

Use of information and communication technologies as a motivational strategy in the blended learning classroom

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Abstract

Introduction. Given today's academic and professional demands, we must promote knowing how to *be*, that is, a feeling of competence and autonomy. A classroom environment where technologies are used for learning and knowledge can be supportive of this purpose. The objective of the present investigation, therefore, was to analyze motivation and sense of autonomy in university students under classroom modalities of blended learning or the traditional classroom, using ICT.

Method: This quantitative investigation used a non-experimental design, with a correlational, cross-sectional scope. A convenience sample was selected, with 60 students from the traditional modality and 69 students from the blended classroom modality, at the Autonomous University of Campeche. A scale on perception of psychological needs (García, 2014) was used; its Cronbach alpha of .75 was considered viable for this investigation. Also included were students' grades on the Departmental Examination for the class subject Sensation and Perception.

Results: A statistically significant difference was observed between students in the traditional and blended classrooms in their average grade attained on the Departmental Exam, and in extrinsic motivation. Extrinsic motivation was greater in the traditional classroom group, while motivation and sense of autonomy were greater in the blended classroom. In the same way, extrinsic motivation was found to have a statistically significant, negative relationship to intrinsic motivation; sense of autonomy had a statistically significant, positive relationship to average grade (EXADES).

Discussion and Conclusions: A supportive environment, where students' sense of competence is reinforced, improves not only what is learned, but also students' satisfaction and motivation.

Key words: Sense of competence, Information and Communication Technology, blended classroom, motivation, university students

Resumen

Introducción: El actual desempeño académico y ante las exigencias del mundo profesional, es indispensable el fortalecimiento del saber Ser, entendiéndose como el sentirse competente y autónomo, a partir de un ambiente sustentador utilizando dentro de las aulas las tecnologías para el aprendizaje y el conocimiento, por lo tanto, el objetivo de la presente investigación fue analizar la motivación y el sentido de autonomía en estudiantes universitarios en la modalidad de aula mixta (blended learning) y en la modalidad de aula tradicional, usando las TIC.

Método: Se trató de una investigación cuantitativa con un diseño no experimental, un alcance correlacional y de corte transversal. La muestra fue selectiva por conveniencia conformada por 60 estudiantes bajo la modalidad tradicional y 69 estudiantes bajo la modalidad de aula mixta de la Universidad Autónoma de Campeche. Se utilizó la “Escala de Percepción de las Necesidades Psicológicas” (García, 2014), con un alpha de Cronbach de .75, considerado viable para esta investigación, así como los resultados del Examen Departamental de la Asignatura Sensación y Percepción.

Resultados: Se observa una diferencia estadísticamente significativa en el promedio obtenido en el Examen Departamental entre las aulas tradicional y mixta y en la motivación extrínseca. La motivación extrínseca es mayor en el grupo de aula tradicional, mientras que en aula mixta la motivación y sentido de autonomía identificada es la mayor. De la misma manera, se encontró que la motivación extrínseca tiene una relación negativa estadísticamente significativa a la motivación intrínseca; el sentido de autonomía tiene una relación positiva estadísticamente significativa con los promedios (EXADES).

Discusión o conclusión: El ambiente sustentador donde se refuerce el sentido de competencia de los estudiantes beneficia no solo el mejoramiento de lo aprendido sino la satisfacción y motivación de los estudiantes.

Palabras clave: Sentido de competencia, Tecnología de la Información y comunicación, Aula mixta, Motivación, Estudiantes universitarios

Introduction

Citizens with a university education are considered to have well-rounded and public-spirited training, which fosters in them a sense of responsibility with regard to the professional activity in which they become inserted in society (Di Genaro, 2008). One of the theories which takes a whole-person view on human beings and their education is called Self-Determination Theory (SDT) (Deci & Ryan, 2000).

It is important to consider development and satisfaction of the psychological need of self-determination, because it plays a part in different aspects of the individual's life (personal, social, scholastic, interpersonal, family).

