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Key Factors for Determining Student Satisfaction in Engineering: A Regression Study*

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The aim of this study is to present empirical evidence of the influence of the use of active didactic methodology on satisfaction with regard to teaching received by engineering students in Spain. Student satisfaction is one of the result indicators established, based on student opinion, to measure the quality of the Spanish university system. It is an important index and is directly related to facilitating the learning process, because a satisfied student is likely to be more receptive in the teaching/learning process and therefore, less likely to abandon university studies. This problem is particularly relevant in certain areas of knowledge, like, for example, Engineering and Architecture. We present here the results obtained in an experimental type study carried out in the Escuela Politécnica Superior de Zamora, University of Salamanca, Spain. Our aim is to discover the influence of satisfaction level in relation to the application of active methodologies. In order to do so, we carried out a comparative study and repeated experiment (with student samples from two academic years) of the results of satisfaction levels obtained for students following a course based on traditional methodology consisting of lectures and evaluation by means of a final examination (control group), and for students who followed a course based on a student-focussed teaching/learning methodology consisting of constructive learning, collaborative work, bLearning resources and learning process integrated evaluation (experimental group). 218 students from four engineering degree courses took part in the experiment. Based on the variables selected, a satisfaction survey was designed and carried out and, using a multiple regression multivariate statistical technique, the joint relationship of a series of predictor variables was analysed in relation to the criterion or dependent variable. The results obtained reveal the existence of different relationships between predictor variables and criterion, depending on the didactic methodology used. This paper focuses mainly on the stages of the statistical process used to obtain results.

Keywords: student satisfaction; active learning methodology; formative processes in engineering; blended-learning; experimental design in education

1. Introduction

The European Higher Education Area (EHEA) resulting from the Sorbonne Declaration of 1988 should be firmly established by now. However, there is still a long way to go. It is now time to solve problems that are arising in this new situation and to plan the future with a view to obtaining the ultimate aim: a European Knowledge Area with a harmonized (not uniform. because diversity is the key) [1] quality European Higher Education System, which is more internationally competitive and in accordance with the European productive system.

The current economic situation is also relevant [2]. In recent reports, concerning the EHEA, differences among European countries have become evident, but it has also been pointed out that Higher Education, without a doubt, is a driving force for social and economic development and for innovation, in a world which is becoming more and more knowledge based. The reports indicate that, at times of economic and financial crisis such as the situation we are currently experiencing, higher education has an important role to play in solving the problems involved [3]. Concrete measures proposed to facilitate the application of the principles agreed in Bologna include the development of working methods such as learning among equals, study visits and other information exchange activities where quality should be the vertebrating principle in the modernization process of higher education in Europe [4, 5].

As Ignacio González pointed out [6], quality has to be approached by relating it to "*the degree of success achieved in European higher education to generate suitable atmospheres for the production*

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and transmission of knowledge, with the conviction that young Europeans should be culturally and intellectually equipped in new ways so that they can build, both personally and collectively, their lives in a satisfactory and meaningful way".

Student satisfaction is one of the indicators established, based on student opinion, to measure the quality of the university system [6–8].

This is an important index directly related to facilitating the learning process. It increases, not only by increasing (teaching or research) centre resources and infrastructures, but also by having well-trained students who show optimal academic performance and who are satisfied with the courses they have taken [9].

A satisfied student is more receptive in the teaching/learning process and less likely to abandon university education, something which is becoming a problem all over the world, as shown by numerous reports [10–16] and as has been discussed at international forum on this subject including, for example, the two editions of the Conferencia Latinoamericana sobre el Abandono en la Educación Superior: I CLABES (17 and 18 November 2011, Universidad Nacional Autónoma de Nicaragua, Managua, Nicaragua); II CLABES (8 and 9 November 2012, Pontifícia Universidade Católica do Rio Grande do Sul Porto Alegre Brazil), held within the framework of the ALFA GUIA Project–Gestión Universitaria Integral del Abandono, financed by the European Commission and coordinated by the Universidad Politécnica de Madrid (Spain).

When students begin their university degree courses, they are motivated, as has been shown in previous studies [17, 18]. If students are satisfied at the end of their first year, this means that their teachers have managed to maintain that motivation and, therefore, raise their expectations of success in their university studies.

