Learning Patterns of First Year Students

Patrones de aprendizaje de los estudiantes universitarios de primer año

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Abstract

During the last decades, technological development has allowed universities to build complex systems to collect information about the students. However, this information is organized thinking in administration issues ignoring the improvement of the quality of teaching and learning as a primary objective. We do not know the students in the sense of the student-centered educative model as promoted by the European Higher Education Area. We have plenty of information about students who enter university but this information is not organized in a learning process sense. This concrete research involves gathering relevant information from students in terms of improving their learning practice. The work consists of a description of "learning patterns" of freshmen regarding variables of gender, level of knowledge and type of education. Participants were 699 first year students (cohort 2006-07) who belong to all academic disciplines (Technical, Humanities, Health, Education, Business, Experimental Science and Law) in representative percentages by means of a convenience sampling strategy. The theoretical basis of the learning patterns concept lies in the interactive learning model (ILM), developed by Johnston (1996, 2009). This model states that learning takes place with the interplay of three components: cognitive (knowledge), conative (acting) and affective (feeling). The action of these elements composes an individual profile, which consists of four different learning patterns: sequential, precise, technical and confluent. Data collection was performed using a Learning Connections Inventory (LCI). LCI is a validated instrument in all

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educational levels and is linked to a specific protocol that facilitates the transfer interpretation of the results to be concrete practices in the educational process. The fact of that the students know themselves could be useful to face different learning situations. The analysis was conducted using statistical methods such as MANOVA analysis, ANOVA, comparison of means for independent samples and the calculation of effect sizes.

Key words: Learning patterns, freshmen, Higher Education, educational guidance, active learning, gender.

Resumen

En los últimos tiempos, el desarrollo tecnológico ha permitido que las universidades construyan complejos sistemas para recopilar información sobre los estudiantes a los que atienden. Sin embargo, esta información se ha organizado pensando más en la gestión administrativa que en cómo mejorar la calidad de los procesos de enseñanza y aprendizaje. Esta investigación trata de recoger información relevante sobre los estudiantes desde el punto de vista de la mejora de la práctica docente, para lo cual investiga a los alumnos en calidad de personas que aprenden. El trabajo desarrollado consiste en una descripción de los «patrones de aprendizaje» de estudiantes universitarios de primero atendiendo a variables como el género, el ámbito de conocimiento y el tipo de enseñanza. En este estudio participaron 699 estudiantes de primer año (cohorte 2006-07) que pertenecen a todas las disciplinas académicas (Tecnología, Humanidades, Salud, Educación, Empresariales, Ciencias Experimentales y Ciencias Jurídicas) elegidos en porcentajes representativos por medio de una estrategia de muestreo de conveniencia. La base teórica del concepto de patrones de aprendizaje se encuentra en el modelo de aprendizaje interactivo (ILM), desarrollado por Johnston (1996, 2009). Este modelo establece que el aprendizaje se produce mediante la participación en tres procesos: cognitivo (saber), conativo (actuar) y afectivo (sentir). El intercambio de estos elementos deriva en un perfil individual que se compone de cuatro patrones de aprendizaje diferentes: secuencial, preciso, técnico y confluente. La recogida de datos se realizó utilizando un Inventario de Conexiones de Aprendizaje (LCI). El LCI es un instrumento validado en todos los niveles educativos y lleva asociado un protocolo de interpretación que facilita la transferencia de los resultados obtenidos a las posibles prácticas concretadas en el proceso educativo. El análisis se realizó utilizando métodos estadísticos como el análisis MANOVA, el ANOVA, la comparación de medias para muestras independientes y el cálculo de los tamaños de efecto.

Palabras clave: patrones de aprendizaje, estudiantes de primer año, Educación Superior, orientación educativa, aprendizaje activo, género.

Introduction

We agree that our society and individuals who habit inside are located in a context plenty of changes in all directions that occur rapidly. In educational setting, more concretely in Higher Education, we are observing the implementation of a new system with new rules in which we must adapt our ways of doing and understanding the educational fact. Once again, educational institutions test themselves to respond the social requirement in terms of efficiency, usefulness and personal development. As the 2010 Horizon report states (Johnson, Levine, Smith y Stone, 2010):

> It is incumbent upon the academy to adapt teaching and learning practices to meet the needs of today's learners; to emphasize critical inquiry and mental flexibility, and provide students with necessary tools for those tasks; to connect learners to broad social issues through civic engagement; and to encourage them to apply their learning to solve large-scale complex problems (p. 4).