Doménech and Gomez (2011) found that students who perceived more satisfaction of their basic needs (except for autonomy) tended to adopt a deep approach to learning, and vice versa, students who perceived less satisfaction of their basic needs (except for autonomy) tended to adopt a surface approach.

During our daily practice as teachers, we hear other teachers' comments, observations and concerns about the students, where they mention behaviors like the lack of engagement and dedication, not doing assigned readings or feedback exercises; carelessness in the proper completion of assignments and turning them in on time; a marked increase in absenteeism; and a sense of disillusionment with study, leading them at times to drop out or transfer to other educational institutions, or to get behind in their studies, as much as a full year. In the same tone, students offer a similar panorama of how they perceive teacher behavior, constantly missing classes, lacking organization in their presentation of material, not giving feedback, using unclear and unfair assessment processes, etc. All this seems to portray a multicausal problem. If we consider the great number of problem areas presented by both teachers and students, problems of a personal nature stand out as detrimental to both teachers' and students' performance.

The academic sphere is certainly one of the areas where motivation is influential, specifically in learning, and consequently in academic achievement. The impulse to learn can have a strong adaptive value; Cervantes (1998) comments that the mission of the school, in general terms, is to awaken in students (and one might add in teachers) a taste for learning.

Santos (1990), as quoted in Polanco (2005), defines motivation as “the degree to which students strive to meet academic goals that they perceive to be useful and meaningful”. From the teacher’s point of view, it means motivating the student to do something, by means of promotion and sensitization. Motivating involves increasing the student’s disposition to actively participate in class work.

The purpose of motivation consists of awakening interest and directing efforts toward meeting defined goals. The teacher finds and leads new and better activities to foster their students’ learning; ICT offers innovative classroom tools that can enhance students’ motivation and sense of competence.

According to Maquilón and Hernández (2011), in the school context, students’ attitudes, perceptions, expectations and representations of themselves, of the task to be completed, and of the goals being pursued, are all factors that guide and direct the student’s behavior in the academic sphere.

Due to the foregoing, we now proceed to present a motivational theory that is less known and less implemented as such in the classroom, that is, Self-Determination Theory. This organism-based theory describes optimal human motivation, tending to see the organism as active, volitional and the initiator of behaviors. This theory has been supported by numerous studies carried out in the field of education during the past three decades, especially in primary and secondary education (Doménech & Gomez, 2011).

One general principle of Self-Determination Theory (SDT) is that human beings are active organisms with innate tendencies toward personal growth and optimal, effective involvement in their surrounding environment (Balaguer, Castillo & Duda, 2008). The organism has intrinsic psychological needs, which energize the organism to act on its environment. This view of the organism sees stimuli not as a cause of behavior, but as opportunities that the organism can use for meeting its needs (Deci & Ryan, 1985).

This theory considers that all human behavior is motivated by three primary, universal psychological needs that seem to be essential for optimal functioning, psychological growth, social development and personal well-being (Deci & Ryan, 2000).

Autonomy: the desire to choose, and to feel like one is the initiator of one's own actions. A certain degree of autonomy in choice and control is required for the subject to self-initiate his or her behaviors, and not act only in response to the requirements of others –in other words, to be self-regulated (Roces & González-Torres, 1998).

Competence: the desire to effectively interact with the environment. However, in order for the sense of competence to positively influence intrinsic motivation, it must be accompanied by autonomy; that is, individuals must not only experience self-confidence or perceived competence, but they must feel that they themselves decide their own behavior, so that intrinsic motivation is sustained, or even improved.

And **Relatedness:** relationship with others, desire to feel connected to others and feel respected by them. This construct is similar to Baumeister and Leary's (1995) *need to belong*, but more general, since it includes both interpersonal and group relations (Doménech & Gomez, 2011).

Like other needs, these needs are regulated by environmental conditions. Hence, contexts or climates that encourage optimal challenges, positive feedback, freedom and possibilities for choice, opportunities for self-direction, recognition of feelings, fostering of social relations and group cohesion, will all help to attain intrinsic motivation (Deci et al., 2000).

