# Global Connectivity, Knowledge and Innovation for Sustainability and Growth: New Paradigms of Theory and Practice


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# *How Innovation Interacts with Mobile Learning in Guadalajara, México*

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**Abstract**

*The information and communication technologies (**ICT**) are producing new and innovative forms of teaching-learning process, so our research question is: **Which is the Empirical Model of How Innovation interacts with Mobile Learning in Guadalajara, México**? This research is aimed to respond it. The final **Factors**, were **4:** Technology (**T**); Contents, Teaching-Learning Management and Styles (**CTLMS**); Professor&Student Rol (**PSR**); Innovation Process (**INNOV**) and **65 Variables**. Our research is based on a documentary study that chose variables used by specialists in **m-Learning** ( **mL**), using Analytic Hierarchy Process (**AHP**). The study was applied on: **20** professors and **800** students both participating in social sciences courses, from **7** Universities located at Guadalajara Metropolitan Area, México (**GMAM**) during the period **2013-2014**.The data of the questionnaires, were analyzed by structural equations modeling (**SEM**), using **EQS 6.1 software**. The final results suggest reinforce **12 variables** to improve the interaction with **mL** at **GMAM**.*
**Keywords: e-Learning, Learning Styles, Teaching Styles, Innovation Technology, Educational Innovation.**

**Resumen**

Las tecnologías de información (**IT**) están produciendo nuevas formas en el proceso de enseñanza-aprendizaje, por lo que nuestra pregunta de investigación, es: **¿Cúal es el modelo empírico de cómo la innovación interactúa con el Mobile Learning en México?** Así, esta investigación se orienta a responderla. Los factores finales fueron **4**: **Tecnología** (**TECH**); Contenidos, Administración de Estilos de la Enseñanza-Aprendizaje (**CTLMS**); Rol Profesor-Estudiante (**PSR**) y el Proceso de Innovación (**INNOV**) y **65 Variables.** El estudio fue aplicado en: **20 profesores** y **800 estudiantes** de ciencias sociales, pertenecientes a **7** Universidades localizadas en el Área Metropolitana de Guadalajara, México (**GMAM**), durante el período **2013-2014**. Los datos de los cuestionarios fueron analizados por modelización de ecuaciones estructurales (**SEM**), usando el software **EQS 6.1**. Los resultados finales señalan reforzar **12 variables** para mejorar la interacción con **mL** en las **GMAM**.
**Palabras Clave: e-Learning, Estilos de Enseñanza, Estilos de Aprendizaje, Innovaciones Tecnológicas, Innovaciones Educativas.**

## INTRODUCTION

The projected growth of education supported by **IT**, responds immediately to resolve problems of geography, time and demand. Unfortunately, it has also drawbacks, such as: low intensity on interactivity between professor-student; feedback tends to be very slow; It presents difficulties error correction materials, assessments;

there are more dropouts than face teaching; etc. (Gallego and Martinez, 2002). E-learning or online, is defined by the Fundación para el Desarrollo de la Función Social de las Comunicaciones **(**FUNDESCO) as: *a system for delivery of distance learning, supported by **ICT** which combines different pedagogical elements: classical training (classroom or self-study), practical, real-time contact (in person, video or chat) and deferred contacts (tutor, forums discussion, email)* (Marcelo, 2002). In the second decade of this century, due to technological advances, we have a growing number of mobile devices, from smartphones to notebooks, notepads, iPads, tablets in general, etc. even stopping the development of the PC. According Forrester Research Portal (2015), a third of the tablets sold in 2016, will have serious purposes for business use (Kaganer et al, 2013).

## PROBLEM AND RATIONALE OF STUDY

According Hernández-Sampieri (2010) we have our research question (**RQ**) as **Which is the Empirical Model of How Innovation interacts with Mobile Learning in Guadalajara, México?** thus, our general objective (**GO**), is to propose factors and variables to discover the determinants from **INNOV** as an Empirical Model of How Innovation improves the Mobile Learning in México. Hence, we propose, the next specific questions (**SQ1**): ¿Which are the factors and variables describing the general empirical model?; (**SQ2**): ¿What about the relationships amongst them?; (**SQ3**); ¿What are the most relevant variables in the empirical model?. A final General Hypothesis (**GH**) is proposed: All the relevant variables in the empirical model have significant positive effect from **INNOV** to **mL**.

## METHODOLOGY

This study is aimed to discover and discuss the Empirical Model of How Innovation interacts with Mobile Learning in Guadalajara, México. It is empirical, correlational and longitudinal study in time because it was applied during the period of **2013-2014**. We propose **4** final **Factors**, such as: Technology (**T**); Contents, Teaching-Learning Management and Styles (**CTLMS**); Professor&Student Rol (**PSR**); Innovation Process (**INNOV**) and **65 Variables**. The study was applied on: **20** professors and **800** students both participating in social sciences courses, from **7** (**GMAM)**. The data of the questionnaires, were analyzed by Structural Equations Modeling (**SEM**), using **EQS 6.1 software**, to respond the **RQ** and **H.**

## THEORETICAL FRAMEWORK

**AHP.-** We made a documentary study of factors (**mL**), among more than **100** works in this regard, proceeding to detect all the variables what are more often mentioned, and by means of AHP (Saaty, 1997) technique, we asked to 5 specialists in m-Learning to select the most important factors and variables to use in our conceptual model. **See Table 1**.

**Table 1.- AHP or Saaty's Theorem.**

| Objective | Mobile Learning (mL) | | | |
|---|---|---|---|---|
| | Variable | | Frecquency | AHP weighing |
| Alternatives | 1 | Technology | 28 | 0.23 |
| | 2 | Contents & Teaching Learning Management | 16 | 0.22 |
| | 3 | Professor | 12 | 0.19 |
| | 4 | Student | 10 | 0.13 |
| | 5 | Innovation | 9 | 0.07 |
| | 6 | Assessing | 8 | 0.06 |
| | 7 | Policies | 7 | 0.04 |
| | 8 | Learning Management | 3 | 0.02 |
| | 9 | Web Learning | 4 | 0.01 |
| | 10 | On Line Communities | 1 | 0.01 |
| | 11 | Multimedia Learning Objects | 1 | 0.01 |
| | 12 | Augmented Reality for learning | 1 | 0.01 |
| **TOTAL** | | | **100** | **1.00** |

Source: own.

**Innovation education.-** Lundvall & Soete (2002) affirm: *" In education systems, people learn specific ways of learning. In labor markets, however, the specific incentives system with their own rules, make the difference between how and what to learn* ". Now, what do we mean when we refer to learning in a context of innovation? The innovation mainly concerns the ability to implement creative ideas. The innovation recognizes a learning cycle that is probably the main key to setting up sustainable capacity to respond successfully to the challenges of education the new millennium. So, we propose the Mejía's, et al. (2013) Innovation Model that encourages the value added aimed in the learning cycle, taking in count: incomes, process, outcomes and the feedback in the innovation process, to keep updated the model (**mL**). In short, the purpose of innovation must be the enhancement of the quality of the learning environment and learning outcomes (Garrison & Anderson, 2003).

