

Inverse Learning Model to Promote Research Skills in University Students-Inverted Technique to Promote Research Skills in University Students

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ABSTRACT

The main objective of the research was to promote the influence that exists between the inverted technique on investigative skills in university students from a university in Peru. Instruments were applied (pre and posttest to both groups). The study was quasi-experimental in a sample of 90 students forming two groups (GE and GC). In the experimental group participated 45 university students from the Faculty of Industrial Engineering and for the control group 45 students from the Faculty of Law. The GE actively participated in 12 sessions, while the CG did not participate. The results showed for the control group, starting level pre-test 57.8% and post-test 51.1%, reflecting a relative decrease. In the same way, at the level of the pre-test process, 31.1% and post-test, 33.3%, a relative increase. At the level of achievement in the pre-test, 11.1% and 15.6% coincided with an average increase. For the experimental group, the averages at the beginning of the pre-test denote 48.9%, and post-test 17.8%, evidencing a significant decrease. At the process level 33.3%, and 46.7% reflecting a significant increase; and for the pre-test level of achievement, 17.8% and 35.6%, raising a significant increase. Concluding the existence of significant influence between the variables investigated in the levels of process and achievement (33.3% to 46.7%) and (17.8% to 35.6%), the same is reflected in the results of the pretest (0.029) and posttest (0.031) reaching a difference of 0.000; while in the experimental group pretest (0.08) and posttest (0.001) reaching a difference of 0.01, less than 0.05

Keywords: Flipped Learning -Scientific Competencies

Introduction

The inverted technique is a pedagogical resource that encourages research for the development of investigative skills. It is the important part in conducting a class. It is teacher driven and student promoted through their own learning styles and paces. They are creative activities, forms and procedures whose purpose is to improve and innovate pedagogical actions; and therefore, the development of learning. The university teacher promotes pedagogical dynamics based on previously designed techniques and strategies. Planning, organization, control, execution and evaluation are dimensions and central components of the defined

strategies of pedagogical and didactic action. The elaboration phase as a defined strategy is based on setting objectives so that the planning of activities is true and practical. University education should promote scientific activities based on teaching practice. In this line, it is a pedagogical strategy of learning investment. It is the innate and innovative commitment that the creative teacher makes in search of the solution to the problem to be investigated. Likewise, the student uses his own resources and strategies as human talent for the execution of tasks with a pedagogical principle based on autonomy. In this regard, from the pedagogical point of view, it is

highly likely to manage investigative skills [1]. In the same way, according to (Sánchez, et al. [2]) refers that study techniques are the strategy, the methodological route that is incorporated into university education to strengthen skills, abilities, and investigative competencies. In this line, university education draws on teaching resources to clarify and enhance research. On the other hand, regarding the development of investigative abilities and skills; According to the United Nations Educational, Scientific and Cultural Organization -UNESCO, it refers to the need to promote research development to generate scientific abilities, skills and competencies [3]. On the other hand, the progressive development of scientific production is familiar with science and technology (R&D). Universities are responsible for promoting and executing research generating scientific skills and competencies in students through their teachers, as reflected in the scientific tenacity of the positive results of highly qualified countries in science and education. However, with the desire to improve the investigative praxis on science, innovations and curricular changes are prioritized, which implies renewing methodologies for educational significance with solid principles and values such as autonomy, creativity and will. That is to say, it is the teachers who articulate change processes influencing the student for their construction of capacities and crystallized intelligence. Having as purpose the formation of scientific thought [4].

In this sense, the existence of the scarce production of scientific articles in the universities of Latin America, especially in Peru, affects the level of learning and development of the student's scientific knowledge. The scientific concomitant is the result of the constant research process and reflects the philosophical academic level and enhances the sense of objectivity and depth [5]. Indeed, the foundation of the inverted technique reinforces the opportunity to exercise active and renewed praxis to direct towards scientific, critical and suggested research. In this order of ideas, the growth of researchers begins with reforms to establish and certify researchers from different universities and scientific communities – as open science. Despite these achievements, four out of five countries continue to allocate less than 1% of their GDP to research, having an impact on scientific development [6]. For his part, the global trend of research in university education is not generated by itself. If not, for reasons of motivation, investment, passion and reflecting the truth. In this panorama, the inverted learning model persists, directing and evading the traditional for the renewed [7-10]. On the other hand, the concept of inverted learning method is interrelated with the pedagogical practice because it develops stages, indications and processes to fulfill them. That is to say, it is a methodological process that channels pedagogical strategies to carry out activities outside the classroom, through the constructivist critical and scientific approach whose basic principles are the assimilation, accommodation and construction

of knowledge through the strengthening of skills. It is also called an inverted classroom or Flipped Classroom model [11-14].

