STRENGTHENING SELF-REGULATING PROCESSES IN HIGHER EDUCATION STUDENTS THROUGH WEB-BASED LEARNING ENVIRONMENTS – WBLE

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Abstract

The objective of the research was to design and implement a Web-based Learning Environment (WBLE) in the psychosocial care and intervention course to strengthen self-regulating processes in higher education students' learning. The study involved 10 students from a private university in Bogotá, Colombia. The research was of a quasi-experimental-type and to develop the study, novices interacted with a WBLE comprised of eight units. The research's independent variable was the WBLE and the dependent variable corresponded to self-regulating development in learning, which was identified with the aid of the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, Smith, Garcia & Mckeachie, 1993). The findings allow us to conclude that using WBLE facilitated self-regulating development in higher education students' learning, which is evidenced by the significant differences found in the MSLQ's subcategories.

Keywords: Web-based Learning Environment, self-regulation in learning, higher education.

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INTRODUCTION

Currently, educators are faced with enormous challenges in learning and knowledge development processes since it is not about transmitting concepts as it was traditionally done, now, the student is the main actor in their own learning and it is the teacher who must provide the environments, spaces, and tools allowing the learner to interact with technology, culture, and their context (Kharb & Prajna, 2016; Postareff, Mattsson & Parpala, 2018). Through these new forms of teaching-learning, a society with critical thinking is being formed, capable of researching and proposing alternatives contributing to society's development.

In this sense, information and communication technologies (ICTs) gain relevance and are integrated into educational processes with the objective of constantly transforming the latter, favoring education's conversion into a dynamic process, thus reformulating

methodologies and improving novices' learning (Kharb & Prajna, 2016; Postareff, Mattsson & Parpala, 2018). ICTs have been integrated into educational scenarios, capturing the learner's attention, allowing them to be a creator, simulating actual problems, and making decisions, thus generating new knowledge that may favor their learning (Alt, 2018; Duţă & Rivera, 2015; Semradova & Hubackova, 2013).

Thus, learning-based pedagogical models that place the learner at the center and integrate technologies have enabled the creation of Web-based Learning Environments (WBLE), which are available to teachers and students. The environments are characterized by the constant use of platforms in which it is possible to interact in real-time with the learner. These WBLEs offer curricular contents, forums, e-mails, chat, tests, schedules, etc. that facilitate the interaction of students and teachers (Munk y Drlík, 2016; Moffat & Robinson, 2015). Thus, enabling the teaching-learning process to be done in different modalities, where the student and teacher can access from anywhere, at any time, generating discussion spaces and strengthening self-regulation in learning (Barreto, 2017; Boulton, Kent y Parker, 2018).

Regarding self-regulation, it is defined as the process in which the student becomes aware and responsible for their learning, carefully studying the task, setting objectives when carrying out said activity, planning the strategies allowing them to successfully complete what has been proposed, and finally, self-assessing themselves when they get their results, thus generating a self-reflection process and a concept about the task developed, identifying strengths and aspects to be improved (Zimmerman & Barry, 1989; Zimmerman & Moylan, 2009).

Due to the foregoing, different studies on the development of self-regulation in WBLE have been proposed in the field of education, concluding that the latter allow improving learning in various knowledge areas and levels of education (Munk & Drlík, 2016; Moffat & Robinson, 2015). In this sense, this study designs and implements a WBLE in the psychosocial care and intervention course to strengthen self-regulating processes in higher education students' learning. The environment was developed in the Moodle platform of a private university of Bogotá - Colombia and was validated with 10 students. The course was implemented during one academic semester, in other words, four months, and the following research question was posited: How does a WBLE contribute to strengthening learning self-regulating processes in higher education students?

TECHNOLOGY INTEGRATION IN THE EDUCATIONAL CONTEXT

Information and Communication Technologies (ICT) have generated changes in society, since they are present in all areas and dynamics in which human beings function: Political, economic, cultural, and educational, among others. In the educational field, they allow strengthening teaching-learning processes, constituting itself as an instrument to acquire knowledge, which is why teachers integrate technologies to improve learning in diverse knowledge areas (Monguillot, González, & Guitert, 2017; Slechtova, 2015). It is also important to mention that through changes in teachers' pedagogical practices and the incorporation of new technologies, the aim will be to respond to society's demands and higher education (Ghavifekr & Rosdy, 2015)

Given that the learning process has been mediated by technology, it is pertinent to use Web-based Learning Environments (WBLE), these are defined as an information space designed for an educational process, where actors effectively and constantly intervene in it, according to certain pedagogical principles that guide knowledge development in topics established for learning, favoring: Knowledge, experiences, and content appropriation (Dillenbourg, Schneider & Synteta, 2014).

