristics of the study groups.* Prepared by Gonzalez, M. [2016]

With the support of teaching resources (listed in Table 5), used as means of transmission and acquisition of information and the methodology used to design instructions in learning activities and assessment rubrics (Table 6), is sought that the student will find motivation and autonomy during the analysis and study of resources and at the time of development of their activities.

With the implementation of the flipped classroom, a learning environment focused on student learning was represented. Through Moodle platform, teachers and students converged, allowing interaction of the actors through communication tools such as forums, chat, skype, zoom and email.

Teaching and learning strategies used were: project-based learning, collaborative learning, electronic evidence portfolios, documentary and field research, production of educational materials in various formats, case studies, solution of practical exercises, analysis of environment and social context, infographics, etc.

Students were free to consult and download all teaching resources placed on the platform, with at least one week prior to the delivery of products or evidence; asking the teacher keep them enabled even if the delivery and valuation period had been completed, in order that the student had them available at any time to carry out activities whose competencies have not been achieved and should be delivered for second chances, this way they administer their time depending on the timing of delivery of activities and evaluation periods (developed in the design phase of the ADDIE methodology).

Teachers must continue evaluating the contents of the subject and performance of their students.

It is intended that with the support of the flipped classroom, the teacher can increase the value of face to face time with students and invest in the design of learning materials and instructional design.

The purpose is not to compare the results of both groups based on the results or grades obtained at the end of the semester; but to share the experiences that each of the groups (given their characteristics) and teachers who participated in the research had with ADDIE model application and flipped classroom.

Results

A. Checklist 1: Monitoring implementation processes of ADDIE model

During the first review of structures were found omissions in the development of the elements of instructional design, same that were disappearing with feedback to the teacher, who initiated the correction process derived from the observations. The teacher was requested that adjustments be made so that will not affect schedules for the development of activities by students.

Of the 20 items considered for instructional design (Table 4), it was detected more frequently in settings and/or redesigns in the following items:

Elements in the structure	Number of teachers who omitted elements		
	First checking	Second checking	Third checking
Teacher photography	13	8	8
Assessment and Accreditation of the subject	10	3	2
Scheduling table of beginning and end dates of each learning unit and evaluation periods.	22	8	5
Diagnostic evaluation	4	2	0
Teaching instrumentation of the subject (tutorial)	16	7	5
For each unit of learning:			
Study period	11	5	3
Description table of activities to evaluate: activity, weighing, delivery date, evidence and generated competency	15	8	3
Learning Activities Designing	18	8	5
Design or use of techno-pedagogical resources	8	4	2

Table 9 *Items adjusted more frequently during the review of structures*
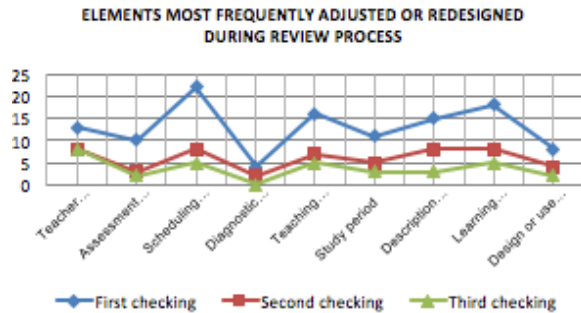
Graph 1 Elements of the structure of the courses most frequently adjusted or redesigned during the review process

As can be seen the trend in settings of each of the elements was down as subsequent revisions that were made, because the teachers made adjustments to the structures of the courses. The 78% of teachers during the first review had observations on the activities scheduling table, which depends largely on the development of the didactic instrumentation, where are established, among other things, the start and term dates of learning units and assessment. The percentage of teachers with observations on the latter element is 54%, where the publication on time of the instrumentation on the platform was the main problem. Regarding the Specifications for Assessment and Accreditation of the subject, 35.7% of teachers not exactly defined conditions of first and second chance for students who have the right set out in the guideline, a condition that substantially improved with 92.8% of teacher participation in subsequent revisions.

However, the element considered by the teacher with the highest degree of difficulty in its development, is related to " Design of Learning Activities " where in first review 64.3% of teachers saw the need to make adjustments in instruction. The main causes of the problem are:

- Not clearly explain the purpose of the activity or learning and development of competency.

