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In this number is presented in Section of Education an article Importance of instructional design for the implementation of Flipped Learning Model in the modality of distance education by GONZÁLEZ-MOSQUEDA, Mayra, MARTÍNEZ-TAPIA, Karla, GONZÁLEZ-CERÓN, Arturo and BERNAL-VELÁZQUEZ, Josefina, in Section of Crowdsourcing an article Facilitating nomadic interaction through a self-managed area-based support by GÓMEZ, Victor, MENDOZA, Sonia, GARCÍA, Kimberly and DECOUCHANT, Dominique, in Section of Operation of Academics Corps an article Human resource management at the Instituto Tecnológico de Pachuca by ROJAS, Rosa, CABRERA, Inocencia, GARCÍA, Patricia, MONTEERRUBIO, Elisa, in Section of Regional Development an article Spain's Energy Policy: Impact of the Debt Crisis in its Renewable Energy Sector Reaching the EU 2020 Goals by VARGAS, Oscar René, RAMOS, María, GARCÍA, Lupe, in Section of Fiscal an article Investment Objectives and Strategies in Behavioural Portfolio: Empirical study in the Iran capital market by SHAHMANSURI, Esfandyar, RAHNAMAY-ROODPOSHTI, Fereydon, NIKOUMARAM, Hashem, in Section of Architecture an article Emergency Care for Local Address Hidalgo National Water Commission by KAMPFNER, Oscar Armando and CAMACHO-ZUÑIGA, José, in Section of Networks an article SCORM for Learning basics of programming by ENCISO, Angélica, LEÓN, Eric, GONZÁLEZ, Mayra, HERNÁNDEZ, Leticia.

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## 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.

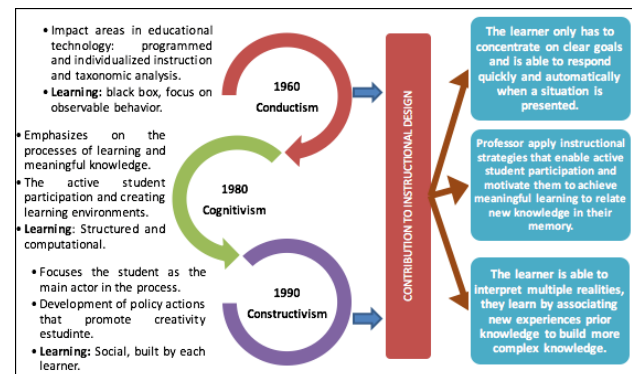
This requires a methodology used to guide instruction and allow the organization of a learning session and complete development of a curriculum.

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:

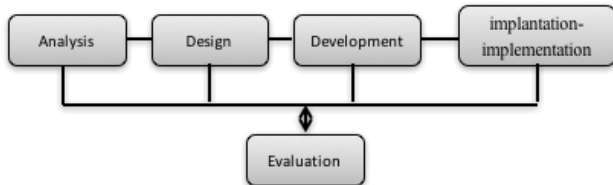


**Figure 2** Characteristics of knowledge networks in the theory of connectivity. Developed by Gonzalez, M. [2016] with information of Siemens, G. (2006b)

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:

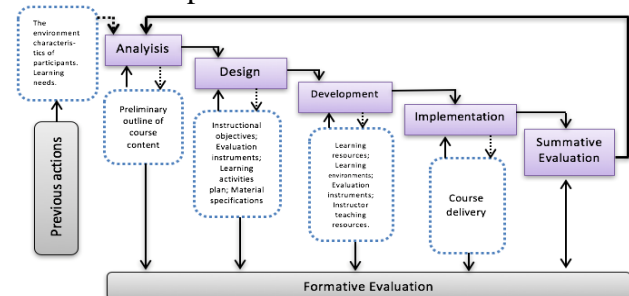
- ADDIE (Analysis, Design, Development, Implementation and Evaluation)
- Performance-Based Training (PBT)
- Criterion Referenced Instruction (CRI)
- ASSURE (Analyze, Set, Select, Use, Require, Evaluate)
- Dick and Carey

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
<b>Analysis</b>	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.
<b>Design</b>	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.
<b>Development</b>	The materials to be used are produced.	Teaching and learning technological resources (Learning Resources -

		course materials) Assessment instruments: rubrics design
<b>Implantation - Implementation</b>	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
<b>Evaluation</b>	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
<b>Total Students</b>	<b>7</b>	<b>24</b>	<b>26</b>	<b>57</b>

**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.
	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)		<b>For each unit of learning:</b>
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
<b>What?</b>	Specify clearly the product or evidence requested to the student.
<b>For what?</b>	The objective of the activity, indicating how and how impacts on the acquisition of skills is established. That is, the reason of the activity.
<b>With what?</b>	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.
<b>How and how much?</b>	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.
<b>When?</b>	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.
<b>Who?</b>	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
<p><b>Participants:</b> A group of 31 students.</p> <p><b>Modality:</b> Distance Education</p> <p><b>Teacher participation:</b> 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.</p> <p><b>Student participation:</b> Review, analyzes and studies the techno-pedagogical materials prior to class. Develops learning activities (diagnostic, formative and summative) during and after the learning sessions.</p>	<p><b>Participants:</b> A group of 26 students.</p> <p><b>Modality:</b> Virtual Education</p> <p><b>Teacher participation:</b> 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.</p> <p><b>Student participation:</b> Review, analyzes and studies the techno-pedagogical materials prior to the counseling session. Develops learning activities (diagnostic, formative and summative) outside learning sessions.</p>

**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*

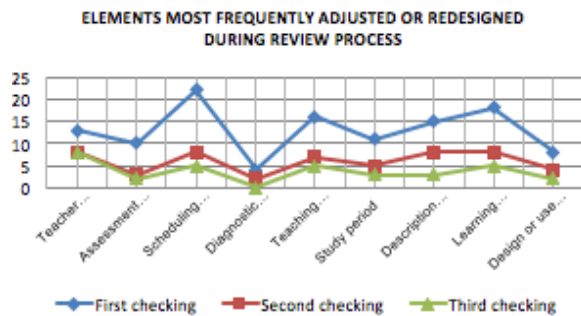
During the first review of structures were found omissions in the development of the elements of instructional design, same that were disappearing with feedback to the teacher, who initiated the correction process derived from the observations. The teacher was requested that adjustments be made so that 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
<b>For each unit of learning:</b>			
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%.

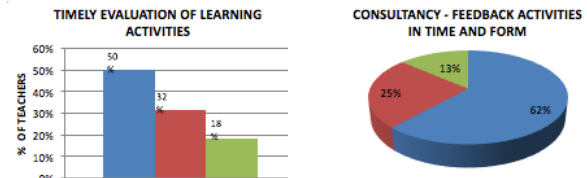
#### *B. Checklist 2: Monitoring the teaching activity regarding the implementation of the flipped classroom strategy.*

- 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.

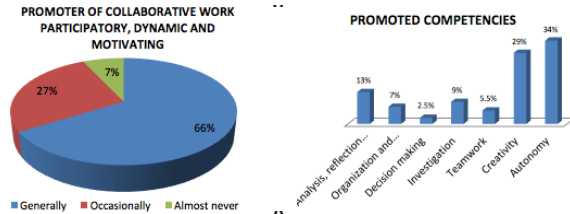


**Graph 2** Feedback, advice and timely evaluation of learning activities

- 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:

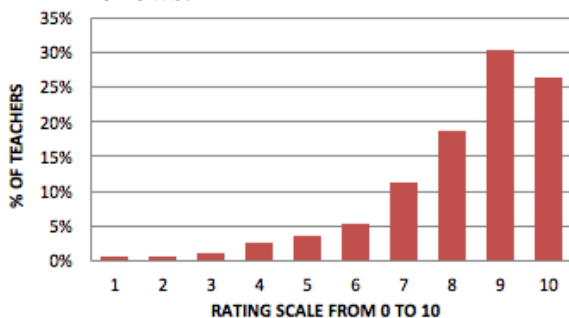


Analysis, reflection and synthesis; organize and plan; decision making; research ability; teamwork; creativity and autonomy; as shown in the following graph.



**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 its proper implementation of instructional design is achieved, it will allow the use of various teaching strategies (such as the flipped classroom) and using technopedagogical 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 Communication 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, nº1. Retrieved July 5, 2016 from [http://www.eumed.net/rev/tlatemoani/01/pdf/63-77\\_mgbl.pdf](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.
- González, 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-Gómez, 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](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](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](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 educación: 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](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.

## Facilitating nomadic interaction through a self-managed area-based support

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### Abstract

Ubiquitous computing integrates network supports (from small sensors to powerful devices) into the people's working and domestic environments, which can be organized in self-managed areas. In this context, a self-managed area should provide useful information about the state of daily life objects (e.g., power failure of a refrigerator) without needing user intervention. Service discovery systems are essential to achieve this sophistication as they enable computing services to discover, configure and communicate with others, in order to facilitate the user's tasks. Although the solutions proposed by these systems cannot be easily reused in other contexts (e.g., support for human collaboration) their different solution approaches provide useful reference points for the design of future discovery systems. In this paper, we describe a service discovery system called SEDINU (Service Discovery for Nomadic Users), which provides a computational and communicational support for facilitating: 1) interaction between a nomadic user and the services provided by the current area where he is located, and 2) collaboration between nomadic users located in such an area. These kinds of interactions depend on a specific context defined in terms of users' roles, location and goals. The proposed system allows a nomadic user: 1) to select and execute a service as many times as he needs; 2) to interact and collaborate with other nomadic users; 3) to use proactive applications, in order to easily interact with the services offered by the current self-managed area, e.g., to gather information required by an area, such as user identification and profile; 4) to create ad-hoc networks within the current area, with the aim of transferring relevant information between nomadic users and organization employees, e.g., e-vouchers and equipment delivery approval.

**Ubiquitous environments, cooperative work; nomadic users; service discovery, self-managed areas; ad-hoc networks**

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## Introduction

Internet users have recently observed important changes arising from the use of communication technology, mostly accessed by means of wired/wireless connections and mobile telephony, to satisfy social needs (e.g., multimedia message transmission [10]), welfare needs (e.g., home-health care applications [11][2]) and urban needs (e.g., GPS-based locative media applications [22][9]). The advantages of this communication technology become obvious in cooperative work environments, where applications and users easily need to access different services (e.g., Web browsing, printing, e-mail and database queries). In such environments, it is possible to assume that the connectivity provided by corporative networks not only offers a high bandwidth but also is reliable and continuous.

On the other hand, the increasing proliferation of heterogeneous but powerful mobile devices and the unstoppable progress of wireless networks allow considering the user [23] as a nomadic entity that evolves within a multi-computer and multi-user environment, where he employs several devices and smart applications to collaborate with other users anytime anywhere. However, when moving from one place to another, users can find substantial changes concerning: 1) the type of available services, 2) the communication technology, and 3) the network bandwidth and latency.

Wireless networks constitute the most suitable interconnection technology for the mobile nature of new devices [29]. In this way, users of smartphones can consult their e-mail anywhere; travelers can surf the Web from airports; tourists can use GPS to locate museums, restaurants or streets; scientists can interchange documents during a conference; people at home can transfer and synchronize information between smartphones and PCs.

However, ubiquitous environments also require efficient discovery systems to deal with: 1) the intrinsic dynamism of these environments, and 2) the growing number and diversity of devices that can provide and request services.

Some representative efforts have been realized, in order to develop service discovery systems [21]. In the academic field, we can mention the Intentional Naming System (Massachusetts Institute of Technology) [1] and the Ninja Service Discovery Service (University of California Berkeley) [12]. Likewise, software companies have integrated service discovery systems into their operating systems, e.g., Jini Network Technology (Sun Microsystems and Oracle) [18], Universal Plug and Play (Microsoft) [24] and Bonjour (Apple) [13]. In the opposite way, IBM Research (DEAPspace [17]), Salutation Consortium (Salutation [5]), IETF (Service Location Protocol [25]) and Bluetooth Special Interest Group (Bluetooth SDP [3]) propose service discovery systems that are independent from the operating system. Nevertheless, the reutilization degree of these solutions mainly depends on the way they were developed and provided [27][20].

Due to service registration and cancellation are dynamic operations, most of the discovery systems asynchronously notify their clients of the service availability [19]. However, the clients of these services are mainly programs, e.g., a printing service can be registered as a proxy object in a lookup server, which acts as a remote control. Therefore, these discovery systems do not support user-service interactions and even less user-user interactions. In addition, services are not provided following a user task-based organization, which supposes a more efficient, suitable and specialized support, but they are merely supplied according to a network organization, e.g., a network topology.

In this paper, we describe the SEDINU (*Service Discovery for Nomadic Users*) system, which facilitates user-service and user-user interactions within a specific context defined in terms of the user's roles, location and goals. More precisely, we are interested in defining a suitable support for ubiquitous environments characterized by users that move and collaborate within a large organization that includes several departments or administrative services. These organizational units serve as a basis for the definition of "self-managed areas", which define and administrate specific human tasks and provide collaborators with contextual services to carry out these tasks. A self-managed area provides nomadic users with services for: 1) activating other services (e.g., slide projection), 2) establishing planned collaborative sessions and ad-hoc network-based opportunistic interactions, and 3) performing specific tasks (e.g., collaborative production of diagnosis). The activation of these services depends on the nomadic user's current context.

This paper is organized as follows: after studying and providing a comparative analysis of related work (section 1), we define the "self-managed area/role attribution" and "hierarchical area organization" concepts and their principles (section 2). These concepts serve as a basis to describe the SEDINU functional schema and distribution architecture; we also present a human face recognition system that aims at facilitating the identification and location of known nomadic users (e.g., organization staff) in closed spaces (section 3). We validate our proposal by describing a use scenario that shows the functionality of SEDINU (section 4). Finally, we present the current research directions of this work.

## Related Work

In this section, an analysis of the most important service discovery systems is presented.

We firstly describe their main characteristics and, at the end of this section, we make a comparison of the studied systems.

## Service Location Protocol

The Service Location Protocol (SLP) proposed by IETF [25] defines a decentralized and extensible service discovery protocol for IP networks. The SLP infrastructure consists of three types of agents: 1) *user agents* perform the discovery of services that satisfy the needs of users' applications; 2) *service agents* announce the characteristics and location of the services, and 3) *directory agents* store information about the announced services.

SLP has two operation modes. In the former, a user agent sends multicast messages asking for a service, whereas service agents offering the service respond through unicast messages. In the latter operation mode, service agents register their services into a directory agent, where user agents look for a needed service.

SLP defines two modes for discovering directory agents. In the passive one, service and user agents listen to multicast messages, whereas directory agents periodically announce their own existence. In the active mode, service and user agents send multicast messages, with the aim of discovering directory agents. If one exists, service and user agents communicate with it by unicast messages, in order to register and look for services, respectively.

## Ninja: Secure Service Discovery Service

The Secure Service Discovery Service (SSDS) [12] is a project of the UC Berkeley. SSDS is similar to other discovery systems but offers some scalability and security improvements.



SSDS is implemented in Java RMI but uses XML documents instead of Java objects for the description and location of services. The SSDS model consists of clients, services and Secure Discovery (SD) servers, which are integrated by a look up directory, a capability manager and a certification authority. An available service is announced by a SD server using periodic authenticated multicast messages, which contain the URL of the service.

Both the SD server and the clients can store information about the services in a cache memory. In addition, the system state can be completely built using multicast messages. This scheme facilitates the error recovery process by decreasing the user's manual intervention. SD servers are organized in a hierarchical way, so that new servers can be added dynamically. The server hierarchy is able to detect whether a server fails, in order to restart it or replace it.

### Jini

Jini [18] is a service-oriented distributed architecture proposed by Sun Microsystems. Because Jini is based on Java, users must have a Java Virtual Machine (JVM) running on their device or must be represented by a JVM-enabled device. Jini defines three components: a) *services* are represented by Java objects that provide computing or control process on devices; 2) *clients* use services, so a service can be a client of another service; and 3) *directory services*, called Jini Lookup Services (JLS), serve as a means for clients and services to discover each other.

To register or look for a service, a JLS can be located by one of the following protocols:

1) the *Unicast Discovery Protocol* is employed when a JLS is already known, 2) the *Multicast Request Protocol* is used to look for a JLS or 3) the *Multicast Announcement Protocol* is employed by all the JLS to announce their availability. Jini implements a rent mechanism, which forces services to update their record periodically in a JLS, so that services can be located by clients.

A user looking for a service on the network first sends a multicast request to find a JLS. If one exists, the corresponding remote object is downloaded to the user's device; the user then employs this object to find the desired service. The service discovery process is made by matching the communication interface or by comparing Java attributes. If the JLS contains a valid service that implements the interface specified by the user, then a proxy of this service is downloaded to the user's device. From that moment, such a proxy is used to call the different functions offered by the service.

### Universal Plug and Play

The Universal Plug and Play (UPnP) architecture [24], promoted by Microsoft, extends the original Plug & Play model for I/O devices to a dynamic environment, where multiple network devices offered by various suppliers can interact. UPnP uses a set of network protocols (TCP/IP) from the lower layers of the Internet model and allows devices to define their own APIs to implement these protocols, using the language or platform supported by such devices. UPnP also uses the Simple Service Discovery Protocol (SSDP) to discover IP-based services. SSDP can operate in the network with or without a directory or search service and works over open protocols and HTTP by means of unicast and multicast messages, respectively.

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When a service advertises itself on the network, it first sends an announcement message to notify its presence. In the case of multicast messages, the service sends this announcement to a reserved address. If a directory or search service is present, it can register this announcement, which contains two URLs: one identifying the published service and the other providing its description. When a client needs a service, the client can either directly access to the server through the URL provided in the service announcement or send a multicast search request. If the client discovers the service through this request, it can be directly treated by the service or by a directory or search service.

**Bonjour**

The Bonjour technology boosted by Apple is based on a previous work started at 1999 by the IETF Zeroconf group. The objective of this technology is to facilitate the creation of ad-hoc networks [13]. Bonjour uses DNS (Domain Name System) standard interfaces, servers, and package formats to look for services in a network. Bonjour provides service discovery support, using already existing DNS resource records, and performs queries that allow the user to get instances of a specific type of services.

Bonjour is based on a hierarchical structure of DNS services and interfaces for name resolution on distributed networks, such as Multicast DNS or LLMNR (Link Local Multicast Name Resolution). Given the type of service and the domain the client is looking for, Bonjour enables discovering name instances of the desired service that just use DNS queries.

**DEAPSpace**

The DEAPSpace system [17] was developed by IBM Research to efficiently work on single hop ad-hoc networks.

The main goal of this system is to provide information about frequent changes produced in the environment, considering the technical limitations of the devices using DEAPSpace. In this way, such devices are able to: 1) detect the presence of nearby devices, 2) share information of available services and 3) detect the unavailability of other devices.

DEAPSpace is based on the push technology [14] to allow all devices to keep a global view, which is periodically sent to all neighboring devices. The general view is updated when DEAPSpace receives the global view from each device. The main contribution of DEAPSpace is the definition of a service description format and a codification mechanism, which minimize the amount of data that need to be transmitted during the service discovery process.

**Salutation**

Salutation [5] is a service discovery system and a session manager developed by the Salutation Consortium. Salutation is an open and independent standard of operating systems, communication protocols and hardware platforms. Salutation solves problems concerning the discovery and access to services offered by a wide set of devices, which interact in an environment owning a high connectivity and mobility range.

The Salutation architecture defines three entities: Functional Units (FUs), Salutation Managers (SLMs) and Transport Managers (TMs). FUs define the most common services (e.g., printers, faxes and file storage) from the client point of view to guarantee interoperability. SLMs allow clients to discover network services and communicate with them.

TMs isolate SLMs from the transport protocol used to access them. In this way, to support a new transport protocol, it is just needed to implement a new TM entity, without modifying the SLM implementation.

The service discovery process can be performed using multiple SLMs. A SLM can discover some other remote SLMs and determine the registered services. Service discovery is carried out by comparing the required type of service, as specified by the local SLM, with the available type of services allocated in a remote SLM. Remote Procedures Calls are used to transmit: 1) the required type of services from the local SLM to the remote one, and 2) the response from the remote SLM to the local one.

**Comparative Analysis**

Figure 1 shows important characteristics of the previously analyzed service discovery systems. All the service discovery systems described in this section compare typical attributes (e.g., the type of service specified by a URL) or attributes of the communication interface (e.g., IP address and the port number of the service host) to check the existence and availability of the services requested by a client.

All the analyzed systems but Jini are language-independent. As Jini is totally dependent on Java, a running Java Virtual Machine is necessary on the involved devices.

Protocol	Language Dependent	Directory Based	Service Information Storage	Service Discovery Technique	Topology	Network type
SLP	✗	✓	Directory Agent (DA)	Centralized Service Repository	• Centralized • P2P	Subnetwork
Ninja SSDS	✗	✓	Lookup Service	XML Descriptions	• Client-Server	Hierarchical Service Structure
Jini	✓	✓	Lookup Service	Centralized Service Repository	• Centralized	Subnetwork
UPnP	✗	✗	Control Point	Requests Flooding	• P2P	Subnetwork
Bonjour	✗	✓	Hierarchic Directory	Centralized Service Repository	• Centralized • P2P	Intranet
DEAPSpace	✗	✗	Global View	Requests Flooding	• P2P	Mobile ad hoc 1-Hop
Salutation	✗	✓	Salutation Manager	Centralized Service Repository	• Client-Server • P2P	Any network Transport dependent

**Figure 1** Comparative Analysis of Relevant Service Discovery Systems

Some service discovery systems use a directory to store information about services available on a network. Particularly SLP, Ninja SSDS, Jini, Bonjour and Salutation are based on a directory, which has different names according to the system (e.g., in SLP, it is called Directory Agent). To access services through a directory, the client first contacts the central directory to obtain the service description and then directly interacts with the service provider. On the contrary, UPnP and DEAPSpace do not use a directory. In this case, providers do not distribute the description of their own services to the rest of the network nodes but maintain it in a local cache of the device.