The implementation of Bolonia process has been concreted in actions focused mainly in estructural aspects and the revision of educative dynamics. These dynamics have a common element that consists in locating the student in the center of teaching and learning processes. The educational model has to move from teacher to student, from contents to competences. In other words, it has to move from things that the teacher wants to teach to things that the student needs to learn. The teacher becomes the person responsible for placing the student in the center of the T/L process. The teacher is responsible for planning the learning process in which the student is able to take an active part.

With regards to the students, they have to assume their new role. They have to be independent in the development of their job as students and they have to claim it. The educative systems have to be organized taking into account this conjuncture in which personal aspects are essential to wellbeing, productivity and competitiveness at the same time.

We know that the current young population presents an increasing diversity in several issues as the participation of youth people in higher the fact of emigration that contributes to the heterogeneity, the new student profiles that combine work and study and the increasing incorporation of women to higher education and labour market.

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One of the key elements to take into account is the connection between the current young population and the information and comunication technologies; many authors are working on this topic (Oblinger and Oblinger, 2005, pp. 5, 12) and developing an adequate innovative didactic scenarios to promote an advanced learning (Dziuban Hartman y Moskal, 2004; Schank, 1994; Prensky, 2004; Siemon, Klockmann, Muñoz y Berasategi, 2003).

Understanding the complexity of student profile at the beginning of their academic life (Tinto, 2007) is a key element to face the challenge of success in HE development. Pancer (2000) says that these students envision a life free of parental control, filled with interesting and novel activities, new people to meet, and stimulating academic work. In a similar sense Berzonsky (2005) describes this as a moment where they face major challenges like establishing new social networks and dealing with more rigorous academic demands and expectations. On the other hand, authors like Parker (2004, 2006) name this transition as a stressful situation where the students must learn to function as independent adults.

Knowing the current university students

Being aware that students should be the center, the arisen question is do we really know our university students?; do we know the current students who enter at University? The answer seems to be: "not enough"; at least we do not know the students in the sense of the centered-student educative model as promoted by EHEA. We do not know exactly which kind of learners is compulsary education forming? How first year students organise themelves as learners?

The university of 21st century has developed systems to obtain a great amount of information about students who enter the university but this information is not organised in a learning process sense. Most of universities have data that is not organized in educative sense. At institutional databases we can find information about prior academic performance, the pre-university curricula or the students' pathways and their academic performance in subjects or university access tests.

This kind of information is useful to identify and to distribute the students, but more information in order to organize the L/T process focused on student learning is needed. That means to know the students

from a broader perspective and taking into account not only their external (sociobiographic) features but their internal or hidden traits.

Searching different ways to analyze students, we observe that the first year stundents profile has become a theme vastly investigated in the last two decades. In fact, universities in the anglosaxon context (USA, Australia, UK) have been pioneers in the emergent first year experience (FYE) research. The majority of these studies focus on decreasing the attrition or dropout of students, to stablish certains access to university criteria or to offer a broad sociological description of the students who enter at the university. But these studies do not pay special attention to knowing students' internal factors that predispose them to learn.

The analysis of the literature on student internal factors which predispose learning reveals that there is enough data availabe. Most research, however, has analysed these factors in an atomized way and it is difficult to see any proposal in an educative sense. On the other hand, to choose the internal factors that determinate the primary essence of learning is an additional difficulty.

Many factors can affect learning; however we want to search factors which lie in the base of learning in order to give planing the teaching and learning process. This aim is undertaken by Yorke (2000) who states that it is necessary to ensure that the approach to teaching is conducive to student learning. This ramifies into institutional learning and teaching strategies, now a requirement of English institutions, and associated matters like recognition and reward mechanisms for teaching.

Being concrete, the variable to analyze in the present work is the "learning patterns" (LP). Learning patterns is a variable that can be considered stable enough and it can explain the essence of the way that students learn. We consider learning patterns as an aspect that tend to remain invariable in any situation of learning. This factor can promote the transfer of learning in different contexts.

In other words, to make an students' diagnostic considering the way in which the students are the basement to help the university get organized as an institution, to help teachers plan and develop their process of teaching by means of the didactic proposals based on learning activities adequated to students profile in LP terms and help students manage their own learning process making them aware of how they learn (regarding LP features). This awareness could facilitate the facing of different learning situations as well as the decision making process along the educative

system. This idea is aligned with first basic principle of the named high-level learning which states as following, Renzulli (2010): "Every learner is unique and therefore, all learning experiences must be examined so as to take into account the abilities, interests and individual learning styles" (p. 36).