**Learning Management.-** There are several theories that attempt to explain how people learn. Over **50** ubicables theories are online; however, most of them are variations of the **3** main lines*: behaviorism, cognitivism and constructivism*. New theories that support the m-Learning are: *connectivism* and *enactivism*, which briefly mentioned according to Woodill (2011). **See Table 2.**

**Table 2.-Learning Management.**

| Learning Management | Description |
|---|---|
| **Conductivism** | Based on the theory that only observable human behavior can be studied scientifically. Reduces human behavior to simple stimulus-response operations, punishment-reward and proposed a set of principles and processes of how these operations work together; Teaching is based on simple tasks, which collected and combined, produce more complex behaviors; however, ignores the experiences of the people; minimizes the social role of learning groups; treating people *as discrete objects with mechanical orientation of programmed learning*, consisting of continuous testing with reward-punishment for the answers. The application in m-Learning is equivalent to the *games and intuitive learning*. **Main features that distinguishes it: behavior** |
| **Cognitivism** | Based on the theory of how we process the information of intangible constructs such as: the mind, memory, attitudes, motivation, thought, reflection and other internal assumptions. Compare the human brain with a computer running, through analogies: |

| | |
|---|---|
| | input-output interfaces, memory, etc. and how information is processed by the brain. It involves studies about memory in short and long time allows the mind to transform information into knowledge. *It does not reject the behaviorist principles*, but it complements in the case of learning and thinking. However, the idea persists in operating on brain processes approaches, so it is not considered appropriate in m-Learning, because disregards the fact that m-Learning students are in connected networks and that each one may have a different learning experience, depending on how it's moving. Main **Main feature that distinguishes it: Mind and Brain** |
| **Constructivism** | Based on the theory that each person builds an understanding of the world through their life experiences, eliminating and accepting experiences as sources of knowledge. He rejects sociocultural influences; supports the idea that each person has views of the world around him to be generally it tends others. We learn through shared culture with other (socially constructed). Wide dissemination in the first decade of the XXI century. However, for m-Learning is not considered enough because does not cover all cases that ICT cause. For example, there are cases where learning is achieved through better use when t*hey are in charge of their own learning* and learning by *metacognition* (learning how to learn). It might be complemented with greater interactivity, leading to a process of *agent-student*, when they decide the further aspects of the learning environment must focus their attention, which requires; purpose, process knowledge, culture, norms, etc. Particularly for students that study methods and time optimization, consulting, self-regulation and metacognitive skill development. Hence, there are two theories that are considered to better explain the phenomenon of learning m-Learning: connectivism and enactivism. **Main feature that distinguishes it: Construction of Knowledge.** |
| **Conectivism** | Since the above three theories are born before the digital age, do not foresee the consequences of being connected (PC, cell phones, smartphones, tablets, etc.) and integrated into a social network, or the consequences of internet offered each day and more varied content. Connectivism is based on the theory concepts share a variety of sources. Some of its principles are: learning and knowledge from diverse opinions; learning is a process of connecting specialized nodes or information sources; Learning may reside in non-human applications; the ability to know more is more critical today than ever. Creating and maintaining connections nodes are necessary to facilitate continuous learning. The ability to see connections between fields, ideas and concepts is a core skill. Daily updating of knowledge is the core activity of the connectivism for learning achievement. Decision-making is itself a learning process. Choosing what to learn and how to appropriate means of information is part of the changing reality. What is right today, tomorrow will not be given the changes in the environment making the information affect decision-making. Connectivism make much sense to m-Learning to consider the personal, organizational and self are all connected at the same time. However, do not take into account how our body and senses directly affect how we learn and what we can know and knowledgeable in the field consider it vital, as the technology is becoming a prosthesis or extension of the human body, while at the same time, it has limitations for the operation. **Feature that distinguishes it: Network Connections**. |
| **Enactivism** | Based on the emerging theory that focuses on how we learn through the body and senses. It is assumed that the body refers the context of our reality given its insertion therein. Thus, all organisms adapt to their environment through the nervous systems of their senses and their connection to the brain. From this point of view, learning is based on the perception and action of the body in relation to action experience. The enactive learning is learning based on social relations at different levels (Kaptelinin and Nardi, 2006). We learn primarily through symbols and icons; this is complemented with the enactive |

| | |
|---|---|
| | learning through active use of the body. New designs of enactive interfaces to computers and mobile devices involve a mixture of several senses of the more natural than using a mouse or a keyboard form. However, the m-Learning is complex since to connect the individual student to sources of information anywhere and anytime, to its connection with other individuals who must interact, collaborate, socialize and learn. Students learn while moving, causing a potential loss of control for retaining the figure of advice as professors or consultants. **Main features that distinguish it: Actions based on the body and senses.** |

Source: Woodill, 2011, by own adaption.

**m-Learning.-** Since the focus has shifted in recent years due to technological advances, so does its definition; **see Table 3.**

**Table 3.- m-Learning Descriptions**

| Author | Descripction |
|---|---|
| Brazuelo y Gallego, 2011 | *"...The educational model that facilitates the construction of knowledge, problem solving learning and development of skills or different skills autonomously and ubiquitous thanks to the mediation of portable mobile devices".* |
| Traxler & Kukulska, 2005 | *"...Any educational process where the only dominant and prevailing technology is provided by equipment type: handheld or palmtop ..."* |
| Keegan, 2005 | "…m-Learning should be restricted to devices based learning where anyone can carry in their pockets" |
| O'Malley et al, 2005 | *"...Any sort of learning that happens when the student is not fixed, or at a predetermined place ... well, is learning happens when students take advantage of the learning opportunities offered by mobile technologies"* |

Source: several authors by own adaption

Learning requires switch the concept of how do we learn. The initial era of e-learning, was supported by multimedia facilities and constructivism given its static nature, however, in the mLearning era, this changes dramatically, thus learning methods change radically, given the dynamic nature of the students. In the current context, learning is based on the relationship *do-have the experience*, activities that can be seen in the use of apps, based on mobile devices. Thus, the student is conceptualized as an *strategic agent* who brings about the change, rather than a passive agent, who hopes that his adviser, consultant or professor tells them what to do in their learning; in other words, they become in *facilitators* that make the student achieves higher levels of knowledge (Woodwill, 2011). Given the challenges of the mLearning to traditional learning theories, is considered a *disruptive innovation*, never before experienced with great potential use, for example: mobile augmented reality for training, making the learning in a set *do it yourself* at anytime, anywhere. This creates different scenarios to use in e-Learning, such as the location of the student, providing connection and location information from mobile camera mode, where the software detects place without any problems and proceeds to inform the student. Other example, is the use of mobile devices as data collectors, which deposit data on specialized sites to be analyzed by peers anytime, anywhere.

**The Contents .-** The design of the contents, from the e-Learning era has been heavily criticized because the inability to generate a new literacy of e-learning with the acquisition of new skills in this area, and b) people perceive e-learning, as a formal course, and not as a tool and an attitude towards lifelong learning to keep the own learning (Cabero, 2012). So, we have the e-learning generations that have passed:

1st. generation or model focused on the materials; 2nd. generation or operators based on platforms and model; 3rd. generation or model based on collaboration and flexibility, stressing the importance of learning as a process partner and fairly based on student activity. Cabero (2012) suggests about to get better perceptions of mLearning: innovation with new didactic materials, improvements in their presentation on a large scale. The most hopeful

isolated initiatives, would be empowerment of students through tools like blogs, wikis and e-portfolios, giving progressive step become, from *learning centered content* to *learning centered activity*, as shown in **Table 4.**

**Table 4.- Differences between Learning Centered in: Content and Activities.**

| Learning Centered Content | Learning Centered activity |
|---|---|
| The student is usually reactive and passive, waiting for what the professor says or decides. | Students have an active involvement in their learning, without waiting for the professor to decide for them; |
| Decision space student, is small. | Wide freedom for students and space for own decisions as important elements of their learning. |
| Individual learning is promoted | Learning is promoted in collaboration with colleagues; students have opportunities to be independent in their learning. |
| Students do not have many opportunities to learn independently. | Process-related skills, with a focus on results, and the search, selection and management of information. |
| Memory replication of content and skills. Personal and professional education often is limited to certain periods of life | Personal and professional education throughout life. |

Source: Cabero, 2012, by own adaption.