In this line, the flipped learning model has gained importance since 2007 through the contribution of Jonathan Bergmann and Aaron Sams, who wanted to help their students who missed classes and wanted to make their time more efficient; optimize time, for this, students had to carry out educational activities at home: read, study, review information, investigate, and analyze videos. That is, review the thematic contents outside the classroom to resolve certain doubts [15-17]. In this regard, the inverted technique is a learning method. It is the strategy that allows generating investigative skills. Its purpose is to build learning in a different and inverse way. They are processes that involve establishing objectives to capture activities outside the classroom and build learning in an autonomous, critical and reflective way [18]. In relation to scientific competencies, it consists of generating performances, capacities, skills and abilities in adherence to the action research process of the same. That is, it seeks that the student's academic activities generate skills to review platforms and repositories through inquiry through the use of the Internet, review of the syllabus and/or content left in class. On the other hand, it seeks the integration and initiative of the student from the perspective of the environment - outside of classes - strengthening scientific competences in its different dimensions and capacities. That is, the flipped learning model builds active strategies (Aguilera, et al. [19]). In the same way, it is self-regulated, cooperative and elaborative, which breaks traditional schemes and has superior and inferior principles of learning based on Bloom's taxonomy, such as: inquire, create, evaluate, analyze, apply and understand [20].

In this sense, the method: flipped learning is the analytical, critical and reflective process that generates maturity in scientific thought. It is the pedagogical model managed by. In this regard, the organization of united nations [21] has left a global proposal called: a new institutional model for higher education, requiring the active participation of students and leaving aside the mere referential in papers, specks, blackboards, and the routine and traditional application of approaches, models and methods. In this order, there is identification of theoretical and didactic problems that the university professor must consider as analysis. On the other hand, the pandemic problem has cracked the educational sense and research development. In effect, the educational conceptual aspect has taken a turn in the paradigm due to its substantive implications. Well, education is a socio-cultural process of change, where pedagogical phenomena and facts revolve around political interest and the development of science and technology. This means that methodologically it is to energize the teaching strategy to propose greater creativity and ensure interpretive effectiveness, discussion, debate and the clear relevance of expressing crystallized intelligence

to the maximum [22]. Indeed, methodologically it consists of energizing the teaching strategy to offer the student greater creativity and ensure the university method from the perspective of analysis, interpretation, dialogue, discussion, comparison, evaluation of results and establish the clarity of the crystallized intelligence that strengthen the development of scientific skills, as explained, in cognitive training: crystallized intelligence in the learning process [23].

In this scenario, as a learning method it serves to broaden theoretical knowledge and give security to learning in connection with the task activity, and to monitor the syllabus; For this reason, didactically it is an inverted methodological process not developed in the classroom, if not outside of it, being the ability of the student who manages to establish investigative purposes so that he finally systematizes and resolves his doubts. To do this, it must follow clear phases or stages

- a) Task distribution stage according to the content of the syllabus
- b) Activity review stage
- c) Inquiry and investigation stage
- d) Information assimilation and comprehension stage
- e) Analysis stage analysis and questions during class
- f) Evaluation stage.

In this line, the role of the teacher is considered as a producer of content and builder of learning (Abio, et al. [24]). Likewise, the National Superintendence of University Education [25], has identified in the universities of Peru, that there is little research in university students, leading to delays in investigative skills. That is, there is a traditional teaching, and therefore, the production and development of investigative skills do not emerge with greater certainty [26]. On the other hand, according to Peinado (2021) he refers, with the intervention of Sunedu, many universities in the country managed to graduate, having greater possibilities for academic development and research, forming research hotbeds. However, it requires reinforcing the pedagogical character in a collegiate and active way that promotes action research. In this context, according to the QS World University Rankings, carried out in 2021, on research carried out by universities in Peru. The Pontifical Catholic University of Peru leads, followed by the Peruvian University Cayetano Heredia (2nd), Universidad del Pacífico (3rd) and Peruvian University of Applied Sciences (4th). National University of Engineering (5th), but at an international level, it does not reflect results, which is undoubtedly inferred in terms of research and development of scientific skills is scarce (Mirla, et. al. [27]).

