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ORIGINAL

Teaching and learning through PBL, PBL and the use of ICTs in a nursing subject

Enseñanza y aprendizaje mediante ABP, ABDP y uso de Tics en una asignatura de enfermería

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ABSTRACT

Introduction: higher education institutions are constantly striving to develop technical skills and interpersonal skills in their students that prepare them for professional life.
Objective: to evaluate the impact of a teaching strategy through the use of problem-based learning, project-based learning and the use of Information and Communication Technologies (ICTs) in the development of the medical-surgical II subject for nursing education.
Method: quantitative, descriptive research, with a comparative component, the universe was 98 students enrolled in the subject, and the sample was calculated with a confidence level of 95 % and a margin of error of 5 %, giving a total of 79 participants distributed in two groups. An evaluation instrument was applied before and after the intervention with the strategy. For the comparative analysis of the impact of the strategy and to determine the normal distribution in both groups, the Kolmogorov-Smirnov test was used.
Results: comparisons between the traditional method and the interventions of the competency-based teaching and learning strategies showed significant differences, shown in a considerable increase in the grades obtained in both groups of students after the application of the strategies; an increase in the grades of group B stands out.
Conclusions: the teaching and learning strategies developed through the use of problem-based learning, project-based learning, and the use of ICTs, improved the academic performance of the students of the Medical Surgical II subject and have an important acceptance and reception by the students.

Keywords: Teaching; Learning; Problem-Based Learning; Education; Nursing.

RESUMEN

Introducción: las instituciones de educación superior de manera constante se esfuerzan por desarrollar en sus estudiantes habilidades técnicas y habilidades interpersonales que los preparen para la vida profesional.
Objetivo: evaluar el impacto de una estrategia de enseñanza mediante el uso del aprendizaje basado en problemas, aprendizaje basado en diseño de proyectos y uso de las Tecnologías de la Información y Comunicación (TICs) en el desarrollo de la asignatura médico quirúrgico II para la formación en enfermería.
Método: investigación cuantitativa, descriptiva, con un componente comparativo, el universo fue de 98 estudiantes matriculados en la asignatura, y la muestra se calculó con un nivel de confianza del 95 % y un margen de error de 5 %, dando un total de 79 participantes distribuidos en dos grupos. Se aplicó un instrumento de evaluación antes y después de la intervención con la estrategia. Para el análisis comparativo

del impacto de la estrategia y para determinar la distribución normal en ambos grupos se utilizó la prueba de Kolmogórov-Smirnov.
Resultados: las comparaciones entre el método tradicional y las intervenciones de las estrategias de enseñanza y aprendizaje por competencias evidenciaron diferencias significativas, expuestas en un aumento considerable en las calificaciones obtenidas en ambos grupos de estudiantes luego de la aplicación de las estrategias; se destaca un aumento en las calificaciones del grupo B.
Conclusiones: las estrategias de enseñanza y aprendizaje desarrolladas a través del uso del aprendizaje basado en problemas, aprendizaje basado en diseño de proyectos, y uso de las Tics, mejoraron el rendimiento académico de los estudiantes de la asignatura de médico quirúrgico II y tienen una aceptación y acogida importante por parte del estudiantado.

Palabras clave: Enseñanza; Aprendizaje; Aprendizaje Basado en Problemas; Educación; Enfermería.

INTRODUCTION

One of the main difficulties faced by higher education lies in ensuring the holistic growth of students, encompassing both generic aspects such as the development of competencies such as creativity, critical thinking, cooperation, communication, collaboration and autonomy. Higher education institutions are constantly striving to equip students with a combination of technical skills and interpersonal skills.[1] The educational objectives of any institution are based on Bloom's taxonomy, which classifies and determines the achievement of these objectives into three categories: the knowledge, skills and attitudes that students will develop during their training.[2]

Problem-Based Learning (PBL) is employed in higher education – especially nursing – from the first year as an integral part of the curriculum and plays a crucial role in demonstrating knowledge and understanding. Swart[3] and Phillips[4] agree that, through PBL, students develop the minimum set of skills that graduates must possess, as established by the program's achievement criteria and assessed at graduation. According to Chen and Yong[5], Problem-Based Learning (PBL) has a significantly positive impact on students' academic performance compared to the traditional learning approach. Under this method, students collaborate to solve and analyze problems,[6] while the role of the teacher is limited to guiding them throughout the project.[7] Self-direction is a key component of PBL, encouraging students to take responsibility for all stages of their work. This establishes a direct connection between students' active participation in their projects and their learning outcomes,[8] allowing them to understand global complexities in a rapidly evolving society.[9] The shift from traditional teaching approaches to PBL implies a transformation in the philosophy of learning,[1] from being teacher-centered to student-centered.