In an attempt to create these supportive conditions in the classroom, we have proposed a gradual change from a traditional classroom to a blended classroom, and from there to move toward an inverted (flipped) classroom. According to Shapiro (2018), the online school needs teachers who have new outlooks on the world and on education. Teachers adopt a new leading role by designing their own learning situations, where new pedagogical practices are employed, further and further removed from the textbook and traditional models.

In modern society, science and technology strongly influence the lives of individuals (Lipovetsky, 1990, quoted in Álvarez & Contreras, 2017). ICT is defined as a diverse set of technological tools and resources used to communicate and to create, transmit, store and manage information (Ghasemi & Hashemi, 2011).

Their use in the classroom has been found to generate high levels of achievement motivation in students (Passey et al. (2004), in Romero, López & Pichardo, 2009). Cabero (2018) mentions that we can organize different components at our disposal, whether technological or human, such that when specific methodologies and strategies are applied in interaction, they collectively form a “stage set” of communication media, and that the student, in interaction with his or her classmates, teacher, and learning objects, may reach the planned objectives and competencies.

Innovation is not achieved by the novelty of the technological application, but by applying criteria to achieve new formative and communicational scenarios. These scenarios are starting to be applied in educational settings as tools for facilitating learning, for disseminating knowledge, for participation and cooperation between participants in the educational act, for students’ creation of learning objects, and for analyzing the reality in which players within the teaching-learning process find themselves immersed (Cabero, 2018).

One of the advantages of a blended classroom is learning at one’s own pace, where students prepare their classes; they can work when they want and take the time they want to finish (as long as it meets the deadline). Moreover, when students already have basic knowledge about a topic, they can dig deeper into the learning materials, and more learning material can be offered to students who are looking for a challenge.

Students can take courses where teachers assign tasks for them to prepare; and the teachers can follow their students’ progress and see their outcomes. This makes it possible to have a clear view of what students’ difficulties are, and which students have the most trouble. In addition, it allows the teacher to identify errors in thinking or in applying the concept (Quizworks, 2015).

As Romero et al. (2019) assert, teaching today must take into account new methods such as use of ICT in the classroom (Hubackova & Ruzickova, 2011). The use of ICT in the classroom offers benefits for both the student and the teacher. In the present study we incorporate Gsuite, which offers automatic information storage (documents, videos, calendar) and allows remote cooperation between students and teacher. It tends to motivate active learning, allowing the student to work at his or her own pace of learning. Thanks to their many ad-

vantages, learning and knowledge technologies can become an important pedagogical tool in the sphere of education.

One of the tools used in the blended classroom was Classroom Google, a free educational platform for blended learning, which allows teachers to have direct contact with the students, as well as allowing students to access course information at any time.

Another tool was YouTube, which was used two ways: (1) viewing videos on the class topic, and (2) finding original videos that one might share with the group, and which were later analyzed in class, reinforcing content. According to Silviyanti (2014), the use of YouTube can be interesting and beneficial, given that it creates enthusiasm and motivation in students.

One of several tools that turned out to be motivational was the Kahoot application, a questions game that simulates competition between participants, and can be used individually or in the group. Kahoot created a competitive environment and gave feedback on learning. Rodríguez-Fernández (2017) mentions that it is highly valued by students, who perceive it to be a tool for improved learning and increased competence in the classroom.

By contrast, in the concept of traditionalist education, we find direct, authoritarian methods, as well as standardization and the supremacy of the external aspect (Rodríguez Cavazos, 2013). The traditional teacher acts as the executor of preestablished directives, limiting individuality and creativity, and resulting in an authoritarian, rigid and controlling teaching style. Humanistic pedagogy, by contrast, offers an active, creative role, investigating and experimenting, resulting in a flexible, spontaneous, and orientative teaching style.

