DEEP LEARNING THROUGH THE CASE METHOD

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Abstract

Environmental Impact Assessment is a subject that aims to sensitize students about the need to study and adequately foresee the consequences that human actions have on the environment. Thus, this subject allows to address the syllabus in an interdisciplinary, complex and dynamic work environment. To success, it is essential that students achieve deep learning, and be able to identify patterns and connections in systems. For that, the subject must be developed as a whole. For this reason, the Case Method is chosen as the learning methodology, by facilitating the relationship with the reality of the selected cases and achieving in the students a greater capacity for analysis, interpretation and use of the concepts worked, enhancing their meaningful learning. Thus, the objective of this research was to verify whether the use of the case method, a methodology focused on learning, improved the learning strategies of students at the University level. For this, we used a pre-test/post-test experimental design using the CEVEAPEU questionnaire.

The results showed that students use more and better learning strategies. There are significant differences in the students' learning strategies, in the global score, in the two scales and four out of six subscales: Motivational strategies, Metacognitive strategies, Information search and selection strategies, and Processing and use strategies. The use of the case method as a pedagogical tool allowed students to learn better, both individually and in groups. This methodology required a proactive, constant and cooperative participation of the students, that promote the responsibility in their work development and allows to get closer to their professional future.

Keywords: Ceveapeu questionnaire, case method, deep learning, motivational strategies, active methodology.

1 INTRODUCTION

The fundamental objective as teaching professionals is that our students learn specific subjects. But "learning" is not "knowing", but "understanding, applying, analyzing, synthesizing ...". It is desired that students understand and also be able to extrapolate what they have learned to all areas of their work, social and human life. "Knowing" simply allows you to reproduce the knowledge and information acquired or at most demonstrate a certain skill for a procedure concrete. Instead, "Understanding" is mastering knowledge and being able to use or transform it for a specific purpose.

These concepts are closely related to the so-called learning approaches. In fact, “knowing” is achieved when learning is superficial, while “understanding, analyzing, synthesizing” is achieved when learning is deep [1]. It can be observed in several research [2] that the students can use two different ways of relating to the learning task that is proposed them, superficial approach and deep approach to learning.

Evaluating the learning strategies and approaches of the students will give a diagnosis to be able to implement pedagogical measures for their improvement [3]. The fundamental objective of this research is to demonstrate that deep learning can be achieved in students using the case method, a teaching methodology that from a simulation context (study of real cases) favors student motivation.

Learning is the result of the interrelation of three elements, intention or motive of the student, process or strategy used and achievements or performance obtained [4]. This is the Biggs's 3P teaching and learning systems model.

When students approach the learning in a superficially way, they study without reflecting on their ultimate goal or purpose [5]. They just focus on memorizing knowledge and data and routinely training procedures. The intention is generally to simply address the requirements of the course. For this reason, they often find it difficult to find meaning in new knowledge, they see little value and meaning in the course and they tend to feel pressured and worried about work. However, when a student focuses his learning in a deep way, he is able to relate the ideas to previous experience and

knowledge. He looks for new patterns, checks and connects evidence, and uses memorization only when necessary. Therefore, the student is usually aware of his own understanding and takes an increasingly active interest in the course. Deep learning is achieved when the student is able to fit in and connect the new information with the previous one, through hierarchical relationships, comparisons or cause-effect relationships [1, 3, 6].

Sometimes there is also a strategic or achievement approach [1, 3], in which the student uses a third way of learning, the strategy. He is motivated to get good grades and pass, and he looks for the best and most organized way to achieve it. It is a very well organized superficial strategy [1]. However, this strategy of achieving academic success (not learning by itself) really consists of using the superficial or deep approach depending on the objectives and the assessment methods [3].

The teaching strategy that we use will make the learning be oriented in a different way and therefore the resulting learning will also differ [3, 7, 8, 9]. Each student will use the superficial or deep approach in response to different circumstances or tasks. Therefore, knowing the learning approach and the associated factors will allow better orienting teaching strategies and the way to generate the appropriate conditions to favor deep learning. There are different factors that influence learning approaches: epistemological beliefs, personal factors, contextual factors (type of content or task, amount of content, teaching methods, evaluation, ...), academic qualification, etc. [10]

The results obtained by [7] show the existence of direct relationships between self-regulatory efficacy (students' confidence in mastering and controlling their own learning processes), the adoption of a deep learning approach and the use of learning strategies.

One of the methodologies that can be used to promote student motivation and deep learning is the case method. It is an active learning technique, where the student works on a real and specific problem and where there is no single concrete solution [11, 12]. The sequence of the method begins with the definition of a specific case and an individual study, continues with an analysis in small groups, a group analysis of the entire class group and ends with conclusions in small groups. The teacher guides the previous knowledge and that generated through debate and discussion [11].

