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ORIGINAL

Evaluation of the impact to the mirror class, as pedagogical strategy to strengthen investigative. UNJu-Univalle

Evaluación del impacto de la clase espejo, como estrategia pedagógica para fortalecer la competencia investigativa. UNJu-Univalle

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ABSTRACT

Research competence is crucial for academic development, however, it faces difficulties in developing critical and methodological skills necessary for scientific research. The Mirror Class (EC) as a pedagogical strategy strengthens ties of international cooperation, academic, scientific and cultural interaction between professors and students. Participants: National University of Jujuy - Argentina and the University of Valle - Bolivia, chairs of Elaboration and formulation of value-added projects and Bromatology. Objective: to evaluate the impact of the Mirror Class on the development of research competence, identifying the main barriers to research skills. Evaluative questionnaires were conducted before and after the intervention, analysis of food research projects to measure improvements in critical methodological competencies, interviews and focus groups to obtain qualitative feedback on the experience and effectiveness. Students showed significant improvements in their research competencies, projects revealed greater methodological rigor and more developed critical skills. Interviews and focus groups highlighted that CE promoted greater collaboration and interactive learning by promoting the development of critical and methodological skills necessary for scientific research. Its adoption is recommended in diverse educational contexts to explore its potential in different areas of knowledge.

Keywords: Education; Mirror Clase; Foods; Investigation.

RESUMEN

La competencia investigativa es crucial para el desarrollo académico, sin embargo, enfrenta dificultades para desarrollar habilidades críticas y metodológicas necesarias para la investigación científica. La Clase Espejo (CE) como estrategia pedagógica fortalece lazos de cooperación internacional interacción académica, científica y cultural entre profesores y estudiantes. Participantes, Universidad Nacional de Jujuy - Argentina y la Universidad del Valle - Bolivia, cátedras de Elaboración y formulación de proyectos con agregado de valor y Bromatología. Objetivo: evaluar el impacto de la Clase Espejo en el desarrollo de la competencia investigativa, identificando las principales barreras de habilidades investigativas. Se realizaron cuestionarios evaluativos, antes y después de la intervención, análisis de proyectos de investigación en alimentos para medir mejoras en las competencias metodológicas críticas, entrevistas y grupos focales, para obtener retroalimentación cualitativa sobre la experiencia y efectividad. Los estudiantes mostraron mejoras significativas en sus

competencias investigativas, los proyectos revelaron un mayor rigor metodológico y habilidades críticas más desarrolladas. Las entrevistas y grupos focales destacaron que la CE promovió una mayor colaboración y aprendizaje interactivo promoviendo el desarrollo de habilidades críticas y metodológicas necesarias para la investigación científica. Se recomienda su adopción en diversos contextos educativos para explorar su potencial en diferentes áreas del conocimiento.

Palabras clave: Educación; Clase Espejo; Alimentos; Investigación.

INTRODUCTION

Education is constantly seeking pedagogical tools that strengthen teaching and learning. New technologies and the pandemic have incorporated terms such as virtual classroom and asynchronous into our daily lives, and they are here to stay. Today, teachers take advantage of all technological resources, such as virtual platforms and online conferences, causing paradigm shifts in the way both virtual and face-to-face classes are conducted. Key factors define educational quality, which can be found in teaching practices. There is currently much controversy and debate regarding perceptions of teaching practice.

Today's classes positively impact teachers' use of technological tools, leading to a rethinking of their teaching methods, facing situations of change in their teaching practices, and thus transforming their daily practices. Academic literacy and research skills are essential in students' critical thinking in the university setting.