This work consists of giving an accurate description of the learnig patterns of freshmen in one students cohort in a midsize Spanish university. In fact, this work represents one of the first approach to describe the students' learning patterns based on the ILM Johnston model; this is a reason why it is not possible to present elements to contrast the results at this point. Nevertheless, this first approach can be useful to validate and consolidate the ILM and the LCI as educational tools of knowing how learning processes occur in university students.

Summarizing, the current research has the following main aim: to extend the knowledge about how our students learn analyzing their learning patterns in order to help them from a didactic perspective.

"Learning patterns": a concept under construction

There are many ways of understanding a learning process, while observing this topic from the historical contraposition between rationalism and empiricism. This debate is related to the origin of the variables that affect what people learn or understand. On the one hand there are those who think that knowledge is a mental creation independent from the interactions with the context and/or the others; and on the other hand there are those who believe the learning process occurs mainly through interaction with the context. In other words, those who consider learning as pure cognition and those who consider learning as a result of interaction with external experience only.

In constructivist terms, students build their own body of knowledge by means of their prior experience and through interaction with one another and their context. It would be convenient for any educational system to consider this concept in order to plan any didactic training sequence. In accordance with this constructivist conception, student-centered learning can be considered a learning model in which the students are active participants by using their own strategies, which demand intrinsic motivation and individualization. Observing the different approaches to learn, from behavioural to more situational perspectives as Lave and

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Wenger (1991) or Greeno et ál. (1993), the complex human essence has been described as the product of the interplay of a tripartite configuration: the cognitive, the affective and the conative. Learning is made up of components of cognitive, conative and affective nature, and is a product of a reciprocal interaction between the individual and the social dimension.

To talk about how the learning occurs requires to mention other concepts as styles, strategies, approaches and orientations towards learning. These terms can be observed in relation to their place in a continuum that goes from the most general to the specific "learning style" as one of the most commonly used concept in studies related to the description of students or the way that a person learns.

Learning style is used as the most general term, close to the cognitive style; it is stable, consistent and student-centered in the person. Learning strategy is centered on tasks and can be defined as the style expressed in terms of performance. Approach to learning is a concrete expression of learning, it has a phenomenological/experiential origin and is related to observed experience. Orientation to learning is a concrete expression of learning as well and is generally applied in scholarly settings (Vermunt, 2005).

Concretely, Busato, Prins, Elshout y Hamaker (1999) make a review of authors describing the different ways of understanding how people learn. These ways of learning can be considered as a kind of general strategy (Marton and Saljo, 1976; Pask, 1976; Schmeck, 1983), as types of learning (Kolb, 1984), as different orientations to learning (Entwistle, 1988) or approaches to learning (Biggs, 1993). Elaborating on these theories, it is possible to find different conceptualization approaches. Marton and Saljo (1976) classify approach to learning in terms of deep and surface learning. Schmeck (1988), and more concretely Biggs (1993), proposed a model where the approaches to learning are the deep, surface and achieving approach to learning depending on two components: strategy (how students approach a task) and motive (why they want to approach it in the first place). In accordance with Biggs' idea, Hativa (2000) also stated that the approach to learning is composed of two components: motivational/emotional and cognitive/ strategic. Vermunt (in Busato et ál., 1999, p. 130) describes the concept as consisting of four aspects: processing strategies, regulation strategies, mental models of learning and learning orientations. Vermunt developed a framework with four learning styles: meaning directed learning, reproduction directed learning, application directed learning and undirected learning.

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Kolb's model suggests that people develop their way of learning through three stages (acquisition, specialization and integration) and defines four learning styles: diverging, assimilating, converging and accommodating. On the other hand, Honey and Mumford (1992) defined four types of learning styles as well: activists, reflectors, theorists and pragmatists.

Following a set of different learning style approaches, the theory based on the interactive learning model (ILM) developed by Johnston (1995, 1996, 2009) can be highlighted. This model states that learning is composed of three components: cognition (to know), conation (to act), affectation (to feel). Johnston establishes four different patterns of learning: sequential, precise, technical and confluent. Learning pattern has been added as a recent term in order to conceptualize the different ways of learning.