The service discovery technique used by the directory-based systems relies on a centralized service repository, excepting for Ninja SSDS, which uses XML-based descriptions. Systems that are not based on a directory send flooding requests to all the network nodes, in order to find the description of the requested service.

The topology of the system [21] defines how service descriptions and client queries are managed. The topology can be P2P, client-server or centralized. UPnP can be deployed in centralized or P2P topologies, whereas Jini operates inside a subnetwork. Ninja SSDS manages a client-server topology based on a hierarchical server structure. Depending on the transport protocol, Salutation can work through a client-server topology or a P2P topology inside any type of network.

All the analyzed systems provide support in terms of service location (e.g., Jini, UPnP and Bonjour) or network topology location (e.g., DEAPSpace and Salutation). Each one of these systems solves a different type of problems, such as service access control, device recognition, network connection or service identification. However, most of them are focused on domestic environments (e.g., locating multimedia services to receive a video call) or enterprise environments (e.g., determining available resources to fulfill a printing request). Therefore, these service discovery systems can not be used in other contexts such as collaborative environments.

Although the studied systems explore different aspects of service discovery in distributed systems, they do not offer a suitable solution to problems caused by the dynamic character of collaborative environments, e.g.,

The automatic detection of services offered by different areas of an organization or the creation ad-hoc networks to give support to user-service interactions and collaborations among users.

### **SEDINU Areas: Concepts and Principles**

In this section, we introduce concepts and principles of areas in SEDINU, whose main goals are: 1) to discover nomadic users and services available in a self-managed area, and 2) to present them to the nomadic user depending on his current location, role, and goals. In section 2.1, we introduce the concept of self-managed area and the principle of role attribution. Then, in section 2.2, we explain how the different areas are hierarchically organized, following the well-known technique of interconnected and nested black boxes.

### **Self-Managed Areas**

Nowadays, large organizations are divided into sub-organizations (e.g., administrative services, departments and sections) in order to be more efficient at providing users with specialized services. Sub-organizations are mapped to self-managed areas, which make the global organization administration easier, since resources (e.g., services, contextual information, workflows and roles) are managed and controlled in a distributed way. Thus, each self-managed area becomes an administration unit, which handles its own resources, while observing the general policies (e.g., security and invoicing) of the organization. The different areas exchange information for coordinating themselves, in order to assist nomadic users in achieving their partial and global goals within the organization. From a physical point of view, a self-managed area can be mapped to several buildings, a building or a part of a building.

Self-managed areas represent a hierarchy of sub-organizations, where higher levels provide general roles and activities, whereas lower levels offer specific ones. Figure 2 illustrates the principle of role attribution in a simple hierarchy, in which the areas A0 and A1 respectively denote the organization and a sub-organization. Each area defines a set of roles, e.g., A0 defines the roles R01 and R02, whereas A1 defines the role R1. Thus, when the nomadic user goes into the area A0 for the first time, the role R01 is attributed to him, e.g., at the institution entrance, the role “*Visitor ComputerScience*” is attributed to a computer scientist, whose goal is to give a lecture at the Computer Science Department. When he comes into the area A1, the role R1 is assigned to him, so that he can perform certain activities within the area A1. Finally, when the nomadic user has finished his task, he comes back from the area A1 to the area A0, which assigns the role R02 to him, i.e., he can play a role different from the one he previously obtained when he went into the area A0 for the first time.

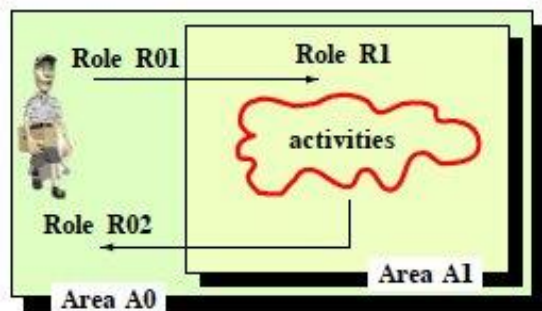


Figure 2 Role Attribution in Self-Managed Areas

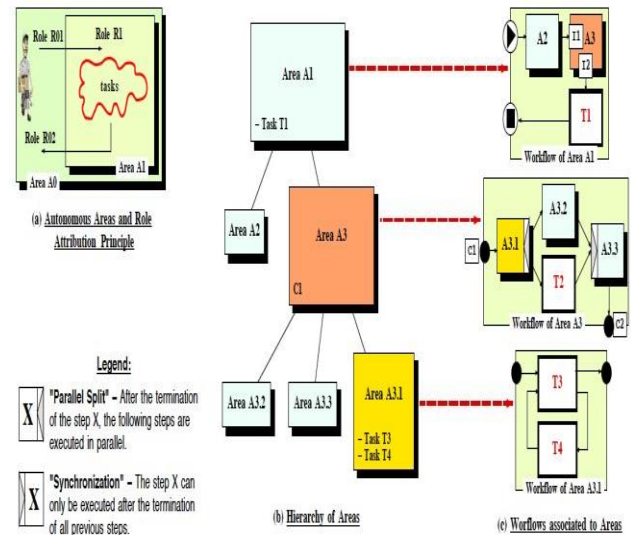


Figure 3 Principle of Hierarchical Self-Managed Areas

Hierarchy of Self-Managed Areas

As briefly introduced, large organizations are usually divided into several departments or units that are structured, following a well defined hierarchical relation. Our proposal consists in defining a hierarchy of areas that follows the organization structure: each organizational unit may be associated with a single self-managed area or several ones. Thus, a department can be represented by several hierarchically interconnected areas, e.g., a Physics Department can represent the main area, which includes the Nuclear Research Laboratory sub-area. This last one will define specific usage and administrative policies (e.g., entrance and exit procedures for people).

On the other hand, large organizations always need a sophisticated workflow system [6] for the management of their resources and tasks. However, defining and managing a global workflow system constitutes a complex and almost unrealizable objective, due to the particularities of the administrative policies in each organizational unit.

Thus, among other considerations, it appears interesting to take benefits from the area-based structuring to efficiently define and administrate the organization workflow system. In this way, a large organization management workflow is logically distributed among the involved sub-areas. Englobing areas provide general workflows, whereas englobed ones specify management workflows that implement particular administrative policies and tasks.

Thus, we define a hierarchical organization in which each self-managed area is in charge of defining and administrating its own component of the global workflow system. Each workflow component defines the connection points, i.e., the entrance and the exit points of this sub-workflow system. For instance, the central part of Figure 3 presents the workflow components of the areas A1 (the root area), A3 and A.3.1. As shown by the hierarchy of areas (left part of Figure 3), these three areas are linked by an “englobing-englobed” relations. Following this relation, the specific workflow of a sub-area constitutes an independent part of a more general workflow associated with an englobing area. The connection points C1 and C2 of the area A3 are respectively linked to the insertion points I1 and I2 of the area A1.

Such an area-based workflow system allows us to efficiently define the global workflow in different independent area sub-workflows that are managed in an autonomous way. More precisely, Figure 3 shows a hierarchy of self-managed areas, where the area A1 includes two sub-areas, A2 and A3. In turn, the area A3 includes three sub-areas, A3.1, A3.2 and A3.3. Each area manages its own environment: contextual information, services, roles and a sub-workflow.

The workflow of the area A1 defines a sequential control flow that successively executes the workflows of the areas A2 and A3 and terminates executing the task T1 within the area A1. The sub-workflow of the area A3 involves executing the sub-workflow of the area A3.1 followed by the parallel execution of: 1) the sub-workflow of the area A3.2 and 2) the task T2 within the area A3. The workflow of the area A3 terminates defining a join point that launches the sub-workflow of the area A3.3. The example we have developed highlights the principle of distributed and independent management of an organization workflow that is based on the well-known technique of interconnecting nested black boxes.

Thus, the simplicity and efficiency obtained by structuring and managing the global organization workflow attests one more time of the interest to structure and administrate an organization, following a hierarchy of self-managed areas.

### Design and Implementation of SEDINU

Following the concepts and principles previously stated, in sections 3.1 and 3.2, we respectively describe the SEDINU functional schema and distribution architecture. The SEDINU components have been designed to allow the nomadic user to interact with other users and with the services available in the self-managed area where he is located. In section 3.3, we introduce a face recognition system, whose goal is to locate nomadic users in closed spaces, even if they are separated from their mobile devices. This system has been designed to efficiently complement a Wi-Fi signal triangulation-based system that locates mobile devices.



Because of the inherent limitations of these two location systems, it appears really interesting to merge their functionality, in order to provide users with freshly updated information that allow them to collaborate in an efficient and consistent way.

### Functional Schema

The SEDINU system has been designed to allow the nomadic user located in a self-managed area to interact with: 1) other users (e.g., to cooperatively produce information) and 2) the services available on such an area (e.g., to request information). Interactions depend on a context-aware workflow, which considers the user's location, role and goals. Managed by the SEDINU system, each area has been designed as an autonomously administrated entity that relies on the *RBAC-Soft* system to communicate and coordinate itself with other self-managed areas. The *RBAC-Soft* system uses the RBAC (Role-Based Access Control) model [16] to manage the roles and resources defined by each self-managed area.

Figure 4 shows the steps followed by the SEDINU system: 1) to provide the nomadic user with services related to his current interaction context, and 2) to allow him to collaborate with other users located in the same area. First, the *Location Detector* (cf. section 3.3) determines the user's specific location within the current building (see #1 in Figure 4). Then, the *Location Detector* transmits this information to the *RBAC-Soft* system (see #2 in Figure 4), which processes it, in order to identify the corresponding self-managed area. Depending on his current location, the *RBAC-Soft* system determines: 1) the role attributed to the nomadic user and 2) the services that are associated with this role (see #3 in Figure 4).

Based on this contextual information, the *RBAC-Soft* system creates a workflow (or searches the already defined one) to guide the nomadic user towards the achievement of his goals (see #4 in Figure 4).

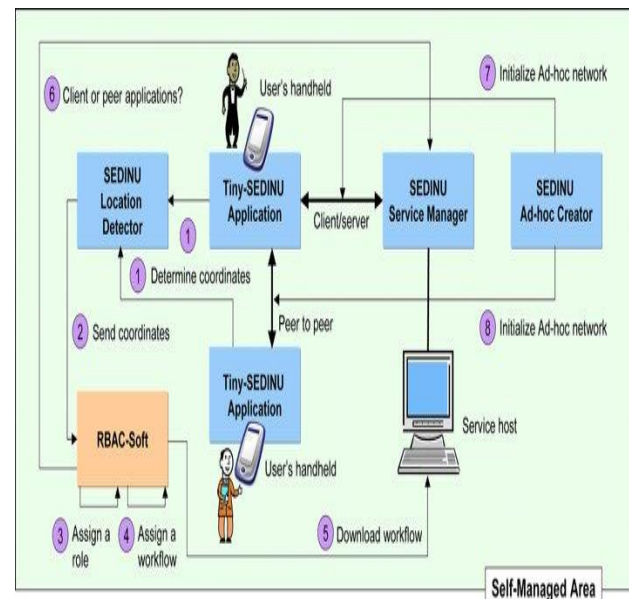


Figure 4 Functional Schema of the SEDINU System

Each activity of the workflow is associated to services that allow the nomadic user to perform his activity. Thus, the *RBAC-Soft* system uploads the workflow to the nomadic user's mobile device (see #5 in Figure 4) and asks the *Service Manager* to upload the needed applications to access the required services (see #6 in Figure 4).

As soon as the nomadic user has access to the services, he can select one of them from his mobile device. The set of available services is controlled by the corresponding workflow, for instance it can activate: 1) one service in the case of a single serialized task or 2) several services in the case of tasks whose execution order is irrelevant. Thus, the *Ad-hoc Network Creator* (see #7 in Figure 4) dynamically establishes an ad-hoc network between:

1) the *Tiny-SEDINU Application* (running on the user's mobile device) and the *Service Manager*, or 2) two *Tiny-SEDINU Applications* running on the devices of the users who intend to collaborate (see #8 in Figure 4). This last kind of ad-hoc network facilitates direct information sharing (e.g., invoices or vouchers) and collaboration among users supported by a P2P (peer-to-peer) communication, instead of passing through a central server.

### Distribution Architecture

The distribution architecture of the SEDINU services is centered on organizing the institution in autonomous areas that manage their own roles, services and workflows. That comes from the decision to make: 1) the area resources available and 2) the system reliable and easily manageable. Thus, when an area corresponds to a whole building or a part of a building, its services are concentrated on a host. On the contrary, when an area corresponds to several buildings (e.g., a department distributed on several cities) its services are replicated among the servers of the different buildings.

Distribution architectures mainly differ from one to another in three aspects: 1) the representation of the components on the participating sites (e.g., replica or proxy); 2) the number of instances of each component in the system, and 3) the possible mobility of components among sites.

The distribution architecture of the SEDINU system is integrated by three types of sites, which allocate different components. Sites of type A hold the *Tiny-SEDINU Application* (see

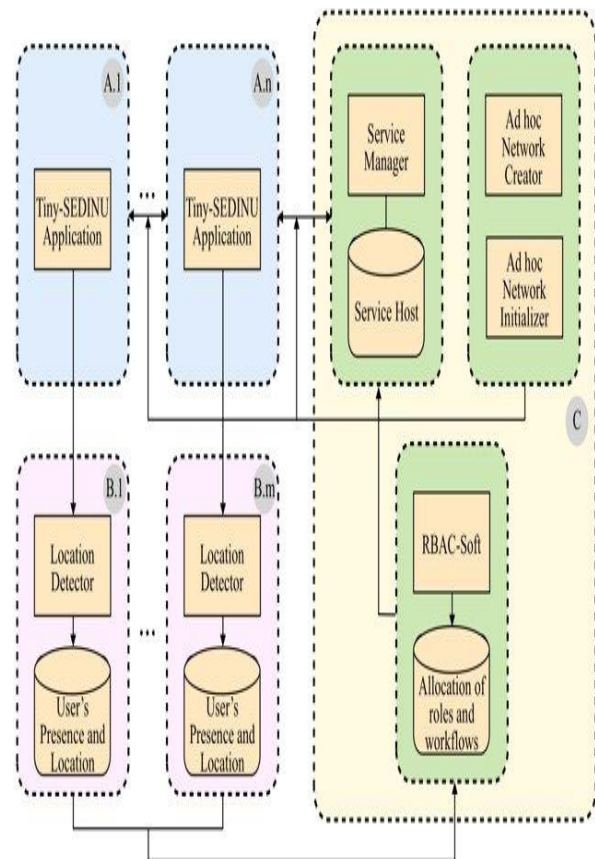


Figure 5 Distribution Architecture of the SEDINU System

Figure 5), which can play the client or peer role, since it allows a nomadic user to interact with services provided by a self-managed area or to interact with other nomadic users. At any moment, there can be multiple sites of type A, at least one per nomadic user.

On the other hand, there are two different types of sites that play the server role:

- Sites of type B store a *Location Detector* (e.g., the face recognition system) and information that it requires and produces (see Figure 5). It is possible to have multiple sites of this type, one per each set of Wi-Fi cameras located in the organization;



- Sites of type C allocate: 1) the *RBAC-Soft system*, which receives the nomadic user's location and relates it with a self-managed area; this system is also responsible for assigning roles and workflows to the user; 2) a *Service Manager*, which stores information about the services and workflows available at the self-managed area; and 3) the *Ad-hoc Network Creator*, which is in charge of initializing an ad-hoc network between two *Tiny-SEDINU Applications* or between a *Tiny-SEDINU Application* and a *Service Manager* (see Figure 5).

In an organization consisting of just one building, it can be placed a single site of type C, if the fault tolerance property is not a concern. However, if the SEDINU system is installed in an organization consisting of more than one building, it could be necessary to place a site of type C on each building. The replication of this type of sites is needed specially when buildings are physically distant from each other.

### Face Recognition-based Location Detector

To provide a system with contextual capabilities such as bringing information closer to nomadic users and allowing them to easily find each other, it is mandatory to determine the location of the system users at anytime. People's nomadic characteristics expose the need of a mechanism capable of locating users in an "implicit" and "accurate" way; "implicit" because it is so tiring and annoying for a user to explicitly have to update his location every time he moves from one place to another inside a building, and "accurate" specially because, when providing support for indoors, it is important to detect whether a user is inside a specific office or in the adjacent one, in order to provide him with information or resources available at that specific place.

Many different ways have been proposed to locate people in closed spaces, but most of them involve a device that needs to be carried or worn out by the person wanted to be located. This constitutes a quite complex and heavy solution because any person can forget his device in any place different from where he is; devices can also be accidentally or intentionally interchanged with other users, making wrong assumptions about the user's current location or causing errors in the delivery of information.

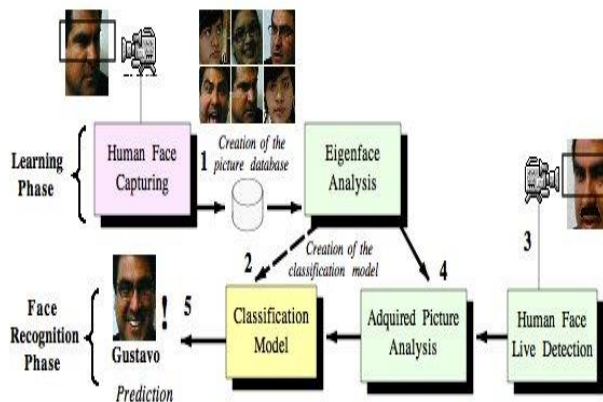
To avoid this problem when locating well-known nomadic users, such as members of staff, the solution proposed in this paper consists in capturing and processing images of their own face rather than trying to detect their wireless devices. This solution appears satisfactory, since the user's face cannot be transferred to another person or left apart in another room. More precisely, we design and implement a face recognition system, which is focused on locating well-known users, in order to make information closer to them and to allow them to easily locate each other within the ubiquitous cooperative environment. In this way, we do not negate the real interest in locating mobile devices by triangulation of Wi-Fi signals [5] and GPS [4], since these solutions are useful when external persons (e.g., deliverymen, guests or visitors) have to be located within the organization.

### Phases of the Human Face Recognition

The proposed computer vision-based system for the recognition of human faces needs to perform a learning phase before the effective real-time face recognition (known as the testing phase). The learning phase is carried out only once, and the testing phase takes place every time a human face is captured by a camera. In order to develop a relatively robust face recognition system, we have combined several techniques as described below.

The learning phase uses an object detector algorithm based on the Haar-like features principle [7] [28], which is able to differentiate a human face from any other object. This algorithm is used to create a picture database of the nomadic users that would be identified. This database constitutes the testing set of images and stores several pictures of each user's face in different positions, e.g., full-face portrait or profile, and customized with accessories, e.g., glasses or hat (see #1 in Figure 6). Once the database is completed, it is analyzed using the Eigenface method [26] and the Principal Component Analysis [15]. The information resulting from this analysis is then used to create classification model (see #2 in Figure 6), which includes information to differentiate one person's face from another.

Once the learning phase is achieved, the real-time face recognition phase can take place. Every time a human face is detected, a picture is captured (see #3 in Figure 6) and then analyzed according to the information produced by the Eigenface method (see #4 in Figure 6) during the learning phase. This information is assessed by the classification model (see #2 in Figure 6), which identifies the nomadic user (see #5 in Figure 6) by establishing a correspondence between the registered persons and the recently captured picture.



**Figure 6** Learning and Testing Phases of the Face Recognition System

## Implementation and Tests

Both the learning and the testing phases of the proposed face recognition system use the OpenCV (Open source Computer Vision) library, which aims at facilitating the implementation of computer vision applications. In particular, this library provides an object detector based on the already mentioned principle of Haar-like features [28], which consists in codifying light contrasts in some areas of the image, in order to obtain particular relationships among similar objects (human faces in this case). To perform this process, the object detector uses a classifier trained with some hundreds of positive and negative samples. Positive samples are images of the object that will be detected (i.e., a human face), and negative samples are arbitrary images.

The OpenCV object detector offers the following functions: 1) recognition of human faces in different sizes and 2) simultaneous detection of multiple human faces. The face size depends on the distance between the person and the camera. When a human face is detected, the camera takes a picture, from which the human face is extracted and resized to 245x245 pixels. The latter function is particularly useful in the real-time recognition phase, since if more than one person is in front of a camera, the OpenCV object detector is capable of simultaneously detecting each human face.

The Eigenface analysis is considered as an appearance-based method, whose goal is to create low-dimensional representations, called "eigenfaces", from the set of face images corresponding to the persons that will be identified. Such representations do not necessarily correspond to eyes, nose, mouth or ears.

Rather, they capture points (light contrasts) that produce significant characteristics among human faces that help to differentiate one registered person from the rest. Based on the calculated “eigenfaces” and the testing set of images, the most representative weights are obtained. These weights serve as input data to the LIBSVM (Support Vector Machine) library [8], which creates the mentioned classification model for determining whether the captured picture belongs to one of the registered persons. The hardware needed for the face recognition system to work is minimum: inexpensive webcams are installed at specific places (e.g., entrances to some offices, common places, hallways and corridors) within each building. Each camera is driven by a client hosted in a PC, which is responsible for capturing nomadic users’ pictures. Clients transfer these pictures to a multi-thread server, which is in charge of processing them to obtain a prediction about each nomadic user’s identity.