Thus, the students perceive that activities are clearly related to the objectives, competencies and skills we seek to achieve; enough time to complete; the criteria that will be used for evaluation are known, and are clear and understandable; they are neither easy to do nor too complex to solve; they must be contextualized; the instructions for completion are clear and understandable; what materials have to be used for easy implementation, and which are the available activities of different types offered. According to Cabero (2012), an important design aspect is that, there are several types: ranging from the methodologies and strategies that will be used in the virtual action (training design), the type of navigation that allows within materials (navigation design), the chances of students, professor relationship (interaction design); graphic forms in which present the information (navigation design), different evaluation strategies to be permitted and used in the training (evaluation design), and ways of presenting content with forms of construction (design of content ).

**The Student.-** This topic takes into account, the cognitive, memory, prior knowledge, emotions and possible motivations. The student will assume the commitment with his own learning process and will find out, in the self evaluation the key to discover his own progress, to make choices. (Montoya, 2008); **see Table 5.**

**Table 5. Variable: Student Requirements (S).**

| Variable | Example/Description | Comments | Source |
|---|---|---|---|
| Previous Knowledge | Tacit and explicit knowledge stored in memory with conditions to be applied in the teaching-learning process | This impacts in how the students are understanding new concepts | Driscoll (2005); Tirri (2003) |
| Memory | Técnicas para codificar exitosamente con uso de señales como: categorización, mnemónica, táctil, auditiva, sensorial, imágenes, etc. | It involves, how multimedia actively encourage the students in their learning | |
| Context & Transference | Static Knowledge vs Dynamic Knowledge | It involves, how to make students use what they learn to strengthen the memory, understanding and transfer the concepts to different contexts. | Carroll & Rosson, (2005); Driscoll (2005) |

| | | | |
|---|---|---|---|
| Learning by Discovering | Application procedures and concepts to new situations; case study | It involves, how to encourage students to develop skills to filter, select and recognize relevant information in various situations | Tirri (2003) |
| Emotions & Motivations | Student's feelings to perform a task; reasons for their achievement. | Student inclination or ability to adopt an attitude that prepares your emotional state or desire to accomplish a task. | Carroll & Rosson, (2005) ; Tirri (2003) |

Source: several authors, by own adaption

Hence, it described how students use, what they already know and how the information is encoded, stored and transferred; It covers theories about the transfer of knowledge and discovery learning (Carroll and Rosson, 2005). The experience and prior knowledge, affect learning as does the atmosphere of the student, the authenticity of the task and the presentation of content in multiple formats. m-Learning however, brings the concept of *episodic memory*, composed mostly of the *experiences* that make students to museums, visits to laboratories, historic sites, etc. so their application is under the *experiential memory* (Driscoll, 2005). By other hand, the same information is presented in different formats for assimilation (*Dual Coding Theory Dual*), allowing the brain to do active differentiations of the concept. Research has found evidence that present information through different approaches, leads to a more effective instruction. Not only must we take into account the learning style of the students, but also the teaching style of professors. In fact most of them, explicitly or implicitly, using observation techniques, try to *know their* students (Gallego & Martínez, 1999), discovering *learning styles*. **See Table 6.**

**Table 6.-Learning Styles.**

| Learning Styles | Description |
|---|---|
| **Activist** | Students are fully and without prejudice involved in new experiences. They are grown to the challenges and get bored with long maturities. They are people very group who engage in the affairs of others and focus around all activities |
| **Reflexive** | Students learn the new experiences but do not like to be directly involved in them. Collecting data, analyzing them carefully before reaching any conclusions. Enjoy watching the actions of others, listening but not intervene until they have taken over the situation. |
| **Theoretical** | Students learn best when they are taught about things that are part of a system, model, concept or theory. They like to analyze and synthesize. For them. if something is logical, it is good. |
| **Pragmatic** | Students apply and practice their ideas. They tend to be impatient when people who theorize |

Source: Honey y Mumford (1992), by own adaption

**The Professor (P).-** The concept of Vygotsky (Moll, 1993) having greater recognition and applicability in the educational field is the zone of proximal development (**ZPD**). This concept *means the individual's actions that he can perform successfully start only in interaction with others, in communication with them and with their help, but can then play in totally autonomous and voluntarily* (Matos, 1995). They are responsible for designing strategies that promote intensive interaction (**ZPD**), taking into account the previous level of knowledge of students, from the culture and the meanings they have in relation to what they will learn(Onrubia, 1998). It is vital to diversify the types of activities, enabling the choice of different tasks of the students and use various support materials. **ZPD** creation occurs within an interpersonal context professor-student interest being transferred to the student professor from lower to higher levels in the area. Essentially, it is to give timely and strategic support students to achieve solve a problem; this support may induce by raising key questions and taking the student to self-questioning. The participation of professors in *instructional for teaching some content* (knowledge, skills, processes) at the beginning process should be somewhat management by creating a support system where students pass; then with the progress

of students in the acquisition or internalization of content, it is reducing its stake to the level of mere spectator empathetic (Onrubia, 1998). The professor assumes the role of mediator, facilitator guides for students to be active learners in meaningful and real social contexts. The process, is established where a group of professors together: design, teach, observe, analyze, and review one class lesson. **See Table 7.**

**Table 7.- Professor Requirements**

| Indicators | Example/Description | Comments | Source |
|---|---|---|---|
| Informatic Culture | Permanent update of information by using of technology | Attitude and intuitive ability to learn the use of technological resources | Ng & Nicholas (2013); Cabero, 2012 |
| Lection Cycle | Groupal planning / experimental lection/ individual reflection / groupal reflection/ lection refomualeted | Teaching based on enactivism | |
| Cognitive Objectives | Bloom's Digital Taxonomy | Association with the enactive cognitive objectives, such as teaching: knowledge; comprehension; the application; analysis-synthesis and evaluation. | Bloom, 2012 |

Source: several authors by own adaption

**The Technology.-** This aspect is described into the OSI (ISO / IEC7498 Open System Interconnection, 1994) model developed by the International Organization for Standardization (ISO) in the 1980. It is a framework for defining interconnection architectures communications systems, consisting of seven layers: *physical, link, network, transport, session, presentation and application.* So, consider the equipment intrinsic features such as: *ergonomics, portability, weight, size, weight, design, speed of access to the telecommunications network, processing, storage, capacity growth of the* equipment and the *equipment extrinsic* based provider of telecommunications services such as: *coverage, price, speed of access, availability, compatibility of protocols* among other features. These features, covering hardware and software so that *impact comfort, psychology, securities and satisfaction technology user*s, in this case students and faculty to find a balanced equilibrium between the hardware-software, paid by the equipment and access service and satisfaction is achieved from *psychological actors* to better use (Shneiderman and Plaisant, 2005).**See Table 8.**