The student, in traditionalist settings, is conceived as a passive subject who reproduces knowledge, not proactive, insecure and showing little personal interest; in humanistic settings he or she is active, constructing knowledge, showing more creativity, directed more from their own cognitive interest, involvement and engagement (Rodríguez Cavazos, 2013).

Hernández Rojas (1998) mentions that traditional education favors direct, rigid teaching that is predetermined by an inflexible, teacher-focused curriculum. By contrast, what we seek to achieve is closer to an indirect, humanistic education, where the teacher allows stu-

dents to learn while prompting and promoting all explorations, experiences and projects that students initiate on their own or decide to undertake in order to achieve meaningful, experiential learning; and where the student is an active constructor of knowledge, showing more creativity, and reflecting more of his or her own cognitive interests, involvement and engagement (Rodríguez Cavazos, 2013).

The social environment plays an important role in satisfying or frustrating basic psychological needs -- in particular the motivational climates created by authority figures. When authority figures present a controlling style, using coercion, applying pressure and acting in authoritarian fashion, such needs are not met (traditional classroom); whereas if participants' autonomy is supported, offering them freedom and encouraging their involvement in the decision-making process, then autonomy, competence, and social relations are encouraged (Balaguer, Castillo, & Duda, 2008)

Given the possible implications of using supportive scenarios in the educational sphere that affect whether or not students feel their needs are being satisfied, we formulated the research question: Do classroom scenarios with use of information and communication technology imply a supportive environment that affects students' sense of competence and autonomy?

Objectives and hypotheses

Considering the importance of developing a supportive environment, ICT use, a sense of competence, a sense of autonomy, and academic achievement, the present study had the following objectives: a) to analyze sense of competence in students from a traditional classroom scenario and from a blended classroom scenario, b) to analyze the level of autonomy in students from a traditional classroom scenario and from a blended classroom scenario, c) to compare academic achievement in students from a traditional classroom scenario and from a blended classroom scenario.

Based on the theoretical review, we could expect that: a) students' sense of competence in a blended classroom will be greater than that of students in the traditional classroom, b) level of autonomy will be greater in students in the blended classroom scenario in comparison to students in the traditional classroom, and c) academic achievement will be greater in students in the blended classroom scenario than in students in the traditional classroom.

Method

Participants

A convenience sample was selected, containing students from the psychology degree program of the Autonomous University of Campeche, who were enrolled in a course on sensation and perception. Groups were selected for the blended classroom modality (2 groups, 69 students) and for the traditional classroom (2 groups, 60 students).

Instruments

The present study measured sense of autonomy, sense of competence, and performance on the EXADES Test as dependent variables, and students' situation (traditional or blended classroom) as independent variables.

Sense of competence and of autonomy

García's scale on perception of the three basic psychological needs was used (García, 2017). This Likert-type scale offers five response options, ranging from 1=disagree completely to 5=agree completely. The scale was obtained based on a bibliographic review, where the definition of each need was operationalized within an educational setting. Students in the sixth semester were asked to write down how they would describe a student with competence, autonomy and relatedness. Next, the data provided by the students was aligned with what was obtained from the review. This output was judged by three teachers who have taught the subject of motivation, resulting finally in 100 statements. These statements were then administered to a pilot group of 30 students from ninth semester. The scale was revised and reduced to 68 statements. A Cronbach alpha of .75 was considered viable for this investigation.

Academic achievement

This was measured using the Departmental Exam (EXADES) of the Sensation and Perception Learning Unit, for the academic years 2016-2017 Phase 2, and 2017-2018 Phase 2. This exam was constructed from items designed by the teaching chair for this subject and then uploaded to an educational platform of the Autonomous University of Campeche. The platform is administered by personnel from the School of Humanities; a computer program creates exams from items selected randomly from the previously created data bank.