The following paragraphs present a study showing which factors influence student satisfaction levels, which, as will be seen, are different depending on the didactic methodology followed in the teaching/learning process.

2. Student satisfaction: methodology

In [17, 18] we present the outcomes of an experimental study carried out during the academic years 2007/2008 and 2008/2009 with engineering students at the University of Salamanca (Spain). We have selected a subject which is common to the four degrees under consideration: Computer Science. That study explored in greater depth the validity of experimental designs coming from educational research and the impact of innovative teaching methodologies. The results obtained confirmed that the learning level and the satisfaction of students will be higher after the implementation of new teaching methodologies, based on constructive learning, collaborative work, and blended learning resources (experimental group), than in more traditional teaching contexts (control group).

The teaching methodology used aims to promote continuous study through tasks students find interesting right from the beginning of the course. The tasks involve dedicated work, help students in the teaching/learning process and promote teamwork by means of four tasks to be done in groups. There is a pre-established tutorial calendar and task submission and presentation dates are spread over the term [19–21]. In addition, in order to stimulate students' critical vision, evaluation instruments and tools, which are integrated in the teaching/learning process, are used for peer evaluation in some of the tasks carried out [22]. Finally, in order to maintain the motivation students bring to university, they were given feedback on all the work they had done, to help them and involve them in their teaching/learning process [23–26]. This was all carried out using a learning platform, a virtual campus (Moodle) as an instrument for course, student, resource and activity management; it became a student meeting place and form of support for following the course, and a place for interaction and collaboration with other teachers and learners [27], but this official elearning platform may be extended with other suitable tools to create personal learning environments for the students [28, 29] that convert the University virtual campus in more open virtual learning environments [30].

In order to show the degree of *general student satisfaction, a satisfaction questionnaire* was used to determine the value of the experience for students, find out how they face their own learning process, and to obtain student evaluation of the didactic methodology used in the course.

Taking a Likert scale as a reference (1—*Completely disagree*; . . . 5—*Completely agree*), the following variables related to satisfaction were observed: *I have enjoyed studying this course; I think I have learned more than I would have done studying the course content on my own; I would recommend this type of methodology for other courses.*

Table 1 shows the (experimental and control) results obtained for these variables. As can be seen, there are statistically significant differences (s.l. 0.01) in almost all items for both academic years and always in favour of the students in the experimental group, who evaluated the experience as very positive and understood that it helped them in the learning process, because in most cases, their evaluation was around a *4* on a scale of *1* to *5*.

Table 1. *Level of general satisfaction,* experimental and control groups, both academic years.

Academic year	Study group	n	Average	Standard deviation	T test t	p
I have enjoyed studying this course						
2007/2008	Control Experimental	26 47	3.27 4.04	0.87 0.66	–4.27	0.00**
2008/2009	Control Experimental	32 40	3.19 3.98	0.74 0.73	–4.51	0.00**
I think I have learned more than I would have done studying the course content on my own						
2007/2008	Control Experimental	26 47	3.62 4.06	1.06 0.99	–1.81	0.07
2008/2009	Control Experimental	32 40	3.47 4.03	0.91 0.95	–2.51	0.01*
I would recommend this type of methodology for other courses						
2007/2008	Control Experimental	21 47	3.33 4.00	0.86 0.96	–2.71	0.01*
2008/2009	Control Experimental	31 40	3.16 4.05	0.58 0.88	–5.12	0.00**

* s.l. 0.05; ** s.l. 0.01.

This paper presents results obtained after analysing factors related to the degree of engineering student satisfaction with the didactic process.

3. Multiple regression analysis results

In order to carry out an in-depth analysis of the "*general student satisfaction*" result variable, an attempt was made to define the relationship between the "*general student satisfaction*" criterion variable (*Y:* "*I have enjoyed studying this course*") and some of the variables involved in this study (X_1 . . . . X_9) [17, 18] both for the experimental group and the control group. To achieve this, multiple regression was used, a multivariate statistical technique which permits analysis of the joint relation of a series of variables, with regard to the dependent variable, which in this case was *satisfaction*.