**Table 8. Technology Requirements.**

| Indicators | Examples/Description | Features PDA | Comments | Source |
|---|---|---|---|---|
| Physical | Size, weight,, composition, disigno, protocols , process speed,memory | Intrinsical | PDA's Hardware & Sotware and its design | ISO/IEC7498; Shneiderman& Plaisant, 2005; Woodill, 2001 |
| Link | Comunicación con teclado, touchscreen, protocolos entre equipos, detección de errores, conexión joysticks, trackball, infrarojos, reconocimiento vocal, etc. del equipo móvil, | Intrinsical | How man-machine communication, is accomplished | ISO/IEC7498; Shneiderman& Plaisant, 2005; Woodill, 2001 |
| Network | Identificación de nodo de conexión, velocidad de acceso a la red | Extrinsical | Dependent on the availability of bandwidth of the access network | ISO/IEC7498 |
| Transport | Velocidad de la red una vez accesada | Extrínsical | Dependent on the availability of bandwidth of the transmission network | ISO/IEC7498 |
| Session | Capacidad de abrir múltiples sesiones multitarea | Intrínsical | Dependant on the capabilities of design | ISO/IEC7498 |
| Presentation | Software de aplicación/ Apps | Intrinsical/ Extrinsical | Dependent on Android / Windows / IOS operating systems, etc | ISO/IEC7498 |
| Application | Software de aplicación/ Apps | | | ISO/IEC7498 |
| Error Detection/Correction | Software que desbloquea y resguarda la correcta operación del equipo ante eventualidades de fallo | Intrinsical/ Extrinsical | Dependent on software mobile equipment, access network and / or transport | ISO/IEC7498 |
| Price | Obtención equipos móviles | Intrinsical | Dependent on the student's or professor's economy | Shneiderman & Plaisant, 2005; Woodill, 2011 |
| | Servicio proveedor de telecomunicaciones | Extrinsical | | |

Source: several authors, by own adaption.

**Policies & Assessing.-** In order to guarantee the continuity and implementation of mlearning technology, is necessary to develop institutional policies to provide direction and enough resources to achieve it, included an assessment system to verify since the participation until the activities and quality of the teaching actions and course contents. Garrison & Anderson(2003).**See Table 9.**

**Table 9.- Topics that a policy document and strategic plan should Include.**

| |
|---|
| 1. Vision: − understand background− define core values− describe strategic goals |
| 2. Needs and risk assessment:− identify issues− identify challenges − identify best practices |
| 3. Educational principles and outcomes described |
| 4. Implementation initiatives and strategy: − link to institutional priorities− create a steering committee − identify communities of practice |
| 5. Infrastructure: − design multimedia classrooms− describe administrative processes |
| 6. Infostructure: − design institutional connectivity− create a knowledge management system− provide digital content− create standards |
| 7. Support services: − provide professional development− provide learner support |
| 8. Budget and resources |
| 9. Research and development framework |
| 10. Benchmarking: − establish success criteria− assess progress− communicate direction and accomplishments |
| 11.Assessing |

Source: Garrison & Anderson(2003), with own adaption.

**The m-Learning (mL).-** This is the core of the model as it is formed as the relationship among **6** factors, such as: Student (**S**); Professor (**P**); Content (**C**); Technology (**TECH**); Policies & Assessing (**P&A**); Innovation (**I**) with **65 underlying variables**. In this part of the mode, lies the balance of features that allow the mLearning provide optimal interaction between the all the elements. **See Table 10**.

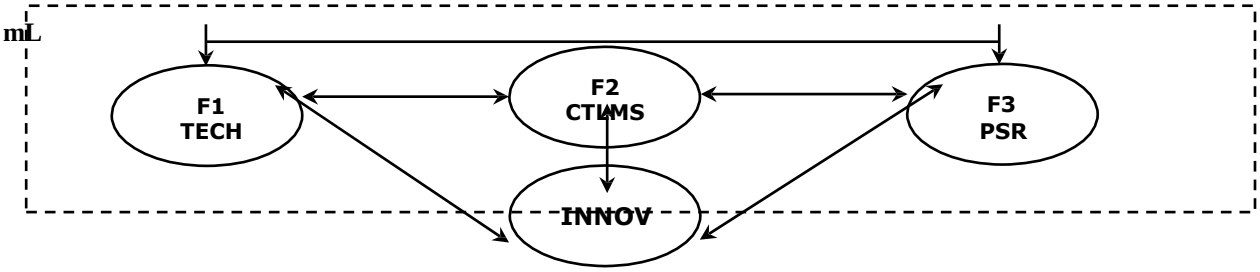
**Table 10. m-Learning (mL) Requirements.**

| Indicadores | Example/Description | Comentarios | Fuente |
|---|---|---|---|
| Interface | Mediation; task cycle apparatus. | The nature of the interaction changes itself in how students interact with each other, their environments, tools and information | Carroll et al. (1991); Woodill (2011) |
| Access to Content | Identifying patterns and relationships; noise information; approaches and relevance | To the extent that the amount of information grows, it requires students to increase their skills and efforts to recognize and evaluate ownership, appropriation and use of information | Moll, (1993); Carroll et al. 1991,Woodill (2011) |
| Navigation and Knowledge Production | Navigation vs. Knowledge production | Knowledge navigation students acquire appropriate skills to select, manipulate and apply information to their own needs. Production of knowledge,professrors determine what and how information should be learned | Moll, (1993); Woodill (2011) |

Source: several authors, by own adaption.

So, our determinant factors model is showed in **Figure 1.**

**Figure 1.- Determinant factors on m-Learning as a General Conceptual Model for Innovation on Education.**




**Notes: F1.- Technology (TECH); F2.- Contents, Teaching-Learning Management and Styles (CTLMS; F3.- Professor&Student Rol (PSR).**
Source: own

**RESULTS**

The Final Questionnaire was obtained, with: **4 Factors, 13 Dimensions** and **65 Independent Variables** grouped, according the principal authors to describe **mL. See Table 11.**

**Table 11**.- **Final Questionnaire**

| **Personal Background** | | |
|---|---|---|
| **If you are a STUDENT:** -Name of the (**mL**) course; -What is your occupation? Manager/Employee non-technical/ Employee technical/Teaprofessorsa or trainer/ Student; -How old are you? 24 or younger /25-29 /30-40 /41-50 / over 50;-Gender? Female / Male; -What is your level of education? High school matriculation/ One to three years of post-secondary education / Four or more years of post-secondary education; -Personal Digital Assistant (PDA) ownership – Do you own? Smartphone/Lap/Palmtop/Other; - Where did you study the mobile learning course? At home/ At the office or work/ While travelling/ Other.<br>**If you are a PROFESSOR:** -Name of the (**mL**) course;-What kind is your assignment? Social Sciences/ Engineering;<br>-Are you: Instructor/ Assistant Professor/ Associate Professor/ Professor;-How old are you? 24 or younger /25-29 /30-40 /41-50 / over 50;-Gender? Female / Male; -What is your level of teaching? High School/ Undergraduate/ Postgraduate/ ;-Personal Digital Assistant (PDA) ownership – Do you own? Smartphone/Lap/Palmtop/Other;-Where did you study the mobile learning course? At home/ At the office or work/ While travelling/ Other | | |
| **Factor** | **Variable** (measured by Likert Scale: Strongly agree/ Agree/ Uncertain / Disagree/ Strongly disagree) | **Author(S)** |
| **F1.- TECHNOLOGY (TECH)** | **D1.-Technology Friendliness (TFRN)** | |
| | **V1**.-I need a special training to use my PDA | Ng & Nicholas (2013) |
| | **V2.**-The screen on the PDA makes it difficult to do my school work. | |
| | **V3.**- Writing with a PDA is easier than writing by hand on paper | |
| | **V4.**- With a PDA it is easy to take my school work home. | |
| | **V5.**-I would recommend mobile learning as a method of study to others | Keegan (2005) |
| | **D2.-Technology-Synchronous Communication (TSYC)** | |
| | **V6**-Chat in mlearning is very useful is better than PC | Keegan (2005) |
| | **V7.**- IP telephony functions are very well with the mlearning course. | |
| | **V8.**-The sending of SMS is very useful | Ng & Nicholas |

