Title: Motivation and Learning Strategies in the use of ICTs among university students

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Abstract: Within the European Higher Education Area (EHEA) considerable efforts are being made to promote the incorporation of Information and Communication Technology (ICTs) in Higher Education (HE), together with placing emphasis on the cognitive and motivational components underlying learning. The objectives of this research were to analyze: (a) the relationship between different uses of ICTs and the learning outcomes and (b) the relationship between learning strategies and motivation and the use of ICTs. Four factors explain 57.4% of the total variance of the types of use of ICTs. It is possible to discern four patterns of use of ICTs (Social, Technical, Academic and Educational Platforms). Our results show significant associations of the different uses of ICT with expectations of improved performance and satisfaction. In addition, the Educational Platform Use (EPU) is linked to performance. In turn, the EPU is predicted by learning strategies and motivation variables which point to primarily motivational components. The results are discussed in relation to the difficulties inherent in the process of implementing the EHEA.
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Motivation and Learning Strategies in the use of ICTs among university students

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Abstract

Within the European Higher Education Area (EHEA) considerable efforts are being made to promote the incorporation of Information and Communication Technology (ICTs) in Higher Education (HE), together with placing emphasis on the cognitive and motivational components underlying learning. The objectives of this research were to analyze: (a) the relationship between different uses of ICTs and the learning outcomes and (b) the relationship between learning strategies and motivation and the use of ICTs. Four factors explain 57.4% of the total variance of the types of use of ICTs. It is possible to discern four patterns of use of ICTs (Social, Technical, Academic and Educational Platforms). Our results show significant associations of the different uses of ICT with expectations of improved performance and satisfaction. In addition, the Educational Platform Use (EPU) is linked to performance. In turn, the EPU is predicted by learning strategies and motivation variables which point to primarily motivational components. The results are discussed in relation to the difficulties inherent in the process of implementing the EHEA.

Keywords: Information and Communication Technologies (ICTs); Higher Education (HE); Virtual Learning Environment (VLE); Motivation, Learning Strategies.
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1. Introduction

The social, economic, labor and education changes that have taken place in Europe have been reflected in the creation of the European Higher Education Area (EHEA). Spanish universities, as a member of the EHEA, have been involved in a process of significant changes affecting academic structures, the teaching-learning processes and the stakeholders (teachers and students).

The EHEA has involved the transition from a traditional university system that focused on controlled and directed instruction by the professor to a new framework in which the student is at the center of the educational system and attaches great importance on autonomous learning versus controlled and directed instruction. With a view that the student adapt to this new scenario, the need to develop different types of competencies is highlighted. Among these, the use of ICT should be noted (Barragan & Buzón, 2004; Underwood, 2004), given its advantages in the process of teaching-learning in higher education (Tang & Austin, 2009; Paechter, Maier, & Macher, 2010).

The promotion of digital literacy, underpinned by the use of computers for the collection and exchange of information (European Council, 2006), find their best course of development in the educational setting. In this context, the use of applications in the teaching-learning processes, such as Wikis (Biasutti & El-Deghaidy, 2012) and blogs (Ebner, Lienherdt, Rohs, & Meyer, 2010), are initiatives to improve learning, motivate students and improve their performance.

Spanish universities, committed to the EHEA, have incorporated different types of ICTS. The UNIVERSITIC report (Conferencia de Rectores de las Universidades Españolas, 2011) aimed at analyzing the ICTs in Spanish universities which stood at 37 students per fixed open access computer and 295 students for every laptop on loan. As
for non-presencial teaching, the report found that 90% of university teachers and students already use Virtual Learning Environments (VLEs). Nevertheless, the report concludes that the level of ICT integration in classroom teaching can clearly be improved. More specifically, García Peñalvo (2008) has collected studies describing how the University of Salamanca, together with other universities, has explored the technical, pedagogical, methodological, and tutorial aspects of e-learning.