This analysis aims to discover which variables have had a greater influence on *student satisfaction.* That is, those which allow us to predict criterion variable (*I have enjoyed studying this course*) behaviour. The multiple regression analysis leads us to an equation (*1*) representing this relationship.

$$Y = B_1X_1 + B_2X_2 + \cdots + B_kX_k + e$$

(1) Multiple regression [31]

where *e* is a constant value, which when all variables are standardised, acquires the value 0.

To find the solution to this multiple regression model, a number of steps were followed: model construction, correlation matrix determination, predictor selection by means of stepwise procedures, calculation of the multiple correlation coefficient (R) and the coefficient of determination (R^2) and prediction equation, and these are presented in the following paragraphs.

3.1 Construction of the model

One very important aspect in multiple regression is the selection of variables which correspond to the base theory (references . . . on student satisfaction and quality). We have selected a set of nine direct predictor variables, taking either those variables where the experimental group differs significantly with regard to the control group (s.l. 0.05 or s.l. 0.01), or those variables which the participants valued more highly, or variables considered by the research team to be more relevant.

A multiple regression analysis was carried out with the variables selected, shown in Table 2, in order to find, if it exists, a sufficiently explicative multiple correlation (*R*) with the criterion variable *General student satisfaction* (*Y*). Figure 1 shows a graphic representation of this multiple correlation.

3.2 Correlation matrix

The first step in multiple regression analysis is to calculate the correlation matrix (this is obtained by using the programme IBM SPSS Statistics 19 with a University of Salamanca campus license). In the correlation matrix (Table 4) it is interesting to observe the high interrelations between the predictor variables, because these could affect results.

Table 2. Predictor variables (Xi) used to carry out multiple regression analysis with the criterion variable (Y) *General student satisfaction*

Symbol	Denomination	Description	Range
X_1	Mark	Academic evaluation	0–10 (numerical)
X_2	Methodology	This teaching methodology has helped me to understand subject content more easily.	Scale of 1 to 5 (1—Completely disagree . . . 5—Completely agree)
X_3	Faculty	Teachers helped me to understand subject content.	
X_4	Achievement Objectives	I think this methodology has enabled me to achieve learning objectives.	
X_5	eResources	Use of online resources helps me to learn more quickly and effectively.	
X_6	Team	I am satisfied with team work carried out.	
X_7	Reflection	I have thought about the subject and made my own contributions.	1–2 (Yes/No)
X_8	Difficulty	Course content is difficult.	Scale of 1 to 5 (1—Completely disagree . . . 5—Completely agree)
X_9	Utility	I think the course content is useful for future Engineering/Architecture professionals.	

3.3 Predictor selection using the stepwise procedure

The nine dependent variables were introduced through the complex model and it was observed that seven of these, both in the experimental group and the control group, did not show a relevant contribution, so to avoid repetition, it was decided to adopt a stepwise inclusion procedure using, as selected variables, those which were significant in the complete model: methodology (X_2) and team (X_6) for the experimental group and usefulness (X_9) and Achievement/Objectives (X_4), for the control group (Table 5).

The stepwise procedure chooses variables step by step. The process starts without any criterion variable in the regression equation, and a variable is introduced or eliminated in each step. When there are no variables left out of the equation, which satisfy either the selection criterion or the elimination criterion, the process is halted.

In the case of the experimental group, we started the first step with the X_2 variable (methodology), and in the case of the control group with the X_8 variable (usefulness), because they show greater correlation (*r = 0.546; r = 0.648,* respectively) with the criterion variable (*Y*). As shown in Table 5, the *multiple correlation* (*R*) is reflected in the second column, between the criterion and the predictor variables which enter into the equation. In the first step, as there is only one variable, *R* coincides with *r,* but in all other cases this will not happen.