At this time there is a wide variety of instruments that can be used to assess students' approach to learning. A review of the most used is discussed in [13]. In this research, to evaluate the learning strategies of the students, we use the Evaluation Questionnaire of the Learning Strategies of University Students (CEVEAPEU) [14, 15, 16]. It has been used in various studies. CEVEAPEU assesses strategies, that is, the specific way of facing learning by students, considering the motivational and affective, metacognitive and cognitive parts, related to the search, selection, processing and use of information.

The CEVEAPEU considers the cognitive and meta-cognitive aspects related to learning strategies, as well as motivational, affective and contextual factors [14]. It is a good instrument, consisting of two scales. On the one hand, affective, supportive and control strategies, and on the other hand the strategies related to information processing. It has six subscales (motivational, affective, metacognitive, context control and other strategies, information search and selection, and information processing and use) and twenty-five strategies.

2 METHODOLOGY

This research focuses on a subject related to the Environmental Impact Assessment of Civil Engineering at the School of Civil Engineering (Universitat Politècnica of Valencia). This course aims to sensitize the student about the need to study and adequately foresee the consequences that human actions, and in this specific case projects, have on the environment in a broad sense. Therefore, this subject is conceived as a tool for decision-making, analysis, prevention and correction of environmental damage generated by some civil works, protection of the environment and improvement of environmental quality, preventing human activities affect environmental quality.

Logically, all this implies the need to provide the necessary knowledge to use and / or structure the project data and the environment for a correct prognosis and evaluation of the environmental effects that the project will produce. This subject will allow them to adapt within this field in an interdisciplinary, complex and dynamic work environment. Therefore, in this specific subject it is essential that students achieve deep learning and that they look for patterns and connections and try to see the subject as a whole.

This subject is taught in the 4th year of the Bachelor's Degree in Public Works Engineering (BD) and in the 1st year of the Master's Degree in Environmental Engineering (MD), being a compulsory subject in both degrees. They are therefore degrees with an engineering approach and where the student is a priori quite reluctant to consider that their future engineering works could affect the environment. In the BD degree the number of students is usually between 20-30 and in MD it is usually around 30. The sample studied coincides with the total population of students taking the subject. In both groups, the teaching methodology applied is identical. After teaching the basic theoretical concepts, students work in small groups of 3 with documents of real cases of environmental impact assessment. These documents are of different types of activities or civil works and are chosen by themselves among all those available in the computer application of the Ministerio para la Transición Ecológica y el Reto Demográfico (Sabia Project).

CEVEAPEU questionnaire [14] consists of 88 items and it is organized into two scales, six subscales, and twenty-five strategies. It is designed with the format of a Likert-type scale, with 5 response options, where (1) indicated Strongly Disagree, (2) Disagree, (3) Undecided, (4) Agree and (5) Strongly Agree Agreement. Its global reliability is $\alpha = 0,897$.

Scale I corresponds to affective, support and control (or self-management) strategies. These strategies are those that start the process and help to sustain the cognitive effort made by the student. It is divided into 4 subscales of strategies, which, although they are not directed to the processing of materials, are absolutely necessary for quality learning. They are the strategies that start the process, help to maintain the effort, mobilize and control the affective part, help to manage the context, and allow the planning, evaluation and control of the learning activity itself [17]. They are:

- Motivational strategies (Motiv-Str), which are responsible for exploring the type of motivation to learn (intrinsic - extrinsic) of the student. It includes 7 strategies, Intrinsic motivation (Intrin-Mot), Extrinsic motivation (Extrin-Mot), Task value (Val-Task), Internal attributions (Int-Attrib), External attributions (Ext-Attrib), Self-efficacy and expectations (Self-Expect) and Conception of intelligence as modifiable (Intellig-Mod).
- Affective components (Affect-Comp), which explore the physical and emotional state of the student. It includes two strategies, the physical and emotional state (Phys-emo-St) and the anxiety state (Anxiety).
- Metacognitive strategies (Metacog-Str), which explore the strengths and weaknesses of the university student when faced with learning. Includes 4 strategies, Knowledge of objectives and evaluation criteria (Know-Obj), Planning (Planning), Self-evaluation (Self-eval) and Control and self-regulation (Cont-Self reg)
- Context control strategies, social interaction and resource management (Control-Str), which examine the study conditions of the student and analyze the work carried out with others to improve learning. Includes 2 strategies, Context Control (Cont-Control) and Peer Learning and Social Interaction Skills (Soc-interac)