The current implementation of the face recognition system is capable of supporting a group integrated by up to 25 members. To illustrate how the human face recognizer works, we trained it to identify 25 collaborators. Thus, a database containing 25 pictures of each person was constructed. As mentioned above, these pictures were taken asking collaborators to move their face in different angles, varying their gestures and using different accessories each time.

### **Validation of SEDINU by a Use Scenario: Management of a Conference Lecturer**

To validate our proposal and provide better understanding of how the SEDINU system allows us to organize and support nomadic interaction within a hierarchically structured organization, we describe a use scenario: the management of a conference lecture.

The prototype of the SEDINU system has been deployed across our institution. Thus, we have divided the test bed organization into five nested areas (see Figure 7), which are organized as follows: the first area (A1) represents the whole institution (root of the area hierarchy). Three sub-areas are included: the Entrance (area A2), the Computer Science Department (area A3) and the Restaurant (area A4). In turn, the Computer Science Department includes the Auditorium (area A5).

Bluetooth ad-hoc networks are established, in order to support proximity communications, e.g., transfers from a user’s device to an e-conference system or another user’s device. The institution area hierarchy is fully covered by a wireless network (Wi-Fi) that provides communication supports among different areas. In this environment, all the users employ mobile Wi-Fi devices (smartphone or tablet) to easily interact and exchange information.

To illustrate the functionalities of the SEDINU system, let us suppose that a computer scientist arrives at the institution (area A1) with the aim of giving a lecture at the Computer Science Department (area A3). First, the lecturer is registered at the Entrance (area A2) where he receives a mobile device running the *RBAC-Soft system*. This one assigns the role “*Visitor\_ComputerScience*” to him and uploads a general workflow to his device, in order to guide him and support his activities within the institution (see #1 in Figure 7). Through an organization map and GPS, the SEDINU system shows him the way to reach the Computer Science Department (see #2 in Figure 7).

When the lecturer arrives at the Computer Science Department (area A3), our system determines the user’s current location.

Since the lecturer is a frequent visitor, his location is stimulated using two techniques that are complementary and can be fruitfully combined. The former refers to the face recognition system (c.f. section 3.3), which identifies and locates known people by using cameras installed at specific points (external public spaces, meeting rooms, corridors, secretary office). In this case, the goal is clearly to follow each user rather than to locate his mobile device, from which he may be regularly separated for a while. The latter technique consists in determining the user's device coordinates using Wi-Fi triangulation techniques [5].

The RBAC-Soft system relates the nomadic user's location to the self-managed area A3 and consequently it attributes the role "*Lecturer\_ComputerScience*" to him. In a complementary way, the RBAC-Soft system uploads a specific workflow to the user's device, in order to guide his activities within the area A3. Relatively to the user's current environment (i.e., the Computer Science Department), the SEDINU system relies on a map and on the Wi-Fi technology to help him to localize the Auditorium (area A5) where his lecture has to take place (see #3 in Figure 7).

As soon as the lecturer arrives at the Auditorium, the SEDINU system determines his new location and sends it to the RBAC-Soft system, which associates his new location with the self-managed area A5 and then assigns him the role "*Lecturer\_Auditorium*". The SEDINU system provides the lecturer with a dedicated "*Slide Projector*" service that allows him to present his slides (see #4 in Figure 7). Thus, a Bluetooth-based ad-hoc network is dynamically created between the lecturer's device and the projector service, in order to allow him: 1) to transfer his slides and 2) to control his presentation using the mobile device. During the lecturer's speech, all conference listeners (with the "*Listener*" role) can use the "*Slide Projector*" service and consult/annotate the slides. During the question session, all users (lecturer, chairman and listeners) can establish a fruitful question-answer collaborative session supported by the "*Slide Projector*" service and their personal devices.

When the lecture finished, the lecturer is invited to have a lunch at the institution restaurant. Thus, the chairman transfers an e-voucher from his device to the lecturer's device by a Bluetooth-based ad-hoc network (see #5 in Figure 7). Then, the SEDINU system provides the lecturer with relevant information to guide him to the restaurant (area A4), where he acts with the role "*Client*" (see #6 and #7 in Figure 7). There, the cashier verifies and charges the lecturer's e-voucher (see #8 in Figure 7). One hour later, the lecturer leaves the restaurant (area A4) and comes back to the entrance (area A2) with the role "*Exiting\_Visitor*" always guided by the SEDINU system (see #9 in Figure 7). Finally, the lecturer gives back the mobile device (see #10 in Figure 7) and leaves the institution (area A1).

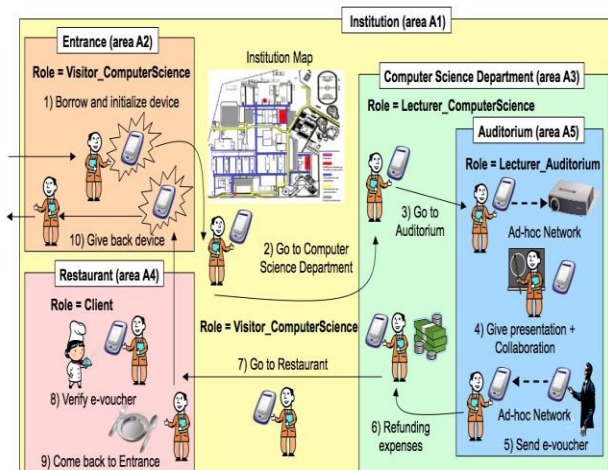


Figure 7 Scenario of the SEDINU System Use

### Conclusion and Future Work

The main contribution of this paper is the definition of concepts and principles for the design and implementation of the SEDINU service discovery system. This proposal can be deployed across organizations, e.g., enterprises, institutions or governmental administrations, in order to facilitate: 1) the interaction between nomadic users and services provided by self-managed areas, and 2) collaboration among nomadic users under specific contexts. When a nomadic user enters to a building, the SEDINU system identifies and locates him or his mobile device, in order to determine the corresponding self-managed area where he is currently situated and to attribute him a role. Based on the user's current location and role, the SEDINU system determines the services available to him and then RBAC-Soft dynamically creates a workflow to guide his interaction or collaboration sessions. The applications required to interact with the available services or with other users are automatically downloaded to his mobile device. As soon as he selects a service, the SEDINU system can create an ad-hoc network: 1) between the user's device and the selected service host to facilitate user-service interaction or 2) among users' devices to support collaborative work.

Wi-Fi signal triangulation and GPS techniques allow us to respectively locate the user's mobile device in closed and open spaces within the organization. Since the user may be temporarily separated from his mobile device, we designed and implemented a face recognition system, which is able to identify the user's face within the organization buildings and to infer his location. However, the face recognition process includes a learning phase that needs the acquisition of several face pictures of the user.

Consequently, this face recognition system cannot be easily employed to manage unexpected users (e.g., visitors, guests or deliverymen) but better for well known and pre-declared ones (e.g., administrative staff, professors, or persons who attend a well planned event). Thus, the combination of these solutions (Wi-Fi triangulation, GPS and face recognition) is suited.

Improvements on the face recognition system are in development, including some modifications to reduce confusing predictions coming from changes in someone's appearance or variations in the environment lighting when a picture is taken. As this system has to be trained with a set of pictures from each user wanted to be identified, it learns to recognize the main features that differentiate a person from another. For example, if a person starts wearing a mustache, the face recognition system would be most likely to give a wrong prediction until a new learning phase with updated pictures would be performed. Consequently, it would be interesting to explore techniques that would allow this system to learn during the real-time recognition phase. In this way, it would not make a mistake when important changes in a user's appearance occur. In addition, drastic changes in the environment lighting can cause wrong predictions. For this reason, cameras have to be placed away from windows or other light changing sources.

The current version of the SEDINU system creates ad-hoc networks between mobile devices using the Bluetooth protocol, which offers several advantages: 1) it is a low-cost infrastructure; 2) users do not need a deep knowledge; 3) no network administrator is required; and 4) mobile devices have a Bluetooth connection. Therefore, the SEDINU system becomes compatible with several mobile devices.

As future extensions of this system, we will develop modules to create ad-hoc networks through ZigBee, which can be used by applications that do not require high data transmission. Moreover, the battery consumption of a ZigBee-enabled device is much lower than the one of a Bluetooth or Wi-Fi-enabled device. Thus, the SEDINU system can create ad-hoc networks able to control accesses to some restricted self-managed areas (e.g., a radioactivity laboratory), so only authorized users will be authorized to come into such areas. The SEDINU system constitutes the basis for the design of an elaborated and powerful platform able to support ubiquitous collaborative work.

## References

- [1] Adjie-Winoto, W., Schwartz, E., Balakrishnan, H., and Lilley, J. (1999). *The Design and Implementation of an Intentional Naming System*. In ACM SIGOPS Operating Systems Review, 33(5):186-201.
- [2] Arslan, P. (2016). *Mobile Technologies as a Support Tool for Health*. In Mobile Technologies as a Health Care Tool, SpringerBriefs in Applied Sciences and Technology Series, Springer International Publishing, pp. 11-41.
- [3] Ballmann, B. (2015). *Feeling Bluetooth on the Tooth*. In Understanding Network Hacks: Attack and Defense with Python, Springer Berlin Heidelberg, pp. 137-148.
- [4] Berman, K. J., Glisson, W. B., and Glisson, L. M. (2015). *Investigating the Impact of Global Positioning System Evidence*. In the 48th Hawaii International Conference on System Sciences (HICSS), IEEE Computer Society, Kauai, Hawaii, pp. 5234-5243.
- [5] Bhatti, N. (2014). *Service discovery protocols in Pervasive Computing: A review*. In the 17th International Multi-Topic Conference (INMIC), IEEE Computer Society, Karachi, Pakistan, pp. 205 - 210.
- [6] Boutamina, S., and Maamri, R. (2015). *A survey on context-aware workflow systems*. In Proceedings of the International Conference on Intelligent Information Processing, Security and Advanced Communication (IPAC '15), Djallel Eddine Boubiche, Faouzi Hidoussi, and Homero Toral Cruz (Eds.). ACM Press, Batna, Algeria, pp. 1-6.
- [7] Castrillón, M., Déniz, O., Hernández, D., and Lorenzo, J. (2011). *A comparison of face and facial feature detectors based on the Viola-Jones general object detection framework*. In Machine Vision and Applications, Springer-Verlag, 22(3):481-494.
- [8] Chang, C.C. and Lin, C. J. (2011). *LIBSVM: A library for support vector machines*. In ACM Transactions on Intelligent Systems and Technology (TIST) Journal, 2(3):1-27.
- [9] Fitzgerald, E., and Adams, A. (2015). *Revolutionary and evolutionary technology design processes in location-based interactions*. International Journal of Mobile Human Computer Interaction, 7(1):59-78.
- [10] Grandhi, S. A. and Lanagan-Leitzel, L. K. (2016). *To Reply or To Reply All: Understanding Replying Behavior in Group Email Communication*. In Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing (CSCW '16). ACM, San Francisco, CA, USA, pp. 560-569.

**CROWDSOURCING**

December 2015 Vol.2 No.3 161-179

- [11] Gutierrez, F. J., Ochoa, S. F., and Vassileva, J. (2016). *Identifying Opportunities to Support Family Caregiving in Chile*. In Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems (CHI EA '16). ACM, Santa Clara, California, USA, pp. 2112-2118.
- [12] Herborn, S., Lopez, Y., and Seneviratne, A. (2005). *A distributed scheme for autonomous service composition*. In Proceedings of the First ACM International Workshop on Multimedia Service Composition, Singapore, pp. 21-30.
- [13] Klauck, R. and Kirsche, M. (2012). *Bonjour Contiki: A Case Study of a DNS-Based Discovery Service for the Internet of Things*. In the 11th International Conference ADHOC-NOW, Ad-hoc, Mobile, and Wireless Networks, LNCS Vol. 7363, Springer Berlin Heidelberg, Belgrade, Serbia, pp. 316-329.
- [14] Lagares-Lemos, A., Daniel, F., and Benatallah, B. (2015). *Web Service Composition: A Survey of Techniques and Tools*. In ACM Computing Surveys, 48(3):1-41.
- [15] Martínez Delgado, J. S., Mendoza, S., and García, K. (2013). *Flexible Bimodal Recognition of Collaborators in Pervasive Environments*. In Special Session Proceedings of the 12th Mexican International Conference on Artificial Intelligence (MICAI), IEEE Computer Society, México, D.F., Mexico, pp. 151-156.
- [16] Mitra, B., Sural, S. Vaidya, J., and Atluri, V. (2016). *A Survey of Role Mining*. In ACM Computing Surveys, 48(4):1-37.
- [17] Nidd, M. (2001). *Service discovery in DEAPspace*. IEEE Personal Communications, 8(4):39-45.
- [18] Oaks, S., and Wong, H. (2000). *Jini in a nutshell: a desktop quick reference*. O'Reilly & Associates, Inc.
- [19] Olbertz, J. H. (2015). *Service Availability and Discovery Responsiveness: A User-Perceived View on Service Dependability*, PhD Thesis, Humboldt Universität zu Berlin, Germany.
- [20] Olson, A. M., Raje, R. R., Devaraju, B., and Gallego, L. S. (2015). *Learning improves service discovery*. In Concurrency and Computation: Practice & Experience, John Wiley and Sons Ltd., 27(7): 1679-1694.
- [21] Raychoudhury, V., Cao, J., Kumar, M., and Zhang, D. (2013). *Middleware for pervasive computing: A survey*. In Pervasive and Mobile Computing, Special Section: Mobile Interactions with the Real World, Elsevier, 9(2):177-200.
- [22] Rodríguez-Amat, J. R., and Brantner, C. (2016). *Space and place matters: A tool for the analysis of geolocated and mapped protests*. In New Media & Society, 18(6):1027-1046.
- [23] Rossitto, C., Bogdan, C., and Severinson-Eklundh, K. (2014). *Understanding constellations of technologies in use in a collaborative nomadic setting*. In Computer Supported Cooperative Work (CSCW), Springer, 23(2):137-161.
- [24] Shi-Cai, Y., Wu, Y. Z., and Guo, R. N. (2013). *A UPnP-Based Decentralized Service Discovery Improved Algorithm*. In the Fifth International Conference on Computational and Information Sciences (ICIS), IEEE Computer Society, Shiyang, China, pp. 1413-1416.

**CROWDSOURCING**

[25] TaeKwon, M., Zafar, B., JaeTek R., KiHyung, K., and SeungWha, Y. (2010). *The efficient DA placement method in SLP*. In Proceedings of the 12th International Conference on Advanced Communication Technology. IEEE Computer Society, Gangwon-Do, South Korea, pp. 364-368.

[26] Turk, M., and Pentland, A. (1991). *Eigenfaces for recognition*. In Journal of cognitive Neuroscience, 3(1):71-86.

[27] Vara, M. I. and Campo, C. (2015). *Cross-Layer Service Discovery Mechanism for OLSRv2 Mobile Ad-hoc Networks*. In Sensors, 15(7):17621-17648.

[28] Viola, P., and Jones, M. (2001). *Rapid object detection using a boosted cascade of simple features*. In Proceedings of the 2001 Conference on Computer Vision and Pattern Recognition, IEEE Computer Society, Kauai, Hawaii, pp. 511-518.

[29] Zhou, J., Liu, L., Deng, Y., and Huang, S. (2014). *A QoS Routing Protocol with Bandwidth Allocation in Multichannel Ad Hoc Networks*. In Wireless Personal Communications, Springer, 75(1):273–291.



## **Human resource management at the Instituto Tecnológico de Pachuca**

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### **Abstract**

In this contribution, a model of human resource management for the area of Administrative Economic Sciences ITP (Pachuca Institute of Technology) is proposed. The methodology involved gathering information about the process used in human resource management in the institution, to analyze the curriculum of each subject, compared with profiles of teachers and make a diagnosis to know and identify the profiles of teachers required for the allocation of academic loads. It is considered as an object of study the profile of teachers and syllabi of the Degree in Administration contained in plans 2016 study results show that there is a regulation for the management of the resource, but sometimes not considered the characteristics programs of study and teacher profile for contingencies that arise in planning activity. According to the results of the methodology, the proposed model helps to improve the location of teachers in subjects according to their professional profiles, this is contributes to the planning of the administrative process in the area and is expected impinges on the quality of educational services.

### **Process Management, Human Resource, Job profile.**

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**Introduction**

Human resource management is a practice based on the effective collaboration of people aimed at achieving organizational objectives, this steadily has been questioned as an area that should link the emerging vision of skills and human capacities. This research was conducted at the Department of Administrative Sciences Economics [CEA] ITP, being a public institution of higher education. This article aims to propose a model of human resource management for the Department of Economic-Administrative Sciences aims to contribute indirectly in maximizing the performance of intellectual capital, understood as the set of skills that create institutional competitive advantages. Considering that the fundamental relationship between the area's needs and allocation of subjects in each semester not always coincide with the management of established human resources, research is aimed at linking and strengthen the process of human resource management area CEA that responds to the real situation, so that, with the proposed diagnosis is to achieve integration of the professional profile of the teacher with the subjects of the program in which it participates. The article is structured as follows: In the first part the theoretical foundation that supports research, for which references were consulted different authors presented; The second part is the methodology used to develop the project, this article was conducted with a focus on descriptive correlational research to manage human resources according to the needs of the area.

The third part is the development arising from the review and analysis of curricula, regulations, profiles of teachers, the area's needs CEA and the processes established in the quality management system of the institution. The fourth part of the article includes the results of research, and finally the conclusions.

**Theoretical framework**

The human resource is the tangible and intangible element that organizations achieve their goals and objectives. [Chiavenato, 2012], assumes that people should be the strategy part of the general plan that the organization adopts to ensure that they can fulfill the organizational mission, on the other hand, [Pascual, 2013] indicates that people management has inevitably have to respond to the needs of the business, so, through the management of human capital, it must be converted into the differential added value in the economic environment. This is a fundamental aspect that impacts heavily on the exercise of human resource management, such as teachers who are an essential part of an educational institution to ensure the achievement of the objectives.

Moreover, [Nyberg, 2014] states that human resource management is influenced by various components, which affect the performance of people in your work area, for example, perceptions and working environment. Equities between these components may vary in different contexts. This research addresses only the performance component, so it is considered that the management model of human resources is a contribution that reinforces the performance of teachers, as well as the internal environment of the institution. Moreover, modern management in education is characterized by a leadership centered pedagogy, as well as new skills and the development of organizational culture with vision, teamwork, constant openness to learning and innovation are pillars that mark their orientation towards achieving the objectives and the main purposes of education.

For [Martin, 2012] educational management is the ability to generate an appropriate relationship between the components of the institution as: the structure, strategy, systems, leadership style, skills, people and objectives, on the other hand [Fowler, 2014] considers the human resource must have two characteristics: energizing and commitment in the performance of their functions, which is consistent Janson [2015] adding that only then the potential of people is released.

As discussed above, educational management includes not only typical administration tasks, but conceives the educational organization as a system that interacts with its context, must seek the necessary strategies to ensure the quality of its offer, by using adequate material, financial and human resources. It is considered that an analysis as presented will contribute to unlocking the potential of teachers and strengthen the educational quality of the institution.

### **Methodology**

This research was a correlational-descriptive approach for describing the processes of human resource management, using as a source of information responsible for the process of allocation of human resources. It is considered as an object of study the profile of teachers and syllabi contained in the 2016 curriculum, which includes 45 subjects corresponding to the Degree in Administration; to carry out the review of the curriculum were divided by areas of expertise, as follow official documents were reviewed, the number of hours and information issues related to human resource management. Once the analysis and diagnosis of documentation made possible the design of the proposed management model teaching human resources.

### **Results**

The main practices of human resource management, specifically the integration process, provision or supply of people within the institution, is regulated by the Internal Regulations of Work of Teachers of Technological Institutes, which referred to the tests that teachers and evaluation criteria used shall be submitted. The supply of people is done in two stages, the first is for new income teachers, the second for teachers who are already part of the plan of the area CEA. Responsible for the process of resource allocation program loading materials including schedule, however, sometimes the academic load of teachers does not always match the profile required in the assigned materials, this because of the contingencies that occur in the planning process.

Skills and personal traits of the teacher profile in force in the institution educational model for the twenty-first century, it is considered that the teacher must be a person who is committed to the institution, society and the environment influences the formation processes for its prestige, moral authority and professional ethics exercises its authority with prudence in the conduct and coordination of learning activities.

Assuming that the teacher is the main actor in education and the job profile is an essential instrument in the process, the SNEST (National System of Higher Education Technology) identifies and recognizes in teaching a set of core competencies that are grouped in the following areas: teaching the teacher creates the set of necessary and sufficient conditions to transform the conceptual, procedural and attitudinal knowledge; Professor generates research, apply and share knowledge related to learning discipline, area of knowledge or expertise; Professor management implements and operates the academic decisions of the institution.

Professor tutoring links with and leads the student of the various modalities for full development and success in their academic career; in linking teacher establishes relationships with business, government and social sectors to strengthen the training of students and finally in training the teacher undertakes, systematically, training activities in the personal, professional and teaching that transform and improve educational practice.