In the second step, the variable selected, because

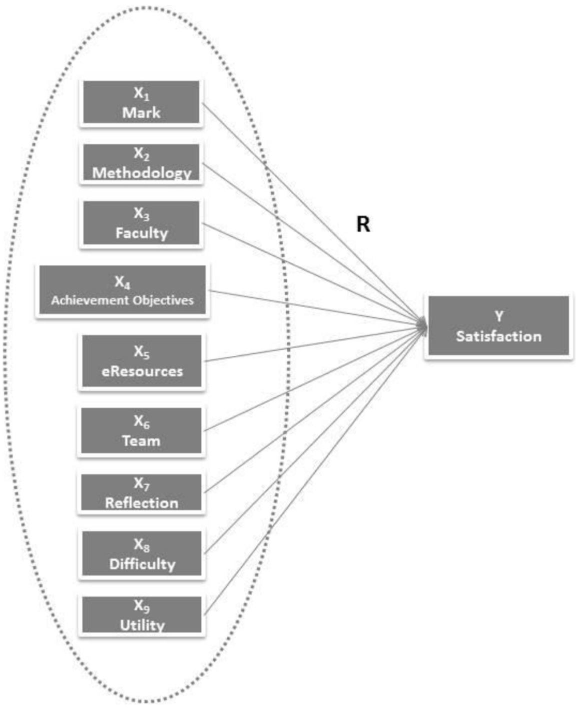

Fig. 1. Graphic representation of the multiple correlation R between X_1 . . . . X_9 e Y.

Table 3. Descriptive statistics of variables used in the regression model

	Experimental (n = 94)		Control (n = 107)	
Variable	Average	Standard deviation	Average	Standard deviation
Y	4.01	0.66	3.22	0.58
X_1	6.88	1.38	6.23	1.82
X_2	3.84	0.72	3.09	0.39
X_3	4.14	0.76	3.60	0.49
X_4	3.82	0.73	3.24	0.45
X_5	4.32	0.74	3.45	0.71
X_6	4.14	0.79	3.22	0.62
X_7	1.83	0.36	2.00	0.00
X_8	2.70	0.79	3.19	0.69
X_9	4.08	0.82	3.38	0.75

Table 4. Correlation matrix and significance of each correlation

EXPERIMENTAL (n = 94)

Pearson Correlation(r)

	Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
Y	1.000									
X_1	–0.017	1.000								
X_2	**0.546**	0.004	1.000							
X_3	0.318	0.144	0.337	1.000						
X_4	0.361	0.150	**0.546**	**0.507**	1.000					
X_5	0.277	–0.114	**0.436**	0.364	**0.583**	1.000				
X_6	0.324	–0.038	0.264	0.127	0.172	0.003	1.000			
X_7	–0.125	–0.199	0.065	–0.110	–0.031	0.033	–0.146	1.000		
X_8	–0.199	–0.108	–0.250	–0.175	–0.183	–0.195	–0.024	0.094	1.000	
X_9	0.354	–0.021	**0.442**	0.069	0.348	0.297	0.266	–0.244	–0.098	1.000

Significance of the Pearson correlation (p)—EXPERIMENTAL

	Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
Y										
X_1	0.436									
X_2	0.000	0.483								
X_3	0.001	0.084	0.000							
X_4	0.000	0.075	0.000	0.000						
X_5	0.003	0.136	0.000	0.000	0.000					
X_6	0.001	0.358	0.005	0.111	0.049	0.490				
X_7	0.114	0.027	0.266	0.145	0.384	0.376	0.080			
X_8	0.028	0.150	0.008	0.045	0.039	0.030	0.408	0.185		
X_9	0.000	0.422	0.000	0.255	0.000	0.002	0.005	0.009	0.174	

CONTROL (n=107)

Pearson Correlation (r)

	Y	X_1	X_2	X_3	X_4	X_5	X_6	X_8	X_9
Y	1.000								
X_1	–0.013	1.000							
X_2	–0.012	0.038	1.000						
X_3	0.206	0.003	0.278	1.000					
X_4	0.309	–0.118	0.191	0.420	1.000				
X_5	0.027	–0.239	–0.081	0.276	0.058	1.000			
X_6	0.016	0.043	**0.451**	0.225	0.036	–0.051	1.000		
X_8	–0.314	–0.073	0.012	–0.067	–0.340	0.200	–0.085	1.000	
X_9	0.648	0.009	0.071	0.175	0.209	0.018	0.132	–0.330	1.000