Scale II corresponds to Strategies related to information processing, aimed at the acquisition, preparation, organization and storage of information. It is divided into 2 subscales of strategies aimed at the search, analysis and selection of information, its processing to build knowledge and its effective use [17]. They are:

- Information search and selection strategies (Search-Str), which explore daily actions to get closer to the information to be learned, and the mechanisms to discriminate what is important from what is not important. Includes 2 strategies, Knowledge of sources and search for information (Know-info) and Selection of information (Selec-info)
- Information processing and use strategies (Info-Str), which explore the actions carried out by the student to acquire, encode and organize information, memorization mechanisms and the ability to transfer and use the information learned. They include 8 strategies, Acquisition of information (Acquis-info), Development of information (Develop-info), Organization of information (Organ-info), Personalization and creativity, critical thinking (Perso-think), Storage, memorization, use of mnemonic resources (Mnem-stor), Storage, simple repetition (Simple-stor), Transference, use of information (Transfe-info), Resource management for using acquired information (Resour-mang)

The methodological scheme that was followed was:

- At the beginning of the course, students in the two groups (BD and MD), answer to the questionnaire CEVEAPEU (pre-test). For this pre-test, the students answered the questionnaire in situ, on the first day of class and in person, thinking about their way of dealing with general learning in the subjects already taken in the degree.
- The case method was applied in both groups throughout the subject.
- After the course, on the last day of class, students answered the questionnaire in person (post-test). In this case, they answered it by thinking about their way of facing learning in this particular subject.
- The results obtained were analyzed through a qualitative and quantitative analysis using the statistical package Statgraphics XVII Centurion.

3 RESULTS

After answering the questionnaires, the normality of the variables was analyzed using the Kolmogorov-Smirnov (KS) test to determine which items could be performed parametric tests. All the items showed a normal distribution. They were subjected to an analysis of variance (ANOVA) using Statgraphics Centurion XVII, comparing the scores obtained in the pre-test with those of the post-test. In addition, the effect size was estimated using Cohen's d, one of the most widely used measures [18]. Generally, as a guideline, it is generally accepted that if d <0.20 the effect size is small, if d is around 0.5 it is moderate, and above 0.8 it is large [19]. Some authors indicate that if d > 1,30 the effect size is very large [20]. It also calculates η^2, indicating little effect if around 0,01, around 0,06 indicate average effect and if greater than 0,14 is already a large effect.

Tables 1, 2 and 3 show the mean, standard deviation, F Anova, p- value, and the size of the effect (Cohen's d and η^2) to the overall score, for each of the two scales, six subscales and 25 strategies.

Table 1. F of ANOVA and significance of the differences in learning strategies (pre-test-post-test) (N = 66; GL = 1; 65). Global and Scales.

	Mean		***SD***		***F***	***p-value***	***Cohen's d***	***η^2***
	Pre	***Post***	***Pre***	***Post***				
Global	3,56	3,89	0,29	0,21	30,050	**0,000**	1,349	0,319
Scale I	3,63	3,94	0,25	0,24	26,560	**0,000**	1,269	0,293
Scale II	3,48	3,84	0,37	0,26	21,220	**0,000**	1,134	0,249

Statistically significant differences were found from pre-test to post-test in the global mean score of the questionnaire, with improvement in the post-test [F(1, 65) = 30,050, p-value < 0,001, Cohen's d = 1,349, η^2= 0,319]. The effect size was large.

Statistically significant differences were also found from pre-test to post-test in the first scale, of affective, support and control strategies [F(1, 65) = 26,560, p- value <0,001, Cohen's d = 1,269, η^2= 0,293], with a value of the size of the effect also large, and improving the scores in the post-test. These strategies are those that start the process and help to sustain the cognitive effort made by the student. It is divided into 4 subscales of strategies, which, although they are not directed to the processing of materials, are absolutely necessary for quality learning. They are the strategies that start the process, help to maintain the effort, mobilize and control the affective part, help to manage the context, and allow the planning, evaluation and control of the learning activity itself [17].

There were statistically significant differences from pre-test to post-test in two of the four subscales: motivational strategies, metacognitive strategies. In both cases the size of the effect was large and improved scores on the post-test. In the other two scales were no statistically significant differences, although higher valuation was obtained in the post-test both affective components as control strategies of the context, social interaction and resource management.

At the next level, in the case of strategies, significant differences were found in 8 of the 15. Thus, within the motivational Strategies (Subscale 1 Motiv-Str), which are responsible for exploring the type of motivation to learn (intrinsic - extrinsic) of the student, the intrinsic Motivation, Extrinsic motivation,

External attributions, Self-efficacy and expectations and Conception of intelligence as modifiable have statistically significant differences, with higher valuations in the post-test and sizes medium or large effect. Motivational strategies of value of the task and internal attributions, although both higher ratings were obtained in the post-test, not show statistically significant differences, finding their p- value close to 0,05.