WBLEs significantly contribute to students' education since they facilitate and improve learning management, generating changes in autonomous, self-regulating, and effective teaching and learning methods. This is because of the options enabled by technology, such as knowledge management, available knowledge, and materials to develop skills, knowledge, and attitudes in learners. Also, the alternatives it offers subjects to study, strengthen knowledge, and develop their academic activities. They also impact the collective construction of knowledge and collaborative work, which is why the novice improves their ability to think critically, since they can interact and think autonomously, simulating actual problems and searching for alternatives within their knowledge to solve what has been posed (Nadja & Seufert, 2018; Pellas, 2014; Phungsuk, Viriyavejakul & Ratanaolarn, 2017).

SELF-REGULATION IN LEARNING

Self-regulation is defined as a process that allows developing learning strategies. Thus, students set objectives, monitor, regulate, and control their cognition, motivation, and behavior with the purpose of reaching the objectives set (Zimmerman, 2001). For this process, the student must be active and set goals to reach the expected objectives, considering what they learn and how they learn.

Wolters, Pintrich, & Karabenick (2005) assert that self-regulation is a constructive and active process in which students set learning objectives, set goals, and subsequently monitor, regulate, and control their cognition. Several authors, such as Boekaerts, (1997); Schunk & Zimmerman, (1994), consider that self-regulation in the educational process leads to academic success. This is because of the use of different strategies and their modification, until the student implements the one they identify as effective; goal identification is done according to motivation and self-efficacy.

Similarly, Schunk & Peggy (2000) consider that self-regulated learning refers to self-generated thoughts, feelings, and actions that are systematically planned and adjusted as needed to affect learning and motivation. Self-regulation comprises processes such as setting learning goals, paying attention, and concentrating on the instruction, using effective strategies to organize, codify, and rehearse the information to be remembered, employing resources effectively, and monitoring performance, managing time effectively, and seeking help when needed, and having positive beliefs about one's abilities.

For Zimmerman and Moylan, (2009) self-regulated learning is a socio-cognitive process developed by the individual that learns, builds knowledge, and becomes efficient when the main learning actor is fully aware and clear on their own cognitive, socio-affective, and motivational processes.

In this cognitive, social reality of awareness and clarity regarding the knowledge to be learned, the student must be guided to question, review, plan, control, and evaluate their own learning actions (Pintrich, 1990).

In the field of research on learning self-regulation, several models of learning self-regulation are distinguished. This research takes the Zimmerman model in its last version (Zimmerman and Moylan, 2009), this with the understanding that the model has been the most widespread in scientific literature in the field of educational psychology or what would be referred to more in Colombia as learning (Panadero and Alonso-Tapia, 2014).

According to Zimmerman (2001), the self-regulation process has three phases: 1. Planning, 2. Execution, and 3. Self-reflection. The planning phase is the initial phase, in which the student analyzes the task, for which they set goals and objectives, thus evaluating their capacity to successfully develop it. In this phase, the student must analyze how much they value the task and what they must do to complete it. This analysis is considered to determine the motivational degree to self-regulate, based on which, objectives are established considering the evaluation criteria and the maximum level of perfection that they wish to achieve.

The second phase is comprised of two processes: 1st, self-control and 2nd, self-observation.
The first is defined as the process to maintain concentration and interest through strategies of a "metacognitive" or motivational-type. On the one hand, metacognitive self-control is established by choosing a specific strategy, for example, when summarizing. On the other hand, motivational self-control refers to stimulating interest, for example, using reminder messages about the goal. The second process is defined as the comparison between what is being done and an ideal execution model.

The last phase, which corresponds to self-reflection, is comprised of two alternate moments. The first, the self-judgment process and the second, the self-reaction process, which interact with each other. On the one hand, self-judgment is the process allowing the student to judge their execution. Thus, the student can perform a self-assessment allowing them to assess their work, based on the quality criteria that should have been clearly established at the beginning of the activity with the teacher and the conscious participation of the individual who has defined the learning task. The student will also perform causal attributions implying how the activity's success or failure is self-explained.

LEARNING ENVIRONMENTS AND SELF-REGULATION

Self-regulation is an indispensable factor in the technology-mediated learning process in higher education contexts, since the student establishes their objectives, what they want to know and the strategy to be followed, in other words, what they must do and how to do it. Thus, generating an action plan, a strategy to acquire knowledge, and identifying criteria to self-asses learning (Seufert, 2018; Räisänen, Postareff, & Lindblom-Ylänne, 2016). The foregoing is evidenced in the studies described below, which have integrated technology and self-regulation to favor learning in different knowledge fields in higher education students.

In this sense, we found the research proposed by Virtanen, Niemi & Nevgi, (2014), which focused on self-regulating skills acquired by higher education students when interacting with WBLE. The study was implemented in five universities, motivating students to learn, and to take responsibility for their own learning through self-regulation. To achieve the objectives set, the program developed a set of self-assessments, tasks, feedbacks, learning journals per student, and tutorials. The study's findings stated that the use of virtual learning environments are more useful for students who are beginning their university life, and for those students who find it difficult to learn collectively, given that these virtual classrooms grant them autonomy, allowing for a better performance, setting objectives and strategies in their learning exercise.