Significance of the Pearson correlation (p)—CONTROL

	Y	X_1	X_2	X_3	X_4	X_5	X_6	X_8	X_9
Y									
X_1	0.447								
X_2	0.451	0.349							
X_3	0.017	0.488	0.002						
X_4	0.001	0.112	0.024	0.000					
X_5	0.392	0.007	0.205	0.002	0.277				
X_6	0.436	0.331	0.000	0.010	0.355	0.301			
X_8	0.000	0.229	0.451	0.246	0.000	0.019	0.191		
X_9	0.000	0.464	0.233	0.035	0.015	0.428	0.087	0.000	

it has greater partial correlation is incorporated. In general, in each step it is taken into account that: a) the variables included in the equation must satisfy the selection criterion for entry [31] and, at the same time, no variable included should satisfy the elimination criterion.

3.4 Calculation of the multiple correlation coefficient (R) and the determination coefficient (R^2)

As has already been shown, the *multiple correlation coefficient (R)* measures the intensity of the relation between the set of predictor variables and the criterion variable. In this case, its value, in the different steps of the process, is reflected in the second column of Table 5. The third column shows the determination coefficient R^2, which represents the proportion of variability of the criterion variable, due to the predictor variables, the value of which is increased as new predictor variables are added. Generally, the value normally used is that of the adjusted R^2 (fourth column), in order to avoid overestimation of the real value of R.

The R^2 *increase* (sixth column, Table 5) represents

Table 5. Multiple correlation coefficients

Model	R	R^2	Adjusted R^2	Typical estimate error	Change statistics				
					Change in R^2	Change in F	gl1	gl2	Sig. change in F
EXPERIMENTAL									
1	0.546[a]	0.298	0.291	0.559	0.298	39.106	1	92	***0.000
2	0.577[b]	0.333	0.319	0.548	0.035	4.764	1	91	*0.032
CONTROL									
1	0.648[c]	0.420	0.414	0.446	0.420	76.034	1	105	***0.000
2	0.672[d]	0.451	0.441	0.436	0.031	5.963	1	104	**0.016

a. Predictor variables: (Constant), methodology (X_2).
b. Predictor variables: (Constant), methodology (X_2), team (X_6).
c. Predictor variables: (Constant), usefulness (X_8).
d. Predictor variables: (Constant), usefulness (X_8), Achievement/Objectives (X_4).
*** $p < 0.001$; * $p < 0.05$.

the relative importance of the new variable incorporated in this step in predicting the criterion and, as has been shown, in each step its value falls.

As shown in Table 5, the *multiple correlation* between the two predictor variables selected in the multiple regression analysis and the criterion variable is 0.577 for the experimental group, and 0.672 for the control group. The *multiple correlation squared* is 0.319 and 0.441 respectively, which indicates that these two predictors (experimental: X_2, X_6; control: X_8, X_4) explain the 31.9% and 44.1% of criterion variability respectively.

To prove the $R^2 = 0$ hypothesis, with multiple variables, an analysis of variance test was carried out (Table 6), taking into account that the total variability of the criterion variable is divided between the part which can be attributed to regression and the residual part.

3.5 Regression equation and definitive model

The statistical data obtained at each step of the regression, as seen in Table 7, are: the *regression coefficient* (*B*), which represents the number of units by which the criterion increases for every unit the predictor variable increases; the *Beta coefficient*, which is the standardized regression coefficient; the result of the *t Student test*, used to prove the null hypothesis between two variables; and its *degree of significance* (*p*) which, if lower than 0.05, means that regression is significant for that variable.

When all calculations have been made, the regression model obtained for each of the groups (experimental and control) follows the equations:

$$Y_{experimental} = 0.459\ X_2 + 0.162\ X_6 + 1.579$$

(2) Multiple regression model, experimental group

Table 6. ANOVA Test for *Satisfaction* criterion variable (Y), for each step

	Model	Squared sum	gl	Quadratic average	F	Sig.
EXPERIMENTAL						
1	Regression	12.226	1	12.226	39.106	***0.000[a]
	Residual	28.763	92	0.313		
	Total	40.989	93			
2	Regression	13.657	2	6.828	22.735	***0.000[b]
	Residual	27.332	91	0.300		
	Total	40.989	93			
CONTROL						
1	Regression	15.156	1	15.156	76.034	***0.000[c]
	Residual	20.930	105	0.199		
	Total	36.086	106			
2	Regression	16.291	2	8.146	42.796	***0.000[d]
	Residual	19.795	104	0.190		
	Total	36.086	106			