| | | |
|---|---|---|
| | | (2013) |
| | **D3.-Technology Asynchronous Communication (TASY)** | |
| | **V9.**- Communication and sending assignments for submission with the students (or tutor) by e-mail functioned well. | Keegan (2005); Ng & Nicholas (2013) |
| | **V10.**- Writing messages to the Forum functioned well | Keegan (2005) |
| | **V11.**-Answering assignments for submission applying the mlearning functioned well. | |
| | **V12.**-Accessing to notes and reading text functioned well. | |
| | **D4.-Technology Multimedia (TMMD)** | |
| | **V13.**-Accessing to sound, video and graphical materials functioned well | |
| | **V14.**-Activities/assignments involving manipulation of graphical materials functioned well | |
| | **D5.-Social Media (TSME)** | |
| | **V15.**- To learn (or teach), I tend to be in different networks, in permanent interaction and collaboration | Woodill (2001) |
| | **V16.**- To learn (or teach), I tend to participate in : gammings, simulations and/or virtual worlds | |
| | **V17.**-To learn (or teach), I feel I spend a lot of time connected in different networks with scarce results | |
| **F2.- CONTENTS, TEACHING-LEARNING MANAGEMENT AND STYLES (CTLMS)** | **D6.-Teaching-Learning Management (CTLM)** | |
| | **V18.**- Accessing course content was easy | Keegan (2005) |
| | **V19.**-Communication with and feedback from the student (or tutor) in this course was easy. | |
| | **V20.**-Mobile learning is convenient for communication with other course students (or proffessors) | |
| | **V21.**- PDAs help me learn (or teach) my subjects better | Ng & Nicholas (2013) |
| | **V22.**-There are no disadvantages in using PDAs in the classroom. | |
| | **V23.**-PDAs make learning (or teaching) more interesting. | |
| | **V24.**- PDAs help me organise my time better. | |
| | **V25.**-I feel my learning (or teaching) process is more willing to punishment-reward cycle | Woodill (2001) |
| | **V26.**-I feel my learning (or teaching) process is more willing to the individual internal brain processes such as: memory, attitude, motivation, self-reflection. | |
| | **V27.**-I feel my learning (or teaching) process is more willing to "learn how to learn" and I select and decide about how they affordable information responds to my needs when I require it. | |
| | **V28.**-I feel my learning (or teaching) process is more willing to the sensation to be connected everywhere, every time to the internet affordances | |
| | **V29.**- I feel my learning (or teaching)process is more willing to respond to the perception of the environment and my actions, through experiencing and doing. | |
| | **D7.-Teaching-Learning Styles (CTLS)** | |
| | **V30.**- As a student, (or professor), I feel that the contents are enough to motivate me to: create new forms of knowledge. You are more Reflexive | Cabero (2012); Bloom (2009); Gallego & Martínez (1999); Honey& |
| | **V31.**- As a student, (or professor) I feel that the contents are enough to motivate me to: evaluate the knowledge acquired. You are more | |

| | | |
|---|---|---|
| | Reflexive. | Mumford (1992) |
| | **V32.**- As a student, (or professor) I feel that the contents are enough to motivate me to: analyze knowledge acquired. You are more Reflexive. | |
| | **V33.**- As a student, (or professor) I feel that the contents are enough to motivate me to: apply the knowledge acquired. You are more Pragmatic | |
| | **V34.**- As a student,(or professor) I feel that the contents are enough to motivate me to: comprehend the knowledge acquired. You are more Reflexive. | Cabero (2012); Bloom (2009); Carrol&Rosson (2005); Gallego & Martínez (1999); Honey& Mumford (1992) |
| | **V35.**- As a student, (or professor) I feel that the contents are enough to motivate me to: memorize the knowledge acquired. You are more Pragmatic. | |
| | **V36.**-As a student, (or professor) I feel the contents are well designed considering: text, context, colors, PDA's formats, accesability, etc. | Montoya (2008) |
| **F3.- PROFESSOR& STUDENT ROL (PSR)** | **D8.-TProfessorr-Student Perception Feasibility(TSPF)** | |
| | **V37.**- I am motivated about using a PDA for mlearning, because is easy to use and I learn (or teach) better with it. | Ng & Nicholas (2013); Driscoll (2005) |
| | **V38.**-When I use a PDA I am very intuitive using my memory and my senses | Driscoll (2005) |
| | **V39.**- Navigation through the mobile learning course was easy. | Keegan (2015); Moll, (1993); Woodill (2011) |
| | **V40.**- For mobile learning (or teaching) to be effective it is necessary to use graphics and illustrations | Keegan (2015); |
| | **V41.**- Evaluation and questioning in the mlearning course was effective | |
| | **V42.**- The use of PDAs have more advantages than a desktop computer. | Ng & Nicholas (2013) |
| | **V43.**-The PDA that I use has a good relation among hardware, software and connectivity network. | ISO/IEC7498;Shneiderman y Plaisant, 2005; Woodill, 2001 |
| | **D9.-Professor-Student Perception Value/Cost (TSPVC)** | |
| | **V44.**- mlearning increases access to education and training. It is still expensive. | Keegan (2005) |
| | **V45.**-The cost of accessing the mobile course materials was acceptable. | |
| | **V46.**- The cost of communicating in the mobile learning course with the tutor and other students was acceptable. | |
| | **D10.Professor-Student Assessing Participation (TSAP)** | |
| | **V47.**-Effectively encourage others to learn? | Garrison & Anderson(2003) |
| | **V48.**-Contribute regularly, at each important stage of the unit? | |
| | **V49.**-Create a supportive and friendly environment in which to learn? | |
| | **V50.**-Take the initiative in responding to other students? | |
| | **V51.**-Seek to include other students in their discussions? | |
| | **V52.**-Successfully overcome any private barriers to participation? | |
| | **V53.**-Demonstrate a reflective approach? | |
| | **D11.-Professor-Student Assessing Activities (TSAA)** | |
| | **V54.**-Each of the activities and strategies employed to assess student | |