Among the strategies metacognitive (Subscale 3 Metacog-Str), which explore the strengths and weaknesses of the university to learning, Knowledge of objectives and evaluation criteria, Planning and Control and self-regulation, show statistically significant differences, with higher evaluations in the post-test and medium or large effect sizes. Only Self-evaluation does not show a significant difference, despite being close to a p- value of 0,05, although it obtains higher valuation in the post-test.

Neither strategies included in the affective components, physical and mood and anxiety (subscale 2 Affect-Comp), exploring the physical and emotional state of the student, showed significant differences, although both higher ratings were obtained in the post-test.

In the same way, none of the two Strategies of Context Control, Social Interaction, and Resource Management (Subscale 4 Control-Str) showed significant differences, although both higher ratings were obtained in the post-test.

Table 2. ANOVA (pre-test-post-test) (N = 66; GL = 1; 65). Subscales and Strategies for Scale I.

Subscale	Strategy	Mean		SD		F	p-value	Cohen's d	η^2
		Pre	Post	Pre	Post				
Motiv-Str		3,46	4,00	0,24	0,29	66,060	**0,000**	2,001	0,508
	Intrin-Mot	4,25	4,56	0,52	0,39	7,190	**0,009**	0,660	0,101
	Extrin-Mot	1,91	3,18	0,73	0,97	36,290	**0,000**	1,483	0,362
	Val-Task	4,05	4,31	0,62	0,44	3,730	0,058	0,476	0,055
	Int-Attrib	4,03	4,23	0,47	0,46	3,100	0,083	0,433	0,046
	Ext-Attrib	2,91	3,35	0,98	0,69	4,440	**0,039**	0,518	0,065
	Self-Expect	4,17	4,51	0,48	0,38	10,210	**0,002**	0,787	0,138
	Intellig-Mod	2,92	3,83	0,42	0,75	37,310	**0,000**	1,504	0,368
Affect-Comp		3,42	3,55	0,39	0,42	1,540	0,218	0,306	0,024
	Phys-emo-St	3,74	3,82	0,64	0,43	0,320	0,576	0,138	0,005
	Anxiety	3,11	3,28	0,54	0,64	1,410	0,239	0,292	0,022
Metacog-Str		3,63	4,08	0,46	0,26	22,980	**0,000**	1,180	0,264
	Know-Obj	3,82	4,21	0,87	0,59	4,630	**0,035**	0,530	0,067
	Planning	2,91	3,80	0,44	0,69	38,300	**0,000**	1,524	0,374
	Self-eval	3,96	4,21	0,61	0,49	3,420	0,069	0,455	0,051
	Cont-Self reg	3,85	4,09	0,49	0,38	5,070	**0,028**	0,554	0,073
Control-Str		4,01	4,16	0,42	0,38	2,190	0,143	0,365	0,033
	Cont-Control	3,94	4,08	0,53	0,43	1,460	0,231	0,298	0,022
	Soc-interac	4,08	4,23	0,60	0,53	1,110	0,296	0,260	0,017

The differences were also significant in the second scale, of strategies related to information processing, aimed at the acquisition, elaboration, organization and storage of information [F(1, 65) = 21,220, p- value <0,001, d 'Cohen = 1,134, η^2= 0,249], with a value of the size of the effect also large, and improving scores in post-test. There were statistically significant differences from pre-test to post-test in the two subscales: information search and selection strategies and strategies processing and use of information. In all cases the size of the effect was large and improved scores on the post-test.

At the next level, in the case of strategies, significant differences were found in 6 of the 10. Strategies related to the search and selection of information (Subscale 5 Search-Str), exploring everyday actions to approach the information to learn, and mechanisms to distinguish the important from the unimportant, is the selection of information which showed statistically significant differences with higher rating in the post-test and a size of the large effect. Knowledge strategy and finding information

sources showed no significant differences, although higher valuation obtained in the post-test (p-value = 0.073).

For the processing strategies and use of information (Subscale 6 Info-Str), exploring the actions taken by the student to acquire, encode and organize information, mechanisms of memory and the ability to transfer and use the information learned, five of them showed statistically significant differences. They are Elaboration, Organization, Personalization and creativity, critical thinking, Storage, simple repetition, and Transfer, use of information. All of them have higher valuations in the post-test and medium or large sizes of the effect. Only information acquisition strategies, storage, memorization, mnemonic use of resources and management resources to use information acquired show no significant difference, although higher valuation obtained in the post-test.