a. Predictor variables: (constant), methodology (X_2).
b. Predictor variables: (constant), methodology (X_2). Team (X_6).
c. Predictor variables: (constant), usefulness (X_8)
d. Predictor variables: (constant), usefulness (X_8), Achievement/Objectives (X_4).
*** $p < 0.001$.

Table 7. Coefficient table

	Model	Non-standardised coefficients		Typified coefficients		
		B	**Standard Error**	**Beta**	**t**	**Sig.**
EXPERIMENTAL						
1	(Constant)	2.069	0.316		6.548	***0.000
	Methodology (X_2)	0.506	0.081	0.546	6.253	***0.000
2	(Constant)	**1.579**	0.382		4.128	***0.000
	Methodology (X_2)	**0.459**	0.082	0.495	5.578	***0.000
	Team (X_6)	**0.162**	0.074	0.194	2.183	*0.032
CONTROL						
1	(Constant)	1.521	0.200		7.602	***0.000
	Usefulness (X_9)	0.504	0.058	0.648	8.720	***0.000
2	(Constant)	**0.868**	0.331		2.618	*0.010
	Usefulness (X_9)	**0.475**	0.058	0.610	8.215	*0.000
	Achievement/ Objectives (X_3)	**0.233**	0.095	0.181	2.442	*0.016

*** p < 0.001; ** p < 0.01; * p < 0.05.

$$Y_{control} = 0.475\ X_9 + 0.233\ X_4 + 0.868$$

(3) Multiple regression model, control group

That is, the variables which are more intensely related to satisfaction of the students on the course in the *experimental* group are the *methodology employed* (which accounts for the 2.98% variance in *satisfaction*, where *Beta is*: 0.495; *t*: 5.578; $p < 0.001$); secondly, it is related to *teamwork* carried out throughout the course (which accounts for the 3.5% variance in *satisfaction*, where *Beta* is: 0.194; *t*: 2.183; $p < 0.05$).

In the case of the students in the control group, their degree of satisfaction is related, first of all, to *usefulness of course content* for future professionals (which accounts for the 42.0% variance in *satisfaction*, where *Beta* is: 0.610; *t*: 8.215; $p<0.001$; and, secondly, because they consider that, with the methodology employed, they have achieved *learning objectives* (which accounts for the 3.1% variance in *satisfaction*, where *Beta* is: 0.181; *t*: 2.442; $p < 0.05$).

4. Discussions

Previous studies [18] have shown that when active learning didactic methodology is used: a) student reaction to the course was positive; b) students learned the necessary knowledge of a basic subject at a declarative level; c) students acquired skills related to defined competencies; and d) students demonstrated transfer of knowledge acquired when carrying out practical activities. These results indicated empirical evidence which led us to reflect on different didactic options, in order to choose those which would contribute more effectively and efficiently to improving learning in engineering. In addition, it was also observed that active learning leads to greater student responsibility in the learning process, greater motivation and a more satisfactory final result for all those involved in the process.

It is interesting to analyse the results obtained in this present study because they can help us to understand the variables which, to a greater or lesser degree, explain the variability observed in the student "*satisfaction*" variable, according to the group the students belonged to: the experimental group, subjected to active methodology, or the control group, where traditional methodology was used.

The regression model carried out shows that, in the case of the students in the control group (Equation 3), their degree of satisfaction seems to be related, first of all, to *usefulness* of course content for future professionals, and, secondly, to the fact that they consider that the methodology employed has enabled them to achieve learning *objectives*.

However, in the case of the experimental group (Equation 2), the degree of satisfaction is mainly related to the *methodology* employed in the teaching/learning process, because they consider that it has helped them to understand the course content better, and, secondly, to *teamwork* carried out throughout the course.