That is why this study decided to use the mirror class to strengthen these skills. Shared digital platforms such as Microsoft Teams, Meet, Generally, and WhatsApp enable communication and collaboration between work teams. In this sense, Yancali et al. affirm that mirror classes are a pedagogical internationalization strategy that strengthens research skills in university students. Various related studies establish a connection with collaborative learning theory, research skills theory, and internationalization theory. The Mirror Class (MC) as a pedagogical strategy strengthens international cooperation and academic, scientific, and cultural interaction between teachers and students participating in the National University of Jujuy (Argentina) and the University of the Valley (Bolivia), professors of Project Development and Formulation with Added Value, a third-year course in the University Technical Degree in Agricultural Production Transformation at the Faculty of Agricultural Sciences and Bromatology, and a third-year course in the Food Engineering program at Univalle Cochabamba.

Research skills are defined as an individual's ability to use scientific knowledge to identify problems, acquire knowledge, clarify scientific phenomena, and draw conclusions in the scientific field. Escudero, J., Cutanda, M., & Trillo, J. (2017) Adequate mastery of these skills is achieved through the guidance, execution, and evaluation of research projects, seminars, research tasks, coursework, and integrative projects, which contribute to the development of professional, digital, and communication skills. The university is considered an environment conducive to research, and the need to incorporate and develop research skills in universities is linked to the challenges posed by today's society and the problems that hinder its progress.

Training, research, and technological innovation are key elements for improving a country's quality and competitiveness and strengthening the sustainable social fabric of the community. For this reason, mastery of these skills is one of the goals established in university degree programs. It contributes to students' comprehensive and balanced education and allows them to apply the scientific method in various professional contexts.

One cause of demotivation is the complexity of university education, which presents greater difficulties for students because they do not master it. In many cases, inappropriate teaching strategies are used in research methodology, while in others, there is a lack of interest in research or limited research training and restrictions on the use of information sources.

In this regard, Mano and Moro (2009) state that "The assessment of the achievement of research competence by students (...) by introducing new elements, applying different methodologies, or using innovative instruments, reorienting the tools, methods, and evaluation criteria (...) that allow us to achieve this objective" (p. 9). It is not a question of introducing new elements but of seeking innovation, the ideal mechanism, and strategies helpful in achieving research competence and the results contemplated within academic learning strategies such as mirror classes.

Competencies as a model involve all the elements present in the training of individuals (...). Today, research developments in various countries show that competencies are becoming a model and are no longer just an approach. Tobon (2007) states that in this quest for competence, it has been found that international practice has imposed certain formal elements that characterize published scientific and technical work. Alpizar (1990), about competencies, indicates that they are being forged and are known as "scientific and technical style" or "scientific and technical language."

This study showed that mirror classes were a successful pedagogical internationalization strategy that strengthened the connection with collaborative learning theory, research skills theory, and the importance of applying ICT in university teaching in various related studies, identifying communication tools in virtual learning and internationalization environments. The theory of collaborative learning on which the pedagogical strategy of mirror classes is based is detailed below.

COLLABORATIVE LEARNING

According to Vigotsky's theory, collaborative learning theory gains importance in mediation, considering the approaches of individual development levels and the actual level of development determined by the ability to solve problems independently. It is a teaching technique that promotes student-centered learning by distributing work into small groups, where students with different skill levels use a variety of learning activities to improve their understanding of a subject. Through this, students can regulate their learning and learn to be tolerant by performing and solving problems daily in different aspects of their lives.

Results obtained by Perez et al. (2010) indicate that "collaborative learning techniques in the classroom can be instrumental in that they allow for intentional teaching (...), through which students can face problematic situations and resolve them constructively" (p.10).

Collaborative learning has different advantages, such as integration, self-confidence, independence, critical thinking, and responsibility, which will quickly enable students to enter the workforce and become successful professionals. Developing a skill goes beyond simply memorizing or applying knowledge in a given situation. Competence involves mastery of knowledge, transfer of knowledge to real-life situations, and mastery of soft skills in knowing how to live together. Understanding the concept of competence will allow us to discern the importance of research competence.