The EHEA is also promoting the development of competencies focused on motivation and learning strategies. These competencies are intended to educate an autonomous independent learner that controls their education (De Juanas & Fernández, 2008) and acquires competencies for self-regulation (Hernández, Sales, & Cuesta, 2010). For the acquisition of these skills, motivation, self-efficacy and other cognitive aspects are crucial. "Learning to learn" makes students build on prior learning and experience and that they can apply in different contexts in which they develop their activity (European Council, 2006).

Among the competencies highlighted in the report Tunning (González & Wagenaar, 2003) it is possible to find both certain instrumental skills related to the use of ICTs (computer literacy, information management, etc.) and other systemic skills linked to basic psychological processes (the capacity to learn, motivation to achieve, etc.), which overall offer the possibility of teaching students metacognitive skills so that they can “learn to think”, “learn to learn” and “learn to be”. Given the importance of these competencies, several studies have focused on analyzing the incorporation of ICTs in the context of Higher Education (Ghislandi, Calidoni, Falcinelli, & Scurati, 2008; Balasubramanian, et al., 2009). They highlight those studies that have analyzed the influence of ICTs on metacognitive aspects of university student (Acevedo, 2005;
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Carneiro, Lefrere, Steffens, & Underwood, 2011; Majós, Álvarez, De Gispert, & Ruiz, 2009). However, less work has focused on analyzing the influence of metacognitive aspects in the use of ICTs (Guo & Tan, 2007; Liu, Magjuka, & Lee, 2008).

From different theoretical stances, emphasis has been placed on the importance of addressing not only the cognitive components involved in the learning process but also the affective or motivational components, thus considering that learning would be both a cognitive process and a motivational one (Boekaerts, 2001; García & Pintrich, 1996; Pintrich & García, 1993; Pintrich, 2000; Wolters & Pintrich, 1998).

In light of such contributions, here we shall focus on the so-called models of self-regulated learning (SRL), since these differentiate three components in self-regulated learning (metacognitive strategies, control strategies, and resources management) (Pintrich & DeGroot, 1990) that fit in with the above framework. In sum, as stated by Zimmerman (1989, 2000), self-regulation theories begin by considering students as active promoters in their own academic performance from a metacognitive, motivational and behavioural perspective. Likewise, such theories consider that motivation and learning strategies are intimately related and that they may operate independently or jointly to affect student learning and performance.

From the point of view of the measurement of motivation and learning strategies by means of the MSLQ (Motivated Strategies for Learning Questionnaire), developed by Pintrich, Smith, García, and McKeachie (1991), García and McKeachie (2005) have identified three motivational components: a) an expectation component, related to students’ beliefs about their ability to perform a task; b) a value component, focused on the students’ reasons for becoming engaged in academic tasks, in which students’ goals are included, the importance they attribute to that task, and the interest it arouses in
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them, and c) an affective component, referring to the emotional reactions of the students when facing tasks, operationalized in terms of how they respond to the anxiety produced by exams. Regarding learning strategies, also measured with the MSLQ, García and McKeachie (2005) have established three types of components: a) cognitive strategies, such as strategies (elaboration, organization, etc.) for the processing of information, which students use to learn and understand their study texts; b) metacognitive strategies, which help students to plan and regulate their own activities, and c) control of resources, such as time and place, effort and help from others, etc. (Pintrich et al., 1991).

Nevertheless, there are no definitive conclusions about how metacognitive, motivational and cognitive aspects interact or how one should proceed with regards determining possible benefits for students (Solé, 1999). Faced with this situation, it seems necessary to seek a more integrated explanation regarding certain motivational and cognitive aspects in academic learning (Rinaudo, Barrera, & Donolo, 2006), and in turn make some inroads as to the role played by such aspects with respect to the use of ICTs (Clayton, Blumberg, & Auld, 2010; Kim & Frick, 2011; Verhoeven, Heerwegh, & De Wit, 2010).

We postulate, first, that the students’ academic performance will be related to the use of certain ICTs. Second, that certain motivations and learning strategies predict the use of ICTs. Therefore, we consider it necessary to categorize, depending on common characteristics, the different types of ICTs used by college students. In short, we intend,

- To analyze the relationship between different uses of ICTs and academic performance.
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-To analyze the effects of Motivation and Learning Strategies on the use of ICTs.