**Characterization of the syllabi**

The area CEA is responsible for the Bachelor in Business Administration and according to the crosshairs issued by National Technology of Mexico, the race have assigned 45 subjects for which each subject has a curriculum that is structured the following 11 points: the first point the general data of the subject are in the second is where the characterization of the subject and didactic intention participants in the design and curriculum monitoring is presented in the third, fourth the competition to develop, in the fifth previous competitions, the sixth the agenda, in the seventh learning activities are, in the eighth practices in the ninth draft subject, in the tenth evaluation by competition and finally the eleventh point contains information sources and none of them indicates the requirements profile of teachers to teach the subject.

It should be noted that because the study programs do not provide information about educational profile to teach the subject, and part of the research was to analyze the requirements of the subject to align with teacher profiles, and thus meet the look didactic teaching of administrative management of teachers. Then the result of the analysis and diagnosis of the programs comprising the grid of the Degree in Administration is presented. According to the information gathered, it was possible to identify the variables that teachers profile and profile of the subjects do not present a complete linkage as evidenced below.

Whereas research was based on the entire workforce [31 teachers] attending the race; of which 23% have a different required in the subjects profile, another 23% need to strengthen and complement their profile in relation to the subjects taught, while 54% of teachers covers the profile of the subject in the table 1 shows the concentrate needs to be covered by subject profile.

Teacher profiles required number of subjects	
Degree in Administration	24
BA in Accounting	6
Degree in Mathematics	4
Industrial Engineers	3
BA in Economics	3
Systems Engineering	2
Environmental Engineering	1
LLB	2

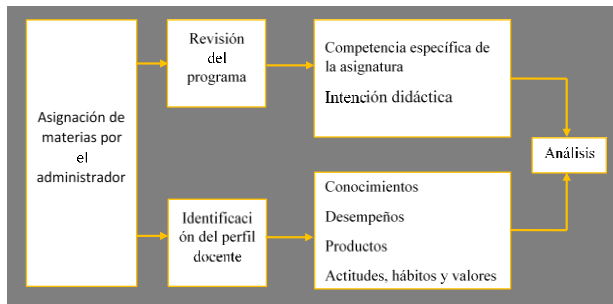
**Table 1** Concentrate subject and teaching profile.

According to analysis was possible to concentrate in Table 2, teachers profiles, subjects and skills required in the curriculum, which contibuyó for model design.

Asignatura	Teoría General de la Administración	Función Administrativa I	Función Administrativa II	Gestión Estratégica del Capital Humano I
Perfil	Lic. Admón.	Lic. Admón.	Lic. Admón.	Lic. Admón.
Competencia		Experiencia en la elaboración de planes y diseñar estructuras organizacionales.	Experiencia en la elaboración de planes y diseñar estructuras organizacionales.	Experiencia en la aplicación de modelos y procesos en el desarrollo del capital humano.

**Table 2** Concentrate subject to required profile and competence.

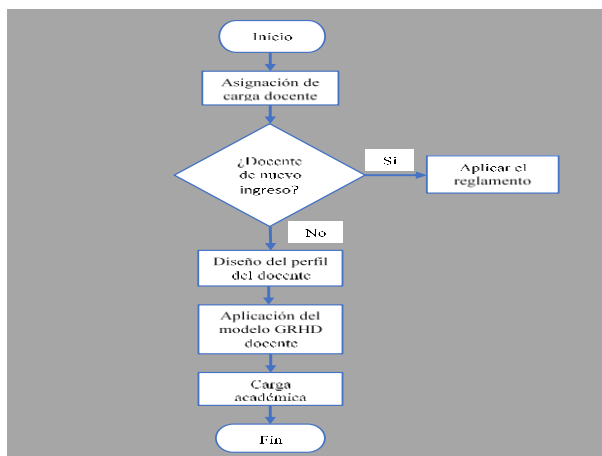
The result establishes the basis for the proposal of a model of human resource management for teachers of ITP



**Figure 1** Model of management of human resources for teachers CEA

In Figure 1 the proposed model which starts with the assignment of materials by the administrator teaching resource, where two important aspects to analyze emerge shown, the first is the review of the subject which includes the specific competence of the same and didactic intention, the second point is the identification of the teacher profile contemplating knowledge, performance products, attitudes, habits and values. The review and analysis of these aspects will allow appropriate allocation of materials.

In Figure 2, each of the process steps that the administrator teaching resource in the area of CEA, can continue to make the allocation of academic burdens on teachers and linking both variables under study shows.



**Figure 2** Diagram of process management.

**Conclusions**

For human resource management, the relationship of the teacher profile and profile required in the subject, are variables that are affected by the contingency planning, ie needs and unforeseen events affecting assignments academic workload and hours of teaching arise. So, the proposed model is intended to influence the administrator role human resource CEA, in the following areas: facilitate viewing and know graphically the link and importance of the variables let you know the necessary elements to be consider for the allocation of materials will help to improve the process of allocation of subjects to teachers, and identify professional development needs of their staff. On the other hand Diagram Figure 2 will facilitate the implementation of the two management options; new personnel and personnel base.

**References**

Chiavenato, I. (2002). Management of human talent. Bogota Colombia. Mc Graw Hill.

Fowler, S. (2014). Why motivating people does not work ... and what does: the new science of leading, energizing, and Engaging (Vol 36, No. 12.). Berrett-Koehler Publishers.

Janson, K. (2015). Demystifying talent management: Unleashed potential to deliver superior results. United States of America, Maven House Press.

Martin Linares, X., Segredo Pérez, A. M., & Perdomo Victoria, I. (2013). human capital, academic management and organizational development. Superior Medical Education, 27 (3), 288-295.

Nyberg, A. J. Moliterno, T. P., Hale, D., & Lepak, D. P. (2014). Resource-based unit-level perspectives on human capital and integration. Journal review of Management, 40 (1), 316-346.

Pascual, J. (2013). Human capital management in organizations. Spain. Altaria.

## Spain's Energy Policy: Impact of the Debt Crisis in its Renewable Energy Sector Reaching the EU 2020 Goals

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### Abstract

Spain's debt overhang has changed the scene of its renewable energy sector, affecting the realization of the country's 2020 renewable energy objectives. By analyzing Spain's i) legal framework, ii) financial approach, iii) energy impact, and iv) social and environmental conditions, both before and after the 2008 financial crisis, this study seeks to establish what directly and negatively affected the Spanish energy sector and its prospective development. This follows (and is inspired by) readings, both rhetorical and empirical, regarding renewable energy sector growth in Spain and the country's susceptibility to fail in accomplishing its renewable energy objectives.

### Renewable energies, sustainable development, policies for development, Spain

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In 2010, leading members of the European Union (EU) signed a strategic plan called “Europe 2020.” It set a number of targets for its member countries to reach by 2020. One of them was for each country to achieve 20% final energy consumption from renewable energy (RE) sources. However, the financial crisis since 2008 has tightened investment in RE projects, and has led to changes in RE policies that stimulated investment in the sector. Both endanger the sector's growth and the realization of the EU's aforesaid target.

According to Eurostat data, The Kingdom of Spain (henceforth, ES) received 14.3% of its energy from renewable sources in 2012, a 0.5% increase since 2010, representing a 8% advance in the goals and an elapse time of 20%. The austerity measures imposed by ES's government on the RE sector created a 68% contraction of investment in the sector in 2013 compared to the previous year. These measures have cut payments and subsidies, have suspended financial aid of new projects since 2012, and have imposed new taxes on the sector (discouraging investment in it).

ES's economic distress is linked partly to the 2007-2008 global financial crisis, partly to the 2010 European debt crisis, and partly to internal economic problems specific to ES (caused by the the former two crises). Beyond stopping subsidizing new RE projects, ES's feed-in tariff cuts, meant to manage its debt crisis, endangered the sustainability of the sector and the likelihood of fulfilling the EU 2020 targets for RE.

The objective of this paper is to identify how ES's external debt crisis is affecting the RE sector and its progress in meeting the EU's directive of receiving at least 20% its final energy consumption from RE sources. I hypothesize that ES's debt crisis caused ES to change its policies on investment in RE projects.

And in so doing endangered the realization of the EU 2020 goals.

The analysis itself contains four sections. The first provides theoretical plausibility to the claim that debt crises can threaten future investment in the RE sector *as well as* threaten governmental incentives to develop that sector. Its inductive approach attends to the role that high debt levels have on influencing investment.

The second section demonstrates that changes in ES's RE policy occurred *after* facing financial constraints from 2007 to today. It draws an inductive sketch of RE sector norms that are counterproductive to meeting the EU 2020 goals.

The third section presents ES's case study, stating ES's status in reaching the EU 2020 goal – projecting 20.8% RE energy consumption by 2020 – and tracing modifications in ES's RE policy from 2007 to 2013. It examines ES's legal framework, financial approach, energy impact, and social and environmental conditions.

The fourth and final section recommends policies in light of results from the prior three.

### Literature Review

Debt overhang generates macroeconomic instability, political instability, higher interest rates, capital flight, less investment, higher inflation, lower demand, and lower productivity. All of these affect economic growth generally and increase the barriers to investment in any sector. What lies first and most specifically for the RE sector is to link energy to economic growth, and then to relate external debt to economic growth.

Energy consumption is part and parcel of all economic activity. Economic activities need energy to transform inputs into final products (Stern & Cleveland, 2004, p. 4), showing that energy is indispensable to production. On the demand side, humans (often must) consume products that use energy to continue their lives. Energy provides heating, light, electricity, and more, and all of these are needed to perpetuate any modern society. GDP growth and consumption are causally connected, so higher demand in a country's GDP will lead to higher demand for energy there (Chontanamat, Hunt, & Pierse, 2006) and we can infer from this that slower or negative GDP growth lowers demand for energy, assuming static energy efficiency. ES has a high level of energy use per capita. According to Yeager, Dayo, *et al.* (2012, p. 396), "the state of economic development and the standard of living in a given region strongly influence the link between economic growth and energy demand."

### Background: Debt Crisis

The financial crisis of 2007 in the United States contaminated the European financial sector and compromised substantial public resources, forcing the state to intervene. The financial crisis led to sizable losses among financial institutions and private enterprises. The economic crunch also produced housing problems in Europe that exacerbated the crisis. Europe's economic recession, and its corollary high deficit and debt levels, evolved into to a debt crisis. ES was among the countries affected by the recession. This loss of state income led to an additional tax burden, since ES's government had to increase taxes or borrow resources to balance its budget in the fiscal year (Petrakis, 2012).

As Moro (2013) put it, "the sovereign debt crisis is a consequence of interactions between sovereign problems and banking problems that caused a severe economic slowdown." ES's economic growth slowed from 4.07% in 2006 to 3.45% in 2007 (in real PPP terms). The first signs of contamination by the US financial crisis were identified in Europe in August 2007. The reason for the slowed economic growth was the contraction of real-estate-sector investment, drops in consumer demand, consumer solvency deterioration, restrictive credit conditions, higher interest rates, risk repricing, increased public debt yields, and substantial increases in international oil and food prices. These conditions had become more restrictive, but tightened significantly after the bankruptcy of Bear Stearns, which aggravated the US financial crisis (Banco de España, 2008, pp. 109-135).

ES's government balance<sup>1</sup> was 2% of the country's GDP, and the debt<sup>2</sup>-to-GDP ratio decreased to 36.3%. Bond yields increased interest rates slightly, making the government pay more when compared to previous periods. Government spending increased 9.6% and was invested in social spending, infrastructure, education, and research. In 2008, ES's economic growth was below 0.9% (in real PPP terms). Internal constraints in the real-estate sector shrank, and the financial crisis's entrance into the real economy reduced exports and investment further. The Spanish Central Bank explained that the crisis led to higher default ratios among enterprises, less domestic consumption, lower financial-asset and real-estate prices, higher unemployment, tightened financial conditions, crises of confidence, decreased wealth, a decline in trade flows, and an increased perception of risk (Banco de España, 2009, pp. 3-24).

<sup>1</sup>The paper uses the Maastricht definition of government balance

<sup>2</sup>The paper uses the Maastricht definition of gross government debt



During this year 2008, there was a change ES's government's financial trends due to the rapid stop in activity. The statistics led the government to enact fiscal stimulus measures to counter the effects of the financial crisis. Automatic stabilizers, like unemployment benefits and a decline in tax revenue, progressively reduced disposable household incomes. The economic downturn saw an increase in the debt-to-GDP ratio and a negative budget balance. By the end of the year, ES's debt-to-GDP ratio was 40.2% and the government-budget-to-GDP was -4.5%. The economy contracted 3.8% in 2009, mainly from housing-sector problems and the financial crisis. The public-revenue-to-GDP ratio fell 6.7% from its 2007 level, unemployment increased 6.7%, real-estate sector prices dropped, and the productive sector suddenly stopped (Banco de España, 2010, pp. 21-36).

The Bank of Spain bailout, a regional lender Caja Castilla-La Mancha, and ES's government created a bank bailout fund worth 99 billion euros, forcing financial restructuring and mergers. The interest rate paid on ES's bonds decreased due to the search for safety from the US financial crisis and a drop in ES's main central banks' interest rates to counter the crisis. ES's primary balance deficit increased 144%, while external debt rose by more than 34%. The debt-to-GDP ratio exceeded 54%, and the primary-balance-to-GDP ratio was 11.1%. ES's economy contracted 0.2% in 2010. The financial crisis further tightened the financial system that affected lending standards and the perception of risk regarding ES's banking system. These matters increased interest rates and bond yields against the German benchmark. Doubts over the commitment to tackle structural problems, higher unemployment rates, labor market dysfunction, deteriorating public finances, and weaknesses in the European institutional framework raised doubts about the course of public spending. (Banco de España, 2011, pp. 23-42).

Turmoil in the Eurozone's sovereign debt markets substantially increased prices of European debt-bond yields, ES's among them. Tension from the Greek (110 billion euros) and Irish (85 billion euros) financial support packages had a contagious effect on the risk of ES's economy, and so ES's debt bonds were downgraded from AAA status to AA+ by Moody's and Fitch and Standard and Poor's. The country adopted a structural adjustment agenda. This implied, among several things, labor reform: Royal Decree-Law 10/2010. The debt-to-GDP ratio exceeded 61.7%, and the primary-balance-to-GDP ratio was -9.6%.

The negative international environment in the 2011 Eurozone undermined ES's growth, and ES dipped further into its recession. The European debt crisis continued to unfold with a bailout to Portugal (78 billion euros) and a second bailout to Greece (155 billion euros). This affected the risk of ES's bond yields, increasing the interest paid up to that point to record highs. This increased lending cost forced the European Central Bank to buy bonds to cut down borrowing costs and to prevent the spread of the debt crisis (Banco de España, 2012, pp. 13-33).

ES's economic growth in 2011 was 0.05%. ES's economy mostly relies on exports to other Eurozone countries, most of which are also undergoing economic adjustments, repressing consumption. Additionally, sluggish domestic demand has resulted from a negative financial outlook regarding ES. This outlook was most fostered by repercussions of the sovereign debt crisis, the restructuring of ES's financial system, increased job destruction, further collapse of the real-estate sector, and spillover effects from government austerity plans. The debt-to-GDP ratio exceeded 70.5%, and the primary-balance-to-GDP ratio was -9.6%. In one austerity measure, ES's Parliament increased the age of retirement.

It also passed a constitutional amendment forcing the government to keep a balanced budget and held early general elections due to political tensions.

In 2012, the Greek government, other Eurozone countries, and the IMF decided to conduct a debt swap of Greek government bonds, explaining that Eurozone government bonds were not risk-free. Cyprus's economic problems followed from considerable losses from investment in Greek bonds. It had to request the Eurozone for a 10-billion-euro bailout. Investors then (and once again) began to request higher-risk premiums for Eurozone government bonds (Gruppe & Lange, 2013 (in Press), pp. 2-3). ES's bond rates rose considerably amid fears of a government bailout of its weak financial institutions, which could lead to another country bailout from the Eurozone (Banco de España, 2013).

ES's government approved another labor market reform, Royal Decree-Law 3/2012, to improve the economy's competitiveness by lowering labor costs. ES's economy then fell into a deeper recession, unemployment grew, and ES had to request 100 billion euros from Eurozone member states to recapitalize its weak financial institutions. This implied loan came with a series of conditions and a new series of structural reforms designed by EU state aid rules and the IMF (IMF, 2012, pp. 5-31). ES's economy shrank by 1.64%. Its debt-to-GDP ratio exceeded 86%, and the primary-balance-to-GDP ratio was -10.6%.

ES's economic growth in 2013 was -1.22%, but officially the third quarter of the year marked the end of its negative economic growth trend. The financial sector assistance program successfully stabilized ES's financial sector. ES's government also continued its adjustment programs in pursuit of a current account surplus (ECB, 2014, p. 69).

ES's general government debt continued to grow. ES's debt-to-GDP ratio exceeded 94.59%, and its primary-balance-to-GDP ratio was -6.77%. Continued revenue contractions, insufficient internal demand, unemployment (27%), and higher social expenditures have led to a persistent macroeconomic imbalance. The government removed regulations that fragmented the domestic market, liberated professional services, cut government jobs, and fostered new regulations for entrepreneurship (IMF, 2013, p. 6).

### **Methodology: Case Study of Spain**

What remains is for us to comprehend how the debt crisis has influenced ES's RE policy. Current economic distress has made ES's government designate fewer resources to its RE sector, putting the EU 2020 goals further from reach. This case provides abundant information on the relative success of RE sector promotion and growth, the current economic climate under debt distress, and the monitoring of RE sector growth to meet the EU 2020 goals.

Utilizing an embedded design, we can focus attention on ES's changes in its legal framework, financial approach, and energy impact, and in the social and environmental conditions ES's energy policy produces. We compare two different time periods: the year before any evident financial distress in ES (2006) and the year following ES's state of financial distress (2013). The conceptual framework utilizes the debt overhang theory. It states that high external debt levels will affect macroeconomic stability, political stability, investment, interest rates, capital flight, poverty, consumption, and productivity. These disincentivize investment in ES's RE sector. We will show how this theory can help us understand the changes that occurred in ES's energy sector.

### Impact of the Debt Crisis:

ES's structural adjustment agenda has three pillars: the restructuring of credit institutions, the culmination of an ambitious fiscal consolidation process, and progress in structural reforms (Banco de España, 2012, p. 21). In response, the government has approved measures to cut money designated to the RE industry, since it is financed by debt, not taxes or citizens' electricity bills. This has changed ES's legal framework, macroeconomic outlook, energy outlook, and social and environmental conditions.

#### Legal Framework

The state regulates the final prices of electricity to homeowners, industries, and the commercial sector. Utilities in ES can raise in any given year. Politicking in this area creates a gap between what utility companies charge their customers and what utility companies pay to produce electricity. The net result is a debt that ES's government assumes as its own. The tariff deficit is an energy debt of 30 billion euros. That debt is still pending payment.

The government obliges the electricity sector to buy electricity from RE projects as a priority. The feed-in tariff system promotes investment in the RE industry. It also establishes a premium option that offers a bonus on top of the prevailing electricity price.

ES is a world leader in RE generation and equipment manufacturing. The country utilizes FITs as an instrument to promote RES-E. FITs are price-based policies which set the price to be paid for every RE-produced kWh generated (in the form of guarantee premium prices), as well as a purchase obligation on utilities (supply companies or grid systems). Costs are borne either by consumers or by the public sector.

According to del Río & A. Gual (2007, p. 998), since 1980 to 2003, there has been continuity and stability in legal RES-E promotion, but it has later suffered a reversal after the financial crisis and debt crisis. This can be made apparent with the differences in legislation relevant to renewable electricity.

The International Energy Agency shows that there have been thirty-six (36) normative changes in the RE sector. They consist of laws and ministerial decisions. Between 1999 and 2007, there were thirteen (13) key elements regulating the industry. After 2008, and to the present, there have been twenty-three (23) new regulations introduced that modify previous rules in most cases. These affected the prices offered to RE technology, modifying the profitability of ES's RE industry.

ES's government, due to financial distress, has deemed the FIT allocated to wind power and other incentives to promote RE excessive for its current budget, leading to important savings and making substantial new market structures.

In response to the crisis, the government has passed a number of highly contested measures to rein in costs, including retroactive changes to existing solar contracts (Robinson, 2012). This decision has stirred up protests from the solar industry and from investors worldwide, and a wave of lawsuits are already in the works to counter the government's plans (E3 Analytics, 2011). This reduced investment in the sector by 68% in 2012.

#### *Macroeconomic Impact*

ES's economic contraction has meant a fall in consumption of energy due to lower economic activity and foreclosures of businesses and industries.

The U.S. Energy Information Administration's (EIA's) statistics confirm that lower economic activity has generated lower energy demand; from 2007 to 2013, the energy demand has decreased 11.4%. In 2007 ES's total energy consumption was 6.7351 quadrillion BTU. In 2012, it was 5.9665 quadrillion BTU.

RE contributes to the GDP growth, export earnings, net fiscal contributors, investment in R&D, and lower energy prices. In 2012, the sector represented 1% of Spain's GDP, 10.563 trillion euros. Despite receiving subsidies from 2005 to 2012, ES has been a net fiscal contributor. In 2012, ES's (ibid.) RE sector was a net fiscal contributor with 569 million euros. The sector also contributed to a positive trade balance, since it entailed net exports of 724 million euros (APPA, 2013). Another positive contribution of the RE industry comes in resources it invests in R&D, 4.23% of its total contribution to the GDP in 2012 (313 million euros). Its total contribution to the GDP is well above the mean of 1.3% that ES invested in R&D that same year. The production of renewable energies has helped lower the price of MW per hour. This cheapened daily market prices, costing approximately 18 euros per MWh and in total represent a savings of 4.056 billion euros to the economy.