On the other Gutman & Kramarski, (2017) conducted an investigation that consisted in assessing 65 students who interacted with the WBLE. The study's objective was to determine the environment's impact on self-regulation development and learning. Which is why two groups were generated, the first was exposed to an environment with self-regulating activators and the second was not. The study's findings evidence that the students who were exposed to the course with self-regulating activators obtained better results compared to the other students who were not guided toward self-regulating processes. The foregoing is deduced from the strategies, substantiated answers, and control demonstrated in the tests by the students who interacted with the learning environment based on self-regulation.

Similarly, research conducted by Verstege, Pijeira, Noroozi, Biemans & Diederen (2019), reviewed the relationships between students' perceived levels of self-regulation and their corresponding behavior and learning outcomes in a WBLE in the field of enzymology. To that end, 97 students were divided into 3 groups according to the perceived level of self-regulation (high, medium, low). The learning behavior in the virtual environment and its learning were compared between the three groups. The study's results evidenced that students with a high level of self-regulation showed the most optimal learning activity compared to medium and low self-regulation groups. These results suggest there is a relationship between the level of self-regulation and learning outcomes in a virtual environment, due to goal-oriented behavior, planning, and task execution.

Considering the studies described that have been carried out to determine the influence of web-based learning environments (WBLE) in students' self-regulation process, it is important to highlight that every case evidenced that the subjects who have interacted with the environments exhibit a greater self-regulating capacity in their learning process. Consequently, the role of the teacher is highlighted, since they are responsible for providing the necessary tools, spaces, and guidance so the student can act effectively and critically in the learning exercise; it is not enough to only offer a virtual environment, but also think of strategies allowing the student to organize the activity's time, generate a self-assessment of what was learned, and reflect on how to solve possible problems, generating motivation and commitment; this is how an effective self-regulation process is achieved in WBLE.

METHODOLOGY

This study was of quasi-experimental-type (pretest-posttest), consisting in a series of measurements taken from participants, before and after applying a treatment (Campbell & Stanley, 1963). This research changed the "Psychosocial care and intervention" course's learning methodology by strengthening self-regulation through a Web-based Learning Environment - WBLE. In this sense, the study's independent variable is the WBLE and the dependent variable was defined as self-regulation developed in student learning and was determined through the Motivated Strategies for Learning Questionnaire (MSLQ) created by Pintrich, Smith, Garcia, & Mckeachie (1993). The course contained activities that were developed face-to-face and others virtually, in other words, the modality was B-Learning.
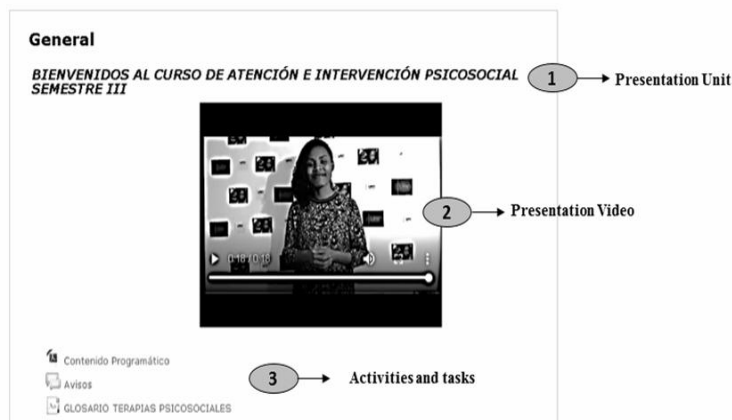
Participants
The research was conducted with 10 students (7 women and 3 men, M = 15.11 years, SD = 0.72) from a private university in the city of Bogotá - Colombia and was of a quasi-experimental-type. To develop the study, novices interacted with a WBLE comprised of eight units in the Moodle platform that strengthened learning self-regulation.

Web-based Learning Environment (WBLE) for Self-regulation Development

The WBLE contained 8 units, each one with its own learning guide, as well as a variety of activities and tasks that students had to upload to the Moodle platform on a weekly basis. In the initial part of the course, a video was used to welcome the students and introduce them to the course's general aspects *(figure 1)*.
Figure 1. Moodle Organization

Below, a description by unit is presented: The psychosocial Therapist's technical language was worked on in unit 1 (Figure 2). The WBLE was used as an aid where students had to enter the virtual classroom and participate in the creation of a dictionary, to which they would add key concepts of their profession, so that, as they acquired the concepts, they would apply them to the context, and at the same time, some activities were indicated enhancing the self-regulation process in learning.