Blended classroom

Some of the more notable aspects of the blended classroom were: tasks were posted on the platform, each student received notification via his/her institutional e-mail whenever an assignment was uploaded, each activity included a detailed description of how it should be presented, the information for doing assignments was available to students through some channel at all times. Completed assignments were uploaded by the students or student groups; one could see which students turned in assignments, their timeliness and format, and students who were still working on them could be notified when the due date was approaching. Feedback was immediate, and students had the opportunity to make changes and resend.

The use of YouTube as mentioned above was useful for two purposes. Links to videos related to the class session were shared prior to class, and classtime was given to analyzing, discussing and reflecting on their content, reinforcing knowledge and encouraging collaborative work in class. It was also used as a search tool, where students were to choose a video on a particular topic and share it on the platform; this had to be original and not a duplicate of what had already been posted on the platform. This encouraged teamwork and reinforcement of concepts, and there was opportunity to feed back the information after viewing the videos.

Other tools used were Google apps for presentations and documents, used in collaborative work, and the online game Kahoot, which created a motivating, fun environment as mentioned above, at the same time reinforcing the material.

Traditional classroom

In this modality, the class syllabus and calendar were physically given to students. Topics were reviewed in the classroom through teacher and student presentations. Group and individual assignments were prepared and handed in in person. The teacher provided videos related to the topic; these were viewed, then analyzed and reflected on in class.

Procedure

To begin, adjustments and modifications were carried out in the *Basic Processes I Learning Unit: Sensation and perception*, to be covered during one semester in a blended classroom. The online Classroom for this subject was created on the University's Google educational platform, and initial information regarding the syllabus, a link to the textbook, and a welcome letter explaining the general outline, programmed activities, and class calendar were

all uploaded. Next, the groups were selected which would follow a blended classroom modality (2 groups, 69 students) or the traditional classroom (2 groups, 60 students).

The “Scale of perception of psychological needs” (García, 2014) was applied, as well as a scale on satisfaction with the use of technologies. Grades on the departmental exam for the Sensation and Perception course were collected for students in the blended classroom and traditional classroom samples.

Data were recorded and analyzed using the Statistical Package for the Social Sciences, results were described and discussed, and finally, the conclusions were drawn.

Design

The present study was quantitative with an ex post facto design, including all the studies whose objective was to test a causal relationship hypothesis, but had more or less serious limitations in doing so successfully. This first group included intervention designs where applications were done in natural situations, where it was impossible to randomly assign participants or control the order of application of levels of the independent variable (Montero & León, 2007).

Using a quantitative approach, data were collected to test hypotheses based on numerical measurements and statistical analyses, for the purpose of establishing behavior patterns; the scope of the present study was causal, and its purpose was to understand the relationship or degree of association between two variables. Variables were associated through a predictable pattern for one group or population in this case, traits of psychological adjustment and drug dependency (Hernández, Fernández & Baptista, 2010).

Data analyses

The Statistical Package for the Social Sciences (SPSS), version 23, was used for data analysis.

A database was created with the results from applying the instruments used in this investigation.

We obtained differences of means between the student samples from the blended learning group and from the traditional classroom, using Student’s *t* parametrical test, for

EXADES exam scores, motivational profile, and the psychological need for autonomy as measured by the Scale of perception of psychological needs.

Correlation between variables was analyzed using Spearman's *Rho* nonparametric test.

The ability to predict one variable as a function of the remaining variables was analyzed using multiple linear regression.

Results

The scores obtained for each variable in the present sample were distributed into ranges, and were interpreted using percentiles, where percentiles from 5 to 30 showed a minimal presence of the variable.