The adoption of PBL can have a significant impact on classroom experiences for both teachers and students. In addition to PBL, the existing literature also evidences the potential benefits of Project Design-Based Learning (PBL) to foster thinking,[10] design,[11] multidisciplinary applications[12] and teamwork skills.[13] Gupta[1] argues that PBL is a constructivist philosophy that motivates students to employ design activities to address real-world problems and reflect on their learning process. This methodology helps cultivate foundational skills, such as creativity and critical thinking, to gain a stronger and deeper understanding of the topic through the integration of research and reasoning.[1] Similarly, technology-driven education has taken teaching beyond the traditional classroom.

Girão A et al.[14] in a systematic review of the literature, concluded that the effective use of current information and communication technologies (ICTs), complemented by minimal revision in the teaching style (through interactive discussions and activity-based sessions), together with conventional teaching methods focused on lectures and tutorials, can add a new dimension to the teaching of nursing subjects. In this context, the objective of this research was to evaluate the impact of a teaching and learning strategy based on PBL, PBL and the use of ICTs in the development of the medical-surgical II subject for nursing education.

METHOD

Quantitative, descriptive research, with a comparative component, the universe was 98 students enrolled in the subject, and the sample was calculated with a confidence level of 95 % and a margin of error of 5 %, giving a total of 79 participants. The total sample was divided into two groups. 45 students administratively assigned to receive the subject in parallel A (Group A) and 34 students assigned in the same way to receive the same subject in parallel B (Group B). The population was made up of a total of 79 students enrolled in the medical-surgical II subject, which is developed in the fifth semester of training a curriculum for the bachelor's degree in nursing at a public university in the coastal region of Ecuador. An educational intervention is implemented before and after the implementation of a competency-based teaching and learning strategy.

The instrument to validate the competency-based teaching and learning (EAC) strategy through PBL, PBL and the use of ICTs in the selected subject was an adaptation of instruments used and validated in similar studies by Rodríguez E et al,[15] In 2010, Margolis A et al,[16] In 2015, both instruments assess the use of ICTs, PBL and PBL in teaching and learning processes at higher education level. The instrument was applied at two specific times. The first, as a diagnosis, was applied in both groups before the implementation of the CAD, and the second moment (impact measurement) was applied in both groups after the intervention with the CAD. The implementation of the strategy was verified through the planning and six-month report of the teaching staff. There it was found that the theoretical-practical contents of unit one were developed through the application of PBL, those of unit two through the use of ICTs and for units three and four ABDP were used. The validity of the strategy was additionally contrasted with the individual academic performance of each student reported quantitatively by the teacher for the final accreditation of the subject. To compare and determine the normal distribution of the latter results, the Kolmogorov-Smirnov test was used. The collected information was processed in a data matrix, using the statistical program IBM SPSS Statistics version 28.0, the numerical data were summarized in descriptive tables and categorical data with frequency tables. In addition, proportional bar graphs, error bars, and box plots were developed for quantitative data.

This research followed the ethical considerations established by Emmanuel,[17] as well as the recommendations set forth in the Resolution of the Ethics and Bioethics Committee No. 53/20.- Report of the Ethics and Bioethics Committee of the Italian University Institute of Rosario, which endorsed the research and the design of informed consent. In accordance with the regulations for the approval and monitoring of Human Research Ethics Committees (CEISH) and Health Care Ethics Committees (CEAS),[18] established by the Ministry of Health of Ecuador, this research is considered to be of minimal risk.

RESULTS

The results show the comparisons between the traditional method and the interventions of the teaching and learning strategies by competencies, in a period of analysis before and after the intervention in both groups of students called group A and group B, where significant differences were evidenced.