Table 3. ANOVA (pre-test-post-test) (N = 66; GL = 1; 65). Subscales and Strategies for Scale II.

Subscale	Strategy	Mean		SD		F	p-value	Cohen's d	η^2
		Pre	Post	Pre	Post				
Search-Str		3,45	3,81	0,46	0,40	10,870	**0,002**	0,812	0,145
	Know-info	3,34	3,65	0,74	0,65	3,320	0,073	0,448	0,049
	Selec-info	3,57	3,96	0,45	0,39	14,670	**0,000**	0,943	0,186
Info-Str		3,50	3,87	0,34	0,25	25,050	**0,000**	1,232	0,281
	Acquis-info	3,97	4,10	0,47	0,32	1,670	0,200	0,319	0,025
	Develop-info	2,91	3,53	0,69	0,72	12,680	**0,001**	0,877	0,165
	Organ-info	3,93	4,19	0,59	0,39	4,710	**0,034**	0,534	0,069
	Perso-think	3,70	4,04	0,52	0,44	7,900	**0,007**	0,692	0,110
	Mnem-stor	3,33	3,71	1,07	0,83	2,510	0,118	0,390	0,038
	Simple-stor	2,29	3,17	1,00	0,92	13,860	**0,000**	0,916	0,178
	Transfe-info	4,11	4,38	0,48	0,47	5,460	**0,023**	0,575	0,079
	Resour-mang	3,76	3,86	0,63	0,79	0,360	0,549	0,148	0,006

These results clearly demonstrate that this methodology significantly improves strategies of learning, mainly in the motivational strategies, metacognitive strategies, in the search and selection of information and in the processing and use of information. However, there are two strategies that, despite improving, do not do so significantly. They are those related to the affective components and the control of the context.

A principal components analysis is performed including the 6 subscales. The purpose of the analysis is to obtain a reduced number of linear combinations of the 6 variables that explain the greater variability in the data. Only a single factor is obtained with an eigenvalue greater than 1. However, in order to extract as much information as possible, the analysis is forced to extract two components. Thus, the first two components explained 50,11% and 14,45% of the total variance and together explain the 64,56% of the variability in the original data. Factorability tests tell us whether it is worth extracting factors from a set of variables. Kaiser-Meyer-Olkin statistic (KMO) is 0,805, so factoring is considered feasible to provide valuable information about priority factors. The Table 4 shows the weights of components.

The component weights provide us with the principal component equations, where the values of the variables in the equation have been standardized by subtracting their mean and dividing them by their standard deviations. Thus, the two components would have the following equations:

*Component 1 = 0,387761 * Motiv-Str + 0,317131 * Affect-Comp + 0,453263 * Metacog-Str + 0,357151 * Control-Str + 0,440821 * Search-Str + 0,470895 * Info-Str*

*Component 2 = 0,199998 * Motiv-Str – 0,745741 * Affect-Comp + 0,32229 * Metacog-Str – 0,452344 * Control-Str + 0,293734 * Search-Str + 0,0954242 * Info-Str*

Table 4. Component Weight Table

	Component 1	*Component 2*
Motiv-Str	0,387761	0,199998
Affect-Comp	0,317131	-0,745741
Metacog-Str	0,453263	0,32229
Control-Str	0,357151	-0,452344
Search-Str	0,440821	0,293734
Info-Str	0,470895	0,0954242

Figure 1 shown diagram of the 66 samples in each of the two extracted components, where "1" corresponds to the pre-test samples and "2" to the post-test samples.