Table 1. *Percentiles of the study variables*

Percentiles	Sense of Competence	Intrinsic Motivation	Extrinsic Motivation
5	77.00	8.50	4.00
10	80.00	10.00	4.00
15	85.00	11.00	4.00
20	88.00	12.00	4.00
25	91.50	12.00	4.00
30	93.00	12.00	4.00
35	96.50	13.00	4.50
40	99.00	14.00	5.00
45	100.50	14.00	6.00
50	102.00	14.00	6.00
55	104.00	15.00	6.00
60	105.00	16.00	7.00
65	107.00	16.00	7.00
70	108.00	16.00	8.00
75	110.50	17.00	8.50
80	112.00	17.00	9.00
85	114.50	18.00	10.00
90	117.00	19.00	11.00
95	120.00	19.00	13.00

Minimal presence was represented by scores of 77, 80, 85, 88 and 91.59 in sense of competence; extrinsic motivation showed scores of 8.5, 10, 11 and 12; and there was a single score of 4 in intrinsic motivation. Percentiles from 35 to 60 represented a medium presence of the variable, where sense of competence had scores of 93, 96.50, 99, 100, 102, 104 and 105, extrinsic motivation showed scores of 13, 14, 15 and 16 and intrinsic motivation a score of 4, 4.5, 5, 6 and 7. Finally, in percentiles 65 to 95, where the variable had the greatest presence, there were sense of competence scores of 107, 108, 110.50, 112, 114, 117 and 120, extrinsic motivation 10, 17 18 and 19, and intrinsic motivation 7, 8, 8.50, 9, 11 and 13. Intrinsic as compared to extrinsic motivation showed increasing scores in the percentiles; the scoring criteria was the same, given that these variables were measured with the same instrument. We can describe the sample as presenting higher ranges of scores in intrinsic motivation; therefore, this type of motivation is prevalent in the student sample of this research study.

Table 2 reveals a maximum score of 191 and a minimum of 55 in sense of competence in our study sample; the mean was 100.83 and standard deviation, 15.827. The mean score for intrinsic motivation, 14.34, was higher than that of extrinsic motivation, at 6.69. Intrinsic motivation, therefore, was prevalent in this sample. In both cases, the minimum score was 4, while the maximum in intrinsic motivation was 20, and the maximum in extrinsic motivation, 19. Standard deviations were 3.188 and 2.980, respectively.

Table 2. *Descriptive statistics of the study variables.*

	<i>Minimum</i>	<i>Maximum</i>	<i>Mean</i>	<i>SD</i>
Sense of Competence	55.00	191.00	100.83	15.827
Intrinsic Motivation	4.00	20.00	14.34	3.188
Extrinsic Motivation	4.00	19.00	6.69	2.980

Of all the factors --EXADES grades, sense of competence, intrinsic motivation and extrinsic motivation-- the only factor where the data showed a normal distribution with respect to the mean was sense of competence (see Table 3). Consequently, a multiple linear regression test was carried out in order to predict sense of competence through intrinsic and extrinsic motivation. The resulting prediction percentage, however, was -.004 (Table 4), and

significance of the prediction was .467 (>.005) (Table 5). Consequently, the Sense of competence model does not allow us to predict extrinsic and intrinsic motivation.

Table 3. *Kolmogorov-Smirnov test for normality*

	Average	Sense of Competence	Intrinsic Motivation	Extrinsic Motivation
N	129	129	129	129
Test statistic	.102	.074	.101	.183
Asymptotic Sig. (bilateral)	.002	.078*	.003	.000

* The distribution is normal

Table 4. *Summary of the linear regression model of sense of autonomy*

<i>Change statistics</i>									
Model	R	R squared	Adjusted R squared	Standard error of the estimate	Change in R squared	Change in F	df1	df2	Sig. Change in F
1	.110 ^a	.012	-.004	15.85672	.012	.765	2	126	.467

a. Predictors: (Constant), EXTRINSIC MOTIVATION, INTRINSIC MOTIVATION

Table 5. *Variability of the linear regression model of sense of autonomy*

Model	Sum of squares	df	Quadratic Mean	F	Sig.
1 Regression	384.702	2	192.351	.765	.467 ^b
Residual	31680.880	126	251.436		
Total	32065.581	128			

a. Dependent Variable: SENSE OF COMPETENCE IN UNDERGRADUATE PSYCHOLOGY STUDENTS AT THE UAC

b. Predictors: (Constant), EXTRINSIC MOTIVATION, INTRINSIC MOTIVATION Significance of prediction (>.005)

The blended classroom and traditional classroom groups had equal parametric variances; therefore, Student's *t* parametric test could be used to analyze differences of means (Table 6). Comparing the two groups, the average score obtained on the EXADES (departmental exam) was 6.66 for the traditional classroom group, while the blended classroom group obtained a mean of 8.07, indicating a difference of -1.40.