5. Conclusions

This paper aims to examine in detail factors relating to students' satisfaction in a specific teaching/learning process. Of the nine factors selected initially by the research team (Table 2), we might think *a priori* that student satisfaction levels could be related to positive academic results (*Academic evaluation* X_1), to the fact that the subject is easy for them (*the course content for this subject is difficult,* X_2) or to the relationship they have with the teacher of the subject (*the teacher has helped me to understand the course*, X_3). However, the results show that the factors directly related to student satisfaction vary depending on the didactic methodology employed in the teaching/learning process, and that the students who are most satisfied are those who follow a course based on a teaching methodology that involves them more in the learning process, and this is precisely the variable which has a greater relation with student satisfaction.

The use of student-centred didactic methodologies involving constructive learning, teamwork, *bLearning* resources, and evaluation integrated in the learning process help us, therefore, to improve the student learning process, because not only do results improve, but the employment of this type of methodology increases student satisfaction and, therefore, facilitates and motivates learning. To support this kind of methodologies and approaches more open virtual learning environments are needed that make easy to use the most suitable technological tools for the bLearning experiences with a personalization orientation to reinforce the student centred process.

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References

1. F. Michavila, *Bolonia entre la retórica y la acción*, in El día después de Bolonia, F. Michavila, M. Ripolles, and F. Esteve, Eds. Madrid: Tecnos, 2011, pp. 14–34.
2. F. Michavila, Bolonia en crisis, *REDU, Revista de Docencia Universitaria*, **9**(3), 2011, pp. 15–27.
3. European Higher Education Area (EHEA) Ministerial Conference, *Bucharest Communiqué. Making the Most of Our Potential: Consolidating the European Higher Education Area*, 2012.
4. A. Sursock and H. Smidt, *Trends 2010: A decade of change in European Higher Education*, European University Association, Brussels (Belgium), 2010.
5. European Higher Education Area (EHEA) Ministerial Conference, Louvaina Communiqué. 2009.
6. I. González López, La Autopercepción de la Formación Universitaria: Evaluación y Calidad, *Revista Iberoamericana de Evaluación Educativa*, **2**(2), 2009, pp. 157–170.
7. P. Spooren, D. Mortelmans and J. Denekens, Student evaluation of teaching quality in higher education: development of an instrument based on 10 Likert?scales, *Assessment & Evaluation in Higher Education*, **32**(6), 2007, pp. 667–679.
8. J. Felmton, J. Mitchell and S. Stinson, Web-based student evaluations of professors: the relations between perceived quality, easiness and sexiness, *Assessment & Evaluation in Higher Education*, **29**(1), 2004, pp. 91–108.
9. A. Jiménez, B. Terriquez and F. J. Robles, Evaluación de la satisfacción académica de los estudiantes de la Universidad Autónoma de Nayarit, *Revista Fuente*, **3**(6), 2011, pp. 46–56.
10. E. Corominas Rovira, La transición de los estudios universitarios. Abandono o cambio en el primer año de Universidad, *Revista de Investigación Educativa*, **19**(1), 2001.
11. E. Himmel, Modelos de Análisis de la Deserción Estudiantil en la Educación Superior, *Revista Calidad en La Educación*, **17**, 2002, pp. 75–90.
12. L. Cabrera, J. T. Bethencourt, P. Alvarez Pérez and M. González Afonso, El problema del abandono de los estudios universitarios, *RELIEVE*, **12**(2), Nov. 2006.
13. L. Esteban Salvador, A. Gargallo Castell, M. Marzo Navarro and A. Martín Villalba, Factores determinantes del abandono de los estudios universitarios: análisis de un caso, in *XII Congreso Universitario de Innovación Educativa en las Enseñanzas Técnicas, Barcelona, 2004.*