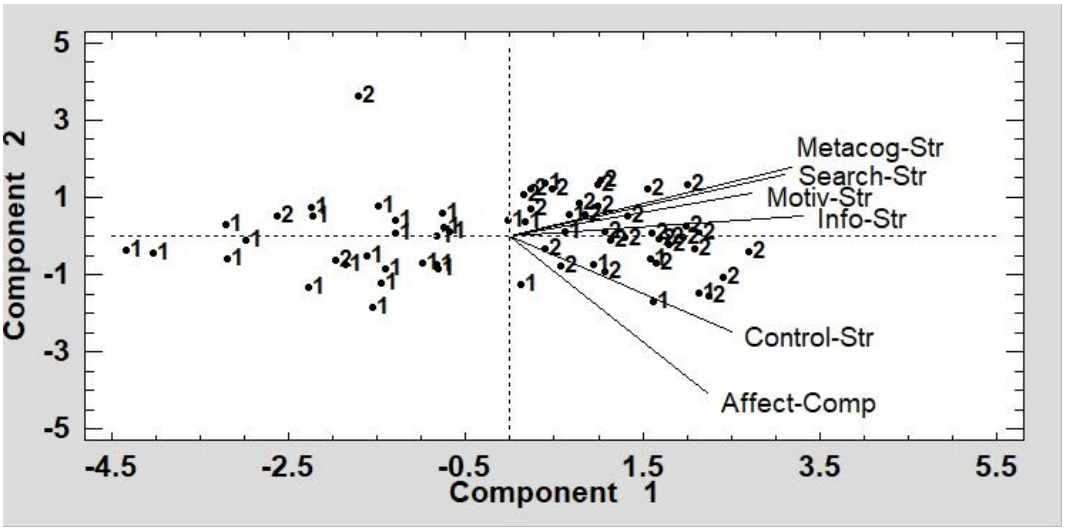

Figure 1. Principal components.

Post-test samples are mostly located on the positive axis of the component 1. Thus, the component 1 indicates the improvement in the six subscales (strategy) with the application of the methodology used. Component 2 indicates that there are differences between the strategies related to affective components (Affect-Comp) and the strategies for context control, social interaction and resource management (Control-Str) and the remaining.

There are many studies that demonstrate the influence of learning approaches on performance. Generally, students with a deep focus obtain better results than those with a superficial focus [21, 22, 23, 24, 25, 8], especially when the tasks are continuous assessment and not simple exams [7]. All students passed the course, with grades that ranged from 7,55 to 9,31, with an average of 8,46, a standard deviation of 0,4674 and a coefficient of variation of 5,52%. The evolution of learning strategies throughout the first year at university has been studied [26], finding that students with a deep focus achieve better academic performance.

Generally, a superficial learning approach is related to a lack of motivation to learn, which in turn leads to a decrease in motivation. However, a deep approach is related to highly motivated subjects, which on many occasions generates an increase in motivation [7]. The deep strategy is usually established based on an intrinsic motivation, oriented to want to know, while in the superficial strategy the motivation is usually external, and oriented to pass [1].

But in general, it is a mistake to consider that superficial learning should be avoided in students. Both approaches are necessary, because if you want to promote deep learning, you must first learn basic and fundamental knowledge that will later be used to understand and reflect on a specific topic in depth.

A student does not have to focus on his learning in the same way in all subjects or even in all the topics of each subject, it depends on how he considers the task that is requested. In fact, it is considered that the learning approaches of the same student change as he encounters the different types of teaching and tasks that are requested [3, 7, 27].

Thus, it cannot be said that there are superficial students and deep students, since the student modifies his approach or way of learning based on the needs of each moment [1, 4]. For this reason, in each discipline, or even in each task, the best way to enhance deep learning must be defined.

Generally, overloading the student with content and evaluating it continuously with small exams or rote tests and without a clear connection between the topics, and even without feedback, favors students to adopt a superficial approach. However, as [28] and [2] point out, if what is desired is to promote deep learning, it must be clearly established what expectations the student has and what prior knowledge they have on the subject. Activities should be proposed that encourage active participation and help them make connections between different topics, courses and disciplines. Sometimes it can even be good to give students opportunities regarding the selection of topics or assessment systems. Do not forget the importance of providing feedback to students on the aspects they need to improve and on their strengths. This will generally also achieve greater student interest and motivation in the subject [1].

The use of the case method has accomplished that the student is able to understand, to know and to analyze the whole context and variables involved in the case [30]. It has allowed them to develop creativity and innovation and represents a resource to connect theory to real practice and therefore to achieve meaningful learning [29, 30, 31, 32]. In a first course, [33] propose to change the students' learning approach by modifying the methodology. The objective is to reduce the shallow focus in the study and increase the deep focus. Their innovation consists in combining the lecture with group work (case studies) and in this group work they have to solve problems that require searching for information. In this way, it aims to make students more responsible for their own learning process, and not be passive receivers of information, that they learn by doing, etc. To verify the effectiveness of the innovation, they compare the two learning approaches (superficial, deep) before the group work and 12 weeks after. As a result, they observe that there is an increase in deep focus in the study and a decrease in shallow focus.

4 CONCLUSIONS

The results of our work show that after the applied teaching methodology (Case method) the students use more and better learning strategies. Significant differences were in the learning strategies of students in the overall score in the two scales and four of the six subscales: Motivational Strategies Metacognitive Strategies, Strategies of Search and selection of information and Strategies of Processing and Use.

The differences were statistically significant in fourteen strategies: intrinsic motivation, extrinsic motivation, external attributions, self-efficacy and expectations, conception of intelligence as modifiable, knowledge of objectives, planning, control and self-regulation, selection of information, elaboration of information, organization, Personalization and creativity (critical thinking), Storage and Transfer and use of information. In other strategies the differences were not statistically significant, but all improved in the post-test.