This result implies an increase in the average scores of the latter group. When analyzing these differences with Student's *t* test, the *t* value obtained is -6. Bilateral significance is .000 in the alpha level, indicating that the statistical difference between the two comparison groups is significant. Statistically significant differences ($p < .050$) in extrinsic motivation were found between the two groups, where students from traditional classrooms presented higher means (7.78) than students from a blended classroom (6.34). Sense of competence and intrinsic motivation did not present statistically significant differences ($p > .050$) in the group means. Regarding intrinsic motivation, the difference in means between the two groups was .276, and in sense of competence, 2.604.

Table 6. Comparison of *t* test means of the study variables, according to type of classroom

Variable	Type of classroom	N	Mean	Levene's test of equality of variances		<i>t</i> test for independent samples	
				F	P	<i>t</i>	P
Average	Traditional classroom	32	6.66	2.440	.121*	-6.579	.000**
	Blended classroom	97	8.07				
Sense of Competence	Traditional classroom	32	101.81	2.604	.109*	401	.689
	Blended classroom	97	100.51				
Intrinsic Motivation	Traditional classroom	32	14.15	.276	.600*	-.393	.695
	Blended classroom	97	14.41				
Extrinsic Motivation	Traditional classroom	32	7.78	.647	.423*	2.416	.017**
	Blended classroom	97	6.34				

* Equal variances are assumed

** Statistically significant data item

When correlations between the study variables were analyzed (Table 7), sense of competence was found to have a statistically significant, positive relationship ($< .050$) with EXADES averages. In this way, higher grades were related to students having a higher sense of competence. Regarding this relationship, the magnitude of the correlation was low. Extrinsic motivation presented a statistically significant ($< .050$), negative relationship with EXA-

DES averages, such that higher EXADES averages were associated with lower extrinsic motivation, and vice versa. The magnitude of the correlation was low. Extrinsic motivation also presented a statistically significant ($<.050$), negative relationship with intrinsic motivation, such that greater intrinsic motivation was associated with lower extrinsic motivation, and vice versa. The magnitude of the correlation was moderate.

Table 7. *Spearman's Rho correlation*

		<i>Average</i>	<i>Sense of Competence</i>	<i>Intrinsic Motivation</i>	<i>Extrinsic Motivation</i>
Average	Correlation	1	.194		-.285
	P		.027*		.001*
Sense of Competence	Correlation	.194*	1		
	P	.027			
Intrinsic Motivation	Correlation			1	-.420
	P				.000*
Extrinsic Motivation	Correlation	-.285		-.420	1
	P	.001*		.000*	

* The correlation is significant

Discussion and Conclusions

Self-determination theory (SDT), as proposed by Deci and Ryan (1985), underscores an important role in the interrelationship between the organism and its environment, in this case, between the student and the school environment that surrounds him or her, since this is where the organism may or may not be supported. For these authors, adequate satisfaction of the three basic psychological needs requires certain environmental characteristics.

Students in the traditional classroom modality were detected as having a lower perception of their level of autonomy in comparison to the blended classroom students. As discussed in the theory, competence is the feeling that one is acting effectively, when reaching or meeting challenges imposed by the environment or by oneself. The idea of competence is very close to that of self-efficacy, and it is well known that many students lose or stumble in self-efficacy in school environments (Dweck, 1999, cited in Filak and Sheldon, 2003).