Figure 2. Unit 1 Psychosocial Therapist's Technical Language

UNIDAD 1. LENGUAJE TÉCNICO DEL TERAPEUTA PSICOSOCIAL

From unit 2 to unit 5, psychosocial problems, types, and components were worked on. For the mentioned units, through a video, the self-regulation process was explained *(figure 3)* and students were invited to self-regulate their learning. In a face-to-face class, work was based on guided exercises, and in the independent work using the Moodle platform, students delved deeper into a variety of topics such as psychosocial history according to their organization by stages.

In addition to the foregoing, each student had to set the goals they wanted to reach for each thematic unit, plan the development of their task, and thus elaborate it (*Figure 4*). For the units already described, they built concept maps using cmaptools, participated in educational forums, questionnaires, activities to relate concepts, film analysis, videos, animations, for which they had to answer questionnaires allowing them to self-monitor, and finally, self-reflect on the developed task's results of success or failure (Bandura, 1991; Heikkiläa, & Lonka, 2006; Pintrich & Zusho, 2002; Schunk, 2005; Zimmerman, 2008), according to established quality criteria (*Figure 5*).

Figure 3. Zimmerman's (2009) Self-regulation

In unit 6, well-being management (future ideals) was addressed, with the purpose of having students enhance the Emerging Psychosocial Model's methodological management and its application. To that end, students prepared a psychosocial care and intervention proposal according to established criteria. Before performing the exercise, in the Moodle platform, they wrote a text discussing what their self-regulation process was like, contemplating their goals and objectives, in addition to defining their

motivation in carrying out the proposal. They also established the strategy they would use to build the proposal.

In the next face-to-face class, a group exercise was performed in which each student had to share their progress in the proposal prepared so far, thus encouraging the student's active participation to propose, express an opinion, and learn. In each class, each student had a space to review the proposal with the objective of evidencing their progress (Nadja, Müller & Seufert T, 2018; Pellas, 2014; Phungsuk, Viriyavejakul & Ratanaolarn, 2017).

Figure 4. Task Planning

Units 7 and 8, work on their profession's fields of action. To that end, material was uploaded onto the virtual classroom, such as links allowing them to delve deeper into the topics seen in the face-to-face classes, hypertexts, blog pages. Students had to conduct a therapeutic group workshop in which the professional's four fields were evidenced: Resilience and human security, Palliative care, Communication, and finally, geriatrics.

In the Moodle platform, they had to upload the pre-workshop report and its implementation was face-to-face. Once implemented, they assessed the procedure.

To achieve an optimal result in the course, each student's access to the platform was monitored, thus confirming the use of the WBLE in the students' independent work, allowing to identify the individual progress and difficulties in the learning process (Räisänen, Postareff, y Lindblom-Ylänne, 2016; Seufert, 2018).

Figure 5. Monitoring and Self-reflection

Tomado de:https://www.youtube.com/watch?v=EVz5vfbB3p4
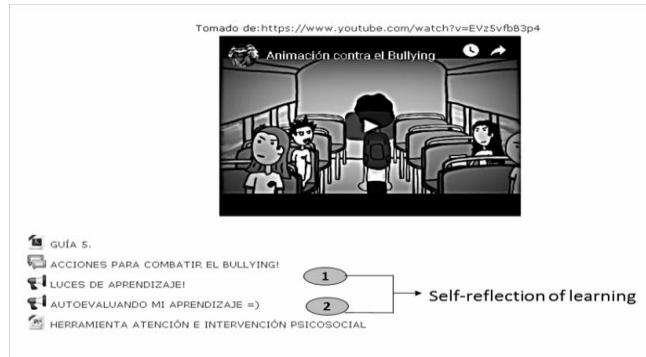
Instruments

The instrument used to identify self-regulation in learning was the Motivated Strategies for Learning Questionnaire (MSLQ) created by Pintrich, Smith, Garcia, & Mckeachie (1993). Students answered the questionnaire before and after the study's implementation. The MSLQ presents 81 items grouped into two broad categories; motivation (31 items) and learning strategies (50 items). Components are also divided into scales and these, in turn, are divided into categories. Table 1 presents the instrument's description.

Table 1. Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, Smith, Garcia, & Mckeachie, 1993)

COMPONENTS	CATEGORIES	SUBCATEGORIES	DEFINITION	NUMBERING
MSLQ Questionnaire — Motivation	Value Beliefs	Guidance toward intrinsic goals	Satisfaction with an academic activity	1, 16, 22, 24
		Guidance toward extrinsic goals	Benefits associated with the development of an activity	7, 11, 13, 30
		Task value	Importance and usefulness assigned to a task	4, 10, 17, 23, 26, 27
	Perception of self-efficacy	Learning control beliefs	Belief of effort when performing an activity	2, 9, 18, 25
		Self-efficacy for learning and performance	Student's appreciation of his or her abilities	5, 6, 12, 15, 20, 21, 29, 31
	Affective	Anxiety in tests	Concern of the student when performing a task	3, 14, 18, 19, 28
Learning Strategies	Cognitive and metacognitive strategies	Review	Elaboration of main ideas according to contents	39, 46, 59, 72
		Preparing	Knowledge organization	53, 62, 64, 67, 69, 81
		Organization	Selection of main ideas	32, 42, 49, 63
		Critical thinking	Relationship between new and previous knowledge	38, 47, 51, 66, 71
		Metacognitive self-regulation	Planning, execution-supervision and self-reflection	33, 36, 41, 44, 54, 55, 56, 57, 61, 76, 78, 79
	Resource management	Time management and study environment	Schedule, plan, and manage time	35, 43, 52, 75, 70, 73, 77, 80
		Effort regulation	Effort the student makes when doing homework	37, 48, 60, 74
		Peer Learning	Academic team activities	34, 45, 50
		Asking for help	Ability of the student to ask for support on an assignment	40, 58, 68, 75