2. Method

2.1 Participants

543 full-time first and second year undergraduate students from various degrees (Social Sciences and Law, 69.4%; Health Sciences, 29.3%; Arts and Humanities, Science and Engineering and Architecture, 1.4%) at the University of Salamanca participated. The mean age of participants was 20.36 years, and 66.9% were female.

2.2 Instruments

For data acquisition, the following instruments were used:

1. A questionnaire for the acquisition of Identification Data. This was aimed at collecting socio-demographic information regarding the students’ age, sex, educational status, etc.

2. The Survey of European Universities Skills in ICT of Students and Staff (SEUSISS, 2003, Spanish version). The objective of this questionnaire is to collect information about the experience, skills, expectations and attitudes of students as regards the use of ICTs. In this Spanish version, we incorporated three questions aimed at estimating academic performance: Performance (as reflected by number of student failures divided by the number of subjects they had signed up for); Expectations of performance (the belief that the use of ICTs will improve performance in the subjects), and Expectations of satisfaction (the belief that the use of ICTs will increase the students’ satisfaction with their subjects).
3. The *Motivated Strategies for Learning Questionnaire* (MSLQ; Pintrich et al., 1991). We used the version adapted and translated into Spanish by Roces, Tourón and González (*Cuestionario de Estrategias de Aprendizaje y Motivación*: CEAM-II, 1995). This is a self-completed questionnaire designed for use in a group application and comprises 81 items, whose answers appear on a 7-point Likert format for students to indicate how well such items describe their personal situation (7: yes, always/1: No, never).

The CEAM II questionnaire comprises a first section, composed of 31 items related to motivational aspects, followed by a second one, formed by 50 items concerning the use of learning strategies. The items of the motivation section give rise to six scales related to different motivational issues: Self-efficacy, Anxiety, Task assessment, Extrinsic goals, Intrinsic goals, and Students’ beliefs about their own control over the learning process. Regarding the section of the CEAM II relating to the use of Learning Strategies, only some of its scales - Elaboration, Organization, Metacognition, Control over the environment, and Repetition - were considered pertinent for our aims.

In order to obtain a single measurement of each construct, we pooled the scores on the motivational and learning strategies scales. This allowed us to calculate the reliability of the Motivation (α= .80) and learning strategies (α= .89) scales.

2.3 Procedure

The questionnaires were completed in the students’ classrooms in a single session during the academic teaching period. The participants were informed that their answers were anonymous and were subject to confidentiality. The mean time invested in completing the questionnaire was approximately 25 minutes. In order to determine any possible relationships between the variables of interest, correlation coefficients and
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regression analyses were performed. A level of significance of $\alpha = 0.05$ was used in all the analyses.

3. Results

Table 1 lists the descriptive statistics derived from variables relating to the use of ICTs. Over 50% of the students very frequently used: web browsers, word processors, usually used for writing papers and reports, and chat to communicate with peers and for social interaction. More than 50% of students say they never used software to develop multimedia educational materials (i.e. Hot potatoes).

In order to detect what the different ICT uses have in common and to reduce the number of variables, we performed a factor analysis of principal components with Varimax rotation on the use of ICTs. The allowed us to establish four factors (Table 2), with eigenvalues greater than one and explaining 57.4% of the total variance.

Factor 1, accounting for 28.31% of the total variance comprises four elements, is related to communication among students (forums and chats), surfing the Internet and the consultation of newspapers and magazines, such that this factor was designated Social Use. Factor 2 explains 11.47% of the total variance and comprises four elements related to the use of professional tools (databases, web page design, etc.); this was designated Technical Use. Factor 3, accounting for 8.73% of the total variance is composed of indicators related to office use (text processors, slide presentations, etc.) and was designated Academic Use. Factor 4 accounts for 8.35% of the total variance
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and comprises two elements (e-learning Software Platforms and e-mail). This was designated *Educational Platform Use* (EPU).