We now proceed to analyze each of the hypotheses posed at the start of the study. A first affirmation stated that students' sense of competence in the blended classroom scenario

will be greater than that of students in the traditional classroom. Results showed that the blended classroom, considered to be the supportive environment --where each student's rate of learning is taken into account, where the material is continuously available on the network for consultation as needed, where clear, precise instructions are available for carrying out assignments, thereby avoiding assumptions and misunderstandings-- provided students with a greater sense of competence in comparison to students who were in the traditional classroom scenario.

The concept of supportive environment means that an individual in a position of authority (for example, a teacher) gains an understanding of the other's (the student's) points of view and feelings, and provides him or her with pertinent information as well as opportunities to choose, while at the same time minimizing any pressure in making demands of their own (Deci & Black, 2000).

Our second affirmation stated that the level of autonomy would be greater in students from the blended classroom scenario as compared to students in the traditional classroom. We found that, in general, the blended classroom provided the elements needed for the student to develop a sense of autonomy, that is, a subjective experience that includes three important qualities: feeling that one is the cause of one's own behavior, the possibility of being able to participate in an activity by choice, and the sense of being able to choose among different options.

Though not exclusive to ICT, its use enabled the development of these qualities, allowing the student to choose what time to spend on the school subject, making him or her responsible for organizing how assignments will be completed and turned in, as well as offering a space for collaboration. We consider that these characteristics support the results seen in students in our blended classroom scenario, namely, a high level of sense of autonomy in comparison with students from the traditional classroom.

These results are backed by the theory, in line with comments by Reeve (2010), that external events, environments, social contexts and relationships vary in terms of how much or how little they support a person's need for autonomy. Some environments or scenarios foster and address the need for autonomy, while others neglect and frustrate that need.

When participants' need for autonomy is supported, offering them freedom and encouraging their involvement in the decision-making process, then autonomy, competence and social relations are encouraged (Balaguer et al, 2008).

Our final affirmation stated that academic achievement would be greater in students in the blended classroom scenario than in those from the traditional classroom; this was upheld by findings of a statistically significant difference between the two groups in results achieved on the EXADES test (departmental exams).

It is possible that an increased motivational climate that supports the students' autonomy helps them to develop a better sense of competence, leading to better scholastic performance, with creativity, meaningful learning and psychological well-being.

The challenges come from two directions. On one hand, a change is required in teachers' representation of their own action and their students' action, a change from seeing themselves as the source of knowledge that will illuminate minds, to seeing themselves as guide and companion in the educational process. On the other hand, students must come to see themselves as active agents within the process and not only as receivers.

The use of technologies for learning and knowledge in the classroom implies an intense effort of organization and detailed planning of class content from the start; however, it represents a strategy that develops competences in line with the demands of present-day society --as long as it is not simply an informational technique, given that information is not the same as knowledge.

Knowledge is one's reflection on the information, it is the ability to discern and to discriminate with respect to the information that one has. Technologies are advancing, and ICT is in the spotlight within the world of education; individuals are being trained with more learning capacities and are coming up to date with new ICT tools. At the same time, it must be said that technologies and motivation are connected to each individual, who seeks to reinforce his or her knowledge in each area as needed, in conjunction with the abilities he or she has developed in learning (Castro, 2007).

One of the limitations of this study was the non-random assignment of students, owing to the characteristics of the research study. Causal relationships, therefore, cannot be established. Similarly, there were individual variables that were not controlled, such as previous academic achievement, ethnic group, learning styles, ICT usage and skill. Even so, we attempted to control other types of variables between the two groups.

The study was conducted with a limited number of students, from one specific school at the university. For this reason, there is little external validity, and it is difficult to generalize the results to other contexts.

Another limiting factor is the type of cross-sectional study, where the effect of the intervention was measured in a certain time frame, and the general impact of ICT in education has not been verified.

Future research might consider a longitudinal study where the impact of ICT use could be observed during students' transition to university. Other proximal and distal factors associated with the process could be observed, and other protagonists and scenarios be considered.

The results obtained in the present investigation may represent a diagnosis that prompts other teachers to include classroom use of ICT in their academic planning, as a motivational tool for learning.

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