RESEARCH SKILLS

Knowledge of competencies also implies mastery of investigative competencies, which is based on the theory proposed by Marzano and Kendall (2008), with the so-called "new taxonomy" that covers a wide range of factors related to the way students think, providing a more complex and well-founded theory, to provide teachers with practical tools to improve their students' learning, particularly in the classroom. "It is the knowledge, attitudes, abilities, and skills necessary to carry out research work" Jaik, Barraza, and Macias (2011, p.24). Therefore, research competence is a theory that identifies students' levels of processing and knowledge domains based on their verbal interventions, incorporating cognitive and metacognitive aspects into these analyses (Morales, 2016).

Studies carried out by Colotta (2017) state that "universities should promote the development of interdisciplinary studies and research on the possibilities of designing a Latin American project for endogenous and sustainable human development, as well as contributing to creating an integrationist awareness and establishing institutes for Latin American studies" (p.13).

It is necessary to assess what students do with this knowledge in different contexts, such as the mirror class, which broke down the barriers of knowledge limits and provided effective feedback through the Microsoft Teams and Meet applications, which are new technologies applied to face-to-face teaching that are supported by learning platforms such as Moodle or virtual campuses. These allow us to break face-to-face classes' physical and temporal limits, expanding the teaching-learning process as a new way of conceiving the process that facilitates teamwork.

Competencies can be seen through student performance, in their arguments when defending their research and contributions, in their use of clear and straightforward language in a sequential and precise manner, and in their answers to the questions posed.

INTERNATIONALIZATION

The last decade has seen both positive and negative innovations, including the strengthening and creation of international cooperation networks; an increase in academic mobility programs for teachers and students; new methods of management, evaluation, accreditation, and financing, including the pursuit of efficiency and profitability, always subject to the essential missions of the university and its social commitment; the diversification of courses, careers, and undergraduate studies; links to society and the world of work; and the growing capacity for foresight, reform, and innovation.

Gorostiaga (2011) discusses the relationship between globalization and the changes that have emerged as a result of this phenomenon in Latin America from a humanistic and critical perspective that emphasizes the achievement of educational policies that promote respect for sociocultural diversity, the formation of essential individuals, and the promotion of educational democratization. According to Gonzalez (2017), the internationalization of education responds to globalization's challenges.

When we talk about Solidarity Cooperation, we refer to a process of internationalization based on a

solidarity-based conception of international and comprehensive cooperation, understanding this comprehensive perspective as one in which teaching, research, and outreach are part of the internationalization strategy of the University of Oregon (2014), taking into account the need to generate mechanisms that allow for the creation of knowledge to meet the needs of society in general. Conducting the mirror class with students from Argentina and Bolivia was an excellent experience that allowed us to internationalize knowledge and compare the levels of research skills among students and teachers.

OBJECTIVES

The general objective was to evaluate the impact of the Mirror Class on the development of investigative competence, identifying the main barriers to investigative skills.

SPECIFIC OBJECTIVES

Implement mirror teaching to enable better development of research skills, improving students' comprehension abilities.

Develop students' ability to produce scientific texts so that it can be applied as a daily teaching strategy.

METHOD

Evaluative questionnaires were administered before and after the intervention, research projects on food were analyzed to measure improvements in critical methodological competencies, and interviews and focus groups were conducted to obtain qualitative feedback on the experience and effectiveness.

The research is qualitative, with an inductive process and an action research design, whose perspectives are technical-scientific, practical, and participatory (Hernandez, Fernandes, & Baptista, 2014), seeking to encourage teachers to constantly reflect on their pedagogical work, moving away from the traditional role and significantly improving their practice by finding solutions or alternatives to the problems that arise.

Action research is a method that comprises a comprehensive activity combining social research, educational work, and action in the achievement of the skills that lead to the attainment of competencies. The research used observation techniques and collected information through instruments such as observation guides. The population consisted of 12 students, 7 of whom belonged to Unju and 5 to Univalle. The research topics were chosen from the areas of food, production processes, and added value.