On the other hand, the Inter-American Development Bank

(IDB, 2020) in terms of university education conducted a survey that showed 30% of students do not have internet access; 46% of Peruvian university professors report that the internet speed is below the expected average; 24% of teachers develop traditional methodologies. Consequently, a scientifically latent education of several important aspects is evidenced; therefore, the negative effects influence learning [28]. On the other hand, according to Marginson, concludes that public and private universities are vulnerable to the economic and educational crisis caused by the pandemic, reflecting the drop in enrollment up to 20%, desertions and non-payment of up to 30%. However, it has also offered economic opportunities to teachers and students with low pensions. Well, the pandemic has increased the crisis in the country, it has reduced the economy by 40.2% and 16.5% of the economically active population (EAP), especially private companies have been harmed. In this line, the experience carried out at the European University of Madrid, Faculty of Biomedical Sciences, according to Sáez, Viñegla, and Piedad, who carried out the study: An inverted learning experience, in a sample of 20 students, finding satisfactory results. In the beginning, the students are unmotivated, and reluctant to the new methodology, but, to the extent of trust and group motivation, a more adequate active and implicit learning was achieved, especially with the Chemistry course. In the same way, it is concluded from the research carried out at the same University of Madrid, and Physiology I-Medicine courses that demonstrate the use of the methodology, concluding that it is useful to promote autonomous learning and critical thinking. Likewise, students claim to be satisfied with the method. Teachers propose increasing the number of activities in the schedule. On the other hand, Johnson and Renner, experimented, in the US institute, the effectiveness of the method in a sample of 62 students, having an experimental group and a control group. Among the inconveniences found was the lack of interest of the parents in the initiative. No significant differences were found between the pre- and post-test scores of the students who participated and those who did not participate in the Flipped Classroom method, although this is attributed to various biases in the project, such as how reluctant they were in most of the students.

In the same way, what was investigated by Bertolo introduces that the flipped classroom technique is potentially important. It used the type of quasi-experimental research, finding the findings of significant differences in the conceptual, procedural and attitudinal competences reached by the students of the experimental group and the control group. Likewise, the implementation of the pedagogical model of Flipped Learning influenced the achievement of these student competencies. That is, there were significant differences between the pre-test and the post-test in the experimental group with a p. value of 0.000, which accepts the alternate hypothesis and rejects the null. Indeed, according to [29] it reinforces the

conceptual idea that scientific competences are the knowledge or set of knowledge and capacities that results from research. On the other hand, [30] refers that science is the set of scientific knowledge. That is, it is the application of objective knowledge of the real world through the formulation of problems and the generality of hypotheses. In this order, the main objective of the research was to promote the influence of the inverted technique on investigative skills in university students from a University of Peru. Given this context, the study population was the UPN-Lima Norte University, 2022, due to the vast scientific research carried out by undergraduate students. However, the quality and promotion of research does not allow raising investigative skills, and therefore, in developing scientific skills, especially in thesis courses I. Added to this, the teaching methodological practice is presented as an obstacle. That is to say, 68% of the teachers embody traditional didactics with little motivation and an inadequate practice to increase the analysis and interpretation. Moreover, learning that raises investigative skills is not generated. Regarding the study sample, there were 90 postgraduate students in a master's degree in criminal procedural law and a master 's degree in Education Administration defined by a non-stratified sampling for convenience.

Methodology

The study was quasi-experimental, of an applied type. It had as a sample 90 administration students (GE=45) classroom C, Thesis course -I, and Accounting (GC=45) classroom B, Thesis course and was randomly selected. Initially, a pre-test and a post-test were applied to both groups simultaneously. The (GE) actively participated in the method learning sessions: inverted learning according to the proposed objective and the (GC) did not participate. That is, the traditional class was continued. At the end of the semester, both groups were administered the post test. Regarding the pedagogical method of flipped learning, it was implemented, planned, designed according to the objective of the investigation in 12 sessions and 12 questionnaires that were the measurement instruments (pre and posttest). Finally, the Spss was processed to compare the results of both groups, making hypothesis test measurements. The corresponding scheme is:

GE 01 X 02

GC 03 - 04

WHERE:

- GE= experimental group
- GC= Control Group

- OR = Students
- 01= Pre-test applied to the experimental group
- 02= Post-test applied to the experimental group
- X=Method: reversed learning
- 03=Pre-test applied to the control group
- 04= Post-test applied to the control group