Procedure

To develop the research, the program's directors were contacted with the purpose of presenting the study's scope and we were able to implement the project in a course during an academic semester. Students were then requested to give their informed consent to participate in the study and were informed that the results would be handled confidentially and were for research purposes.

FINDINGS

To determine the changes produced by the independent variable, in other words, the WBLE, on the dependent variable referring to self-regulation development in learning in students participating in the study, the Student's T-test was employed for related samples. The data analysis was performed with the help of SPSS (Statistical Package

for the Social Sciences) version 23.0 and considered the pre and post scores of the MSLQ questionnaire of Pintrich, Smith, Garcia, & Mckeachie (1993).

To verify the data come from a normally distributed population, the Kolmogorov-Smirnov test of normality was applied. The results in Table 1 show the data have a normal distribution, since the p-values in the two components of the MSLQ are greater than 0.05, which means that the probability is greater than 5%. Regarding the homogeneity of variances, it is important to clarify that this requirement is not analyzed because three is only one group of students.

Table 2. Kolmogorov-Smirnov Test of Normality

	Motivation						Learning Strategies								
	GTI	GTE	TV	LCB	SLP	AIT	REV	PRE	ORG	CTH	MET	TIM	EFR	PEL	AFH
Z	0.645	0.774	0.933	0.811	0.433	0.403	0.433	0.485	0.612	0.411	0.574	0.600	0.632	0.702	0.695
P	0.799	0.587	0.349	0.526	0.992	0.997	0.992	0.973	0.848	0.996	0.897	0.864	0.819	0.709	0.720

Note 1: GTI: Guidance toward intrinsic goals; GTE: Guidance toward extrinsic goals; TV, Task value; LCB: Learning control beliefs; SLP: Self-efficacy for learning and performance; AIT: Anxiety in tests; REV: Review; PRE: Preparing; ORG: Organization; CTH: Critical thinking; MET: Metacognitive self-regulation; TIM: Time management and study environment; EFR: Effort regulation; PEL: Peer learning; AFH: Asking for help.

Once the assumptions of normality were verified, the Student's T-test was applied for related samples (table 3).

Table 3. Student's T-test for Related Samples

Components	Category	Test	Mean	Mean Difference	Standard Deviation	Standard Error of the Mean	t	gl	P
Motivation	Guidance toward Instrinsic Goals	Pre	5.575	-0.725	0.594	0.188	-3.856	9	0.004*
		Post	6.300						
	Guidance toward Extrinsic Goals	Pre	4.125	-1.150	1.081	0.341	-3.363	9	0.008*
		Post	5.275						
	Task Value	Pre	6.066	-0.450	0.555	0.175	-2.560	9	0.031*
		Post	6.516						
	Learning Control Beliefs	Pre	5.325	-0.925	0.527	0.166	-5.543	9	0.000*
		Post	6.250						
	Self-efficacy for Learning	Pre	5.550	-0.650	0.642	0.203	-3.200	9	0.011*
		Post	6.200						
	Anxiety in Tests	Pre	5.440	1.880	1.738	0.549	3.419	9	0.008
		Post	3.560						
Learning Strategies	Review	Pre	4.650	-1.175	0.808	0.255	-4.596	9	0.001*
		Post	5.825						
	Preparing	Pre	4.750	-0.966	0.665	0.210	-4.592	9	0.001*
		Post	5.716						
	Organization	Pre	4.525	-0.900	0.555	0.175	-5.125	9	0.001*
		Post	5.425						
	Critical Thinking	Pre	3.980	-1.480	0.844	0.267	-5.543	9	0.000*
		Post	5.460						
	Metacognitive Self-regulation	Pre	4.658	-0.466	0.716	0.226	-2.061	9	0.069
		Post	5.125						
	Time Management	Pre	4.537	-0.550	0.837	0.264	-2.076	9	0.068
		Post	5.087						
	Effort Regulation	Pre	5.375	0.000	1.322	0.418	0.000	9	1.000
		Post	5.375						
	Peer Learning	Pre	3.800	-1.666	0.566	0.179	-9.303	9	0.000*
		Post	5.466						
	Asking for Help	Pre	4.125	-1.550	0.984	0.311	-4.978	9	0.001*
		Post	5.675						

*<0.05 significant difference.