- Teaching resources that the teacher provides for the development of learning activities were not sufficient and/or did not specify clearly the location of the same.
- The evaluation rubrics partially explained the criteria to be evaluated, but not deepened in form and structure; also they lacked performance levels.

As to the development and implementation phase concerning the Design or use of didactical and techno-pedagogical resources, the findings about the participation of teachers are:

- 100% of teachers provided teaching resources to students to develop their learning activities (33% over 2 resources); however, 28.3% of teachers during the first review, had observations because the statement did not detail the exact location of teaching resources to support student, percentage decreased in the second and third follow-up to 7%.

B. Checklist 2: Monitoring the teaching activity regarding the implementation of the flipped classroom strategy.
- In the implementation phase, within the third revision of courses structures, conducted to teachers were found:
- 68% of them met the scheduled dates for the beginning and end of their learning units during the course of the semester, 21.4% were outdated between 1 to 2 weeks and 10.7% over 2 weeks.
- The 28 teachers who participated in the project used various teaching and learning strategies under the flipped classroom dynamics (described in Step 2 of this document).

C. Questionnaire 1: student satisfaction regarding the quality of instructional design and experience with the flipped classroom strategy.

The results derived from the opinion of the 57 students compared to teacher performance in the field of instructional design and experience with the use of the flipped classroom are:

- 84% of teachers was characterized by always show interest and motivation, in constant and timely manner attended the training sessions scheduled in the academic schedule of the subject. His attitude was of disposition, attention, resolved all doubts of cordial and friendly manner, either synchronous (chat) or asynchronous (forums, posts).

- 73.2% designs instructions clearly and precisely specifying what, how, when, with what and how to deliver the learning activities. However 26% showed difficulties omitting information, resources, and specifications in form and structure.

- The previous section explains largely why only 45% of teachers, properly designed evaluation rubrics, specifying the criteria, elements and features to value learning activities. 37% partially made rubrics omitting the specification of performance levels and not detailed in structure and form each criterion to evaluate.

- 91% of teachers at the start of the course published the schedule of activities, dates of assessments first and second chance; 87% released didactic instrumentation. While most teachers published on time and the schedule of activities, it was observed that only 81% of them respected the scheduled dates in himself, regarding the evaluation of first and second chances.

- As for second chances, 73% of teachers respected the guidelines of accreditation, evaluating them according to the attention of observations made at the first opportunity (i.e., were developed by the student exclusively activities unaccredited or undelivered first opportunity).

- Generally, 61% of teachers, and sometimes 23% of them, used pertinently information and communication technologies (WebEx, videoconferencing, chat, zoom, others) to provide advice and feedback.

- As for the use of teaching resources (anthologies, software, electronic presentations, notes, practice guides, books, study guides, etc.) 70% of teachers makes frequent use of them and 30% occasionally, but all use the least one for design activities. 83% of the teaching materials available to the student, show a positive impact as tools that contribute to achieving the learning objectives.

- It was found that only 62% of teachers, feedback activities accurately and timely manner in order to improve students levels of academic achievement and only 50% evaluate (qualify) in a timely manner (within no more than 5 business days) activities requested.
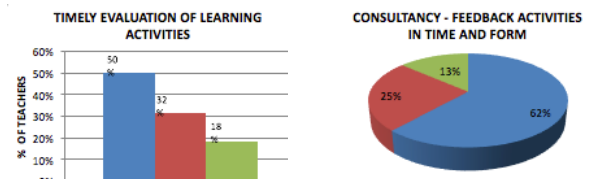
**Graph 2** *Feedback, advice and timely evaluation of learning activities*

- 93% of teachers are seeking to achieve meaningful learning in their students, adequately relating the themes of each learning unit with a real context of social and professional type.

- Regarding the work environment, 66% of teachers generally led collaborative, participatory, dynamic and motivating work.