Discussion of Results

From the study population, two sample groups were organized with their own characteristics to establish the objective of the research to promote how the technique invested in investigative skills at a university in Peru. For this, questionnaire instruments (pre and posttest) were applied. Initially, a pre-test and a post-test were applied simultaneously to both groups. He (GE) actively participated in 12 reverse technique sessions, according to the proposed objective. He (GC) did not participate, the traditional class was continued. At the end of the semester, both groups were administered the post test. Regarding the pedagogical method of flipped learning, it was implemented, planned, designed according to the objective of the investigation in 12 sessions and 10 questionnaires that were the measurement instruments (pre and posttest). Finally, the Spss was processed to compare the results of both groups, making hypothesis test measurements. Regarding the study, it was of a quasi- experimental type, it had 90 administration students (GE=45), classroom C, Thesis-I, and Accounting (GC=45), classroom B Figure 1. Thesis. The results showed levels of the control group at the start level of the pre-test of 57.8% and post-test of 51.1%, reflecting a relative decrease. Process level in pretest 31.1% posttest of 33.3% relative increase; and in the level achieved in the pre-test, 11.1% and 15.6% average increase. Regarding the experimental group, the averages at the beginning of the pre-test are 48.9%, and 17.8% post-test, evidencing a significant decrease. In process 33.3%, and 46.7% reflecting a significant increase and level of achievement in pre-test 17.8% and 35.6% a significant increase. Likewise, favorable results are evidenced for the process and achievement levels; the percentages rise significantly from 33.3% to 46.7% and the level of achievement from 17.8% to 35.6%, which shows the existence of a favorable influence in the application of the inverted technique on the investigative skills of university students of a university in Peru. That is, it is significant in the pre-test 0.029 and in the post-test, it is 0.031, reaching a difference of 0.000; while in the experimental group in the pre-test it is 0.08 and in the post-test 0.001 reaching a difference of 0.01, less than 0.05. As shown in Table 1.

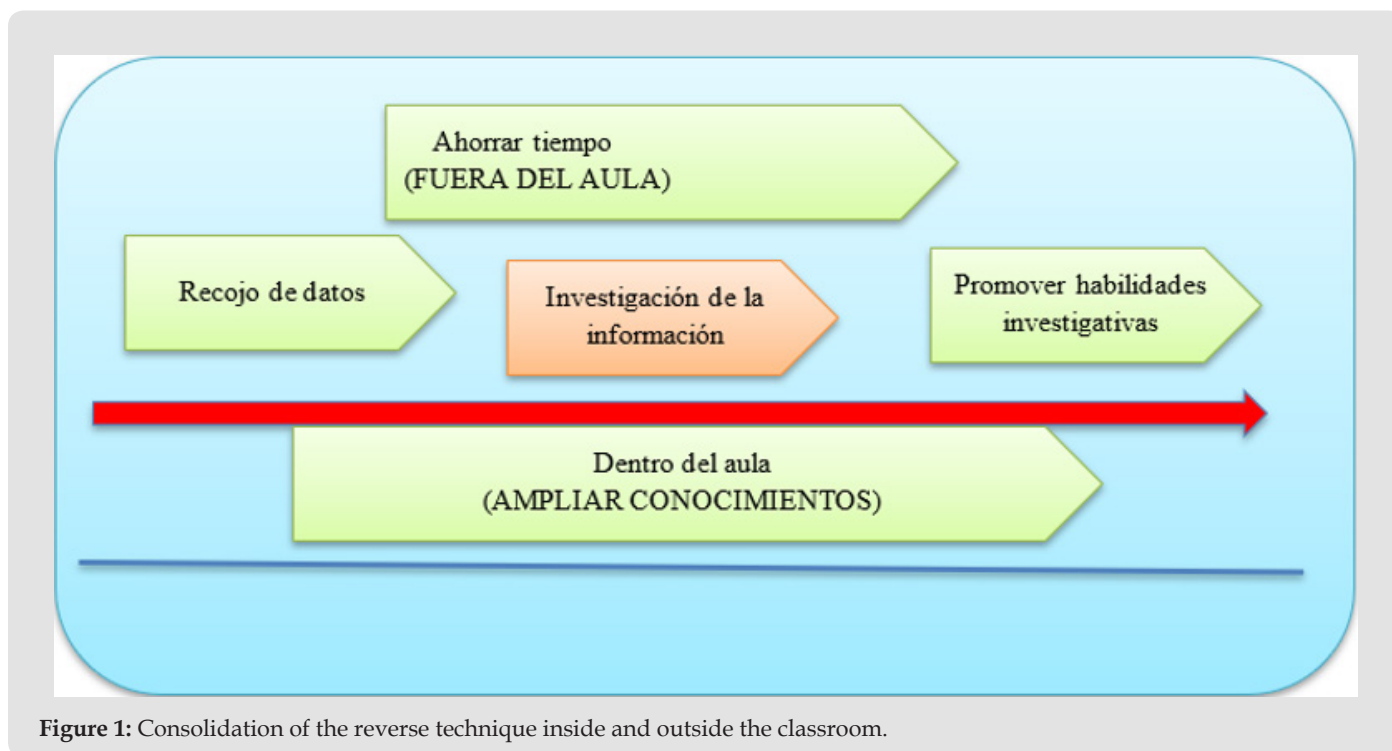


Figure 1: Consolidation of the reverse technique inside and outside the classroom.