Vermunt (2005, p. 207) argues that the term learning style is too often associated with unchangeability, an invariable feature of students, deeply rooted in their personality. This could be useful in order to know what people are like. But the decision of researching this most hidden factor by means of personality traits had already been made. Currently, there exist several authors who put in relationship some variables as learning styles, personality and academic achivement (Swanberg and Martinsen, 2010; Chamorro-Premuzic and Furnham, 2009).

Interactive learning model: a way to understand students as learners

Observing the different terms and models, the use of the term learning pattern, understood in the line of interactive learning model (ILM) seems to be right. ILM is mainly based upon cognitive science, brain science, and multiple intelligences and understands learning patterns as a result of the temporal interplay between personal and contextual influences.

From the ILM perspective, learning process occurs as a brain-mind connection by a sequence of interpretation, decode and translation of the stimuli that are received; learning patterns are the natural foundation of how we interpret and understand the world around us. ILM states that learning patterns are the simultaneous interaction of the three fields of the mind: cognition (our thinking), conation (our acts), and affectation (our values) that work jointly to guide our individual patterns of learning. For Johnston (2009), following Bruer (1994), all learners use all four pattern filters but to varying degrees; the degree to which we use each of these

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filters is measured by how each pattern facilitates or limits the stimuli's entry into the mind.

This way of understanding learning is totally coherent with the idea in which this work lies and the student-centered model defined upon the paradigm of EHEA. Furthermore, this ILM model has a continuity in terms of educative action. That is to say that there is an action plan for students derived from the results of the questioning of the Learning Connections Inventory® (LCI), which is the specific instrument used to determine the students' learning pattern profiles. This action plan is concreted in the so called Let me Learn® (LML). LML is an advanced learning system based on the ilm model that uses knowledge of learning patterns as a starting point to develop processes and strategies to improve the learning process in students and to make the teaching instructional proposals more efficient.

Each person can present a personal combination of patterns and each person has his own tendency to learn in the prectice. The interplay of the three fields of mind forms four learning patterns called sequential, precise, technical and confluent. A brief definition of the patterns follows, as well as specific explanation in terms of preferential use or avoidance. *Sequential* learners follow a plan and seeks step-by-step directions. He organizes, plans work carefully and likes to finish assignments from beginning to end without interruptions. *Precise* learners look for and retains detailed information. He reads and writes in a highly specific manner and asks questions to find out more information. *Technical* learners like working autonomously at hands-on activities. Paper and pencil tasks are very often avoided and the learner reasons out technical ways to do things. He works alone without interference and shows what he knows by physically demonstrating skills. The technical learner likes to learn from real world experiences. *Confluent learners* avoid conventional approaches and seek unique ways to complete any learning task. The learner is ready to take risks, to fail and to start again. More often than not a confluent learner starts before all directions are given and likes to improvise.

The definition of the mentioned patterns is fostered from a multidimensional perspective. This feature becomes essential because the tools, inventories, o questionnaires to test people should be built in a multidimensional view. That is to say, each pattern is formed by elements that belong to different dimensions.

The ILM model and the patterns concept have to be considered when describing this data; nobody has a unique learning pattern. Each person

projects a profile that participates of the four patterns. The difference between persons is the dominance of or tendency to use certain patterns. This argument means that LCI has its own methodology of interpretation. The different patterns are expressed in terms of *avoidance* (values up to 17), *use if it is needed* (values between 18 and 25) or *preferential use* (values over 25). The combination of patterns makes complete sense when an individual approach is followed. However, when dealing with a group some tendencies or general characteristics can be observed as well.

Specific profiles in LCI

Each person can present a personal combination of patterns. The most common combination is that with two dominant patterns, named *dynamic* learners; additionaly, we want to mention two specific profiles as result of the specific combinations of the patterns: *strong-willed* persons and *bridge* persons.

Persons named *strong-willed* score high values in three of the four patterns. These persons tend to stress autonomy and ultimate control over any assigned task. These persons tend to perform using those patterns in which they score high and they tend to avoid one of the patterns, i. e. they are also characterized by the pattern in which they do not score high.

Persons named *bridge* score mid-values in all patterns. These persons are able to use any pattern if it is necessary. The *bridge* profile is especially useful to facilitate tasks as a working group. This kind of person is very valued in organizational settings because they facilitate interpersonal relationships and are used in solving problem tasks.

To identify these two kinds of profiles can be very useful at the moment of developing team working tasks and assigning different roles in the group.

Table I and Table II present a deeper description of these patterns associated to factors to consider educational proposal in all scholarship levels.