14. R. Salim and M. Lotti de Santos, Aprendizaje en el primer año de estudios universitarios: motivaciones, estrategias y enfoques, es una publicación editada por la OEI. ISSN: 1681–5653, **52**(5), 10-May-2010.
15. M. C. González Afonso, P. R. Álvarez Pérez, L. Cabrera Pérez and J. T. Bethencourt Benítez, El abandono de los estudios universitarios: factores determinantes y medidas preventivas, *revista española de pedagogía*, **LXV**(236), 2007, pp. 71–85.
16. A. Seidman, *College Student Retention: Formula For Student Success*, Greenwood Publishing Group, 2005.
17. A. B. G. Rogado, M. J. R. Conde, S. O. Miguelnez, B. G. Riaza and F. J. G. Peñalvo, Assessment of a blended-learning methodology in engineering, *International Journal of Technology Enhanced Learning*, **2**(4), 2010, pp. 347–357.
18. A.-B. González, M.-J. Rodríguez, S. Olmos, M. Borham and F. García, Experimental evaluation of the impact of b-learning methodologies on engineering students in Spain, *Computers in Human Behavior*, **29**(2), 2013, pp. 370–377.
19. M. J. Leon (coord.), et al, Innovación docente de calidad y mejora de la enseñanza universitaria. Programa de Estudios y Análisis de la Dirección General de Universidades (MEC), ref. EA2009-0101, 2009.
20. R. M. Felder and R. Brent, Active learning: an introduction, *American Sociality for Quality (ASQ) Higher Education Brief*, **2**(4), 2009.
21. K. E. Holbert and G. G. Karady, Strategies, Challenges and Prospects for Active Learning in the Computer-Based Classroom, *IEEE Transactions on Education*, **52**(1), Feb. 2009, pp. 31–38.
22. V. M. López Pastor, L. F. Martínez and J. A. Julián Clemente, «a Red de Evaluación Formativa, Docencia Universitaria y Espacio Europeo de Educación Superior (EEES). Presentación del proyecto, grado de desarrollo y primeros resultados, *REDU. Revista de Docencia Universitaria*, **5**(2), Sep. 2007, pp. 1–19.
23. G. Gibbs and C. Simpson, Condiciones para una evaluación continuada favorecedora del aprendizaje. Barcelona: Octaedro, ICE, 2009.
24. [24]
A. Pérez Pueyo, B. Tabernero, V. M. López, N. Urueña, E. Ruiz, M. Caplloch, N. González, and F. J. Castejón, Evaluación formativa y compartida en la docencia universitaria y el espacio europeo de educación superior: cuestiones clave para su puesta en práctica, *Revista de Educación (MEC)*, **347**, 2008, pp. 435–451.
25. G. Almerich, B. Gargallo and E. García Félix, Evolución de las estrategias de aprendizaje en el alumnado universitario del primer curso [CDROM], in Actas XV Congreso Nacional y I Internacional de modelos de investigación educativa. *Educación en un mundo en red*, UNED—Madrid, 2011.
26. J. M. Such, N. Criado and A. García-Fornes, Experiencias con una técnica de aprendizaje activo basada en retroalimentación instantánea y anónima, *IE Comunicaciones: Revista Iberoamericana de Informática Educativa*, (14), 2011, pp. 15–23.
27. M. Á. Conde González, Personalización del aprendizaje: Framework de servicios para la integración de aplicaciones online en los sistemas de gestión del aprendizaje, 05-Jul-2012. [Online]. Available: http://grialdspace.usal.es:443/handle/grial/223. [Accessed: 12-Dic-2012].
28. F. J. García-Peñalvo, M. Á., Conde, M. Alier and M^{a} J. Casany, Opening Learning Management Systems to Perso-

nal Learning Environments, *Journal of Universal Computer Science*, **17**(9), 2011, pp. 1222–1240.
29. M. Á. Conde, F. J. García-Peñalvo, Mª J. Rodríguez-Conde, M. Alier, Mª J. Casany and J. Piguillem, An evolving Learning Management System for new educational environments using 2.0 tools, *Interactive Learning Environments*, DOI:10.1080/10494820.2012.745433, in press.
30. F. J. García Peñalvo and J. García Carrasco, Los Espacios Virtuales Educativos en el Ámbito de Internet: Un Refuerzo a la Formación Tradicional, *Teoría de la Educación. Educación y Cultura en la Sociedad de la Información*, **3**, 2002.
31. R. Bisquerra, Introducción conceptual al análisis multivariable: un enfoque informático con los paquetes SPSS-X, BMDP, LISREL y SPAD. Barcelona: PPU, 1989.

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