- Students believe that the main competencies promoted with the implementation of the "flipped classroom" supported by instructional design were:

GONZÁLEZ-MOSQUEDA, Mayra, MARTÍNEZ-TAPIA, Karla, GONZÁLEZ-CERÓN, Arturo and BERNAL-VELÁZQUEZ, Josefina. Importance of instructional design for the implementation of Flipped Learning Model in the modality of distance education. ECORFAN Journal-Spain. 2015 2-3: 140-160

Analysis, reflection and synthesis; organize and plan; decision making; research ability; teamwork; creativity and autonomy; as shown in the following graph.
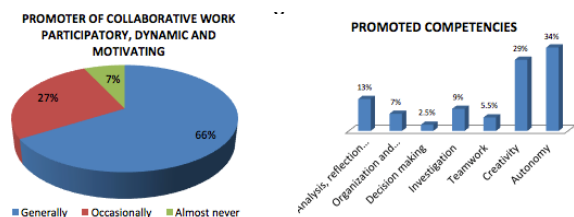
Graph 3 *The teacher as promoter of working environment and competencies with the "flipped classroom"*

- Used a scale of 1 to 7 depending on the impact on competency generated (where 7 is the highest) it shows that 34% of students consider that autonomy competency is the one that got further development, followed by creativity with 29%.
- 78% of students believe that the Instructional Design developed by the teacher, encouraged the development of activities and learning sessions under the strategy "flipped classroom", while 22% say that lacked specification of instructions and providing support resources with learning objectives to be achieved.

- Finally, within a scale of 0 to 10, students evaluate the performance of the 28 teachers as instructional design, as follows:
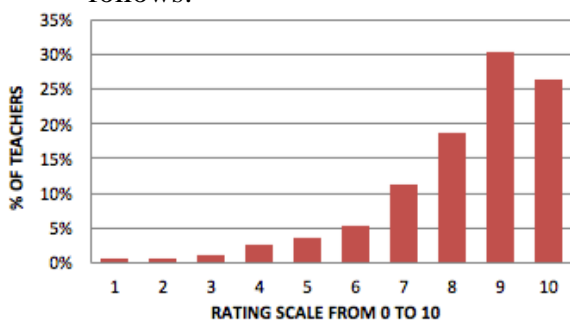
Graph 4 *Evaluation of teacher performance as an instructional designer.*

- As shown in the graph, students evaluate 75% of teachers with more than 8 points score, a percentage that matches the above point.

Interview: Teaching experience regarding the implementation of ADDIE instructional design model and its perception regarding the dynamics of learning and student autonomy with the flipped classroom.

The 100% of teachers believe that instructional design is an indispensable tool for distance learning, especially when communication with students is not always synchronously, and is required to document in writing the specifications of each of the learning activities requested to student.

They are aware of the importance of previously preparing the calendar of activities and evaluation periods; however, find it difficult to adapt to the scheduled times, as many times depend on student responsibility and compliance on the previous study of resources and timely attendance to learning sessions.

Particularly teachers who participated in the Group 1:

xxJacala of Ledezma, proved to have greater complexity to accommodate to the scheduled times, stating that the main causes of phase shift must be among other things, that while learning sessions are used to the development of thematic content using strategy of "flipped classroom"; some students not previously analyzed the resources causing sessions to become professorships by the teacher. Similarly stated that there was tardiness and absenteeism by students who in turn did not deliver on time and requested activities.

In Group 2: Sahagún City, teachers do not externalized problems in terms of compliance in a timely manner by the student; they consider that most students are responsible for their learning and study resources provided at prior learning session, using this latter space for advice and feedback through the use of various teaching strategies under the "flipped classroom".

This allowed teachers time optimization and the use thereof for the design of other activities and for student the acquisition of various competencies and greater autonomy.

Most teachers said the excess of inherent activities in teaching practice plus instructional design, development of teaching resources, assessment rubrics, development of instructions, etc., do not allow them to timely respond to learning activities submitted by students, impacting negatively on the timely delivery of qualifications and publication of the same; presenting this problem with greater incidence in the teachers who taught classes in Group 1. This is explained in some way, because in group 2 as a result of the virtual modality, the teacher can use, sometimes, the scheduled academic session for the development of design activities and teaching resources necessary for teaching; visibly optimizing time and investing it favorably not only this but on closer attention to student needs, an advantage Group 1 does not possess.

As for the design of instructions, the main difficulty of teachers was related to the development of assessment rubrics, this due to the time required to invest in the development of each.