### The Energy Impact

RES-E generators could have chosen one of two alternatives before the crisis: a) a fixed premium (on top of the electricity market price) or b) a fixed total price (fixed feed-in). The premium in (a) had been updated annually since 1999, but the government, in line with the variation in the average electricity sale price, applied the total sum of the market price plus the premium.

The choice (b) also adjusted annually, allowed generators to know their revenues would grow regardless of changes in market price.

ES's FITs were successful in promoting wind and solar energy projects. FITs, however, are but one factor influencing the deployment of RES-E. Administrative procedures, grid connections, corruption, and trust also play roles. In 2013, ES represented more than 19% of the total wind energy installed in Europe, 22,959 MW of 117,289 MW. That same year, wind energy installations decreased by 84%. Most wind energy investments are moving abroad. This situation comes in response to the halt in new RE subsidies in ES. This not only threatens jobs and investment in the RE industry, but risks ES's companies no longer being competitive leaders in that sector. ES's share of energy in gross final energy consumption was 14.3% in 2012. A slowdown of this share implies increased energy independence from traditional sources like coal, natural gas, petroleum, and nuclear energy. The energy intensity<sup>3</sup> of the economy was 136.4 that same year. The APPA estimates that, from 2000 to 2012, it grew 37.8%, while the demand grew 2.4% (APPA, 2013, p. 121).

Fulfillment of directive 2009/28/EX of the European Parliament asserts that ES has to have at least 20% of its gross final consumption come from renewable sources. The report from Ecofys Consultancy for the European Commission explained that ES's changes in its legal framework from 2010 to 2012 undermined investors' confidence and will affect its RE sector's growth rate. The most optimistic simulation tool shows that ES will not reach the EU 2020 targets and will only reach 17.15% (Ecofys, 2012, p. 66). This report did not consider the latest RE sector reform, Royal Decree-Law 2/2013.

<sup>3</sup> Gross inland consumption of energy divided by GDP (Kg of oil equivalent per 1000 Euros)

Which limits increases on the tariff according to the consumer price index and eliminates premiums, aggravating the sector with more regulatory instability.

#### *Social and Environmental Conditions*

The Flash Eurobarometer 360 of the European Commission published that 81% of Spaniards believed that the future energy options should support renewable energies. Public support for RE should be considered in the elaboration of ES's energy matrix plan (APPA, 2013).

Ecologically speaking, renewables significantly combat climate change. RE technologies are becoming more competitive compared to wholesale electricity prices, but their continued growth hinges on subsidies to facilitate development and drive further cost reductions. The RE sector prevented the importation of 13,480,857 tons of oil (TOE), preventing the emission of 36,745,548 tons of CO<sub>2</sub> into the atmosphere in 2012. This is equivalent to 2,429 million euros in savings on imports. From 2005 to 2012, estimates state that renewables prevented the emission of more than 215.5 million tons of CO<sub>2</sub>, equivalent to 3.095 trillion euros in associated savings. It also prevented the emissions of 171,752 tons of NO<sub>x</sub> and 322,874 tons of SO<sub>2</sub>. ES had a very high unemployment rate in 2013. Its RE sector has also experienced job losses since 2008 (the sector's employment peak). In global terms, the sector's workforce decreased 17% in from 2008 to 2012, from 137,522 to 113,899 people. A report of ES's Renewable Energy Association (citation) stated that 54,938 jobs are created directly by the sector, and 58,961 indirectly. The economic crisis has also reverted the tendency to substitute energy consumption from highly contaminating sources, which are cheaper. ES's coal consumption increased 98.5% from 2010 to 2012.

The consumption went from 15.9295 million short tons in 2010 to 31.635 million short tons in 2012. The reasons behind this increase were the introduction of subsidies to coal and preferential access of the wholesale power market to coal-powered generators (EIA, 2014).

#### **Conclusions**

ES's fulfillment of the EU 2020 goals to reach 20% of its final consumption from RE sources was compromised once ES's government adopted measures to reach fiscal and debt sustainability. The legal framework, the macroeconomic outlook, the energy outlook, and the social and environmental situation has been affected by the debt crisis. The present legal changes that regulate the sector have created legal insecurity, weakening investors' confidence and the profitability of existing RE projects. The growth rate of the RE sector faces a bleak future once energy demand increases. The renewable share of total energy consumption will be lower in coming years if changes are not made and re-establish confidence among investors.

## References

- Ajayi, S. (1997, June). An Analysis of External Debt and Capital Flight in the Severely Indebted Low Income Countries in Sub-Saharan Africa. *International Monetary Fund Working Paper*, 1-62.
- Alesina, A., & Guido, T. (1989). External Debt Capital Flight and Political Risk. *Journal of International Economics*, 27, 199-220.
- APPA. (2013). El 81% de los Españoles Apuesta por las Energías Renovables. *APPA Info*, 19.
- APPA. (2013). *Study of the Macroeconomic Impact of Renewable Energies in Spain*. Madrid: Spanish Renewable Energy Association.
- Ardagna, S., Caselli, F., & Lane, T. (2006). Fiscal Discipline and the Cost of Public Debt Service: Some Estimates for OECD Countries. 1-35.
- Banco de España. (2008). *Annual Report 2007*. Madrid: Banco de España.
- Banco de España. (2009). *Annual Report 2008*. Madrid: Banco de España.
- Banco de España. (2010). *Annual Report 2009*. Madrid: Banco de España.
- Banco de España. (2011). *Annual Report 2010*. Madrid: Banco de España.
- Banco de España. (2012). *Annual Report 2011*. Madrid: Banco de España.
- Banco de España. (2013). *Annual Report 2012*. Madrid: Banco de España.
- Baum, A., Checherita-Westphal, C., & Rother, P. (2012). Debt and Growth New Evidence for the Euro Area. European Central Bank Working Paper(1450), 1-22.
- Boyce, J. (1990). *The Political Economy of External Indebtedness: A Case Study of the Philippines*. : Institute of Development Studies.
- Boyce, J. K. (1992). The Revolving Door? External Debt and Capital Flight: A Philippine Case Study. *World Development*, 20(3), 335-349.
- Buchanan, J. (1958). *Public Principles of Public Debt: A Defense and Restatement*. Homewood: Richard D. Irwin Inc.
- Chontanamat, J., Hunt, L., & Pierse, R. (2006, June). Causality Between Energy Consumption and GDP: Evidence from 30 OECD Countries and 78 Non-OECD Countries. *Surrey Energy Economics Discussion Papers*.
- Clements, B., Bhattacharya, R., & Nguyen, T. (2003, December). External Debt, Public Investment, and Growth in Low-Income Countries. *International Monetary Fund Working Paper*(249), 1-25.
- Cohen, D. (1993). Low Investment and Large LDC Debt in the 1980s. *American Economic Review*, 83(3), 437-449.
- Datastream International. (2014c, 02 27). *GROSS GOVERNMENT DEBT (% OF GDP) MAASTRICHT DEFINITION*. Retrieved 02 27, 2014c, from GROSS GOVERNMENT DEBT (% OF GDP) MAASTRICHT DEFINITION: <http://product.datastream.com/NavigatorLegacy/seriesmetadata.aspx?navcode=ESXGGM%25>.
- Datastream International. (2014d, 02 27). *INTEREST RATES: GOVERNMENT SECURITIES, GOVERNMENT BONDS*. Retrieved 02 27, 2014d, from INTEREST RATES: GOVERNMENT SECURITIES, GOVERNMENT BONDS: <http://product.datastream.com/NavigatorLegacy/seriesmetadata.aspx?navcode=ESY61...>
- del Río, P., & A. Gual, M. (2007). An Integrated Assessment of the Feed-in Tariff System in Spain. *Energy Policy*, 994-1012.

- Diamond, P. (1965, December). National Debt in a Neoclassical Growth Model. *The American Economic Review*, 55(5 Part 1), 1126-1150.
- Dornbusch, R. (1985). External Debt, Budget Deficit and Disequilibrium Exchange Rate. In G. Smith, & J. Cuddington, *International Debt and the Developing Countries*. Washington D.C.: The World Bank.
- Dornbusch, R. (1989). Debt Problems and the World Macroeconomy. In J. Sachs, *Developing Country Debt and Economic Performance* (Vol. 1, pp. 331-358). Chicago, United States of America: University of Chicago Press.
- Dornbusch, R., & de Pablo, J. (1990). An Overview of Debt and Macroeconomic Problems. In J. Sachs, *Developing Country Debt and Economic Performance* (Vols. Volume 2: The Country Studies -- Argentina, Bolivia, Brazil, Mexico, pp. 41-53). Chicago, United States of America: University of Chicago Press.,
- E3 Analytics. (2011). *Boom, Bust and Retroactive Cuts: Spains RE Odysy*. E3 Analytics.
- Eaton, J. (1987). Public Debt Guarantees and Private Capital. *The World Bank Economic Review*, 1(3), 377-395.
- ECB. (2014). *Annual Report 2013*. European Central Bank.
- Ecofys. (2012). *Renewable Energy Progress and Biofuels Sustainability*. Ecofys.
- EIA. (2014, 06 20). *U.S. Energy Information Administration*. Retrieved 06 20, 2014, from U.S. Energy Information Administration: <http://www.eia.gov/countries/country-data.cfm?fips=sp#tpe>
- Elmendorf, D., & Mankiw, N. (1998, Mach). Government Debt. *National Bureau of Economic Research*(6470), 1-94.
- Engen, E., & Glenn Hubbard, R. (2004). Federal Government Debt and Interest Rates. *National Bureau of Economic Reseach Working Paper*(10681), 1-71.
- Fisher, I. (1933). The Debt-Deflation Theory of Great Depressions. *Econometrica*, 337-355.
- Fofack, H. (2009, September). Causality Between External Debt and Capital Flight in Sub-Saharan African. *World Bank Reseach Working Paper*(5042), 1-31.
- Fry, M. (1993). Foreign Debt Accumulation: Financial and Fiscal Effects and Monetary Policy Reactions of Developing Countries. *Journal of International Money and Finance*, 12(4), 347-367.
- Garciandía Garmendia, R. (2011). *La Deuda Externa en la Actualidad: Nuevas Perspectivas para el Endeudamiento Internacional de los Estados*. Granada: Comares.
- Green, J., & Villanueva, D. (1991). Private Investment in Developing Countries. *International Monetary Fund Staff Papers*, 38(1), 33-58.
- Gruppe, M., & Lange, C. (2013 (in Press)). Spain and the European Debt Crisis. *European Journal of Political Economy*.
- Hjertholm, P. (1999). Analytical History Indebted Poor Country (HIPC) Debt Sustainability Targets. *Discussion Papers Department of Economics University of Copenhagen*, 1-46.
- IMF. (2012). *Spain 2012 Article IV Consultation*. Washington D.C.: International Monetary Fund.
- IMF. (2013). *Spain: 2013 Article IV Consultation*. Washington D.C.: International Monetary Fund.

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- Keynes, J. (1920). *The Economic Consequences of the Peace*. New York: Harcourt, Brace, and Howe.
- Khan, M., & Ul Haque, N. (1985). Foreign Borrowing and Capital Flight. *International Monetary Fund Staff Papers*(32), 606-628.
- Krugman, P. (1988). Financing vs Forgiving: A Debt Overhang. *National Bureau of Economic Research Working Papers Series*(2486), 1-34.
- Kumar, M., & Woo, J. (2010). Public Debt and Growth. *International Monetary Fund Working Papers*(174).
- Laubach, T. (2007). New Evidence on the Interest Rate Effects of Budget Deficits and Debt. *Finance and Economics Discussion Series Divisions of Research & Statistics and Monetary Affairs Federal Reserve Board*, 1-34.
- Laubach, T. (2009, June). New Evidence on the Interest Rate Effects of Budget Deficits and Debt. *Journal of the European Economic Association*, 7(4), 858-885.
- Lora, E. (2007). Public Investment in Infrastructure in Latin America: Is Debt the Culprit? *Inter American Development Bank Working Paper*(4502).
- Maier, R. (2005). External Debt and Pro-Poor Growth. *Proceedings of the German Development Economics Conference. Research Committee Development Economics No. 23*. Kiel: Verein für Socialpolitik.
- Meade, J. (1958). Is National Debt a Burden? *Oxford Economic Papers*, 10(2), 163-183.
- Mill, J. (1965). Of a National Debt. In J. S. Mill, *The Collected Workd of John Stuart Mill (Principles of Political Economy: with some of their applications to social philosophy)* (Vol. III, pp. 873-879). Canada: University of Toronto Press and Routledge & Kegan Paul.
- Modigliani, F. (1961, December). Long-Run Implications of Alternative Fiscal Policies and Burden of the National Debt. *The Economic Journal*, 71(284), 730-755.
- Modigliani, F. (1961, December). Long-Run Implications of Alternative Fiscal Policies and Burden of the National Debt. *Economic Journal*, LXXI, 730-755.
- Moro, B. (2013 (in Press)). Lessons from the European economic and financial great crisis: A Survey. *European Journal of Political Economy*.
- Moro, B. (2013). Lessons from the European economic and financial great crisis: A Survey. *European Journal of Political Economy*.
- Najdawi, C., Banasiak, J., Spitzley, J.-B., & Steinhilber, S. (2013). *Keep-on-Track! Project: Analysis of Deviations and Barriers 2013*. Eclaron, Fraunhofer.
- Ndikumana, L., & K. Boyce, J. (2003). Public Debts and Private Assets: Explaining Capital Flight from Sub-Saharan Africa Countries. *World Development*, 31(1), 107-130.
- Nguyen, T., Bhattacharya, R., & Clements, B. (2003). External Debt, Public Investment, and Growth in Low-Income Countries. *International Monetary Fund Working Papers*(249).
- Nicholson, J. (1920, March). Adam Smith on Public Debts. *The Economic Journal*, 30(117), 1-12.
- Pastor, M. (1990). Capital Flight from Latin America. *World Development*, 18(1), 1-18.
- Petrakis, P. (2012). *The Greek Economy and the Crisis: Challenges and Responses*. London: Springer Heigelberg Dordrecht.
- REN21. (2013). *Renewables 2013 Global Status Report*. Paris: REN21.



Ricardo, D. (1821/1951). Taxes on Other Commodities than Raw Produce. In P. Sraffa, & M. Dobb, *The Works and Correspondence of David Ricardo* (Vol. I: On the Principles of Political Economy and Taxations, pp. 243-256). Cambridge: Cambridge University Press.

Robinson, D. (2012). Pulling the Plug on Renewable Power in Spain. *Energy Comments Oxford Institute of Energy Studies*.

Sachs, J. (1989). The Debt Overhang of Developing Countries. In G. Calvo, *Debt Stabilization and Development: Essays in Memory of Carlos Díaz Alejandro*. Oxford: Basil Blackwell.

Savvides, A. (1992). Investment Slowdown in Developing Countries During the 1980s: Debt Overhang or Foreign Capital inflows? *Kyklos*, 45(3), 363-378.

Seriux, J., & Yiagadeesen, S. (2001). The Debt Service Burden and Growth: Evidence from Low-Income Countries. *The North-South Institute Working Paper*.

Servén, L. (1997). Uncertainty, Investment and Irreversible Investment: Theory, Evidence and Lessons for Africa. *World Bank Working Papers*(1722), 1-52.

Smith, A. (1981). Of Public Debts. In A. Smith, R. H. Campbell, & A. Skinner (Eds.), *An Inquiry into the Nature and Causes of Wealth of Nations* (Vol. I and II, pp. 907-947). Indianapolis: Liberty Fund.

Stern, D., & Cleveland, C. (2004). Energy and Economic Growth. *Rensselaer Working Papers in Economics*, 1-42.

Sutherland, D., Hoeller, P., Merola, R., & Ziemann, V. (2012). Debt and Macroeconomic Stability. *OECD Economic Department Working Papers*(1003), 1-36.

Tsoufidis, L. (2013, March 6). Public Debt and J.S. Mill Conjecture: A Note. *Munich Personal RePEc Archive*(44777), 1-12.

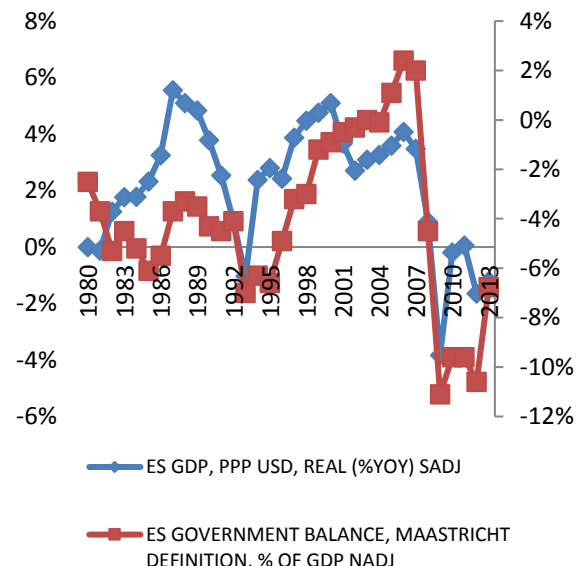
WB. (2005). *Economic Growth in the 1990s: Learning from a decade of Reform*. Washington D.C.: The World Bank.

Wiser, R., Pickle, S., & Goldman, C. (1998). Renewable Energy Policy and Electricity Restructuring: A California Case Study. *Energy Policy*, 26(6), 465-275.

Yeager, K., Dayo, F., Fisher, B., Fouquet, R., Gilau, A., & Rogner, H.-H. (2012). Chapter 6 Energy and Economy. In T. Johansson, A. Patwardhan, N. Nakicenovic, & L. Gomez-Echeverri, *Global Energy Assessment: Toward a Sustainable Future* (pp. 385-421). Cambridge: Cambridge University Press.

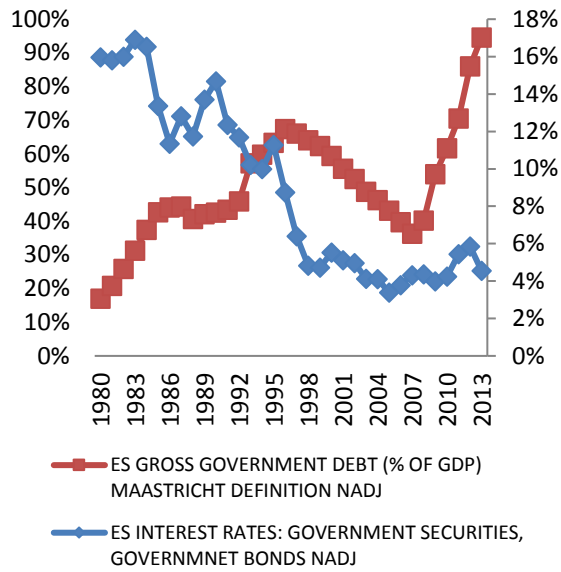
## Annex

### Annex 1 Spain Economic Growth and Government Budget Balance



Source: (Datastream International, 2014c)

**Annex 2 Spain Debt and Bond Yield Interest rates**



Source: (Datastream International, 2014d)

## **Investment Objectives and Strategies in Behavioural Portfolio: Empirical study in the Iran capital market**

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### **Abstract**

Objectives and strategies have a significant relation with investor's performance. In this research, we classified strategies and objects of individual investors in Tehran stock exchange during (2011-2015). Investor's objectives divided to 5 groups such as financial capital growth, Building financial buffer, saving for retirement, hobby and speculation. Then their strategies classified in 3 conventional strategies: fundamental, technical and heuristically. Finally according to behavioral characteristics like risk taking, aspiration levels and over confidence we tested relation among these objectives and strategies with their investors' performance.

Results show that behavioral characteristic of investor's has a significant effect on objectives and investing strategies and their performance. There is a relation between aspiration level and risk taking with investor's objectives, especially there is a strong significant relationship for investors whose object is makes capital grow and investors with technical strategy, has higher aspiration and risk taking level but the average yield of this approach is lower than average yield of fundamental strategy

### **Behavioral Portfolio Theory (BPT), Investing Strategies, Investment Objectives.**

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**Introduction**

In these paper we examined what are the differences between the investors in terms of their personal characteristics, what are their specified objectives, what are their investment strategies, and what are the effects of these factors on their performance. Graham et al (2009) believe that knowing these factors makes it possible to elaborate a vast range of personal characteristics, strategies, and objectives of the investors. Statman (2002) believes that behavioural preferences play an important role in choosing the stock portfolio. The portfolio choice of the investors and, consequently, their performance is influenced by characteristics such as ambition, hope, fear, and narrow framing in dealing (transaction) decisions. Crossly & Browning (2001) found out that in case of encountering different investment opportunities it is important to realize the investors' differences in a triangular relationship between the decisions made by them, the process which lead to these decisions, and the consequence of the investment performance. Recognizing the invisible differences in the individual level of the investors might help discovering the extensive behavioural abnormalities demonstrated by them while making the investment decisions (Graham et al, 2009).

Heckman (2001) and Pennings & Garcia (2009) express that knowing the type of choice and behaviour of the investors in the financial market requires discovering the invisible variables like their preferences and beliefs. Recognizing the difference in the individual level can help perceiving the factors which cause these behavioral abnormalities. Also Lee et al (200\*) believe that these difference haven't been much used to explain and justify the investors' decision-making or performance.

Muralidhar (2016) believes that applying the behavioural financial and the modern portfolio theory can prevent us from merging the investors' objectives, as the focal point and main center of their investment and savings, with the analyses. Shefrin & Hoffman (2011) examined the information obtained from a questionnaire research in order to achieve a better perception of the relationship between the investors' decisions, the processes which lead to these decisions, and the performance consequences.