Regarding participation in research projects, the answer options were “yes”, “sometimes” and “never”, after the EAC intervention, 80 % of the students acknowledged having participated in research projects. For their professional training, the classroom project is considered important in both groups, a result after the implementation of the strategies for 93,3 % and 61,8 %, students evaluate the information to reference their research citations in a percentage of 88,9 % and 91,2 %, in group A 93 % of students choose to organize their research work digitally, while in group B, 76,5 % organize their work digitally, 20,6 % sometimes do so. Within the applications they use to enhance their projects, the text editor predominates, followed by the spreadsheet in both groups. Knowledge integration projects in 93,3 % and 94,1 %, respectively, have been the strategy that has guided the different forms of research. Finally, for students, the knowledge seen in class is applied to the resolution of research problems, reflected in 75,6 % and 88,2 % (tables 1 and 2).

Table 1. Before-and-After Survey Results with CAD in Group A

Group A		Before	After
		No. (%)	No. (%)
Have you participated in research projects?	Never	3 (6,7)	2 (4,4)
	Sometimes	7 (15,6)	7 (15,6)
	Yes	35 (77,8)	36 (80,0)
Is the classroom project important to your professional training?	Never	0 (0,0)	0 (0,0)
	Sometimes	2 (4,4)	3 (6,7)
	Yes	43 (95,6)	42 (93,3)
Do you select information related to the topic before starting your project?	Never	0 (0,0)	0 (0,0)
	Sometimes	6 (13,3)	3 (6,7)
	Yes	39 (86,7)	42 (93,3)
Do you evaluate the selected information to use as a reference in your research?	Never	0 (0,0)	0 (0,0)
	Sometimes	9 (20,0)	5 (11,1)
	Yes	36 (80,0)	40 (88,9)
Do you organize the digital information that will be used in your research paper?	Never	2 (4,4)	0 (0,0)
	Sometimes	6 (13,3)	3 (6,7)

	Yes	37 (82,2)	42 (93,3)
Do you consider that the research conducted in your training process serves to exchange and/or transmit knowledge?	Never	2 (4,4)	0 (0,0)
	Sometimes	4 (8,9)	3 (6,7)
	Yes	39 (86,7)	42 (93,3)
Which of the following applications have you used to realize your projects?	Text Editors	16 (35,6)	24 (53,3)
	Excel spreadsheet	11 (24,4)	14 (31,3)
	Software	18 (40,0)	7 (15,6)
Which of the following methods have you developed in class guided by your teacher?	Case Analysis	18 (40,0)	21 (46,7)
	Situational Health Analysis	16 (35,6)	16 (35,6)
	Case Study	7 (15,6)	4 (8,9)
	Problem Solving	4 (8,9)	4 (8,9)
Do you think the learning activities in the course helped you learn?	Never	0 (0,0)	0 (0,0)
	Sometimes	3 (6,7)	4 (8,9)
	Yes	42 (93,3)	41 (91,1)
Which of the following forms or research projects have been guided or developed in classes?	Knowledge Integrators Project	41 (91,1)	42 (93,3)
	Projects to link with society	1 (2,2)	1 (2,2)
	Literature reviews	3 (6,7)	2 (4,4)
Do you apply the knowledge you see in class to solve research problems?	Never	0 (0,0)	0 (0,0)
	Sometimes	9 (20,0)	11 (24,4)
	Yes	36 (80,0)	34 (75,6)

Table 2, Before-and-After Survey Results with CAD in Group B

Group B		**Before**	**After**
		No, (%)	**No, (%)**
Have you participated in research projects?	Never	28 (82,4)	7 (20,6)
	Sometimes	6 (17,6)	6 (17,6)
	Yes	0 (0,0)	21 (61,8)
Is the classroom project important to your professional training?	Never	28 (82,4)	2 (5,9)
	Sometimes	6 (17,6)	5 (14,7)
	Yes	0 (0,0)	27 (79,4)
Do you select information related to the topic before starting your project?	Never	24 (70,6)	0 (0,0)
	Sometimes	7 (20,6)	3 (8,8)
	Yes	3 (8,8)	31 (91,2)
Do you evaluate the selected information to use as a reference in your research?	Never	23 (67,6)	0 (0,0)
	Sometimes	11 (32,4)	3 (8,8)
	Yes	0 (0,0)	31 (91,2)
Do you organize the digital information that will be used in your research paper?	Never	23 (67,9)	1 (2,9)
	Sometimes	8 (23,5)	7 (20,6)
	Yes	3 (8,8)	26 (76,5)
Do you consider that the research conducted in your training process serves to exchange and/or transmit knowledge?	Never	2 (4,4)	0 (0,0)
	Sometimes	4 (8,9)	9 (26,5)
	Yes	39 (86,7)	25 (73,5)
Which of the following applications have you used to realize your projects?	Text Editors	30 (88,2)	11 (32,4)
	Excel spreadsheet	4 (11,8)	14 (41,2)
	Software	0 (0,0)	9 (26,5)