During the evaluation stage of the ADDIE model used for instructional design, 83% of teachers said they felt a personalized support during the three reviews made structures, same that allowed them to modify and/or improve the structural design and content of the subject, impacting positively on the development of learning activities by students to have clear and precise instructions. 17% (corresponding to 5 teachers) expressed have felt discomfort when receiving the reviews, they did not agree with the specifications requested for the design instructions and partially complied with the structure required for the design of their subject.

Conclusions

The study allows to highlight the importance of effectively implementing an Instructional Design, as a guide to ensure that the student autonomously develop with minimal conflict the learning activities entrusted, avoiding those difficulties arising from not understanding instructions, omitting information, lack of educational support resources, lack of evaluation criteria and activities assessment rubrics, etc.; impeding the satisfactory range of competencies, without forget the responsibility as students have on their learning process, complementary element to achieve academic goals.

Although development of an instructional design takes time and duplication of effort by the teacher, the short-term benefits for himself and the student are palpable, this will allow to work more agile, with innovative and flexible teaching resources to our educational model.

Offering students a structured course design keeping always updated content and activities consistent with their needs and interests, and invest more in effective bilateral communication type.

As it proper implementation of instructional design is achieved, it will allow the use of various teaching strategies (such as the flipped classroom) and using techno-pedagogical resources to get a greater impact on the achievement of learning objectives which contribute to the generation of competencies required by each program of study.

By implementing the flipped classroom highlights the importance of competencies as teachers must have the management of ICT in the teaching and learning processes, hence the need for prior training and induction to the use of Moodle platform, design of teaching tools and web surfing, the latter for the teacher to learn to be selective about teaching resources to provide the student.

Because of these depend largely the motivation student shows during participation at learning meetings and development of their activities.

The functionality of any model, teaching strategy and/or use of resources, depends on the participation and disposition of students, the work and professionalism of teachers and the support of experts in multimedia and pedagogy. The results provide the starting point for identifying variables that through analysis can identify areas for improvement and generate new opportunities for the community of Technological Institute of Pachuca, contributing at the same time with parallel needs of other educational institutions.

References

Ambriz, M. L. S. (2015). *Formación docente: aprendo a invertir e invierto mi clase/Teacher training: learning to invest and invest my class.* Tecné.

Association for Educational Comunication and Technology (2004). *The Meanings of Educational Technology.* Retrieved July 5, 2016 from http://www.aect.org/

Benitez, M.G. (2010). *El modelo de diseño instruccional Assure aplicado a la educación a distancia.* Tlatemoani, Revista Académica de Investigación, n°1. Retrieved July 5, 2016 from http://www.eumed.net/rev/tlatemoani/01/pdf/63-77_mgbl.pdf

Belloch, C. (2013). *Diseño instruccional.* Universidad de Valencia. Retrieved July 5, 2016 from http://www.uv.es/~bellochc/pedagogia/EVA4.pdf

Bergmann, J., & Sams, A. (2012). *Dale la vuelta a tu clase.* Biblioteca innovación.

Cacheiro-González, M. L. (2011). Recursos educativos TIC de información, colaboración y aprendizaje. *Pixel-Bit: Revista de medios y educación*, (39), 69-81.

Crouch, C. H., & Mazur, E. (2001). *Peer instruction: Ten years of experience and results.* American journal of physics, 69(9), 970-977.

Davies, R. S., Dean, D. L., & Ball, N. (2013). *Flipping the classroom and instructional technology integration in a college-level information systems spreadsheet course.* Educational Technology Research and Development, 61(4), 563-580.

Gaughan, J. E. (2014). *The flipped classroom in world history.* History Teacher, 47(2), 221-244.
Gonzáles, S., & Mauricio, D. (2006). *Un modelo blended learning para la enseñanza de la educación superior.* Virtual educa, 20-23.

Góngora Parra, Y., & Martínez Leyet, O. L. (2012). *Del diseño instruccional al diseño de aprendizaje con aplicación de las tecnologías.*

Horn, M. B. (2013). *The transformational potential of flipped classrooms.* Education Next, 13(3).

Lage, M. J., Platt, G. J., & Treglia, M. (2000). Inverting the classroom: A gateway to creating an inclusive learning environment. *The Journal of Economic Education*, *31*(1), 30-43.