| | | |
|---|---|---|
| | learning has methodological and epistemological shortcomings. | |
| | **V55.**-All the student products are stored in a Database of learning products | |
| | **V56.**-The assessment is based on using problem-based learning (PBL) activities in m-learning education. | |
| | **D12.-professor-Sudent Assessing Quality (TSAQ)** | |
| | **V57.**-As a Student (or Professorr) I evaluate the course objectives, activities, contents, technology affordances are aligned and congruent with the tutoring (or goals) of the course. | |
| | **V58.**-As a student I evaluate the knowledge acquired vs the initial expectations (If you are a professor: Do you evaluate the knowledge acquired vs the initial expectations of each student?) | Garrison & Anderson(2003**);** Woodill (2001) |
| | **D13.-Professor-Student Policies (TSPO)** | |
| | **V59.**-I'm informed (If I'm a Tprofessor: inform to the students), the security and support policies | |
| | **V60.**- I'm informed (If I'm a professor: inform to the students, the educational principles and outcomes described | |
| **F4.-INNOVATION PROCESS (INNOV)** | **V61.**-I suggest improvements to the mlearning course to be more innovative in value added though contents in the student-professorprocess | Mejía-Trejo (2013 et al.) Garrison & Anderson(2003) |
| | **V62.**-I suggest improvements to the mlearning course to be more innovative in value added though technology in the student-professor process | |
| | **V63.**-I suggest improvements to the mlearning course to be more innovative in value added though policies in the student profdessor process | |
| | **V64.**-I suggest improvements to the mlearning course to be more innovative in value added though feedback evaluation the student-professor process | |
| | **V65.**- I feel that the process is planned as a strategic innovation | |

Source: Own

**VALIDITY AND RELIABILITY OF THE MODEL**

We show the **Table 12** with a summary of the test and values used in this research.

**Table 12. Technical Research Data, Test and Values used in this Research**

| **Technical Research Data** | |
|---|---|
| **Features** | **Survey** |
| Universe | 20 professors and 800 students both participating in social sciences courses, from **7 GMAM,** México during the period 2013-2014. |
| Scope | Guadalajara Metropolitan Area, México |
| Sample Unit | **7** Universities |
| Collection Method of Data | e-Mail/ Inquiry |
| Scale | Likert 5 |
| Date of Fieldwork | January-2013-December 2014 |
| **Total e-Mail/Inquiry completely answered** | **680** |

| **Test used in this Research** | **Value /Description** | **Author** |
|---|---|---|
| **Ratio NC/VoQ=** Number of cases (**NC**) & Variables Of Questionnaire (**VoQ**) | **NC/VoQ** = **NC** (20 professors + **680** students (>=100 and <=1000, according Hair et al.,2010 ) / 65 **VoQ = 12.30>10** (it is >**10** recommended by Hair, 2010) | |
| **CFA** by Maximum Likelihood Method, and Covariance Analysis by **EQS 6.1** software | To verify the Reliability and the Validity of the Measurement Scales | Bentler, (2005); Brown, (2006); Byrne, (2006) |
| Cronbach's Alpha (**CHA**) and Composite Reliability Index (**CRI**) | **ChA (Per Factor Via SPSS) & CRI>=0.7 /** Reliability of the Measurement Scales | Bagozzi & Yi, (1988); Nunnally & Bernestain,(1994); Hair et al., (2010) |
| Mardia's Normalized Estimate.(**M**) | **M>5.00 /** Distributed as a unit normal variate such that large values reflect significant positive kurtosis and large negative values reflect significant negative kurtosis. Bentler (2005) has suggested that in practice, values >5.00 are indicative of data, that are non-normally distributed | Bentler (2005); Byrne, (2006) |
| The Satorra–Bentler scaled statistic (**S-B$\chi$2**) | **SB$\chi$2.-** By specifying ME=ML, ROBUST, the output provides a robust chi square statistic ($\chi$**2**) called. This is to minimize the outliers and achieve goodness of fit | Satorra & Bentler, (1988) |
| Normed Fit Index **(NFI)** | **NFI>=0.8 and <=.89. /** Index used for more than two decades by Bentler and Bonett's (1980) as the practical criterion of choice, as evidenced in large part by the current "classic" status of its original paper (Bentler, 1992; and Bentler & Bonett, 1987, cited by Byrne, 2006). However, **NFI** has shown a tendency to underestimate fit in small samples, | Bentler & Bonnet,(1980); Byrne (2006) |
| Comparative Fit Index **(CFI)** | **CFI>=0.8 and <=.89.** Bentler (1990, cited by Byrne, 2006) revised the **NFI** to consider sample size and proposed the Comparative Fit Index (**CFI**). Values for both the **NFI** and **CFI** range **from zero to 1.00** and are derived from comparison between the hypothesized and independence models, as described previously. As such, each provides a measure of complete covariation in the data. Although a **value > .90** was originally considered representative of a well-fitting model (see Bentler, 1992, cited by Byrne, 2006), a revised cutoff value close to 0.95 has been advised (Hu & Bentler, 1999, cited by Byrne, 2006). Although both indexes of fit are reported in the EQS output, Bentler (1990, cited by Byrne,2006) suggested that the **CFI** should be the index of choice | |
| Non-Normed Fit Index **(NNFI)** | **NNFI>=0.8 and <=.89.** It is a variant of the **NFI** that takes model complexity into account. Values for the **NNFI** can exceed those reported for the **NFI** and can also fall outside the zero to 1.00 range.(Byrne, 2006) | |
| Root Mean Square Error of | **RMSEA>=0.05 and <=0.08 /** The **RMSEA** considers the error of approximation in the population and asks the question, "How well | Hair et al, 2010; Byrne, 2006; |

| | | |
|---|---|---|
| Approximation **(RMSEA)** | would the model, with unknown but optimally chosen parameter values, fit the population covariance matrix if it were available?" (Browne & Cudeck, 1993, pp. 137-8, cited by Byrne, 2006). This discrepancy, as measured by the **RMSEA**, is expressed per degree of freedom, thus making it sensitive to the number of estimated parameters in the model (i.e., the complexity of the model). Values less than .05 indicate good fit, and values as high as .08 represent reasonable errors of approximation in the population (Browne & Cudeck, 1993, cited by Byrne, 2006). Addressing Steiger's (1990, cited by Byrne, 2006) call for the use of confidence intervals to assess the precision of **RMSEA** estimates, EQS reports a 90% interval around the **RMSEA** value. In contrast to point estimates of model fit (which do not reflect the imprecision of the estimate), confidence intervals can yield this information, thereby providing the researcher with more assistance in the evaluation of model fit. | Chau, 1997; Heck, 1998 |
| Convergent Validity (**CV**) | All items of the related factors are significant (**p < 0.01**), the size of all standardized factorial loads are exceeding **0.60** (Bagozzi & Yi, 1988) the extent to which different assessment methods concur in their measurement of the same trait (i.e., construct)—ideally, these values should be moderately high (Byrne, 2006) | Bagozzi & Yi, 1988; Byrne, 2006; |
| Variance Extracted Index (**VEI**) | **VEI > 0.50** / In all paired factors as constructs. In a matrix representation, The diagonal represents the (**VEI**), while above the diagonal part presents the variance (the correlation squared); below the diagonal, is an estimate of the correlation of factors with a confidence interval of 95%. See the Table. *Discriminant validity of the theoretical model* mentioned below. | Fornell & Larcker, 1981 |
| Discriminant Validity (**DV**) | **DV /** It is the extent to which independent assessment methods diverge in their measurement of different traits—ideally, these values should demonstrate minimal convergence.(Byrne, 2006). **DV** is provided in two forms: First, with a 95% interval of reliability, **none of the individual elements of the latent factors correlation matrix contains 1.0** (Anderson&Gerbing,1988). Second, **VEI** between the each pair of factors is higher than its corresponding **VEI** (Fornell&Larcker,1981). Therefore, based on these criteria, different measurements made on the scale show enough evidence of reliability, **CV** and **DV**. See the Table. *Discriminant validity of the theoretical model* mentioned below. | Byrne, 2006; Anderson & Gerbing,1988; Fornell & Larcker,1981 |
| Nomological Validity (**NV**) | It is tested using the chi square, through which the theoretical model was compared with the adjusted model. The results indicate that no significant differences are good theoretical model in explaining the observed relationships between latent constructs | Anderson & Gerbing,(1988); Hatcher, (1994) |