The strategies that improve, after application of case method, are motivational strategies (primarily extrinsic motivation and conception of intelligence as modifiable), metacognitive strategies (especially the planning), strategies for finding information (fundamentally the selection of information) and the strategies of processing and use of the information (fundamentally the elaboration). The strategies that slightly improve, after applying the case method, are those corresponding to the affective components (physical and emotional state and anxiety) and the strategies for context control, social interaction and resource management.

The results obtained are quite relevant, because the use of methodologies focused on learning greatly improve learning strategies. Mainly it is the Motivational strategies that improve, which confirms that the use of the applied methodology improves the motivation of the students. Metacognitive strategies also improve to a great extent, which is highly related to the work required of students, who need this type of skills. In the same way, all the strategies related to information processing, which are essential to successfully carry out learning through the case method, also improve.

The use of the case method as a pedagogical tool has made students learn better, both individually and in groups. This methodology has required an active, constant and cooperative participation of the students, who have had more responsibility in the development of their work and have approached the reality of their professional future.

REFERENCES

[1] E. Fasce, "Aprendizaje profundo y superficial, Tendencias y perspectivas", *Rev. Educ. Cienc. Salud*, vol. 4, no. 1, pp. 7-8, 2007.

[2] P. Ramsden, *Learning to teach in Higher Education*. Nueva York: Routledge, 2003.

[3] C. Fernandez, and J.L. Arquero, "Evaluación de innovaciones y enfoques de aprendizaje. Presentación preliminar de un instrumento de medida. Innovations assessment and approaches to learning. Preliminar presentation of a questionnaire" in *IV Jornadas de Innovación e Investigación Docente*. Sevilla: Edición Digital Atres. 214-225, 2011. Retrieved from http://hdl.handle.net/11441/43202

[4] M. Lopez-Aguado, and A.I. Lopez-Alonso, "Los enfoques de aprendizaje. Revisión conceptual y de investigación //Learning Approaches: Theoretical and Research Review", *Revista Colombiana de Educación*, vol. 64, pp. 131-153, 2013.

[5] N. Entwistle, *The Approaches and Study Skills Inventory for Students (ASSIST).* Edinburg: Centre for Research on Learning and Instruction, University of Edinburg, 1997.

[6] J. Hattie, *Visible Learning: A Synthesis of 800 Meta-Analyses Relating to Achievement*. Routledge, 2013.

[7] A. Diaz-Mujica, and M.V Perez-Villalobos, "Autoeficacia, enfoque de aprendizaje profundo y estrategias de aprendizaje", *International Journal of Developmental and Educational Psychology*, *INFAD Revista de Psicología*, vol. 2, no. 1, pp. 341-346, 2013.

[8] M. Lopez-Aguado, and L. Gutierrez-Provecho, "Modelo explicativo del efecto de los enfoques de aprendizaje sobre el rendimiento y el papel modulador de la dedicación temporal", *Revista de Investigación Educativa*, vol. 32, no. 2, pp. 447-462, 2014.

[9] C. Antonelli, "¿Cómo incentivar el aprendizaje profundo?", *XXV Jornadas de Reflexión Académica en Diseño y Comunicación*, vol. 30, pp. 133-135, 2017.

[10] F. Monroy, *Enfoques de enseñanza y de aprendizaje de los estudiantes del Máster Universitario en formación del Profesorado de Educación Secundaria*. Universidad de Murcia, 2013.

[11] Servicio de Innovación Educativa, *El método del caso*. Universidad Politécnica de Madrid, 2008.

[12] J.M. Núñez-Tabales, F.J. Fuentes-García, G.A. Muñoz-Fernández, and S.M. Sánchez-Cañizares, "Análisis de elaboración e implementación del método del caso en el ámbito de la educación superior", *Revista Iberoamericana de Educación Superior, RIES. Universia*, no 16, vol. VI, pp. 33-45, 2015.

[13] V. Bustos, A. Oliver, L. Galiana, and P. Sancho, "Propiedades psicométricas del CEVEAPEU: Validación en población peruana", *Educación XX1*, vol. 20, no. 1, pp. 299-318, 2017.

[14] B. Gargallo, J.M. Suarez-Rodriguez, and C. Perez, "El cuestionario CEVEAPEU. Un instrumento para la evaluación de las estrategias de aprendizaje de los estudiantes universitarios", *Relieve*, vol. 15, no. 2, pp. 1-31, 2009.

[15] B. Gargallo, G. Almerich, J.M. Suárez-Rodríguez, and E. García-Félix, "Estrategias de aprendizaje en estudiantes universitarios excelentes y medios. Su evolución a lo largo del primer año de Carrera", *Relieve*, vol. 18, no. 2, 2012.