Martínez, A. (2009). *El diseño instruccional en la educación a distancia. Un acercamiento a los modelos.* Apertura, Revista de innovación educativa, Año 9, núm. 10 (nueva época). Universidad de Guadalajara.

Martínez-Olvera, W., Esquivel-Gámez, I., & Castillo++, J. M. (2014). *Acercamiento teórico-práctico al modelo del aprendizaje invertido.*

Martínez, P. S., Rodríguez, E. Q., & Rodríguez-Arroyo, J. A. (2015). *Curso híbrido y de aula invertida apoyado en MOOC: experiencia de autoevaluación.* Apertura, Revista de Innovación Educativa, 7(1).

McLaughlin, J. E., Roth, M. T., Glatt, D. M., Gharkholonarehe, N., Davidson, C. A., Griffin, L. M., ... & Mumper, R. J. (2014). *The flipped classroom: a course redesign to foster learning and engagement in a health professions school.* Academic Medicine, 89(2), 236-243.

Morales, B., Edel, R., & Aguirre, G. (2014). *Modelo ADDIE (análisis, diseño, desarrollo, implementación y evaluación): Su aplicación en ambientes educativos*. Los Modelos Tecno-Educativos, revolucionando el aprendizaje del Siglo.

Muñoz Carril, P. C. (Abril de 2015). *Modelos de diseño instruccional utilizados en ambientes teleformativos.* Revista Digital de Investigación Educativa Conect@2. Retrieved 5 July, 2016, from http://www.revistaconecta2.com.mx/archivos/revistas/revista2/2_2.pdf

Network, F. L. (2014). *The four pillars of FLIP™.* Retrieved 5 July, 2016, from http://www.flippedlearning.org/cms/lib07/VA01923112/Centricity/Domain/46/FLIP_handout_FNL_Web.pdf.

Paz, A. P., Serna, A., Ramírez, M. I., Valencia, T., & Reinoso, J. (2015). *Hacia la Perspectiva de Aula Invertida (Flipped Classroom) en la Pontificia Universidad Javeriana desde una tipología de uso educativo del Sistema Lecture Capture (SLC).* Conferencias LACLO, 5(1). http://www.revistaconecta2.com.mx/archivos/revistas/revista2/2_2.pdf

Pérez, M. E. D. M., Cernea, D. A., & Martínez, L. V. (2010). Objetos de aprendizaje 2.0: Una nueva generación de contenidos en contextos conectivistas. *Revista de educación a distancia*, (25).

Renó, L. (2012). *Transmedia, conectivismo y educacion: estudios de caso.* CAMPALANS, Carolina; RENÓ, Denis; GOSCIOLA, Vicente. Narrativa transmedia: entre teorías y prácticas. Bogotá: Editorial Universidad del Rosario.

Saettler, P. (2004). *The Evolution of American Educational Technology.* USA: Information Age Publishing Inc.

Salas, D. M. C. (2007). *Impacto del Diplomado Maestro Virtual, Impartido en Modalidad 100% Virtual*, en la Planeación, Presentación y Desarrollo de la Cátedra Presencial en la Universidad Tecnológica de Pereira, Colombia - Edición Única.

Siemens, G., & Fonseca, D. E. L. (2004). Conectivismo: Una teoría de aprendizaje para la era digital. Retrieved 5 July, 2016.

Siemens, G. (2006b). *Connectivism: learning theory or pastime of the self-amused?* [blog Elearnspace]. Retrieved 5 July, 2016, from http://www.elearnspace.org/Articles/connectivism_self-amused.htm

Schuman, L. (1996). *Perspectives on instruction.* Retrieved 5 July, 2016, from http://edweb.sdsu.edu/courses/edtec540/Perspectives/Perspectives.html

Stone, B. B. (2012). *Flip your classroom to increase active learning and student engagement.* In Proceedings from 28th Annual Conference on Distance Teaching & Learning, Madison, Wisconsin, USA.

Thompson, C. (2011). *How Khan Academy is changing the rules of education*. Wired Magazine, 126, 1-5.

Yukavetsky, G. (2003). La elaboración de un módulo instruccional. *Centro de Competencias de la Comunicación Universidad de Puerto Rico en Humacao.* Retrieved 5 July, 2016.