The descriptive values corresponding to the means, standard deviations and the Pearson correlations among the Motivation and Learning Strategies scales are shown in table 3.

Insert table 3 about here

To analyze the structure and the relationships among the Motivation and Learning Strategies scales, we performed a factor analysis of principal components with Varimax rotation. This allowed us to establish three factors (Table 4), with eigenvalues greater than one, that overall accounted for 58.9% of the total variance.

Insert table 4 about here

Factor 1, explaining 31% of the total variance, comprises four indicators (Organization, Metacognition, Elaboration and Control of the Environment) and was defined as *High-Level Learning Strategies*. Factor 2 explains 16.6% of the total variance and comprises four indicators (Self-efficacy, Beliefs about Control, Intrinsic Orientation and Task Value); it was identified as *High-Level Motivation*. Factor 3, accounting for 11.4% of the total variance, comprises three elements (Anxiety, Extrinsic goals and Repetition) and was designated *Low-Level Learning Strategies and Motivation*.

In view of the aims established, it became necessary to detect the possible relationships between these uses of ICTs and the variables: Performance, Expectations of performance and Expectations of satisfaction (Table 5). The results show a correlation coefficient of moderate intensity and a negative one between EPU and
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Performance. The coefficients relating to the expectations that use of ICTs would improve performance and satisfaction in studies employing these educational platforms are also significant, but of low magnitude. The other uses of the ICTs do not show significant correlation coefficients with Performance, and only show low-magnitude coefficients with Expectations of performance and Expectations of satisfaction.

Insert Table 5 about here.

With a view to determining the effect of the motivational and learning strategy might have on EPU, we performed step-wise regression analyses (see Figure 1).

Insert Figure 1 about here

The analyses were carried out using the scales related to motivational components and those related to Learning Strategies as predictive values for EPU. Three predictors proved to be significant: Elaboration (β= 0.269, p=.000), as the only Learning Strategy, and Intrinsic Goals (β= 0.126, p=.007) and Task Value (β= 0.111, p=.018), among the motivational components.

4. Discussion and Conclusions

Use of ICTS by college students has a high variability. From barely used tools, such as programs to design multimedia educational materials to frequently used tools such as the browsers or chat tools. Such variability is reasonable considering that students are not usually involved in the design of multimedia educational materials, unless specifically required to as an assignment to be evaluated. At the other extreme, chatting allows them to communicate quickly and economically with members of their social networks.
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The results of the present work also afford a classification of the different uses of ICTs and their double relationship; on one hand with the Learning Strategies and Motivation, and, on the other, with academic performance. The results of the factor analysis revealed four well differentiated uses of ICTs. First: Social use, linked to recreational communication among students, either in its synchronic mode (chats) or in its asynchronous mode (forums), in addition to include reading newspapers. Second is Technical use, related to the use of data management programs (data bases and spreadsheets); web page design, and audiovisual programs. These are followed in third place by the Academic Use factor, which describes the use of office programs related to academic tasks such as the elaboration and presentation of projects (word processors, slide presentations, etc). Finally, the fourth factor is the EPU, which describes the use of the tools provided by the academic institution to afford students virtual resources that will allow them to attain the competencies required by the subjects they follow. These findings would enable the development of training programs that would be more in keeping with the real uses that university students make of ICTs and at the same time permit an analysis to be made of the relationships with other training variables of interest.

On the other hand, have been detected relations between Motivation and Learning Strategies similar to that reported by Pintrich and García (1993), Rinaudo, Chiecher, and Donolo (2003) and Gil, Bernaras, Elizalde, and Arrieta (2009). In particular, the factor analysis performed on the Motivation and Learning Strategies variables suggests the existence of three components. Two of them encompass learning Strategies and Motivation, considered to be of high level because they group more elaborate and complex learning strategies (Organization, Metacognition, Elaboration and Control over the environment) or because they have a positive motivational style.
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(self-efficacy, beliefs about control, Intrinsic Orientation, and Task Value). The third factor groups a heterogeneous set of Learning Strategies and Motivation whose main characteristics would be a motivation profile driven by Extrinsic goals, in which anxiety during exam periods would also be present, associated with Low-Level Learning Strategies, such as Repetition.