Author: several authors, by own adaption

**DISCUSSION**

The **CFA** results are presented in **Table 13** and suggests that the model provides a good fit of the data (**S-BX $^2$ = 232.636; df = 124; p = 0.0000; NFI = 0.901; NNFI = 0.928; CFI = 0.976; RMSEA = 0.075**). According **Table 12,** as evidence of the *convergent validity*, the **CFA** indicates that all items of the related factors are significant (*p <0.001*) and the magnitude of all the factorial loads are exceeding **0.60** (Bagozzi & Yi,1988). All the values of the

scale exceeded the value recommended **0.70** for the *Cronbach's Alpha* and **CRI**, which provides evidence of reliability and justifies the internal reliability of the scale of the business competitiveness (>= **0.70**), recommended by Nunnally&Bernestain (1994) and Hair (et al., 2010) and the *Variance Extracted Index* **VEI**(**>=0.5**) was calculated for each pair of constructs, resulting in an **VEI** more than 0.50 (Fornell&Larcker, 1981).

**Table 13. Internal Consistency and Convergent Validity of the Theoretical Model**

| Factor | Variable | Factorial Load | Robust t-Value | Loading Average | Cronbach's Alpha (>=0.7per Factor via SPSS) | CRI >=0.7 | VEI >=0.5 |
|---|---|---|---|---|---|---|---|
| **F1 TECH** | **V13** | 0.956*** | 1.000a | **0.922** | **0.765** | **0.758** | **0.510** |
| | **V16** | 0.906*** | 5.720 | | | | |
| | **V17** | 0.904*** | 8.543 | | | | |
| **F2 CTLMS** | **V28** | 0.890*** | 1.000a | **0.915** | **0.815** | **0.752** | **0.504** |
| | **V30** | 0.879*** | 19.350 | | | | |
| | **V33** | 0.977*** | 17.560 | | | | |
| **F3 PSR** | **V38** | 0.978*** | 1.000a | **0.924** | **0.798** | **0.760** | **0.514** |
| | **V40** | 0.953*** | 21.453 | | | | |
| | **V44** | 0.841*** | 17.312 | | | | |
| **F4 INNOV** | **V61** | 0.923*** | 1.000a | **0.916** | **0.881** | **0.753** | **0.505** |
| | **V62** | 0.974*** | 17.615 | | | | |
| | **V65** | 0.852*** | 15.791 | | | | |
| **S-BX $^2$ = 232.636; df = 124; p = 0.0000; NFI = 0.901; NNFI = 0.928; CFI = 0..976; RMSEA = 0.075** | | | | | | | |
| a.- Parameters constrained to the value in the identification process. | | | | | | | |
| ***= p < 0.001 | | | | | | | |

Source: Own

According the same **Table 12**, with the evidence of the convergent validity, discriminant measure is provided in two forms as we can see in **Table 14**. *First*, with a **95%** interval of reliability, none of the individual elements of the latent factors correlation matrix contains **1.0** (Anderson&Gerbing,1988). *Second*, extracted variance between the two constructs is greater than its corresponding **VEI** (Fornell&Larcker,1981). Based on these criteria, we can conclude that the different measurements with the model show enough evidence of discriminant validity and reliability.

**Table 14. Discriminant validity of the theoretical model.**

| Factors | TECH | CTLMS | PSR | INNOV | CHI Square Differences Test (Values <VEI) |
|---|---|---|---|---|---|
| **TECH** | **0.510** | 0.402 | .236 | 0.312 | |
| **CTLMS** | 0.270, 0.410 | **0.504** | 0.503 | 0.430 | |
| **PSR** | 0.323, 0.581 | 0.496, 0.758 | **0.514** | 0.500 | |
| **INNOV** | 0.400, 0.573 | 0.356, 0.649 | 0.500, 0.710 | **0.505** | |
| **Interval Confidence Test (<1.0 )** | | | | | |

**Note:** The diagonal represents the Variance Extracted Index (**VEI**), while above the diagonal part presents the variance (the correlation squared); below the diagonal, is an estimate of the correlation of factors with a confidence interval of 95%.

Source: Own

To obtain the statistical results of the research hypotheses, we applied the **SEM** as a quantitative method with the same variables to check the *structure model* and to obtain the results that would allow the hypotheses posed, using the software **EQS 6.1** (Bentler, 2005; Brown, 2006; Byrne, 2006) Furthermore, the *nomological validity* of the theoretical model was tested using the *chi square*, through which the theoretical model was compared with the adjusted model. The results indicate that, the no significant differences in the theoretical model are good in explaining the observed relationships between latent constructs (Anderson & Gerbing,1988; Hatcher, 1994). Taking in account only the **Factors** described and using again **EQS 6.1**, we obtained the **Table 15** to demonstrate our Hypotheses**.**

**Table 15. Results of hypothesis testing the theoretical model**

| **Hypotheses** | **Structural Relation** | **Standardized Coefficient** | **t Value** |
|---|---|---|---|
| **H1.-** A high level of **INNOV** generates a high level of **TECH** in **mL** at the **GMAM**. | **INNOV→TECH GMAM** | **0.741***** | 13.321 |
| **H2.-** A high level of **INNOV** generates a high level of **CTLMS** in **mL** at the **GMAM** | **INNOV→ CTLMS GMAM** | **0.730***** | 27.320 |
| **H3.-** A high level of **INNOV** generates a high level of **PSR** in **mL** at the **GMAM** | **INNOV→ PSR GMAM** | **0.880***** | 36.736 |
| **S-BX $^2$ = 152.655; df = 104; p = 0.0005; NFI = 0.931; NNFI = 0.901; CFI = 0.923; RMSEA = 0.065*** p < 0.001** | | | |

Source: Own

The Hypotheses results obtained after applying the **SEM** method, are showed in **Table 16**.

**Table 16. Hypotheses Results**

| **Hypotheses** | **Description** |
|---|---|
| **H1** | (β = **0.741**, p <0. 001), the relationship between **INNOV** and **TECH** from **mL** has significant positive effect. |
| **H2** | **(**β = **0.730**, p < 0.001), the relationship between **INNOV** and **CTLMS** from **mL** has significant positive effect. |
| **H3** | (β = **0.880**, p < 0.001), the relationship between **INNOV** and **PSR** from **mL** has significant positive effect. |

Source: Own

Summarizing, we can conclude that **INNOV** is positive and significant over the **3** variables measuring **mL**.