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TABLE I. Preferent use of learning patterns

WHEN I USE FIRST A LEARNING PATTERN				
	How I think	**How I do things**	**How I feel**	**What I might say**
Sequential	I organize information. I mentally categorize data. I break tasks down into steps.	I make lists. I organize. I plan first, then act.	I thrive on consistency and dependability. I need things to be tidy and organized. I feel frustrated when the game plan keeps changing. I feel frustrated when I'm rushed.	Could I see an example? I need more time to doublecheck my work. Could we review those directions? A place for everything and everything in its place. What are my priorities?
Precise	I research information. I ask lots of questions. I always want to know more.	I challenge statements and ideas that I doubt. I prove I am right. I document my research and findings. I write things down.	I thrive on knowledge. I feel good when I am correct. I feel frustrated when incorrect information is accepted as valid. I feel frustrated when people do not share information.	I need more information. Let me write up the answer to that. I'm currently reading a book... Did you know that…. Actually…
Technical	I seek concrete relevance – what does this mean in the real world? I only want as much information as I need – nothing extraneous. How does this work?	I get my hands on it. I tinker. I solve the problem. I do!	I enjoy knowing how things work. I feel self sufficient. I feel frustrated when the task has no real world relevance. I do not feel the need to share my thoughts.	I can do it myself! Let me show you how… I don't want to read a book about it, I want to doit! How can I fix this? I could use a little space…
Confluent	I think outside the box. I brainstorm. I make obscure connections. Unique ideas.	I take risks. I am not afraid to fail. I try new things. I might start things and not finish them. I will start a task first – then ask for directions.	I enjoy improvisation. I feel comfortable with failure. I feel frustrated by people who are not open to new ideas. I feel frustrated by repetition.	Why do we have to do it that way! Can we try this? Let's bend the rules. I have an idea……. I have another idea…

Source: Johnston, 2009.

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TABLE II. Avoidance of learning patterns

	WHEN I AVOID A LEARNING PATTERN			
	How I think	**How I do things**	**How I feel**	**What I might say**
Sequential	These directions make no sense! I did this before. Why repeat it? Why can't I just jump in?	Avoid direction; avoid practice. Can't get the pieces in order. Ignore table of contents, indexes, and syllabi. Leave the task incomplete.	Jumbled Scattered Out of synch Untethered/Unfettered Unanchored	Do I have to do it again? Why do I have to follow directions? Does it matter what we do first? Has anybody seen…?
Precise	Do I have to read all of this? How am I going to remember all of this? Who cares about all this stuff'?	Don't have specific answers. Avoid debate. Skim instead of read. Take few notes.	Overwhelmed when confronted with details. Fearful of looking stupid. Angry at not having the 'one' right answer'!	Don't expect me to know names and dates! Stop asking me so many questions! Does it matter? I'm not stupid!
Technical	Why should I care how this works? Somebody has to help me figure this out! Why do I have to make something; why can't I just talk or write about it?	Avoid using tools or instruments. Talk about it instead of doing it. Rely on the directions to lead me to the solution.	Inept Fearful of breaking the object, tool, or instrument. Uncomfortable with tools; very comfortable with my words and thoughts	If it is broken, throw it away! I'm an educated person; I should be able to do this! I don't care how it runs; I just want it to run !
Confluent	Where is this headed? Where is the focus? What do you mean, imagine?	Don't take social risks. Complete one task at a time. Avoid improvising. Seek parameters.	Unsettled Chaotic No more change or surprises, please!	Let's stay focused! Where did that idea come from? Now what? This is out of control!

Source: Johnston, 2009.

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Method

Participants

Participants included 699 freshmen (cohort 2006-07 academic year): 414 females (59%) and 285 males (41%). The mean age of the sample is 18,89 (*sd* = 2.618). Sample selection aimed to include students from all academic disciplines in representative percentages of population by means of the non-probability quota sampling technique. We decided the grouping criteria attending to the five traditional scientific domains; however, we divided the social domain in three sub-domains: Business, Education and Law. This sub-classification allows a more specific view of these students who, in fact, are physically separated in the especific research context. Thus the students belong to the following disciplines: Experimental (3%), Health (4%), Humanities (9%), Business (25%), Education (26%), Law (9%) and Technical (24%).