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Which of the following methods have you developed in class guided by your teacher?	Case Analysis	10 (29,4)	17 (50,0)
	Situational Health Analysis	5 (14,7)	12 (35,3)
	Case Study	19 (55,9)	4 (11,8)
	Problem Solving	10 (29,4)	1 (2,9)
Do you think the learning activities in the course helped you learn?	Never	15 (44,1)	0 (0,0)
	Sometimes	5 (14,7)	2 (5,9)
	Yes	4 (11,8)	32 (94,1)
Which of the following forms or research projects have been guided or developed in classes?	Knowledge Integrators Project	29 (85,3)	32 (94,1)
	Projects to link with society	4 (11,8)	1 (2,9)
	Literature reviews	1 (2,9)	1 (2,9)
Do you apply the knowledge you see in class to solve research problems?	Never	31 (91,2)	0 (0,0)
	Sometimes	0 (0,0)	4 (11,8)
	Yes	3 (8,8)	30 (88,2)

Through the Kolmogorov-Smirnov test, a comparison of the marks obtained before and after the application of the strategies in both group A and group B was established to determine their normal distribution. This analysis reported that all the evaluations have a P value of 0,0001,, that is, the strategies used caused a considerable increase in the grades obtained in both groups of students. A larger increase in Group B ratings stands out (Figure 1). It is highlighted that the PBL strategy applied in the first thematic unit of the subject caused a statistically significant change in the grades of the students in group A, as well as the effectiveness of the teaching and learning strategy based on ICTs in group A and B, which was reflected both in the students' grades and in the evaluations obtained with Project Design Based Learning (PBL).

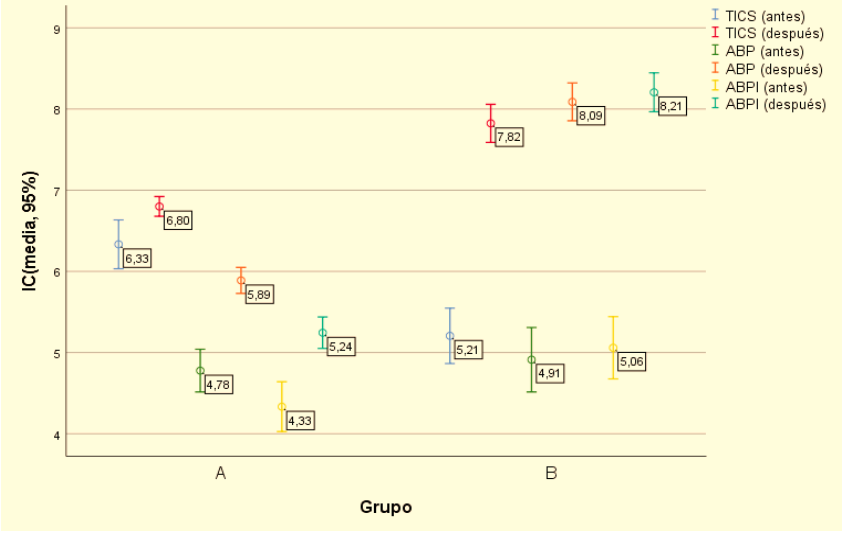

Figure 1. Comparison of before and after grades in group A and group B

DISCUSSION

The results obtained allow us to clarify that training is a long and complex process that requires students to assimilate scientific knowledge, develop skills, acquire attitudes, necessary competencies, values and aptitudes, in addition to multidisciplinary training and clinical competence.[19] The subject Medical-Surgical Nursing II, being taken in the fifth semester of training, can contribute to the development of specific and generic competencies, since the student's training has to contemplate strategies that serve, under the guidance and supervision of a group of experienced teachers, to progressively acquire the ability to solve individual or collective health problems independently and competently.