The main theme of the present research focuses on the investors' difference and its role on their behaviour and seeks to answer questions such as "what are the differences between the investors in terms of their investment general objective and their attitude toward risk, aspiration, and overconfidence?", "what strategies do they take?", "is there any significant meaningful difference between the investment strategies in terms of their efficiency?", and "is it possible to suggest an appropriate pattern to the investors proportionate to their strategies?".

In this paper we present the research hypotheses and theoretical fundamentals in the first section and the research methodology and data extraction in the second section. The third section includes the research model and discussions related to the simulation of market with regard to the theoretical fundamentals. The findings and the results of the research are presented in the fourth and fifth sections respectively.

**Literature**

The present research is particularly focused on the theories of the investors' individual behavior in terms of the behavioral characteristics and effect of such behavior on the investment objectives.

Researches performed by Barber & Odean (2001), pointing out the role of the investors' behavioral and, especially, overconfidence characteristics, emphasize on the role of individual views and beliefs asking why some of the investors are too optimistic and have too audacious predictions. Kahneman et al (1991) concluded that if the investors have so much confidence on their own skills in choosing their stocks that assume it improbable to get repentant in future, then they will achieve highly desirable evaluation of their portfolio and will make more audacious predictions besides having the ability to overcome the bias governing their decisions.

Camille & Eleonore (2014) and Lopez (1987) believe that in risky situations the individual's aspiration level is used by the decision-maker as a predetermined pattern to accommodate the efficiency results with their needs level. Diecidue & Van de Ven (2008) consider the aspiration level as related with the results of financial decision-making, so they conclude that in case of encountering a financial decision the investor, consistent with the aspiration level, regards not only the risky projects but also the probability of failure and success in the investment. Therefore, in the present research, we categorized the behavioral characteristics in three groups as risk-taking, aspiration, and overconfidence; then, we tested whether a meaningful relationship exists between the investors' aspiration level and their risk-taking level or not.

Another area to be investigated in this research is the investors' objectives and motivation for entering the capital market. Shefrin & Statman (2000) believe that the relationship between the investors' objectives and its effect on choosing the investments options, in case of no-confidence situation, is defined in the focal point of Lopez's risky choice two-factor theory.

The first factor is focused on the financial buffer and security objectives and the second one focuses on the investment potentials. Camille & Eleonore (2014) believe that the investors choose their stock portfolio consistent with their aspiration level; while, according to Lopes's behavioral theory they assume their portfolio as a pyramid of assets. The lower layer indicates the tendency toward security and using low-risk stocks and the upper layer includes assets with higher risk and higher efficiency potential. So based on these theories, we classified the investors' objectives with regard to their preferences into five groups as financial buffer, capital growth, saving for retirement, hobby (entertainment), and speculation, and then tested some related hypotheses. We thought about what kind of investment strategy for choosing the transaction and investment option is taken by those investors whose objective is to achieve capital growth and financial buffer.

Ravindra Jain et al (2015) found out that, under pressure of some behavioral mistakes, the investors make unreasonable decisions and thus achieve weak return and efficiency. Numerous studies have been done on applying specified investment strategies in most of the organized stocks markets. Many of these studies figured out that applying specified transaction strategies can increase the return of exchanges and stocks. Among these researches, Shefrin & Huffman (2014), and Lewellen & Lease & Schlarbaum (1980) are the most well-known ones. In their researches, they classified the investment strategies into technical, fundamental, and heuristic analyzers and professional consultation. In the present research we made some hypotheses in order to figure out that which strategy is chosen by each of the investors, in each category of the objectives and behavioral characteristics. Aimed to achieve the research goals, we classified the investment strategies fundamental, technical, and heuristic strategies and used them as the basis for classifying the investors.

In this research we presented a new innovation. In fact, we could provide the investors with an appropriate pattern through simulating the market investment strategies and, besides, we could evaluate the simulation results by comparing them with the average stock index return and the questionnaire return. Steps and results of this innovation will be discussed in following sections.

### Data and Methodology

The present research is among a few studies in which the researcher collects the data required for evaluating the study objectives through two information sources, namely research by questionnaire based on determination of the investors' behavioral characteristics and statistical test of simulating the investment strategies, and thus can present a pattern appropriate for any category of the investors. To test the research hypotheses, the present research uses descriptive statistics for examining the demographic aspects and inferential statistics for analyzing the data and testing the hypotheses. In this research we used one-sample t-test, simple linear regression, and one-way analysis of variance (ANOVA) for testing the research hypotheses. After determining the existence or lack of difference between the averages of the tested groups, the LSD test was used to determine which groups have meaningful difference.

Variable	Range	Frequency	Abundance %
Age	Lower than 20	0	0.0%
	Between 20 to 25	31	9.0%
	Between 25 to 35	169	49.3%
	Between 35 to 50	104	30.3%
	More than 50	37	10.8%
Educational level	Diploma or less	19	5.5%
	Associate degree	12	3.5%
	Bachelor degree	67	19.5%
	Master of science	184	53.6%
	Ph.D. candidate	45	13.1%

**Table 1** Frequency and educational level of respondents.

In order to examine the collected data about the investors' behavioral characteristics including risk-taking, aspiration, and overconfidence, and the investment objectives in the capital growth, financial buffer, saving for retirement, and speculation groups, and also the investors' chosen strategies based on the heuristic, technical, and fundamental analysis, we tried to gather a sample of 343 individuals of the capital market activists by distributing the Shefrin & Huffman standard questionnaire with regard to Graham et al theories. Through 40 categorized questions we could examine and extract the investors' strategies, objectives, and characteristic aspects.

Results from descriptive statistics of the respondents indicate that more than 90 percent of those participating in this survey has a bachelor's degree, master's degree and Ph.D. and most of them are relatively expert investors and in the age range of young and experienced that adds to the credibility of the results and significance of this study.

Cronbach Alpha was used to measure the questionnaire reliability; since the analysis of Cronbach Alpha yielded 0.879 and is higher than 70% thus the general reliability of the questionnaire is acceptable.

Objectives	Number	Average	Standard deviation	Mean rank	Rank
<i>Capital growth</i>	343	4.379	0.847	4.390	1
<i>Financial buffer</i>	343	3.579	1.005	3.420	2
<i>Saving for retirement</i>	343	3.010	1.083	2.740	3
<i>Speculation</i>	343	2.793	1.039	2.460	4
<i>Entertainment (hobby)</i>	343	2.291	1.066	1.990	5

**Table 2** Friedman test for investment objectives ranking

Since t tests, simple linear regression and analysis of variance are of parametric tests which their utilization requires assumptions about population parameters that one of these main assumptions is the normality of the used data in these tests so Kolmogorov–Smirnov test is used to assess the normality of the main variables of research before conducting and analyzing tests. Cronbach’s alpha was obtained 0.879 for questionnaires’ stability.

Variable	Confidence level	K-S
Overconfidence	<0.95	0.029
Ambition	<0.95	0.027
Risk-taking	<0.95	0.04

**Table 3** Kolmogorov-Smirnov test values

According to Table 3 all values of Kolmogorov-Smirnov test are less than 0.05 which the normality assumption of data at the significance level of 95 percent is accepted.

The ranks average in the table of the ranks average is consistent with results of the research performed by Roudposhti et al (1389).

The responder regarded the most priority (preference) and importance to investment growth, financial buffer (security), saving, speculation, and hobby respectively.

Strategy	Number	Average	Standard deviation	Standard error	Confidence interval for mean95%		Mean rank	Rank
					Lower bound	Upper bound		
<i>Fundamental</i>	343	3.656	0.7263	0.0392	3.579	3.733	2.45	1
<i>Technical</i>	343	3.067	0.791	0.0427	2.983	3.151	1.86	2
<i>Heuristic</i>	343	2.959	0.7462	0.0403	2.88	3.038	1.70	3
<i>Total</i>	1029	3.227	0.8141	0.0254	3.178	3.277		

**Table 4** Friedman test for investment strategies ranking

In terms of frequency, more than 50% of the capital market activists and responders had chosen the fundamental strategy, 26% had chosen the technical strategy, and about 16% had chosen the heuristic strategy as their strategy.

After collecting and analyzing the data obtained from questionnaire the new classification of the capital market active investors will be presented. In this classification, every individual’s behavioral characteristics will be recognized proportionate to the investment strategies and objectives; thereby, results of the statistical test and hypotheses test will demonstrate that every investor, by choosing a specified strategy for his investment, would accept what range of objectives and behavioral errors such as risk, aspiration, and overconfidence.

### Model for evaluation of the behavioral portfolio choosing strategies

Later in this research, in order to evaluate the investors' performance, we will require their trading data extraction which, in this particular case, Shefrin & Huffman (2014 & 2011) studies are based on the online trading real data. However, in the Iranian capital market, with regard to the difference of return measurement methods and measurement time, numerousness of brokers, possibility of using multiple online codes and brokers, confidentiality of the users' information, and insufficiency of the online data, the researcher has attempted to extract the capital market data for simulating the stocks of active companies in capital market in heuristic, technical, and fundamental groups in order to achieve the individuals' trading data in the Iranian capital market; because the investors choose the stocks whose features are consistent with their chosen strategy. For example, an investor whose investment strategy is fundamental he seeks to find stocks with strong fundamental features in the capital market but a technicality investor, by testing previous prices and future trade volume, predicts the prices and specifies the opportunities of purchase and sales through assessing the range of market oscillations (John Murphy, 1999).

### Simulation of investment strategies

In the present research in order to simulate the capital market investment strategies, to extract risk and return for evaluating the performance of each investment strategy, and to extract the infrastructural data of financial statements, risk, and return of the stocks of active companies in Tehran Stocks & Exchange Market.

### Simulation of fundamental portfolio

There are various models for extracting the fundamental companies' stocks but in this research we regarded the financial health of companies, taken from Altman model (1983), as the basis of choosing.

This model specifically focuses on operating profit, asset, market value, and liability reimbursement ability; thus it is used to recognize those stocks with desirable status and financial statement and high financial power. This model is called Altman-Z model.

$$z = 0x_4 + 1x_5/3x_3 + 6/1x_2 + 3/1x_1 + 4/2$$

In this model:

- $x_1$ : Ratio of gross working capital to assets,
- $x_2$ : Ratio of accumulated profit to assets,
- $x_3$ : Ratio of operating profit to assets,
- $x_4$ : Ratio of the stocks' market value to liabilities
- $x_5$ : Ratio of sales to assets.

The definition domain of Z is introduced as follows:

If  $Z < 81$  the financial health is low; if  $1.81 \leq Z \leq 2.99$  the financial health is medium, and if  $Z \geq 2.99$  the fundamental variables are strong and the financial health is high. The researcher has selected the value domain of Z above 2 in order to choose the stocks with medium to high financial health.

### Simulation of technical portfolio

As for companies with technical features, recognizing and purchasing the chosen stocks was done using AMIBROKER software and one-filter programming. In this section, common and conventional indicators of the technical analyzers have been chosen for filtering, and validity of this method had been evaluated and confirmed based on a group of experts and five technical experts. The portfolio choosing filter has been compiled as follows:



Buy=(Cross(TEMA(Close,5) ,MA(Close,5)) AND  
TEMA(Close,5)> MA(Close,5))

OR (Cross (RSI, (14),30) AND RSI(14)>30) OR  
Cross(CCI(14),-100)

OR (StochK(15)<30) AND  
Volume>MA(Volume,15) OR  
Volume>MA(Volume,15);

In this filter which is programmed for AMIBROKER software, TEMA stands for “Triple Exponential Moving Average Oscillator”, CCI stands for “Commodity Channel Index” (comparing the current price level with average price), StochK stands for “Stochastic Oscillator” (a momentum index which indicates the resistance and support points), MA stands for “Moving Average”, and RSI stands for “Relative Strength Index”.

**Simulation of heuristic portfolio**

The trading volume filter was used to extract stocks of the companies with heuristic features; this means that stocks having the highest trading ratio compared to their weight (compared to the capital or number of the stocks) in choosing date were evaluated as stocks which have high attractiveness and the stockholders have more tendency to buy them in the trading day.

$$x = \frac{\text{trading day value}}{\text{total market value of share}}$$

After extracting and classifying the stocks in defined strategies, the researcher will be able to calculate the risk and return of each share using RAHAVARDNOVIN software and then allocate it to each portfolio.

In order to achieve more accommodation between the return reported in the questionnaire and the simulated market real data, the high-risk and low-risk stocks in each portfolio were determined and classified for each strategy.

To do this, using quartiles, the stocks in the first and fourth quartile ranges were recognized, respectively, as high-risk and low-risk shares. According to table-5, the performance resulted by the simulated market strategy was compared to the responders’ strategy thus the researcher could evaluate and compare the performance of these two databases (according to table-6) with the performance of the Stocks Average Index. The obtained results indicate that the simulation model’s return demonstrates a better performance compared to Tehran Stocks Average Index.

Return of simulated strategies				Result	Return of responders in questionnaire				
Strategy	Year	Risk range	Simulated return	Difference	Responders' return	Risk range	Year	Strategy	
Technical	89	Low	5.3	14.1	-8.8	Low	89	Technical	
		High	113.0	114.0	-1.0	High			
	90	Low	-39.3	60.6	21.3	Low	90	Technical	
		High	42.6	10.1	32.5	High			
	91	Low	-30.5	-50.3	19.8	Low	91	Technical	
		High	46.7	23.1	23.6	High			
	92	Low	70.8	42.6	28.1	Low	92	Technical	
		High	249.8	203.7	46.1	High			
	93	Low	-52.1	-104.6	52.5	Low	93	Technical	
		High	53.6	-18.9	72.5	High			
	Fundamental	89	Low	6.6	-3.3	9.9	Low	89	Fundamental
			High	99.7	96.6	3.1	High		
90		Low	-10.9	-42.8	31.9	Low	90	Fundamental	
		High	74.6	35.1	39.5	High			
91		Low	-19.9	38.5	18.6	Low	91	Fundamental	
		High	82.2	59.9	22.3	High			
92		Low	38.8	2.0	36.8	Low	92	Fundamental	
		High	181.0	131.6	49.4	High			
93		Low	-46.1	-96.4	50.3	Low	93	Fundamental	
		High	39.2	-58.7	98.0	High			
Heuristic		89	Low	-3.5	-15.9	12.4	Low	89	Heuristic
			High	131.9	135.0	-3.1	High		
	90	Low	-33.1	-56.4	23.3	Low	90	Heuristic	
		High	78.7	48.9	29.8	High			
	91	Low	-46.1	-68.7	22.6	Low	91	Heuristic	
		High	95.9	75.3	20.6	High			
	92	Low	52.4	18.1	34.3	Low	92	Heuristic	
		High	235.1	205.9	29.1	High			
	93	Low	-58.9	096.4	37.5	Low	93	Heuristic	
		High	53.18	06.11	59.3	High			

**Table 5** Difference of return between market simulation strategies and investors’ strategy

Time Return		Average Index Return		Market Simulated Return		
Year	3-month return	Annual stocks	Average stocks	Technical return	Fundamental return	Heuristic return
1389	89.3	0.85	13.00	30.0	21.5	27.4
	89.6		29.00	53.6	44.4	55.1
	89.9		-2.00	1.6	2.7	3.3
	89.12		27.00	27.9	31.1	46.1
1390	90.3	0.09	6.00	9.4	12.3	9.3
	90.6		7.00	25.1	19.7	28.2
	90.9		-8.00	1.1	15.8	12.5
	90.12		6.00	7.1	26.8	28.7
1391	91.3	0.45	0.00	10.9	9.3	6.7
	91.6		2.00	1.5	11.6	21.2
	91.9		33.00	19.3	36.4	45.6
	91.12		6.00	15.0	25.0	22.5
1392	92.3	1.05	27.00	67.5	60.2	73.9
	92.6		27.00	59.2	43.0	57.5
	92.9		38.00	94.9	57.9	72.5
	92.12		-9.00	28.2	19.9	31.2
1393	93	-0.21	-8.00	11.2	0.3	11.9
	93.6		-2.00	12.4	17.6	9.9
	93.9		-3.00	24.6	21.0	28.0
	93.12		-11.00	5.4	0.3	3.3

**Table 6** comparison of market simulation strategies with Tehran Stocks & Exchange Market Average Index

**Research findings**

Results show that, with regard to the test statistic, F equals 10.048 and the significance level of the test is equal to 0.000 thus H<sub>0</sub> is rejected; that is, the average overconfidence of those investors who apply fundamental strategy is equal to technical strategy but more than heuristic strategy.

Moreover, testing the investors’ risk-taking level showed that F test statistic value is 4.39 and significance level of the test is 0.013; thus, there is a meaningful difference between the fundamental, technical, and heuristic investors in terms of risk-taking level such that the technical-analysis-based investors show more risk-taking level compared to fundamental and heuristic investors. These findings are inconsistent with findings of Shefrin & Huffman (2011) since they believe that investors who are based on fundamental analysis have more aspiration and trading turnover, take more risk, have too much overconfidence, and demonstrate better performance compared to the technical-analysis-based investors.

As for the aspiration level, the research results are not consistent with Shefrin’s results. This study shows that the technical analyzers’ aspiration level is much more than that in heuristic and fundamental ones. With regard to the significance level, the analysis of variance shows that there is a meaningful relationship between heuristic, technical, and fundamental investors in terms of aspiration level; furthermore, the average aspiration of the technical analyzers is more than the other ones.

The descriptive analysis and Friedman test results for investors’ objectives show that the significance level of the test is 0.00 and, with regard to the average ranks obtained from the rankings average table, the responders have regarded the highest priority and importance for capital growth, financial buffer, saving for retirement, speculation, and hobby respectively.

Results obtained by Shefrin & Huffman (2014) show that investors with speculation objectives accept more aspiration and risk and consider themselves more progressed than those ones whose objective is building financial buffer or saving for retirement. However, regarding the results of hypotheses testing for investors’ objectives in the present research, the Pearson correlation coefficient is 0.168, the significance level is 0.003, and there is a meaningful positive relationship between the investors’ risk-taking and aspiration, that is, the higher the level of aspiration, the higher the level of risk-taking.

As for the relationship between the investors’ strategies and objectives, the obtained results show that since the value of F test statistic is 4.215 and the significance level is 0.028 thus different investors have different capital growth objectives. That is, capital growth objective in heuristic investors is less than that in fundamental and technical ones but no difference is observed between the technical and fundamental investors in terms of capital growth objective.

Besides, with regard to the significance level of the test (0.017), no meaningful difference is observed between technical and fundamental investors in term of financial buffer objective while the financial buffer objective in fundamental investors is less than that in the heuristic ones. Results show that those investors with heuristic strategy follow less financial buffer and capital growth objectives compared to the technical and fundamental investors but technical and fundamental strategies have no meaningful difference. So although there exist a positive meaningful relationship between the investors' aspiration level and risk-taking level but this relationship is absent in the investors' risk-taking and speculation objectives. On this basis, the results obtained in this research for risk-taking and speculation objectives are not consistent with the results of Shefrin & Huffman (2014) research.

In order to introduce an appropriate solution to investors for choosing portfolio in each of the above-mentioned strategies, the researcher has used Tehran Stocks & Exchange Market data for simulating the investment portfolios in for of three fundamental, technical, and heuristic strategies correspondent to the presented theoretical literature.

Considering the analyses performed for simulation of the heuristic, technical, and fundamental strategies of the Iranian capital market, the results show that the average return in the five-year period from 2011-2015 for simulated strategies with low risk-taking is less than the Average Stocks Index; however, the average return during the same time period for simulated strategies with high risk-taking is meaningfully more than the Average Stocks Index.

The three-month average return resulted by simulated strategies is more than the three-month average return of the Average Stocks Index. Results obtained from evaluation of the returns announced by the responders, return of the market simulated model, and return of the Average Stocks Index indicate that the return of the simulated model with high risk can yield more return compared to the Average Index.

### **Conclusions**

The analytical-descriptive results obtained from 343 behavioral questionnaires related to the market activists show that, in terms of frequency, more than 50% of the responders have chosen fundamental strategy, and the technical and heuristic strategies have been chosen by, respectively, 26% and 16% of the responders. However results of Friedman test, in significance level 0.05, have shown that the responders regard the most importance and priority to the fundamental, technical, and heuristic strategies, respectively; but there is no meaningful difference between heuristic and technical strategies. Inconsistent with results of Shefrin & Huffman (2014), the obtained results indicate that the average of overconfidence and diversity of portfolios in fundamental strategies are equal to technical strategy and more than heuristic strategy; on the other hand, the technical investors demonstrate more risk-taking and aspiration level compared to the fundamental ones.

Results of testing the hypotheses in terms of investors' objectives show that, consistent with Shefrin & Huffman (2011), there is positive meaningful relationship between aspiration and risk-taking levels but no meaningful relationship is observed between speculation and risk-taking level.

The innovation of the present research is manifested in the results obtained from comparison of the capital market strategies simulated model with Tehran Stocks & Exchange Market Average Index. In this research, using simulation of the investment strategies in the capital market, we could create higher average return compared to Tehran Stocks & Exchange Market Average Index by choosing the high-risk portfolios.

General results obtained from testing the hypotheses show that the Iranian capital market enjoys a particular behavioral method among the investors with various investment strategies which affects their performance. But the simulation results indicate that if the investors use the simulated models and elaborated filters of the present study simulating the strategies, in case of choosing high-risk portfolio, they will be able to achieve higher and more desirable return compared to the Average Stocks Index.