Instruments

Learning Patterns (LP) – This set of variables focuses on how students learn. As mentioned earlier, in keeping with Johnston (1996), learning is the result of the temporal interplay between personal and contextual influences. Johnston's (1996) interactive learning model led to the development of the assessment instrument the Learning Combination Inventory (LCI) (Johnston and Dainton, 1997; 2005). The four learning patterns defined are *sequential, precise, technical* and *confluent,* hereafter italicized. The survey is composed of 28 Likert scale items (in which respondents select one of five responses ranging from "never" to "always") and three open written responses that are used to validate the questionnaire. The values were calculated on a scale from 1 to 5 in the analysis process. Referring the theoretical learning approach, the LCI scale can be considered as a multidimensional formative scale; this fact is relevant in terms of validity of the scale.

Procedure

The survey used for the purposes of the present research was performed between September and October 2006 within the specific context of

Welcome Week. Answering this survey takes approximately 10-15 minutes and is done in web format, what facilitates database feeding and latter statistic analysis.

Students were requested to authorize the educational research use of their surveys results. Participation is not. The tendency, however, is that this type of data collection is becoming a standard procedure.

Statistical analysis design

As a previous step, a validation process was made in order to analyze the reliability and validity of the LP scale. LCI survey is already validated in prior researches (Aguado, Lucía, Ponte y Arranz, 2008; Johnston and Dainton, 2005) by means of statistic (factor analysis, test-retest validity, lineal regressions, etc.) and qualitative methods both to observe their construct validity, criteria validity, internal consistency or stability.

Considering that LP scale is based on a multidimensional model, her formative nature and their five options to response, high scores in alpha values are unexpected using LCI survey. Covariation among the indicators is not necessary by formative indicator models because the measures do not necessarily capture the same aspects of the construct's domain. Therefore they are not necessarily interchangeable and there is no reason to expect them to have the same antecedents and consequences (Jarvis et ál., 2003). According to that, Elosúa and Zumbo (2008) state that the alpha coefficient is not an adequate index to estimate reliability for ordinal scale; in the same direction, these authors cite several studies that show that using alpha Cronbach coefficient to measure the internal consistency in Likert scale with less than five options produces a decrease in its magnitude; this magnitude works better with scales that use more than six options.

To develop this work, the statistical analysis will be based on the following methods: MANOVA analysis, comparison of means for independent samples, effect sizes calculation[1], 1 Factor ANOVA analysis.

(1) Effect size is calculated with Cohen's *d* (Cohen, 1988).

Results

Before the complete analysis, a Kolmogorov-Smirnof test was done in order to observe the condition of normality of the scale in the sample. This test is a broadly goodness-of-fit test for normal and uniform data sets. Once verified this condition, we proceeded with the rest of the analysis.

Attending the stated before about learning pattern scale, Cronbach coefficient was calculated (Table III) in order to compare to previous research. Table III shows that the values are coherent with previous studies (Johnston and Dainton, 2005). This comparison can support its reliability in terms of stability of the tool in different contexts of application.

TABLE III. Reliability test of learning patterns scale

Learning patterns			
	α	*n2*	α *(prior studies)*
Sequential	,67	699	,65
Precise	,57	699	,58
Technical	,74	699	,85
Confluent	,56	699	,55

Source: Johnston and Dainton, 2005.

Boxplot shows information about the sample distribution. In this sense, the graph shows a negative asymmetry (the most extreme values are below the mean) for the *technical* pattern. The other three patterns present symmetry around the median, but if the extreme and atypical values are observed, they show negative asymmetry.

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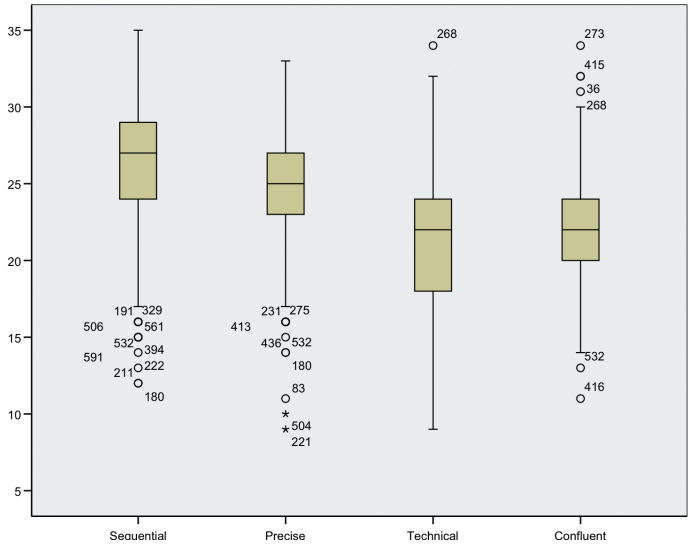
FIGURE I. Boxpot of learning pattern distribution in the sample



Currently, LCI is being widely used mostly in the USA. It is interesting to give some elements of comparison in order to contrast the results of this research. The study developed in Cumberland County College in the last three freshman cohorts shows the following mean results: *sequential* = 26,6; *precise* = 22,5; *technical* = 23,7; and *confluent* = 21. These results confirm the recurrent tendency to score high in the sequential pattern; this sequential pattern is linked to development in scholarly settings in which the students' performances depend mainly on the teacher instructions.