## CONCLUSIONS

We confirmed that **4 Factors**, such as: **TECH, CTLMS, PSR** and **INNOV** are involved into the **mL** process, with **13 Dimensions** and **65 Variables** as Indicators so, we solved the **SQ1** by mean to have proposed as theoretical framework what is showed in **Table 1, Figure 1,** and **Table 11** as a main questionnaire; using **SEM**, we obtained **Table 13** to solve **SQ2** and **Table 14** to justify the enough validity to solve **SQ3.** To prove the main Hypothesis, by the results obtained in **Table 15,** where ***GH****: all the relevant variables have significant positive effect from **INNOV** to **mL*** is **affirmative**. In fact, **H4.** A high level of **INNOV** generates a high level of **PSR** in **mL** at the **GMAM** shows the most relevant latent factor . So we solved the **RQ** at **100%.**

However, ¿how the latent variables are interacting? to answer this, we applied the **SEM** as a quantitative technique and we can see how the underlying variables are interacting amongst them at the same time of multiple regressions are in progress. We found **12/65 independent variables as most important on mL** indicators that are improved by **INNOV**, to reinforce the model. In order to get it, we have:

**F1.-TECH: TECHNOLOGY**

This factor representing a great opportunity to the **GMAM** to increase the **INNOV over the mL** for students and professors because, we have to get better technologies and friendliest around Multimedia (**TMMD**) issues, in other words: *accessing to sound, video and graphical materials must work, pretty well* (**V13**)( Keegan ,2005). The social media (**TSME**) is already present and with a great potential, for analyze the benefits on learning, when the student or professor perceives: *I tend to participate in: gamings, simulations and/or virtual worlds* (**V16**). Hence it is very important, minimize the sensation of: *To learn (or teach), I feel I spend a lot of time connected in different networks with scarce results* (**V17**) **(**Woodill, 2001).

**F2. CTLMS CONTENTS, TEACHING-LEARNING MANAGEMENT AND STYLES.**

This factor reveals the **mL** potential through the Contents, Teaching-Learning Management and Styles (**CTLMS**) when the student or professor, perceives: *I feel my learning (or teaching) process is more willing to the sensation to be connected everywhere, every time to the internet affordances* (**V28**) (Woodill, 2001); so, we ought take advantage from this point, Contents, Teaching-Learning Management and Styles (**CTLMS**), to prepare the encourage conditions and final attitudes, for both: student and professor when they finally perceive : *I feel that the contents are enough to motivate me to: create new forms of knowledge. You are more Reflexive* (**V30**). Or even more, as a result of **INNOV,** when they become more pragmatic (*I feel that the contents are enough to motivate me to: apply the knowledge acquired. You are more Pragmatic*.**V33**) (Cabero,2012; Bloom 2009; Gallego & Martínez, 1999; Honey& Mumford, 1992).

**F3.- PSR: PROFESSOR & STUDENT ROL**

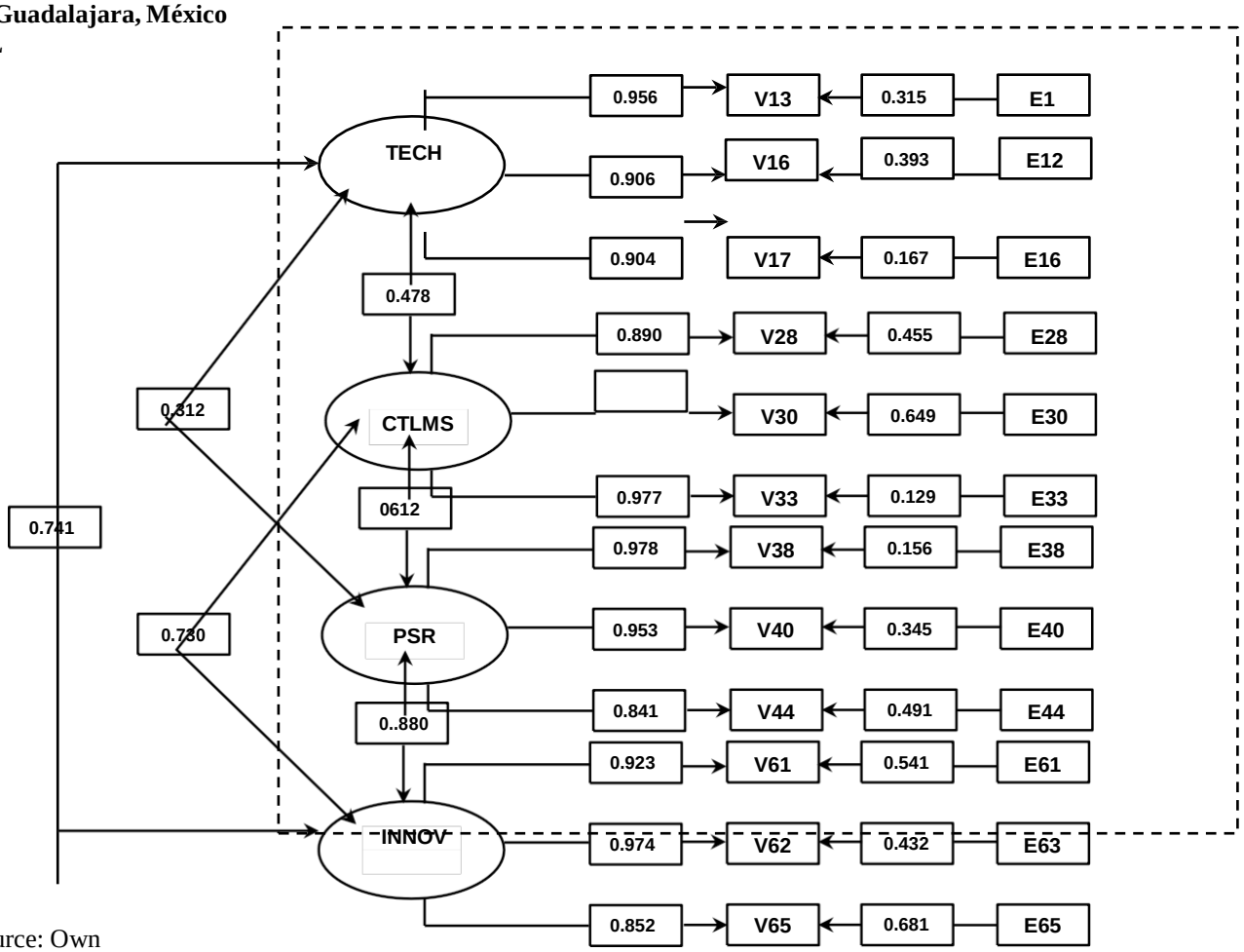
**Professor-Student Perception Feasibility (TSPF)** must increase the future contents and design devices around the intuitive senses, when both: student and/or professor perceives**:** *When I use a PDA I am very intuitive using my memory and my senses*. (**V38**) (Driscoll, 2005) and *be effective it is necessary to use graphics and illustrations.* (**V40**) (Keegan, 2005) Enactive education processes have a great chance to be explored and implemented here (Woodill, 2001). Unfortunately, about the *cost/value perception* where ***mL*** *increases access to education and training . It is still expensive* in México. (**V44**). We have to expect the rate of prices to broadband access, be lower in the near future for the **GMAM**.

**F4.-INNOV: INNOVATION PROCESS.**

Finally, we discovered the importance to involve more the *value added* in different stages of our previous innovation model (Mejía-Trejo et al, 2013), such as : contents (**V61**); technology (**V62**) including an entire innovation strategic planning (Garrison & Anderson; 2003),(**V65**).

**The Final SEM is showed in Figure 2.**

**Figure 2.- Empirical Hypothesized Model of First-Order of How Innovation interacts with Mobile Learning in Guadalajara, México**




Source: Own

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