[16] B. Gargallo, G. Almerich, J.A. Giménez, C. Campos, and B. Sarria, "La evaluación de los enfoques de estrategias de aprendizaje en estudiantes universitarios", *XII Jornadas de Redes de Investigación en Docencia Universitaria*, pp. 2157-2171, 2014.

[17] B. Gargallo, I. Morera, and E. Garcia, "Metodología innovadora en la universidad. Sus efectos sobre los procesos de aprendizaje de los estudiantes universitarios", *Anales de psicología*, vol. 31, no. 3, pp. 901-915, 2015.

[18] P. Morales, *El tamaño del efecto (effect size): análisis complementarios al contraste de medias*, 2012. Accessed 8 September 2019. Retrieved from http://web.upcomillas.es/personal/peter/investigacion/TamañoDelEfecto.pdf

[19] J. Cohen, *Statistical Power Analysis for the Behavioral Sciences*. 2nd. edit., Hillsdale, N.J.: Lawrence Erlbaum Associates, 1988.

[20] J.A. Rosenthal, "Qualitative descriptors of strength of association and effect size", *Journal of Social Service Research*, vol. 21, no. 4, pp. 37-59, 1996.

[21] A. Valle, R. González-Cabanach, J. Núñez, J.M. Suárez, I. Piñeiro, and S. Rodríguez, "Enfoques de aprendizaje en estudiantes universitarios", *Psicothema*, vol. 12, no. 3, pp. 368- 375, 2000.

[22] B. Gargallo P. Garfella, and C. Pérez, "Enfoques de aprendizaje y rendimiento académico en estudiantes universitarios", *Bodon*, vol. 58, no. 3, pp. 45-61, 2006.

[23] E. Ruiz, M.F. Hernández-Pina, and F. Ureña, "Enfoques de aprendizaje y rendimiento institucional y afectivo de los alumnos de la titulación de Ciencias de la Actividad Física y el Deporte", *Revista de Investigación Educativa*, vol. 26, no. 2, pp. 307-322, 2008.

[24] A.M. Bliuc, R.A. Ellis, P. Goodyear, and D. Muntele, "The role of social identification as university student in learning: relationships between students' social identity, approaches to learning and academic achievement", *Educational Psychology*, vol. 31, no. 5, pp. 559-574, 2011.

[25] L. Gutiérrez-Provecho, and M. López-Aguado, "Relación de los enfoques de aprendizaje con el rendimiento y la estimación del tiempo dedicado por los estudiantes en la realización del prácticum. The relationship between learning approaches and learning achievement and estimated time required by students during their practicum", *Bordón*, vol. 65, no. 3, pp. 25-37, 2013.

[26] B. Gargallo, J.M. Suárez-Rodríguez, E. García-Félix, C. Pérez, and P. Sahuquillo, "Enfoques de aprendizaje en estudiantes universitarios excelentes y medios", *Revista española de pedagogía*, vol. 252, pp. 185-200, 2012.

[27] N. Entwistle, *Teaching for Understanding at University: Deep Approaches and Distinctive Ways of Thinking*. Hampshire & New York: Palgrave Macmillan, 2009.

[28] J.B. Biggs, and C. Tang, *Teaching for Quality Learning at University*, 3rd edit. Glasgow: Open University Press., 2007.

[29] M.J. Labrador, M.A., Andreu, and J.A. González-Escrivá, "Método del caso" in *Metodologías Activas*. Ed. Universidad Politécnica de Valencia, 2008.

[30] M.A. Gómez-Rueda, "El estudio de casos: estrategia para lograr un aprendizaje significativo en los estudiantes de Anatomía Médica", *Docencia Universitaria*, vol. 10, pp. 97-110, 2009.

[31] A. Estrada, and K.L. Alfaro, "El método de casos como alternativa pedagógica para la enseñanza de la bibliotecología y las ciencias de la información", *Bibliotecológica*, vol. 29, no. 65, pp. 195-211, 2015.

[32] C. Pizarro, O. Maltés, M. Díaz, M. Vargas, and M.A. Peralta, "Método de casos. Una metodología activa para adquirir aprendizajes significativos en química. Case method. Active learning methodology to acquire significant in chemistry", *Avances en Ciencias e Ingeniería*, vol. 6, no. 3, pp. 53-60, 2015.

[33] M. Hall, A. Ramsay, and J. Raven, "Changing the learning environment to promote deep learning approaches in first-year accounting students", *Accounting Education*, vol. 13, no. 4, pp. 489-505, 2004.