Table 1: Investigative skill levels of university students.

Investigative Skill Levels	Groups							
	Control				Experimental			
	Pretest		post test		Pretest		post test	
	Alum.	%	Alum.	%	Alum.	%	Alum.	%
Start	26	57.8	23	51.1	22	48.9	8	17.8
Process	14	31.1	fifteen	33.3	fifteen	33.3	twenty-one	46.7
Accomplished	5	11.1	7	15.6	8	17.8	16	35.6
Total	Four. Five	100	Four. Five	100	Four. Five	100	Four. Five	100

On the other hand, the results coincide with those investigated by [31] in which reverse learning refers to a new alternative to investigate and develop scientific knowledge, therefore it is relevant to configure its usefulness for didactics. In the same way, when comparing with what was investigated by López and Maneau, it is induced that investigative skills are research chains that are acquired with autonomy and attitude to investigate. What resolves the described panorama to generate interest for the investigation. Also, it yielded 53.3% of the control group at the starting level of the pretest and 48.9% posttest, reflecting a relative decrease. At the process level of the pretest 37.8% and posttest 35.6% a relative increase. On the other hand, at the level achieved in the pre-test, it showed an average significant increase of 8.9% and 15.6%. While, for the experimental group, the averages at the beginning of the pre-test are 46.7%, and 11.1% post-test, evidencing a very significant decrease. Regarding the level of process, 40.0% and 48.9% reflecting

a significant increase and for the level of achievement in pre-test 13.3% and 40.0% a high significant increase. In the same way, the results allow us to demonstrate the level of significant influence of the Method: invested learning in terms of its dimensions, scientific inquiry, and project execution, being significant, since we must interpret the p-value «Sig.Asyntotica (bilateral)» = 0.000 < 0.05.

Results also coincide with what was investigated by: [31], understanding scientific knowledge as the basis of science. On the other hand, the results establish foundations and relevant contributions of the constructivist and scientific theory proposed by: (Abio, et al. [32]). This reaffirms the theoretical construction and the significant contribution to the nature of research through pedagogical innovation. Regarding the dimensions: scientific knowledge and attitude towards the course, the p-value «Sig. Asymptotic (bilateral)» = 0.000 < 0.05. That is, it is significant.

Results that also coincide with those investigated by: [33] and keep contributions to solve the problem, in terms of the theoretical foundations on scientific competences referring to the set of abilities and skills to increase scientific knowledge, explained by: [34-36].

Conclusion

- a) The inverted technique influences the development of investigative skills in university students at a significance level $\alpha = 0.05$ at 95%.
- b) Regarding the sessions developed, the need to solve previous procedures of the inverse technique was evidenced, such as knowing how to investigate and review scientific-based information to analyze and interpret information constructs.
- c) In the same way, it is significant to instill in the student the application of the reverse technique as a procedure and strategy assumed for the strengthening of research from different forms - review of repositories and virtual platforms structuring the times to read research outside the classroom, execute projects, ask questions and formulate hypotheses to consolidate the tasks left in the classroom.
- d) On the other hand, regarding the development of investigative skills, 57.8% showed levels in the control group at the beginning of the pretest and 51.1% posttest, reflecting a relative decrease and in the level of the process in the pretest the 31.1% and posttest 33.3% evidencing a relative increase.
- e) Similarly for the level achieved in the pre-test, 11.1% and 15.6%. For the experimental group, the averages at the beginning of the pre-test showed 48.9%, and post-test 17.8%, evidencing a significant decrease. Regarding the process, 33.3%, and 46.7% reflecting a significant increase.
- f) Pretest 17.8% and 35.6% a significant increase. Which shows favorable results for the levels of process and achievement. That is, the percentages rise significantly from 33.3% to 46.7%. This shows that the activities and tasks left by the teachers are critically developed outside the classroom so that it is finally integrated and consolidated in presentations and debates by the students.
- g) It is pertinent to clarify that the method: flipped learning influences the development of scientific skills in postgraduate students; For this, it must improve the methodological aspect and strengthen the research seedbeds.

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