As shown in Table 2, significant differences were found in 11 of the 15 MSLQ categories overall. In the motivation component, differences were found in 5 of the 6

categories. In the learning strategies component, significant differences were found in 6 of the 9 categories (Figure 6)

Figure 6. MSLQ Pre and Post Results
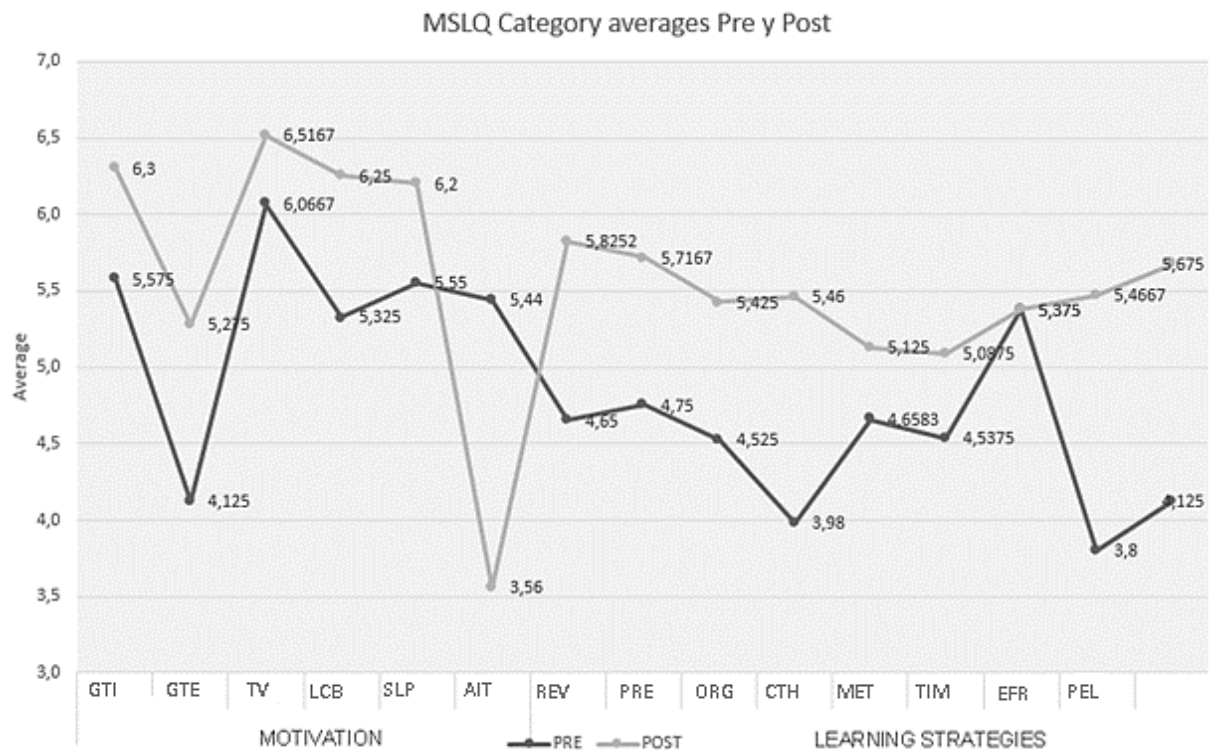
Note 1: GTI: Guidance toward intrinsic goals; GTE: Guidance toward extrinsic goals; TV, Task value; LCB: Learning control beliefs; SLP: Self-efficacy for learning and performance; AIT: Anxiety in tests; REV: Review; PRE: Preparing; ORG: Organization; CTH: Critical thinking; MET: Metacognitive self-regulation; TIM: Time management and study environment; EFR: Effort regulation; PEL: Peer learning; AFH: Asking for help.

In the motivation component, the following results were established; in the guidance toward intrinsic goals (GTI) category, significant differences were obtained between the pre and post (t = -3.856; ρ = 0.004 < 0.05). The results indicate that the implementation of the WBLE allowed students to set goals according to motivation and task complexity, allowing them to be constantly challenged to obtain successful results.

Regarding guidance toward extrinsic goals (GTE), significant differences were found (t= -3.363; ρ = 0.008< 0.05), evidencing students feel motivated when their effort is compensated with good grades, making them competitive. The foregoing means that the tools provided by the WBLE were likely effective.

For the task value (TV) category, a significant difference was found between the pre and post results (t= -2.560; ρ =0.031 < 0.05). The foregoing shows that through the implementation of the WBLE, the participants' interest in developing the proposed tasks was stimulated, giving a value to the activities according to their importance and usefulness, thus strengthening the learning process.