Table IV shows the descriptive stadistics of the variables in the sample. These data cannot be compared regarding standardized values in population; we have no reference terms to compare, therefore the analyses have to be done as a description of a given sample.

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TABLE IV. Descriptive statistics in the sample

	Sequential	Precise	Technical	Confluent
Mean	26,3	25,0	21,4	22,0
Median	27,0	25,0	22,0	22,0
Mode	27,0	25,0	22,0	22,0
Std. deviation	4,1	3,4	4,7	3,1
Minimun	12,0	9,0	9,0	11,0
Maximun	35,0	33,0	34,0	34,0

Source: own elaboration.

Taking this sample as a whole, these students tend to make predominant use of the sequential and precise patterns and they use the confluent and technical patterns if they are needed. The sample subjects show a tendency to learn following an established plan and developing tasks step by step. They like to search for information by asking questions to develop actions.

Analysis of learning patterns in the sample by gender, domain and type of study

Analysis by gender

This MANOVA is defined by a design in which the dependent variables are: *sequential, precise, technical, confluent* and the independent variables, *gender, domain* and *type of study,* taking into account the interactions between independent variables. The variables are expressed as follows:

*Intercept + gender_code + Study_code + domain_code + gender_code * Study_code + gender_code * domain_code + Study_code * domain_code + gender_code * Study_code * domain_code*

We apply the Box test as a preliminary test in order to verify the equality of variances – covariance matrices. Box test (M = 559,631; F = 1,264; *df1* = 370; *df2* = 17486.65; *sig.* < 0,0005) shows that the variables have different variances. Following, a Tamhane (T2) test is applied followed by the between-subjects effects test, which yielded the following results: statistically significant differences in the values for the variables *sequential* (F = 13,348; p < 0,0005) and *technical* (F = 8,667; p = 0,003) on *gender* and statistically significant differences (F = 2.038; p = 0,004) in values for the variable *technical* on *type of study*.

Women present a statistically significant higher tendency to sequential reasoning than men. Women show an attitude which is more oriented towards managing their learning in an organized and categorized manner. Women have a greater need than men for feeling that things are organized. They have a greater need to establish priorities and to break tasks down into steps. Men show a statistically significant greater ability with technical issues than women, that is to say that men show a greater tendency to develop actions that imply thinking in terms of concretion and relevance, acting from real world experiences, and feel themselves self-sufficient enough for solving problems without the need to share information with others.

Applying a comparison of means for independent samples the results show that there is a significant gender difference in sequential, technical and confluent learning patterns.

Deepening in this gender analysis, applying a more sensitive statistical analysis, the results show that the confluent pattern presents a slight difference between genders.

Men show higher values than women in managing learning processes based on thinking that explore unconventional approaches. Also men have a tendency to take more risks than women, being ready to fail and start again. They feel comfortable improvising and show him/herself opened to new ideas.

Summarizing, once calculated the effect size (Cohens' d value) and the percent changes, the pattern technical presents large effect (d = 0,84) and medium change between groups (18%). Therefore, this value support that men have significant higher levels in technical than women. On the other hand, it can be observed that sequential pattern has a medium effect (d = 0,57) but a small percent change (8%), so women present significant higher values than men but the magnitude of the difference is not so big as in the case of technical pattern.

Analysis by domain and type of study

To analyze the different domains and the corresponding learning patterns, the 1 Factor ANOVA analysis is applied. The results are interpreted by the Tukey post-hoc test because the Levene test shows no different variances in the sample. The patterns which present statistically significant differences in the ANOVA analysis are sequential and technical.

The students from the Educational domain score higher values than the rest of the students in the use of the sequential pattern and a statistically significant higher value in relation to students from the Technical and Humanities domains.

With regard to the statistical differences in the technical pattern, the students from the Technical domain present higher values than the others, especially those from the Humanities and Education domains. The Health and Experimental domains also show high values in the technical pattern.