These findings support the existence of patterns of relationships between motivation and cognition that are compatible with the proposal reported by Pintrich and García (1993) to the effect that positive motivational beliefs (high scores on Intrinsic Goals, Task Evaluation and Self-efficacy) would be associated with a greater degree of cognitive compromise and self-regulation by students. Moreover, the present findings would be consistent with the cognitive strategies typical of Meaningful Learning (Garrison & Vaughan, 2008; Heikkilä & Lonka, 2006), as advocated by constructivist psychology. This consistency is based on the need for students to develop broad metacognitive knowledge in order to integrate new knowledge, auto-regulate themselves and autonomously build their own learning as promoted by the EHEA.

Upon relating the motivational and Learning Strategies scales, we detected certain inconsistencies in their factor composition, in particular among the motivational components. In this sense, we observed that two of the Learning Strategies –Elaboration and Repetition- also had weight in the Motivational factors. Accordingly, we believe that it is necessary to revise the psychometric properties of the CEAM II. Similar inconsistencies were reported by Roces et al. (1995) in a revision performed on the MSLQ.

According to the results obtained, EPU is the only factor that is associated with Performance. This observation is hardly surprising, since the following of materials by
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means of these platforms provides information about programs, support resources, schedules, and assessment questionnaires that impinge on the academic grades of the students. At the same time, the lack of an association between performance and the other uses of ICTs, especially the academic and technological uses, could reveal the actual limitations of an education system in transition, such as the Spanish Higher Education System. Clearly, in this sense, there is need for time to practice, by students and teachers, so that ICTs have a greater effect (Underwood & Dillon, 2004). In the Spanish context, one such limitations is that teachers often place programs on the platform that are strongly focused the assessment and performance of their students, in detriment to their learning. As a result, the system departs from the aims of the EHEA, considered as a teaching model in which the students are the both core of the educational activities and their main agents. This implies ending the current practice of giving teacher controlled and directed teaching the highest priority for autonomous self-regulated learning that is constructed by the student.

However, other aspects are more consistent with EHEA guidelines as well as being consistent with fundamental SRL concepts. Thus, we found a positive association of the EPU, both with performance expectations and use of VLE satisfaction. In the first place, we note that both associations were in line with the advantages of the use of ICTs (Balasubramanian et al., 2009), in general, and the beneficial features of VLEs (adaptability, interactivity, etc.), in particular as outlined in Carneiro et al. (2011). Secondly, from a metacognitive perspective, both associations suggest the role these affective aspects may be playing regarding VLEs, and, to a lesser extent, other ICT uses. Together, these associations can be interpreted as supporting the VLEs, in the EHEA framework, given that, in addition to demonstrating its positive relationship with
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performance, this use appears to be accompanied by favorable expectations of successful outcomes.

Upon observing the relevance of the EPU factor with respect to performance, our second objective focuses on determining whether the Learning strategies and Motivation were related to EPU. The results allowed us to identify Elaboration as the Learning Strategy that best predicted EPU. It could be directly interpreted that the Elaboration Strategy is the variable that best predicts the EPU. However, those items have a significant self-regulatory and motivational component as shown in Table 3. This leads us to consider the important role motivational aspects associated with the use of VLEs ultimately play. Furthermore, as outlined by the SRL, the knowledge of strategies and how to use them are not sufficient by themselves to ensure their effective and efficient use. In short, the motivational components of learning will determine that students make productive use of VLEs.

Finally, according to the correlational data obtained here, it would be necessary to carry out further research aimed at analyzing the casual relationships between the variables considered. All this would allow improvements to be made in teaching quality and in the learning process within the EHEA context, directed at students’ competencies in “learning to think” and “learning to learn”.
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References


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[Consulted on 22 July, 2012].