## References

- Altman E.I.; Corporate financial distress: A complete guide to predicting, avoiding and dealing with bankruptcy; New York: John Wiley and Sons, Inc, 1983.
- Barber B. M. And Odean T.(2001). "Boys Will Be Boys: Gender Overconfidence and Common Stock Investment" *Quarterly Journal of Economics* Vol . 116, Pp.261-292.
- Browning, M. and T. F. Crossley (2001). The Life-Cycle Model of Consumption and Saving. *Journal of Economic Perspectives*, 15(3), 3-22.
- Camille-Eléonore MAGRON (2014), *Approches comportementales de la gestion individuelle de portefeuille*, UNIVERSITÉ DE STRASBOURG.
- Diecidue Enrico , van de Ven Jeroen, Weitzel Utz (2008), Shareholders' expectations, aspiration levels, and mergers, McCarthy, K.J., Dolfsma, W. (eds.) "Understanding Mergers and Acquisitions in the 21st Century", Palgrave Macmillan, pp.148-164.
- Jain, R., Jain, P., & Jain, C. (2015). Behavioral Biases in the Decision Making of Individual Investors. *IUP Journal of Management Research*, 14(3), 7.
- Graham, J. R., C. R. Harvey, and H. Huang (2009). Investor Competence, Trading Frequency, and Home Bias. *Management Science*, 55(7), 1094-106.
- Heckman, J. J. (2001). Micro Data, Heterogeneity, and the Evaluation of Public Policy: Nobel Lecture. *Journal of Political Economy*, 109(4), 673-748.
- Hoffmann, A. O., & Shefrin, H. (2011). Online Investors: What They Want, What They Do, And How Their Portfolios Perform. What They Do, and How Their Portfolios Perform (September 20, 2011).
- Hoffmann Arvid O. I., Shefrin Hersh (2014), Technical Analysis and Individual Investors, *Journal of Economic Behavior and Organization*, 107 (November), pp. 487-511.
- Kahneman, D., Knetsch, J. L., & Thaler, R. H. (1991). Anomalies: The endowment effect, loss aversion, and status quo bias. *The journal of economic perspectives*, 193-206.
- Lee, H.-J., J. Park, J.-Y. Lee, and R. S. Wyer (2008). Disposition Effects and Underlying Mechanisms in E-Trading of Stocks. *Journal of Marketing Research*, 45(3), 362-78.

Lewellen, W. G., R. C. Lease, and G. G. Schlarbaum (1980), "Portfolio Design and Portfolio Performance: The Individual Investor," *Journal of Economics and Business*, 32(3), 185-97.

Lopes, L. (1987). *Between Hope and Fear: The Psychology of Risk*. *Advances in Experimental Social Psychology*, 20 255-95.

Muralidhar, A. (2016). *Goals Based Investing, the KISS Principle, and the Case for New Financial Instruments*. Available at SSRN 2715053.

Pennings, J. M. E. and P. Garcia (2009). *Risk & Hedging Behavior: The Role and Determinants of Latent Heterogeneity*. *The Journal of Financial Research*, Forthcoming.

Murphy, J. J. (1999). *Technical analysis of the financial markets: A comprehensive guide to trading methods and applications*. Penguin.

Statman, M. (2002). *Lottery Players / Stock Traders*. *Financial Analysts Journal*, 58(1), 14-21.

Shefrin, H., & Statman, M. (2000). *Behavioral portfolio theory*. *Journal of financial and quantitative analysis*, 35(02), 127-151

Technical in high Return		Technical in high Risk		History
30.0	H Return	12.3	H Risk	8903
4.7	L Return	4.1	L Risk	
53.6	H Return	13.6	H Risk	8906
12.2	L Return	3.8	L Risk	
1.6	H Return	8.5	H Risk	8909
-17.2	L Return	2.5	L Risk	
27.9	H Return	10.5	H Risk	8912
5.7	L Return	5.2	L Risk	
9.4	H Return	13.8	H Risk	9003
-11.1	L Return	4.2	L Risk	
25.1	H Return	13.7	H Risk	9006
-6.0	L Return	6.5	L Risk	
1.1	H Return	7.7	H Risk	9009
-12.8	L Return	3.0	L Risk	
7.1	H Return	8.4	H Risk	9012
-9.4	L Return	2.7	L Risk	
10.9	H Return	11.9	H Risk	9103
-3.2	L Return	4.9	L Risk	
1.5	H Return	15.6	H Risk	9106
-6.3	L Return	3.2	L Risk	
19.3	H Return	12.4	H Risk	9109
-6.5	L Return	3.2	L Risk	
15.0	H Return	10.2	H Risk	9112
-14.6	L Return	3.7	L Risk	
67.5	H Return	22.2	H Risk	9203
26.2	L Return	10.1	L Risk	
59.2	H Return	30.5	H Risk	9206
13.5	L Return	12.4	L Risk	
94.9	H Return	32.8	H Risk	9209
35.4	L Return	10.4	L Risk	
28.2	H Return	20.5	H Risk	9212
-4.4	L Return	8.8	L Risk	
11.2	H Return	13.8	H Risk	9303
-21.8	L Return	5.9	L Risk	
12.4	H Return	16.2	H Risk	9306
-9.8	L Return	5.4	L Risk	
24.6	H Return	20.0	H Risk	9309
-4.4	L Return	6.9	L Risk	
5.4	H Return	14.6	H Risk	9312
-16.1	L Return	6.9	L Risk	

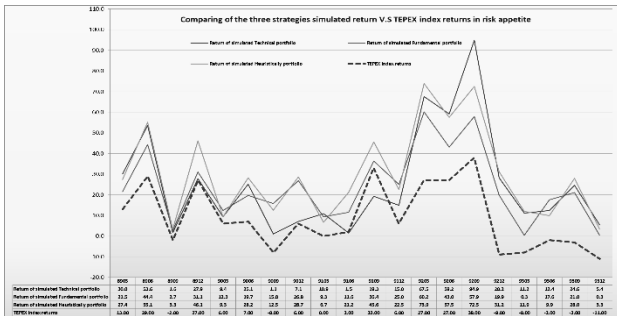
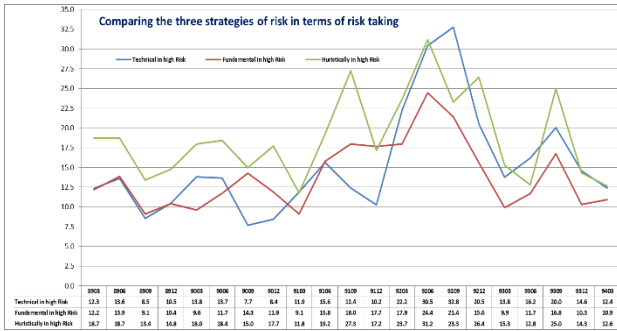
**Appendix 1** High Risk and Low Risk V.S High Return Low Return of simulated Technical portfolio

Fundamental in high Return		Fundamental in high Risk		History
21.5	H Return	12.2	H Risk	8903
1.8	L Return	3.3	L Risk	
44.4	H Return	13.9	H Risk	8906
10.8	L Return	4.7	L Risk	
2.7	H Return	9.1	H Risk	8909
-11.8	L Return	2.8	L Risk	
31.1	H Return	10.4	H Risk	8912
5.8	L Return	3.1	L Risk	
12.3	H Return	9.6	H Risk	9003
-1.8	L Return	3.2	L Risk	
19.7	H Return	11.7	H Risk	9006
0.2	L Return	3.9	L Risk	
15.8	H Return	14.3	H Risk	9009
-8.6	L Return	4.3	L Risk	
26.8	H Return	11.9	H Risk	9012
-0.8	L Return	4.5	L Risk	
9.3	H Return	9.1	H Risk	9103
-5.8	L Return	2.7	L Risk	
11.6	H Return	15.8	H Risk	9106
-6.2	L Return	2.3	L Risk	
36.4	H Return	18.0	H Risk	9109
-0.7	L Return	4.2	L Risk	
25.0	H Return	17.7	H Risk	9112
-7.2	L Return	4.5	L Risk	
60.2	H Return	17.9	H Risk	9203
15.5	L Return	7.1	L Risk	
43.0	H Return	24.4	H Risk	9206
9.3	L Return	7.8	L Risk	
57.9	H Return	21.4	H Risk	9209
21.0	L Return	8.9	L Risk	
19.9	H Return	15.6	H Risk	9212
-6.9	L Return	5.7	L Risk	
0.3	H Return	9.9	H Risk	9303
-16.3	L Return	3.8	L Risk	
17.6	H Return	11.7	H Risk	9306
-8.0	L Return	4.2	L Risk	
21.0	H Return	16.8	H Risk	9309
-5.7	L Return	5.2	L Risk	
0.3	H Return	10.3	H Risk	9312
-16.0	L Return	3.6	L Risk	

**Appendix 2** High Risk and Low Risk V.S High Return  
Low Return of simulated Fundamental portfolio

Heuristically in high Return		Heuristically in high Risk		History
27.4	H Return	18.7	H Risk	8903
3.3	L Return	6.3	L Risk	
55.1	H Return	18.7	H Risk	8906
14.7	L Return	5.6	L Risk	
3.3	H Return	13.4	H Risk	8909
-22.1	L Return	4.6	L Risk	
46.1	H Return	14.8	H Risk	8912
0.6	L Return	6.2	L Risk	
9.3	H Return	18.0	H Risk	9003
-11.4	L Return	5.3	L Risk	
28.2	H Return	18.4	H Risk	9006
0.3	L Return	7.1	L Risk	
12.5	H Return	15.0	H Risk	9009
-15.7	L Return	5.4	L Risk	
28.7	H Return	17.7	H Risk	9012
-6.3	L Return	7.6	L Risk	
6.7	H Return	11.8	H Risk	9103
-23.0	L Return	6.5	L Risk	
21.2	H Return	19.2	H Risk	9106
-5.6	L Return	7.4	L Risk	
45.6	H Return	27.3	H Risk	9109
-0.1	L Return	10.0	L Risk	
22.5	H Return	17.2	H Risk	9112
-17.4	L Return	6.9	L Risk	
73.9	H Return	23.7	H Risk	9203
26.8	L Return	10.5	L Risk	
57.5	H Return	31.2	H Risk	9206
12.9	L Return	14.1	L Risk	
72.5	H Return	23.3	H Risk	9209
22.8	L Return	11.3	L Risk	
31.2	H Return	26.4	H Risk	9212
-10.0	L Return	10.7	L Risk	
11.9	H Return	15.3	H Risk	9303
-21.3	L Return	7.2	L Risk	
9.9	H Return	12.8	H Risk	9306
-11.5	L Return	6.2	L Risk	
28.0	H Return	25.0	H Risk	9309
-7.2	L Return	12.0	L Risk	
3.3	H Return	14.3	H Risk	9312
-18.9	L Return	7.1	L Risk	

**Appendix 3** High Risk and Low Risk V.S High Return  
Low Return of simulated Heuristically portfolio



**Emergency Care for Local Address Hidalgo National Water Commission**

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**Abstract**

The National Water Commission (Conagua) was born on January 16, 1989 as a decentralized body of the Secretariat of Environment and Natural Resources, to address all matters related to the administration of national waters and their inherent public goods. The creation of Conagua is because the federal government recognized the strategic value of water, with the premise that a country without water, can not develop. The agencies that preceded it, were responsible for the construction of infrastructure required by the country; however, the task currently is the preservation of water, with the participation of the 3 levels of government and organized society. One of the guiding objectives of Conagua is "Preventing the risks arising from hydrometeorological events and attend to their effects." To address this guiding objective, the Local Address Conagua has been organized to address the meteorological contingencies arising in Hidalgo, in coordination with the State Government; It has developed planning risk management.

**Water management, weather, prevention, risk management.**

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**Introduction**

Mexico because of its geographical location is vulnerable to various hydroclimatological extraordinary phenomena, especially to tropical cyclones, whose season formally starts on May 15 for the Pacific Ocean and June 1 for the Atlantic; They conclude on November 30 on both coasts. 2016 14 Tropical Cyclones for the Pacific and 15 are forecast for the Atlantic.

In modern history, hurricanes are remembered by their magnitude and degree of destruction; in the case of Gilberto and Diana in the 80 that hit the coast of the Gulf of Mexico. In 1997 Hurricane Pauline destroying important infrastructure in the states of Guerrero and Oaxaca, one year after Mitch was presented causing destruction in Chiapas was presented. 2005 was an extraordinary season with 27 systems (14 hurricanes and 13 tropical storms), some very intense as Emily, Katrina, Rita and Wilma category V, Dennis Category IV, and Mary and Beta Category III on the scale Zafiro-Simpson; during this Season Seven cyclones hit directly on the coast of Mexico, Hurricane Emily and Tropical Storm Stan, both crossed the Yucatan Peninsula causing significant damage to the infrastructure of the city of Cancun and followed his career over the Gulf of Mexico, touching earth a second time on the coasts of the states of Tamaulipas and Veracruz.

In 1999, Tropical Depression No. 11, which remained semi-stationary interaction with the cold front # 5 was presented, prompting accumulated rainfall of 243 mm height, causing significant damage to the infrastructure of the Valley of Tulancingo. In 2007 Hurricane Dean brought large volumes of water and new account infrastructure damage were taken in the region of Tulancingo. In 2011 Hurricane "Arlene" that provoked strong presipitaciones was presented; however, there was extensive damage, as drainage infrastructure had been rehabilitated.

Derived from these events among others, the National Water Commission has gained experience in handling these emergencies.

Their participation in the care of emergencies in its field of competence, has been essential to prevent these increase their scale and focuses its activities on providing drinking water to the affected population, take actions sanitation and reconstruction of the infraestructura of potable water to restore its operation, drainage and irrigation systems.

In recent years, Conagua has been transformed for the mandated activities efficiently and has defined its mission and vision as:

Mission:

"To manage and preserve national waters, with the participation of society to achieve sustainable resource use."

View:

"Being a regulatory and technical authority and promoting the participation of society and levels of government in water management body".

From 2006 Conagua has developed and strengthened its strategic planning, which has enabled it to clearly define its strategic objectives to be achieved. In this vein one of its objectives is to "prevent risks related to hydrometeorological events and attend to their effects."

In 1999, Tropical Depression No. 11 was parked off the coast of Veracruz, causing moisture penetration in the states of Veracruz and Hidalgo mainly causing heavy and intense rains for several days (from 4 to 7 October).

For the particular case of the state of Hidalgo these occurred on the basins of the Metztitlán, Tulancingo and Avenidas river, causing damage among others to the city of Tulancingo and surrounding communities, as well as La Vega de Metztitlán and localities near the lagoon Metztitlán . Local Address Hidalgo Conagua, was coordinated with the State System of Civil Protection and other state and federal agencies of the executive, to develop actions to mitigate the impact of floods; subsequently, Conagua continued reconstruction and prevention actions to minimize possible damage to the population to another extraordinary rain.

Local Address it assisted in a timely manner to the disaster zone was declared and therefore could be applied FONDEN resources. Drinking water systems that were rebuilt amount to approximately 76 at a cost of \$ 2,581,717.00; and hydro-agricultural infrastructure Tula Irrigation District 003, 008 and 028 Metztitlán Tulancingo, with an investment of \$ 31,301,320.00 was also rebuilt.

#### Risk management

In order to be more efficient care hydroclimatological contingencies, is developing a program called "Planning for Emergency Management", where human and material resources are clearly established available to the Local Address Hidalgo, for situations emergency and prevention.

Formally technical-administrative groups responsible for coordinating and addressing, in the area of competence settled, possible emergencies Hydroclimatological named "Task Force", which is in charge of Local Director and Group Captain.

The staff assigned to each group depends on the magnitude of the emergency.

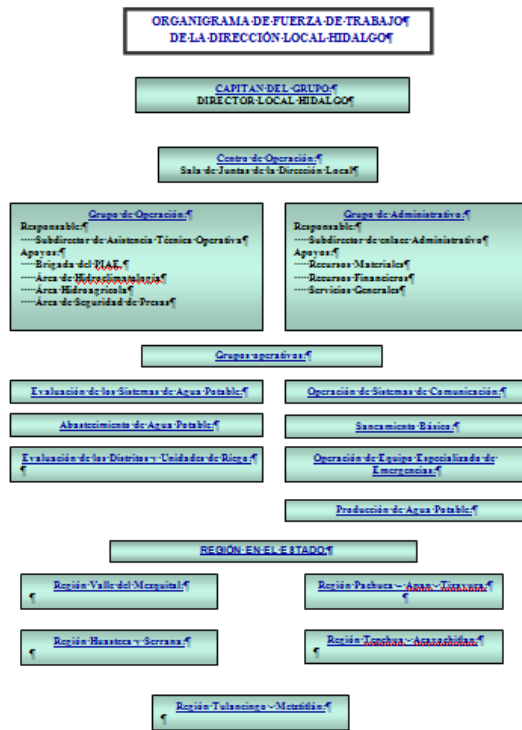
The team captain is responsible for coordinating preventive actions and actions during and after the event; he joined the inter-agency group, whose leader is in command state governor, who presented the report occurred damage.

The operating group is responsible for information on the damage and present the respective Group Captain report.

The governing body has the responsibility to provide for the staff involved in emergency care has the necessary resources to perform the task.

Also, the task force has other areas of support:

- Communication Systems
- Drinking water production
- Water supply
- Assessment districts and irrigation units
- Basic sanitation
- Operation specialized emergency teams



**Figure 1** Flowchart Workforce

The group structure "Task Force" has also been organized according to the different regions of the state, considering the foreign facilities that comprise the Local Address:

- Region Valle del Mezquital
- Pachuca-Apan-Tizayuca Region
- Huasteca region and Serrana
- Region Tehuacan-Acaxochitlán
- Region Tulancingo-Metztlán

Phase I called Surveillance, starts from June 1 and ends on November 30, during this stage the operation group monitors the hydroclimatological events, with information provided by the Division of the National Weather Service and with the help of satellite images, as long as there is not any system affecting the country, bulletins are issued every 24 or 12 hrs.

Phase II called Early Warning starts at a cyclone in the Atlantic mainly that could approach the national territory, while it is more than 500 kilometers of national coasts, during which notices with information provided by the Branch issued detected National Weather Service every 6 hours.

Alert Phase III called Emergent, begins when a cyclone is 500 kilometers or less of the national territory, from the time notices are issued with information provided by the National Weather Service Branch every 3 hours; notices in the position of the cyclone, its possible path, prognosis and areas of possible effects is included.

The captain of the group, with the information collected informs the state board of civil protection, through its technical secretary, who is responsible for raising awareness of the arousal of public awareness and disseminating the recommendations before, during and after the phenomenon instance. Conagua also contributes with information provision and fostered a culture of prevention before extraordinary hydrometeorological phenomena.

The state board of civil protection is organized as follows:



**Figure 2** Organization of the State Council of Civil Protection

## State characterization

The state covers an area of 20,905.12 square kilometers, constituting 1.1% of the national territory and has 2'235,591 inhabitants of which 50.7% are located in rural areas and 49.3% in urban areas. Hidalgoense 94.7% of the territory is located in the hydrologic region 26 panuco and 5.3% in the hydrologic region 27 Tuxpan-Nautla, with an average annual rainfall of 821 millimeters.

The state is divided into 84 municipalities and 4,749 localities, of which 4,643 are less than 2,500 inhabitants, 93 people between 2,500 to 20,000 inhabitants, 11 have between 20,000 to 50,000 inhabitants and 2 with more than 50,000.

## High-risk areas to extreme events

As already he mentioned the Local Address has regionalized state based on the distribution of staff and infrastructure, but also in each defined region has established the type of risk that may occur.

## Huasteca region

## Flood

- (46) Orizatlán
- (32) Jaltocán
- (28) Huejutla de Reyes
- (26) Huazalingo
- (11) Atlapexco
- (80) Yahualica

## Tizayuca-Pachuca-Apan region

## Flood

- (69) Tizayuca
- (48) Pachuca
- (51) Mineral de la Reforma
- (22) Epazoyucan
- (83) Zempoala

- (72) Tlanalapa
- (61) Tepeapulco
- (08) Apan

## Actopan-Tula region-Ixmiquilpan

## Flood

- (30) Ixmiquilpan
- (50) Progress Obregon
- (54) San Salvador
- (03) Actopan
- (23) Francisco I. Madero
- (41) Mixquiahuala
- (05) Ajacuba
- (70) Tlahuelilpan
- (65) Tetepango
- (74) Tlaxcoapan
- (10) Atitalaquia
- (76) Tula de Allende

## Serrana region

## by mudslides

- (49) Pisaflores
- (40) The Mission
- (34) Lolotla
- (14) Calnali
- (20) Eloxochitlan
- (31) Jacala de Ledesma
- (62) Tepehuacan Gro.
- (18) Chapulhuacan
- (42) Molango de Escamilla
- (33) Juarez Hidalgo
- (81) Zacualtipan Angeles
- (36) San Agustin Metzquititlan
- (79) Xochicoatlán
- (37) Metztitlan
- (68) Tianguistengo
- (73) Tlanchinol
- (71) Tlahuiltepa

## Region Tepehua

## Flood and Mudslides

- (53) San Bartolo Tutotepec
- (27) Huehuetla

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- (04) Agua Blanca de Iturbide
- (60) Tenango de Doria
- (35) Metepec

National Water Commission. (2014). National Water Program. Mexico City: Official Gazette. Programa Sectorial de Energía (2013-2018)

Vega region Metztitlan-Tulancingo

#### Flood and Landslide

- (37) Metztitlan
- (12) Atotonilco el Grande
- (24) Huasca de Ocampo
- (45) Omitlán de Juárez
- (01) Acatlan
- (77) Tulancingo
- (02) Acaxochitlan
- (16) Cuauhtepic de Hinojosa

#### Conclusions

The experience gained by the Local Address Hidalgo Conagua in emergency care by extraordinary hydroclimatológicos phenomena has been very helpful and has established an order for care, particularly through the creation of specialized groups in different tasks required implement in these situations, and according to the vulnerability of the geographic regions of the state of Hidalgo.