Regarding learning control beliefs (LCB), significant differences were obtained (t= -5.543; ρ=0.000 < 0.05), which demonstrates that the environment had a positive incidence on the beliefs that the student has when completing academic activities to obtain satisfactory results.

In the self-efficacy category (SLP), significant differences were found (t= -3,200; $ρ$= 0,011<0.05) in the MSLQ's pre and post results, demonstrating that, to achieve student's expected results, they had to have a positive personal appreciation of their knowledge and abilities at the end of the environment's implementation.

Regarding the anxiety in tests (AIT) category, the results are not as expected and are contradictory (t=3.419; $ρ$=0.008<0.05), since students exhibit greater anxiety at the end of the intervention, which is likely due to the environment's small amount of activities in this sense allowing to diminish tension in a learning episode. In this respect, there are studies with similar results establishing that women exhibit a higher level of anxiety compared to men, which can be related to the results since the population was comprised of mostly women. Consequently, it is possible to deduce that the environment must strengthen the actions that allow reducing the concern for learning activities (Ferrés, 2016).

In the learning strategies component, significant differences were found in 6 of the 9 categories. Regarding the review (REV) category, significant differences were obtained (t= -4.596; $ρ$ =0.001 < 0.05), which indicates that students employed this strategy more frequently. The foregoing is because of the permanent availability of knowledge in the environment, offering the possibility of studying diverse contents as many times as necessary to broaden their knowledge and strengthen their learning.

For the preparing (PRE) category, significant differences were found (t= -4.592; ρ =0.001 < 0.05), demonstrating that when implementing the WBLE, students continuously used elements from the environment allowing them to organize their knowledge and link it to what was learned. At the same time, they prepared summaries, analyzed information, and wrote proposals on the course's subject matter.

With respect to the organization (ORG) category, significant differences were obtained (t= -5.125; $ρ$ =0.001 < 0.05), which indicates that, after implementing the environment, students likely managed to better organize the information in the texts when extracting the main ideas and materializing them into tools such as mental or concept maps, which will allow them to have a greater understanding of the course's contents.

Significant differences were found in the critical thinking (CTH) category (t= -5.543; $ρ$=0.000 < 0.05). The results establish that the implementation of the WBLE allowed students to establish a relationship between new and previous knowledge, thus managing to analyze, address, and resolve the proposed learning situations.

As for the metacognitive self-regulation (MET) category, a difference is established, but not statistically significant (t= -2.061; $ρ$= 0.069 > 0.05). The foregoing is because the WBLE likely influenced students' self-regulation processes, leading them to plan, execute, monitor and finally, assess their own learning strategies to obtain a better understanding of their studies, but it is necessary to intensify these aspects in the

environment with the objective of achieving better results in future studies that allow establishing significant differences.

The same thing occurred in the time management (TIM) category (t=-2.076; p= 0.068 > 0.05). After the implementation of the environment, students likely used the time appropriately to study and develop their activities, but the change was not significant. Similarly, in the effort regulation category (EFR), there were no significant differences (t= 0.000; p= 1.000> 0.05), but better results were found in the post demonstrating that students made an effort to meet their goals, despite the difficulties arising in task development, which allowed them to control their performance and attention to complete established activities. According to the foregoing, we suggest intensifying the environment's activators to achieve the expected results in the three mentioned categories.

Regarding the peer learning (PEL) category, significant differences were found (t= -9.303; p= 0.000 < 0.05), which evidences that after the environment's implementation, students' interest in developing team activities was stimulated, generating support to clarify doubts, reinforce and broaden knowledge. The foregoing, through argumentative discussions, debates, forums, among others.

And, finally, significant differences were found in the asking for help (AFH) category (t= -4.978; p=0.001 < 0.05), which shows that when students interact with the environment, they strengthen their ability to ask the teacher or their classmates for help when they have difficulty understanding any content.

CONCLUSIONS

This research's findings indicate that the WBLE facilitated the learning self-regulation development in higher education students, which is consistent with previous studies (Kramarski & Gutman, 2016; Verstege, Pijeira, Noroozi, Biemans & Diederen; 2019 Virtanen, Niemi y Nevgi, 2014). Graph 2 shows the effect of the independent variable on self-regulation development in learning, as observed in the motivation component, statistically significant differences were established between pre and post in 5 of the 6 categories of the MSLQ, while in the learning strategies component, significant differences were found in 6 of the 9 categories of the mentioned instrument.