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(Cuestionario de Estrategias de Aprendizaje y Motivación II) [Preliminary assessment of the CEAM II (Learning and Motivation Strategies Questionnaire)]. *Psicológica*, 16(3), 347-366.


**Table 1. Descriptive data on ICT frequency of use**

<table>
<thead>
<tr>
<th>ICT Use</th>
<th>Average</th>
<th>Stand. dev.</th>
<th>Percentiles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Text processors</td>
<td>3.70</td>
<td>.781</td>
<td>3.00</td>
</tr>
<tr>
<td>Spreadsheets</td>
<td>2.56</td>
<td>1.043</td>
<td>1.00</td>
</tr>
<tr>
<td>E-Mail</td>
<td>2.81</td>
<td>1.169</td>
<td>1.00</td>
</tr>
<tr>
<td>Databases</td>
<td>2.01</td>
<td>.957</td>
<td>1.00</td>
</tr>
<tr>
<td>Image editors</td>
<td>2.50</td>
<td>1.130</td>
<td>1.00</td>
</tr>
<tr>
<td>Web page design</td>
<td>1.57</td>
<td>.965</td>
<td>1.00</td>
</tr>
<tr>
<td>Slideshows</td>
<td>3.46</td>
<td>1.056</td>
<td>2.00</td>
</tr>
<tr>
<td>Multimedia educational material design software</td>
<td>1.46</td>
<td>.870</td>
<td>1.00</td>
</tr>
<tr>
<td>Browsers</td>
<td>3.91</td>
<td>.940</td>
<td>2.00</td>
</tr>
<tr>
<td>Chat</td>
<td>3.60</td>
<td>1.202</td>
<td>1.00</td>
</tr>
<tr>
<td>Forums</td>
<td>3.23</td>
<td>1.188</td>
<td>1.00</td>
</tr>
<tr>
<td>News</td>
<td>3.52</td>
<td>1.074</td>
<td>2.00</td>
</tr>
<tr>
<td>Moodle</td>
<td>2.36</td>
<td>1.309</td>
<td>1.00</td>
</tr>
</tbody>
</table>
Table 2: Matrix of factor saturations of the variables related to the use of ICTs

<table>
<thead>
<tr>
<th>Components</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Use of text processor</td>
<td></td>
<td>.758</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Use of spreadsheets</td>
<td></td>
<td>.623</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Use of e-mail</td>
<td></td>
<td></td>
<td>.488</td>
<td></td>
</tr>
<tr>
<td>4. Use of data bases</td>
<td></td>
<td>.596</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Use of image editing</td>
<td></td>
<td></td>
<td>.503</td>
<td></td>
</tr>
<tr>
<td>6. Use of Web page design</td>
<td></td>
<td></td>
<td>.683</td>
<td></td>
</tr>
<tr>
<td>7. Use of presentations</td>
<td></td>
<td></td>
<td>.747</td>
<td></td>
</tr>
<tr>
<td>8. Use of multimedia materials</td>
<td></td>
<td></td>
<td>.663</td>
<td>.437</td>
</tr>
<tr>
<td>9. Use of Browsers</td>
<td>.628</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Use of chat</td>
<td></td>
<td>.837</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Use of Forums</td>
<td></td>
<td>.833</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Use of newspaper</td>
<td></td>
<td>.676</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Use of Moodle</td>
<td></td>
<td></td>
<td></td>
<td>.787</td>
</tr>
</tbody>
</table>

Extraction method: Principal Component Analysis.
Rotation method: Varimax normalization.
a. The rotation converged in 8 iterations.
**Table 3. Correlations between Motivational scales and Learning strategies scales**