In order to analyze the LP by type of study, the 1 Factor ANOVA analysis is applied. The results are interpreted by the Tukey post-hoc test because the Levene test shows no different variances in the sample. The results show that the sequential (between the studies Technichal Engeneering: Information Systems and Pedagogy) and technical patterns show significant differences in terms of type of study.

The technical pattern shows many significant differences. The technical pattern shows notably higher values in studies in the Technical domain compared to studies in the Educational domain, and especially the Humanities domain.

The differences by types of study reflect that most technical studies have notably different values compared to the rest of the studies. This seems to be coherent with the intuitive thinking learning approach of student who is involved in technical branch studies.

Results of specific LCI profiles: dynamic, strong-willed and bridge profiles

As it was stated before, the dynamic learners were the most common profile in the sample (83%). Analyzing the two other main especific profiles we searched the place where these specific profile persons (strong-willed and bridge) are located in the sample.

We found an amount of 10,6 % strong-willed learners and 6,3% bridge learners in the sample. However, knowing these figures does not add relevant information regarding the sample characteristics; it is necessary

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knowing the tendency of the dominant character. The strong-willed profiles were disaggregated depending on the pattern that showed the lowest value, that is to say, the pattern avoided. In that sense, we can found that the amount of strong-willed persons who avoid confluent and technical are larger (6,3% and 2,7% respectively) than those who avoid sequential and precise patterns (0,9% and 0,7% respectively).

These results add support to the idea that in the educational setting it is more frequent to be dominant by avoiding patterns characterized by creativity or improvisation than by avoiding patterns that promote organization or the amount of information.

It is interesting to observe the studies that contain more individuals with these profiles. With regard to the strong-willed who avoid confluent pattern, the distribution of the studies shows that Technical Engineering Information Systems (13,6 %), Medicine (13,6%) and Architecture (13,6 %) contain the majority of these persons in comparison with the percentages in the sample.

On the other hand, the bridge profile reaches 6,3 % in the sample. The results show that Business Administration and Management (25%), Teacher Training: Physical Education (11,4%) and Architecture (9,1%) contain the majority of bridge individuals compared to the sample percentage. In other words these studies contain the most amount of persons who are characterized by facilitating interpersonal relationships, resolution of conflicts and working group tasks.

Conclusions

This work is a first step to analyze the way in which people learn in an innovative manner. In fact, this is one of the first experience using the ILM model and LCI tool to analyse the students learning pattern in Higher Education. Therefore, it should be useful to consolidate a preliminary knowledge as the basis of future research works. On the other hand, this descriptive work allows us to share certain ideas steaming from the results but in terms of tendencies.

Being conservative in getting differences steaming from the results, the only striking ones are the gender differences found in sequential and

especially technical pattern. Additionally, we can observe how the studies that belong to Technical domain tend to present higher values in technical reasoning pattern.

Freshmen are oriented to managing their learning process in directive terms. The educational system does not promote active learning environments where the students could investigate, discover, simulate, try, etc. In educative terms, the educational environment should be the propitious setting in which creating, strategies and resources that contain transfer power and innocuous effects in terms of professional development. It should be the place where using didactic strategies such as error, conversation or debate.

LCI can be very useful as a tool of personalization to compose working groups attending to the strengths and weaknesses of each one of their members.

This work and further related researches can generate relevant information to promote educational changes in higher education institutions. This changes become challenges at different levels of aggregation: at university level, the description can be used in order to contrast the youth population in general; at study level, to design curricula and facilitate understanding of the entering students and the profiling of graduate students who have to deal with professional development in the labour market. At classroom level, this information can help teachers to promote learning activities adapted to the student profile as well as the curricular requirements, and at the end, at individual level, if the student is aware of what he is like and how he learns, he could be ready to face the different learning situation. In the educational system, this individual level can be related to the tutoring process in two possible directions: the self-awareness process that the facilitation of one's own learning process as well as interaction with others and to help in the decision-making process. This help could be done in different stages as the first courses the tutoring process; in transition periods included entering the labour market.

Some ideas oriented to develop further research lines can be stated: to analyze this learning pattern variable using the academic performance as the reference; to complete a more comprehensive students profile incorporating other factors, also in qualitative terms; to test the efficiency of the implementation of the tutoring process considering the information obtained by about learning patterns; to verify the stability of LP across the stage at university and to develop comparative studies among the different higher education institutions.

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