The responsibility for the success of implementing competency-based teaching and learning strategies is shared by multiple variables, he system, the teacher, and the student. Therefore, when applied in a systematic and comprehensive way, it can contribute to an improvement in educational dialogue, considering the contribution made by the student as an active protagonist in learning. The relationship between learning strategy and teaching strategy is remarkably close because the teacher must direct the cognitive and affective processes that must be assimilated to shape the learning strategies. In this regard, Jerónimo and Yaniz[20] and

Espinal[21] state that teaching strategies are established and executed by teachers, while learning strategies are those actions that students put into practice to acquire knowledge.

With respect to the competency-based teaching-learning (EAC) strategies, the data obtained in the application of PBL, ICT and PBL, indicated a high degree of satisfaction for the students who took the subject medical-surgical nursing II, during 2020-2021, despite this, it is possible to identify self-detected weaknesses; These were worked on in the course of the course of the course. The teaching accompaniment in this first instance of instructing the students was a valid resource for the student to identify their learning needs.

In agreement with the work of Salazar C et al,[22] and Ros-Martín[23], the actions carried out by the teacher – with the conscious objective that the student learns in the most effective way – are sequenced, controlled actions, which have a high degree of complexity, and which include the use of teaching methodologies that facilitate the control, monitoring and evaluation of the objectives that are intended to be achieved regarding student learning. The impact of the teaching strategies with PBL on the students of the 5th semester of the nursing career was notoriously satisfactory and the results obtained are important, since it is evident that the students managed to acquire and develop the competencies required by this strategy. According to Velázquez R et al,[24], PBL is a methodology that has as its starting point the acquisition and integration of new knowledge, where students are the protagonists of their learning, in which teachers facilitate this process. For Trullás J et al,[25] PBL is seen as an orientation that requires students to solve a real-life problem through their own research and reflection, in which teachers facilitate this process by creatively testing, questioning and challenging their learners. In addition, through this strategy (PBL) the inclusion and implementation of the same is promoted, improving this aspect since it is especially suitable to be able to attend to diversity in an easy and effective way by allowing us to attend to the different rhythms of learning, the modes of acquisition of knowledge and the difference in curricular level that students present due to the diversity of forms and approaches that allow us to address a problem of one way or another[26,27] and, in addition, based on the results of this study, we can affirm that PBL is adapted to each student.

On the other hand, education in digital skills is essential in today's globalized world, since social relations revolve around digital communication networks: it is necessary to transform large volumes of information into knowledge, learning implies generating new knowledge, highlighting the role of the teacher that is characterized by requiring the student to apply knowledge bearing in mind digital skills; Macias G et al,[28] mention that ICTs have now played a leading role in the training process at all levels of education, since their use has been essential to be able to carry out this work. Indeed, for Veliz V et al,[29] This new virtual modality for training this generation is a fact, and the development of ICT continues to provide many and varied ways of acquiring new knowledge, which are becoming increasingly complex, representing a challenge for ICT learning.

Finally, the implementation of competency-based learning strategies evidenced their effectiveness in increasing students' academic performance. These findings are consistent with the results of Parra D et al,[30] who conclude that the use of student-centered methodologies, such as PBL, in addition to improving academic performance, led to a greater development of generic competencies in students, including critical thinking and problem solving. On the use of ICTs, the research by Pardo M et al,[31] yielded similar results and concluded that there is a relationship between the use of digital tools and academic performance, and noted that the complexity of ICTs used in teaching and learning processes is also influential. For Barrera F et al,[32] The design of research projects as a teaching and learning method is an incentive for students to get involved in their own process, and in accordance with the results of this study, it is a strategy that fosters collaborative learning and therefore impacts not only the individual results of the student but the entire group.

CONCLUSIONS

The teaching and learning strategies developed through the use of problem-based learning, learning based on project design, and the use of ICTs, improved the academic performance of the students of the medical surgical II course and have an important acceptance and reception by the students. These active teaching and learning strategies, in addition to breaking with traditionalism with new perspectives on teaching and learning, provide a range of content that would not be explored in the traditional method, or, if they were, would not have as much meaning for the student. In active learning methodologies, the greater the student's involvement in the content covered, the greater their ability to comprehend.

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