<table>
<thead>
<tr>
<th>Motivational scales</th>
<th>Organization (3.73; .71)</th>
<th>Elaboration (3.27; .60)</th>
<th>Metacognition (3.66; .57)</th>
<th>Control of environment (4.07; .78)</th>
<th>Repetition (3.66; .85)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy</td>
<td>(.31; .58)</td>
<td>.095(*)</td>
<td>.355(**)</td>
<td>.231(**)</td>
<td>-.113(*)</td>
</tr>
<tr>
<td>Anxiety</td>
<td>(.04; .84)</td>
<td>.028</td>
<td>-077</td>
<td>.067</td>
<td>.021</td>
</tr>
<tr>
<td>Task value</td>
<td>(.45; .57)</td>
<td>.312(**)</td>
<td>.487(**)</td>
<td>.367(**)</td>
<td>.186(**)</td>
</tr>
<tr>
<td>Extrinsic goals</td>
<td>(.47; .77)</td>
<td>.088(*)</td>
<td>.108(*)</td>
<td>.219(**)</td>
<td>.128(**)</td>
</tr>
<tr>
<td>Intrinsic goals</td>
<td>(.51; .66)</td>
<td>.229(**)</td>
<td>.488(**)</td>
<td>.278(**)</td>
<td>.068</td>
</tr>
<tr>
<td>Beliefs about control</td>
<td>(.62; .64)</td>
<td>.092(*)</td>
<td>.203(**)</td>
<td>.159(**)</td>
<td>.049</td>
</tr>
</tbody>
</table>

Next to each variable (in brackets) is the score corresponding to the mean and standard deviation.

** The correlation is significant at the 0.01 level (bilateral).
* The correlation is significant at the 0.05 level (bilateral).
Table 4: Matrix of factor saturations relative to the Motivational and Learning strategies scales

<table>
<thead>
<tr>
<th>Components</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy</td>
<td></td>
<td>.774</td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td></td>
<td></td>
<td>.763</td>
</tr>
<tr>
<td>Tak value</td>
<td></td>
<td>.648</td>
<td></td>
</tr>
<tr>
<td>Extrinsic goals</td>
<td></td>
<td></td>
<td>.726</td>
</tr>
<tr>
<td>Intrinsic goals</td>
<td></td>
<td>.664</td>
<td></td>
</tr>
<tr>
<td>Beliefs about control</td>
<td></td>
<td></td>
<td>.731</td>
</tr>
<tr>
<td>Organization</td>
<td>.826</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elaboration</td>
<td>.687</td>
<td>.476</td>
<td></td>
</tr>
<tr>
<td>Metacognition</td>
<td>.812</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control of Environment</td>
<td>.597</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repetition</td>
<td>.421</td>
<td></td>
<td>.569</td>
</tr>
</tbody>
</table>

Extraction method: Principal Component Analysis.
Rotation method: Varimax normalization.
a. The rotation converged in 5 iterations.
Table 5. Correlations of the use of ICTs with respect to the proportion of failures and the expectations that they will improve performance and satisfaction

<table>
<thead>
<tr>
<th>Types of ITC use</th>
<th>Performance</th>
<th>Expectations of performance</th>
<th>Expectations of satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social use</td>
<td>-.054</td>
<td>.056</td>
<td>.113(**)</td>
</tr>
<tr>
<td>Technical use</td>
<td>-.062</td>
<td>.096(*)</td>
<td>.104(*)</td>
</tr>
<tr>
<td>Academic use</td>
<td>-.037</td>
<td>.098(*)</td>
<td>.130(**)</td>
</tr>
<tr>
<td>Educational Platforms Use (EPU)</td>
<td>-.239(**)</td>
<td>.154(**)</td>
<td>.150(**)</td>
</tr>
</tbody>
</table>

** The correlation is significant at the 0.01 level (bilateral).
* The correlation is significant at the 0.05 level (bilateral).
Figure 1. Summary of the regression analyses of the Motivational and Learning Strategies variables with respect to their effect on the EPU (n = 543)
Motivation, Learning Strategies and ICTs among university students

This research was funded by the Samuel Solórzano Foundation.
Motivation, Learning Strategies and ICTs among university students

► Four patterns of ICT use: Social, Technical, Academic and Educational Platforms.
► Association between the use of Educational Platforms and learning outcomes.
► Motivational components predicts the use of Educational Platforms.