It would be interesting and of great benefit carry out exchange of experiences among states that have attended emergencies such as those described and submit vulnerability to the effect of extraordinary hydroclimatological phenomena, in order to enrich the strategies to be followed in these situations and in involving the responsible for state and municipal governments.

#### References

Republica government. (2013). National Development Plan. Mexico City: Official Gazette.

## **SCORM for Learning basics of programming**

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### **Abstract**

The present article is developed in the context in which the learning management platforms (LMS) implement standards that enable the integration of resources with educational content external to the system. The standard to be used for this type of content is SCORM which enhances the visual quality and interactivity of the study material on the LMS systems. The creation of the SCORM for the subject of basics of programming required the development of independent drives calls learning objects that incorporate multimedia elements, hypermedia, images and text, using the model ADDIE i settling in an LMS based on Moodle. The implementation will allow greater interactivity with study materials, evaluations and immediate feedback. It is concluded that the development of this type of educational materials based on the SCORM standard makes the teaching resources are dynamic, interactive, visually attractive and of specific content.

### **SCORM, learning objects, LMS**

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**Introduction**

The use of ICTS and their adaptation to a learning online is a great challenge for designers of these courses within the educational institutions, due to this form of learning is a transformation of the traditional models, therefore requires knowledge of ICT tools, instructional design and some methodology for the development of digital educational materials. Through the development of on-line learning scenarios are given the opportunity to generate digital teaching educational resources focused on students, i.e. that all study materials together with activities are focused to attract the attention of the student, hold it and at the same go generating knowledge and raising their levels of competence.

These study materials should be visually attractive, interactive so that you can navigate through them in an intuitive way and with instant feedback, in addition to be flexible so that students can proceed at their own pace.

However, students in the area of computer science, as every professional in this branch are suggested to have programming knowledge and for this must be from conceptual elements that are provided through the foundations of the own programming, it is here where many of the students require educational materials that enable them to develop the necessary logic, creativity indispensable, confront challenges and challenges, to do this the teaching materials must contain features such as dynamic, interactive and visually appealing.

For engineering students learn a programming language proves to be a complex task due to the high demand of the logic, intellectual, creativity, dedication, long hours of study and experimentation required.

To achieve this requires not only the technology but the content development that comply with the aforementioned characteristics in addition to the monitoring of a methodology that ensures the good development of the contents. For educational materials that meet these requirements are required for external tools to the LMS systems, but which in turn are compatible with them. The standard to be used for the generation of this type of content is SCORM.

This article is structured in the following way: introduces the theoretical framework and a brief description of the SCORM standard. Continues with the development of the case basics of programming in the stages of design, construction of learning objects and evidence of the same in the Moodle platform, and ends with the results and conclusions.

**Theoretical Framework****SCORM**

Content development under a standard as SCORM (Sharable Content Reference Model), which was an initiative of the United States Department of Defense has features such as accessible, reusable, multiplatform, dynamic and durable. In accordance with Preduelo (2004) SCORM divides the world of the learning technology in two fundamental components: the training platform (LMS) and interchangeable content objects (SCO - Sharable Content Objects-). The SCO become what is known as learning objects (LO).

A LMS platform that contains content or digital teaching educational resources based on SCORM offers both to the developers of the courses as well as users with a user-friendly environment that allows you to manage your own content and give a follow up to the students. For Akhshabi (2011) a SCORM must have two things:

1. All content in a single package or package.
2. This content can run in real time and have exchange of information.

The components of this model are three:

1. Model of Agregation of Content (CAM), who is responsible for ensuring the format and procedures for the storage and retrieval of contents.
2. Execution Environment, has the function of the definition of the API (Application Program Interface) for communication with the LMS system and the data model.
3. model of sequencing and navigation to the presentation of a dynamic and interactive of the didactic content or material of study, houses the rules of sequence that has introduced the designer.

The SCORM integrates from LO, provides a solution that spans from the packaging, structure and labelling, passing through the communication and storage of information until the flow definition of the sequence of content (Blanco, 2011).

The entire contents of a SCORM is packaged in a package interchange file or in a file compression in zip format, the content can be integrated by a combination of the following types of components,

- 1- Animations
- 2- Pictures
- 3- Videos
- 4- Text
- 5- Podcast
- 6- Hyperlinks

### **Learning Objects**

The LO are digital resources that have specific characteristics and to be able to develop them you must follow a methodology of instructional design. For Cortés (2009) a learning object is an informative content organized with a formative intentionality, it is also subject to some standards of cataloging that facilitate their storage, location and digital distribution and that can operate on different platforms of tele-training (e-learning).

From the foregoing it establishes that the development of a go requires a technological part and another part teaching that implies a instructional design. Said Wiley (2003) that the central idea of learning objects is: the instructional designers can build small components of instruction (in relation to the size of a full course) that can be reused several times in different contexts of study.

It is important to highlight that the LO are independent and formed by small structures which must be composed of the following components:

- Learning Objectives (they want to achieve in the student).
- Informational content (information needed to achieve the goal).
- Learning Activities (actions that must be performed by the student designed to achieve the goal).
- Evaluation (allows the student to recognize the level of competence achieved).
- Metadata (data that allow the search and accommodation of LO in a repository or bank of LO).



## Learning Management System

The OA are encapsulated in a zip file which is called SCORM and it is possible to manage it through LMS platforms like Moodle, Blackboard Dookeos, Edmodo, inter alia, allowing students to interact with the content. An LMS is an environment that allows communication between teachers and students that uses the web technology as a means of distribution of the contents, resources or study materials and activities to be developed by the student. Boneu (2007) said that the LMS (learning management system) provide an environment that enables the upgrade, maintenance and expansion of the web with the collaboration of multiple users.

Are oriented to learning and education by providing tools for the management of academic contents, allowing to improve the skills of the users of the courses and their intercommunication, in an environment where it is possible to adapt training to the requirements of the enterprise and the own professional development.

## ADDIE model

Of agreement with Cortés (2009) internal organization of LO, it should possess the necessary structural elements to perform a autonomous learning, which it does not necessarily mean that either alone, individualistic or that do not take into account that learning is a social construction, but that in the learning process takes an active part in one who learns and also that the LO has been built by people who have contributed their knowledge even when they are not physically in the moment of the delivery of the final product; in addition, that the LO is an educational content and as such is only a part of the process of which they also part the student and the teacher or tutor.

Therefore it should be borne in mind that for the development of LO is required of the pedagogical and didactic aspect of the study materials that promote the teaching content and achieve programming in students.

ADDIE is a model of instructional design that provides a sequence of steps for the development of LO, consists of the following stages:

- 1- Analysis: It is the first step and where you should obtain information about the students, content and environment of training needs.
- 2- Design: sequences and organize content, specifies how to learn.
- 3- Development: production of materials.
- 4- Implementation: implementation and in practice the materials with the participation of the students.
- 5- assessment: Determine the points of improvement of the instructions within the materials.

Figure 1 graphically shows the stages of the ADDIE model and sequence of the same.

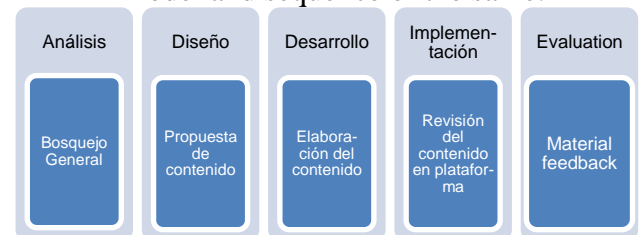


Figure 1 Stages of the ADDIE model

## Related work

According to Del Blanco (2011) there are several applications for the SCORM, among them is their use for the integration of games and simulations as part of courses implemented in LMS systems or virtual teaching (EVE).

Muñoz (2008) uses the SCORM within the project AulaWeb to establish the management of learning, the inclusion of interactive multimedia content and which permit the monitoring by the teacher/tutor to students that for the first time received computer skills as a subject face within the plan of studies of Industrial Engineering.

Lopez (2015) exposes the development of LO and implements it in an LMS for the teaching of programming to people with hearing disabilities. These are some examples of the usefulness and application of the LO and SCORM for the teaching of various skills that can be used in different areas and are available for it to be revised at times that are necessary on the part of the students.

**Methodology**

For the development of the SCORM through which presents the study materials for basics of programming is used the model ADDIE following the Decalogue which proposes :

Espinosa (2015) about the recurring design criteria for LO which subsequently integrated the SCORM, in accordance with the properties and capabilities offered by the internet as a medium for communication and an LMS as a scenario for presentation, these criteria are:

- 1- Organization of information
- 2- Motivational aspects
- 3- Interactivity
- 4- Multimedia
- 5- Hypertext Multimedia
- 6- Navigability
- 7- Interface
- 8- Usability
- 9- Accessibility
- 10- Flexibility

following the model ADDIE for the instructional design of the LO in the Table 1 shows the actions and products of each the stages.

Stages of the model ADDIE	Actions	Results
<b>Analysis</b>	Review of the program of study. Objective analysis of the population.	Needs for materials to be developed for the construction of the LO.
<b>Desing</b>	Development of the topics to be presented. Identification of the resources. Definition of the activities. Design of the instructions.	Didactic strategies for the presentation of the contents and the guide instruccional.  Initial proposal of the LO.
<b>Develop</b>	To prepare the contents (study materials, activities and evaluation) to be presented and to integrate them by means of the software for the LO construction. To generate the SCORM.	SCORM
<b>Implementation</b>	It tries the SCORM with students' support. It tries on the part of teachers.	Feedback about the SCORM both of students and of teachers.
<b>Evaluation</b>	Application of the feedback generated in the previous point. Use of a survey to obtain additional information and its interpretation in order to improve the instruction and contents.	Final presentation of the SCORM.  Final report of the product (evaluation and recommendations).

**Table 1** Application of the ADDIE model.

For the production of the LO to must analyze the tool to be used in such a way that would allow the integration of the various elements that compose it together with the rules that allow the interactivity and dynamic content. For this particular case is used the tool eXe Learning because it provides a simple and intuitive environment for the development of the OA and in addition is a free software

To be integrated the SCORM within an online course is accessed through an icon and name that distinguishes it, students can then give follow up to the content, resources and activities designed in such a way as to be a guide in the learning process of the subject of basics of programming.

## Results

The visual and interactive elements that a SCORM offers it allows to the students autonomous, intuitive and dynamic learning, in addition to having the opportunity to revise the topics that the LO contains so many times be necessary for the comprehension of the above mentioned topics, acquisition of the skills and/or knowledge.

The access to the SCORM is realized across a course in line implemented inside a platform LMS based on Moodle, the Figure 2 allows to observe the main interface of the SCORM.



Figure 2 Main window of the SCORM

On the main page of the SCORM the students will be able to navigate through the different options that are presented, suggesting for those admitted for the first time to review each paragraph sequentially or in its defect can continue in the section that have visited on his last access. To navigate through the different sections found in the contents: videos, audios, examples, text and images.

As a point of departure in the SCORM is the diagnostic evaluation which is very important for students to have a referent of the previous competitions that require to be able to address the topics to be addressed. In Figure 3 will appreciate some of the questions included in the diagnostic evaluation.

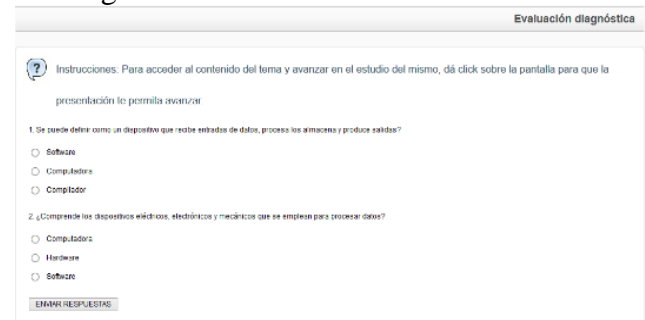


Figure 3 Diagnostic evaluation

Another important aspect within the SCORM is the feedback provided to students when they perform the assessments and the practice exercises, this allows that reinforce the knowledge or correct errors immediately. This form of presenting the contents of study makes the study of the same is in a more simple and depending on the configuration of the online course can that the outcome of the evaluations that are within the SCORM is integrated into the book of qualifications within the course or simply run the SCORM as formative activities designed, planned and organized within the process of teaching and learning.

## Conclusions

The progress which we have in technology allows its application in various areas or disciplines among which is without any doubt the education, in such a way that enables the construction of LO which are a means by which you can share knowledge and information to generate and programming skills. The LO packaged as SCORM allow students who wish to discover and take part in the wide world of programming have the opportunity to access the contents placed at its disposal.

This article discusses the use of a SCORM to provide content of fundamentals of programming, through which we wish to reach objectives, indicated within the own SCORM. The use of the standard permits a better utilization since it can be installed on different platforms LMS by their characteristics of communication between the own standard and the platform. After this development has gained experience in the application of the model ADDIE for the creation of LO and the generation of the SCORM, as well as its implementation in an online course, taking advantage of the potential of the tools that facilitate this process of development of the LO for developers.

Following the methodology are products that offer the user, in this case the students materials and resources that will give them the ease of a ubiquitous learning.

## References

Akshabi, M. (2011). Educational standard content design system for virtual university. *Procedia Social and Behavioral Sciences*.

Altamirano, V., & Carlos, J. (2015). Las plataformas virtuales y su incidencia en el proceso enseñanza-aprendizaje en la materia de programación de los (as) estudiantes de tercero de bachillerato, especialidad informática y computación del ITS “Juan Francisco Montalvo” de la ciudad de Ambato, provincia de Tungurahua.

Ardila Muñoz, J. Y., Cañadulce, R., & Marcela, E. (2015). Three dimensions for learning management system (LMS) evaluation. *Zona Próxima*, (22), 69-86.

Arteaga, J. M., Rodríguez, F. J. Á., Urrutia, B. O., & Salas, J. P. C. (2006). Objetos de aprendizaje. *José Trinidad Padilla López*, 109.  
Badillo Perero, G. P. (2014). Estudio comparativo de estándares para implementar un repositorio de objetos de aprendizaje. Caso práctico: Facultad de Informática y Electrónica.  
Boneu, J. M. (2007). Plataformas abiertas de e-learning para el soporte de contenidos educativos abiertos. *RUSC. Universities and Knowledge Society Journal*, 4(1).

Bonilla, A. H., & Salcedo, L. O. G. (2014). Elaboración de un ambiente virtual colaborativo usando eXe Learning para la enseñanza de Ciencias Naturales [Elaborating of a collaborative-virtual-environment by using eXe Learning for teaching of Natural Sciences]. *Ventana Informática*, (31).

Cabero-Almenara, J., & Vázquez-Martínez, A. I. (2014). Production and evaluation of a Personal Learning Environment for faculty training: analysis of an experience/Producción y evaluación de un Entorno Personal de Aprendizaje para la formación universitaria: análisis de una experiencia. *Cultura y Educación*, 26(4), 631-659.

Cortés, J. C. (2009). Los tres escenarios de un objeto de aprendizaje. *Revista iberoamericana de educación*, 50(1), 2.

del Blanco Aguado, Á., Torrente, J., Martínez-Ortiz, I., & Fernández-Manjón, B. (2011). Análisis del uso del estándar SCORM para la integración de juegos educativos. *Revista Iberoamericana de Tecnologías del/da Aprendizaje/Aprendizagem*, 118.

Díaz Espitia, J. S., Sáenz, S., & Uldy, C. (2014). Estudio para la implementación de un ambiente virtual de aprendizaje para la asignatura de sistemas en la Fundación Compartir.

Gallardo, P. C. (2014). Un Modelo para el diseño de Material Computacional Interactivo. *IE Comunicaciones: Revista Iberoamericana de Informática Educativa*, (19), 1.

García, L. C., Morteo, G. L., Gamboa, R. M., Arteaga, J. M., Paredes, J. P. C., Castillo, J. J. C., ... & Angulo, R. V. Norma Mexicana para la Interoperabilidad entre Entornos de Objetos de Aprendizaje.

Goyes, A. H., Sandoval, O. J., Ramírez-Gonzalez, G., Chantre, Á. R., & Fuentes, G. A. Propuesta para la Creación de Objetos de Aprendizaje utilizando la PDI, Caso Enseñanza Profesional en Turismo.

Guerrero Chacón, M. E. (2015). *Integración de un conjunto de Herramientas Telemáticas en una Solución de Apoyo al proceso de Aprendizaje de la Asignatura de Programación en la FIEE* (Doctoral dissertation, Quito, 2015.).  
Guevara Villafuerte, J. Y. M. M. Y. (2014). El B-Learning en el proceso de refuerzo académico en programación de aplicaciones de cuarta generación en la unidad educativa Juan Francisco Montalvo.

López, D. L., Muniesa, F. V., & Gimeno, Á. V. (2015). Aprendizaje adaptativo en moodle: tres casos prácticos/Adaptive learning in moodle: three practical cases. *Education in the Knowledge Society*, 16(4), 138.

López, M. (2015). Diseño de objetos de aprendizaje accesibles y adaptativos e integración a un Sistema de Gestión de Aprendizaje.

Marzal García-Quismondo, M. Á., Calzada Prado, J., & Cuevas Cerveró, A. (2006). Desarrollo de un esquema de metadatos para la descripción de recursos educativos: el perfil de aplicación MIMETA. *Revista española de documentación científica*, 29(4), 551-571.

Moya Prieto, J. F. (2015). Los escenarios pedagógicos digitales y su incidencia en su desempeño estudiantil de los estudiantes del tercer semestre de la asignatura de Programación II, de la carrera de Docencia en Informática de la Facultad de Ciencias Humanas y de la Educación de la Universidad Técnica de Ambato.

Muñoz, D. J., García-Beltrán, A., Martínez, R., & Muñoz-Guijosa, J. M. (2008). Implementación de un Módulo de Gestión de Contenidos SCORM en la Plataforma AulaWeb. In *IV Simposio Pluridisciplinar sobre Diseño, Evaluación y Desarrollo de Contenidos Educativos Reutilizables (SPDECE07)*, Bilbao (pp. 19-21).

Ortuño, R. A. C., Morgado, E. M. M., & Rodríguez, C. M. O. (2016). Diseño de Objetos de Aprendizaje adaptados para cuatro estilos de aprender: un estudio de caso. *Revista de Educação Pública*, 25(59/2), 548-572.

Payan Pamplona, D., & Ospina, J. A. (2015). Diseño de un modelo práctico para la creación de cursos virtuales de aprendizaje orientados a estudiantes que inician en la Universidad Tecnológica de Pereira caso práctico curso matemáticas.

Pedruelo, M. R. (2004). El estándar SCORM para EaD. *Proyecto Fin de Carrera, Tesina del Máster en Enseñanza y Aprendizaje Abiertos y a Distancia Universidad Nacional de Educación a Distancia*.

Prendes Espinoza, M. (2015). Diseño de cursos y materiales para teleenseñanza.

Rodríguez, M. S., Guzmán, S. C. B., & Zallas, F. A. E. (2015). Desarrollo y utilización de un objeto de aprendizaje para el estudio de consultas estructuradas en una base de datos de SQL server. *Revista Electrónica sobre Tecnología, Educación y Sociedad*, 1(4).

Rodríguez, N., Romero, S., & Ramírez, M. S. (2014). Objeto de aprendizaje para la formación docente orientado al desarrollo de competencias de comunicación. *Teoría de la Educación; Educación y Cultura en la Sociedad de la Información*, 15(2), 108.

Rotaech Zubillaga, L. A. (2016). Creación de objetos de aprendizaje para la enseñanza virtual del análisis por termografía infrarroja.

Vázquez, A. R. (2014). Consideraciones para el diseño didáctico de ambientes virtuales de aprendizaje en salud. *Horizonte Sanitario*, 9(3), 16-21.

Wiley, D. A. (2003). *Connecting learning objects to instructional design theory: A definition, a metaphor, and a taxonomy*.

Zambrano Rivera, M. E. (2014). Aplicación conjunta de las metodologías oohdm y pacie para el diseño y desarrollo de cursos en línea utilizando herramientas web 2.0 y second life con un IMS caso de estudio: curso en línea para la materia de programación ii del departamento de ciencias de la computación de la espe.

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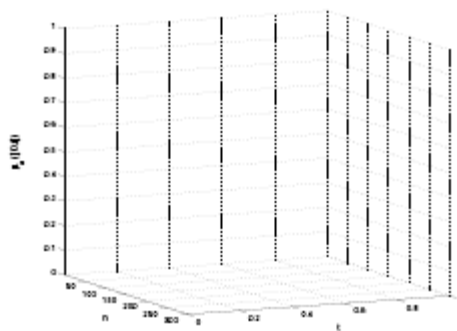
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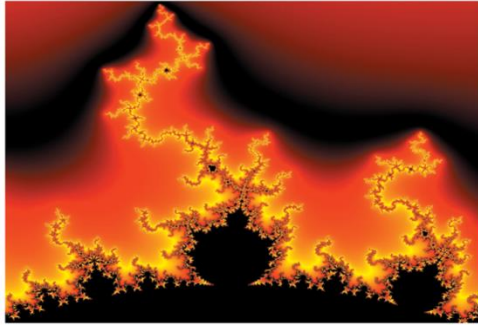
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