Figure 7. WBLE Effect on Self-regulation in Learning
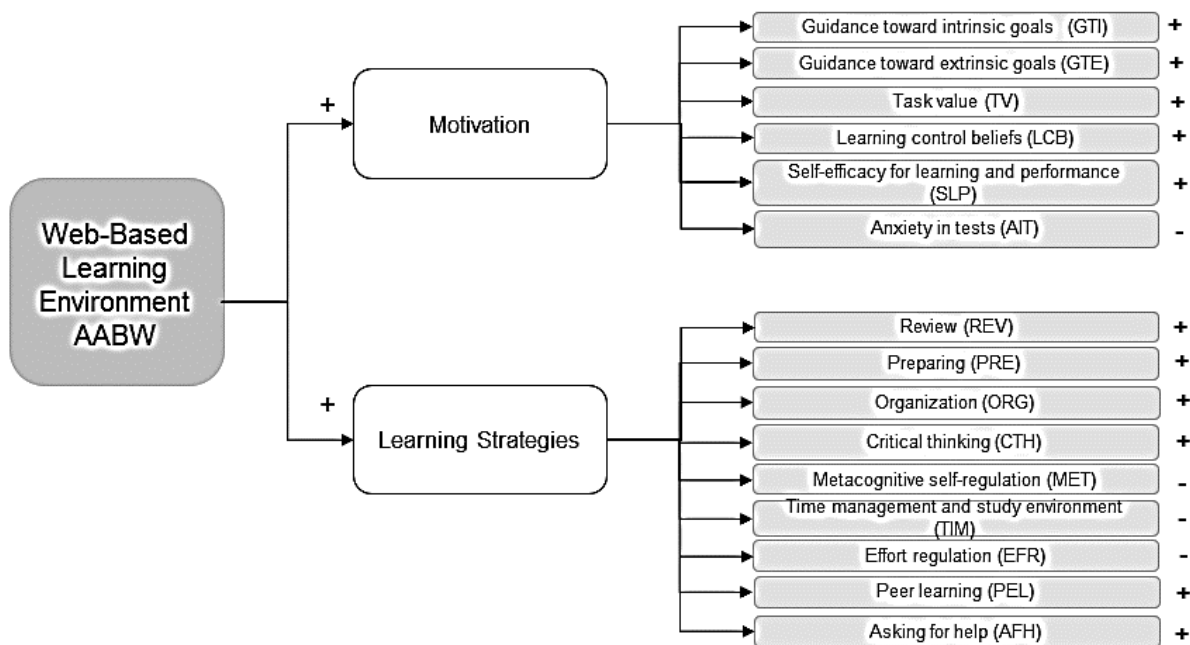
The findings allow us to conclude that the WBLE strengthens and noticeably improves: the conscious motivational guidance for significant knowledge learning, evidenced in the appropriation of clear learning goals of an intrinsic and extrinsic nature, where students developed the competency of targeting tasks, their level of complexity, and the strategies to reach them (Boulton, Kent & Parker, 2018; Virtanen, Niemi & Nevgi, 2014).

The study is conclusive in expressing, with certainty, that significant learning and successful achievement in the construction of professional knowledge is assured in an inseparable relationship that must exist between the WBLE and self-regulation, understood in three moments, planning as the decision of goals and objectives related to knowledge that will be built; execution as the development and implementation of strategies to appropriate knowledge; and self-reflection in learning as the continuous monitoring and self-evaluation in the learning process and knowledge development (Biswas, 2015; Verstege, Pijeira, Noroozi, Biemans & Diederen, 2019).

The research concludes that WBLEs are powerful spaces for meaningful learning and generators of new knowledge because they have a didactics integrating one's own time management strategy, the completion and fulfillment of goals, the effective selection of main ideas, critical reading as a proven structuring of information in an organized and categorical fashion, focusing on students applying an efficient management of their learning goals leading to the achievement of learning (Biswas, 2015).

A conclusion of a fundamental nature in the study and to ensure success in higher education, defined that available, organized knowledge with an appropriate conscious strategy by the learner, self-regulated, which is generated from a WBLE, significantly improves superior or professional knowledge, increases the levels of knowledge domain, reaches effective learning, obtains effective approval levels of the course's

students, and academic success towards a career in higher education (Munk y Drlík, 2016; Moffat y Robinson, 2015).

Thus, it is possible to assert that significant learning, knowledge building, effective competencies development, actually occurs in an individual's cognitive, emotional, procedural, and social cognitive structure. It is the result of their autonomous decision, the consequence of their personal management, of a strategic action to complete the task. The cognitive process that occurs when the learner has organized knowledge with the purpose of learning, training, and developing abilities to solve problems and innovate in career and life (Pellas, 2014; Nadja, Müller y Seufert T, 2018).

LIMITATIONS

This study's limitations focus on the external generalization of the findings since it was implemented with a reduced number of participants, where the representative simple is a particular case according the number of students enrolled in the program course.

RECOMMENDATIONS FOR FUTURE RESEARCH

Based on the study's findings, it is possible to make the following three recommendations: 1. It is necessary to strengthen the WBLE's actions in reducing students' anxiety levels in learning activity development. 2. It is necessary to boost and strengthen students' effort regulation activities in their learning process in virtual classrooms to ensure self-regulation development in learning. And 3. The findings obtained in this study foster continued work through higher education virtual platforms that act as an aid in face-to-face classes and promote self-regulated learning in students.

THANKS

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