Table 1. Thermal structure

Category	Topics	Sequence
Ability to understand new information	1	Strategy of choosing the mirror class to be developed, carried out in week 7 and 9 of UNJU and week 10 and 13 of Univalle. The academic cycles of both universities begin in different months.
	2	The collaborative work with students was organized in 2 inverted groups that worked in the chosen line of research and received theoretical training in scientific method and support for the completion of their research, which should be supported by means of the mirror class strategy.
	3	Systematization of the topics and time of each group of universities participating in the mirror class to be held.
	4	Submission of research papers during the mirror class by Microsoft Teams, in front of their peers from the participating universities.
Ability to produce scientific texts	5	Evaluation of the mirror class by the participants, formulating conclusions and recommendations. For the sustainability of the use of the mirror class as an educational experience

Based on theoretical foundations such as meaningful learning and collaborative work, five teaching activities were designed and implemented during the first academic quarter with the aim of teaching students to use the scientific method appropriately, leading to mastery of research skills.

RESULTS

The results obtained after the mirror class with the students showed notable progress in the presentation and defense of the observable research products. The projects revealed greater methodological rigor and more developed critical skills. The interviews and focus groups highlighted that CE promoted greater collaboration and interactive learning, fostering the development of critical and methodological skills necessary for scientific research.

Table 2. Levels of improvement after using the mirror class in the research methodology course

No. of investigations	Products observed	Professional Career	No. of students % of students	Achievement level	Rating
10	Research work	Bromatology	30,47 %	unanimously approved	7-12
			10,16 %	approved with correction	5-10
5	Research work	Development of value-added projects	11,18 %	unanimously approved	7-12
			10,19 %	approved with correction	5-10
TOTAL			61,100 %	approved by majority	24-12

A special interest and motivation toward the ability to understand new information and produce scientific texts was noted among students in the degree programs that participated in the mirror class. Similarly, it was noted that students were motivated to master research skills, demonstrating fluency in searching for information in databases and scientific journals, as well as acquiring various texts on scientific research methodology, APA 7th edition standards, and voluntarily participating in MIC, Spps, and Atlas Ti workshops.

DISCUSSION

Building mirror classes as a teaching strategy strengthened research skills among university students. Research skills involve understanding and transferring knowledge, abilities, attitudes, and values aimed at significantly stimulating the research potential of both teachers and students to obtain results and findings from real-life situations with a social impact on their community both inside and outside the university. While it is true that CE is just another tool, it is essential to emphasize that improving the quality of teaching in education systems requires commitment and demands in teaching-learning processes. In a global and local context, the strategic role of higher education is recognized both in the generation of knowledge and technological innovations and in the training of professionals capable of studying and contributing to the understanding and solution of environmental problems. Therefore, it is necessary to design and implement instances that favor the formation of skills for the productive development of research activities that we consider to contribute to education.

CONCLUSIONS

This study showed greater mastery of research skills among university students and of implementing mirror classes as a teaching strategy. Participants showed notable progress in the presentation and defense of observable research products, with 65 % of mirror class participants passing unanimously, demonstrating mastery of research skills. The study showed that the mirror class is a pedagogical strategy with a positive impact, linking students and teachers who have shared their experiences with this new way of teaching and learning.

Teaching is a continuous improvement of educational systems, with tools constantly being introduced into the teaching-learning processes and virtual learning environments in which the mirror class is developed, supported by internationalization that allows for the linking and creation of international multidisciplinary scientific research networks among participating universities that have contributed to the publication of scientific articles and participated as peer reviewers of research projects among their members. Likewise, the mirror class has linked teachers to develop international research projects with a social commitment. Finally, students can access diverse approaches, perspectives, concepts, and views on the same topic with global experts. Similarly, remote teamwork skills are strengthened and developed, professional networks with teachers and students are expanded, and participation in future academic mobility and/or international activities by teachers and students is encouraged. Its adoption is recommended in various educational contexts to explore its potential in different areas of knowledge.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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