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System Thinking and System Dynamics Simulation of Sustainable Human Resource Management In Culinary Msmes In West Java, Indonesia

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ABSTRACT

Research training remains a challenge in university economics programs, particularly in peripheral regions with limited academic resources. This study analyzes the association between active methodologies and research competence among final-year economics students at a public university in the Peruvian Amazon. A quantitative, correlational, cross-sectional design was used. A structured questionnaire measuring the use of active methodologies and four research competencies, problem formulation, methodological management, data analysis and communication of results) was administered to 178 students, selected by stratified probability sampling from a population of 331, 95% confidence level, 5% margin of error. Data were analyzed in SPSS v. 26 with descriptive statistics and Spearman's rank correlation. Project-based learning showed the highest share of students at the efficient level 50.0% and the flipped classroom the lowest 38.8%. Among research competencies, communication of results had the highest share at the efficient level 47.8% and data analysis the lowest 38.8%; problem formulation had the highest share at the deficient level 15.2%. Active methodologies were positively and significantly associated with every research competence dimension $\rho = 0.429–0.524$ and with overall research competence $\rho = 0.569$; $p < 0.01$. Because of the cross-sectional design, these associations cannot be read as causal effects. The findings point to applied data-analysis workshops and problem-formulation laboratories as priorities for strengthening research-based education in economics programs in the Amazon region.

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Active Methodologies; Research Competence; Economics Education; Research-Based Education; Peruvian Amazon.

1. Introduction

Over recent decades, universities have faced the challenge of moving from teaching models centered on passive transmission toward approaches that promote active student participation. Active methodologies such as problem-based learning, project-based learning, collaborative work and the flipped classroom have become established alternatives that foster critical thinking, autonomy and the practical application of knowledge in real contexts (Røe et al., 2022). They also integrate the digital dimension, encourage the collective construction of knowledge and align with the demands of the twenty-first century for sustainable, interdisciplinary and research-oriented learning (Watters, 2014). Arcos-Alonso and Arcos Alonso (2021) likewise highlight the potential of methodologies that make students and teachers jointly responsible for generating knowledge, favoring professional development that is sensitive to changes in the social and labor world. Recognizing different learning styles and encouraging students to analyze problems from multiple perspectives widens opportunities for diverse, inclusive and meaningful learning experiences, which contributes to stronger, context-relevant research competencies (Polo Escobar et al., 2022).

In economics education, these methodologies have been reported to improve students' analytical capacity, problem solving and conceptual synthesis, which are essential for professional development (Alonso et al., 2022). Nevertheless, challenges persist: economics teaching is still marked by lecture-based models, with students who play a passive role and who often struggle with research and scientific

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production tasks (Sekwena, 2023). Developing authentic competencies in higher education requires transforming teaching practices toward the alignment of learning outcomes, instructional activities, and assessment, while fostering meaningful and active student learning (Biggs & Tang, 2011). Teachers must not only master what and how to teach but also understand their role as active agents in building and transforming knowledge in a changing society (Jara, 2025).

Recent literature emphasizes that the impact of active methodologies is not limited to conceptual learning but also strengthens key research competencies such as problem formulation, methodological management, data analysis and scientific communication (Canavesi & Ravarini, 2024). Meta-analytic evidence shows that active learning improves student performance compared with traditional lecturing (Freeman et al., 2014). Nevertheless, economics education has historically remained dominated by "chalk-and-talk" instruction, with relatively limited adoption of active and student-centered methodologies (Becker & Watts, 2001; Allgood et al., 2015). However, evidence remains limited on the use of active methodologies in university economics programs within multicultural contexts such as the Amazon region, particularly regarding their relationship with students' research competence.

In this study, active methodologies are understood as student-centered teaching approaches that promote active participation through problem solving, collaborative work, discussion, and other practice-oriented strategies (Idoiaga Mondragon et al., 2024). Research competence refers to the integrated capacity to formulate research problems, apply methodological procedures, analyze and interpret data, and communicate research findings (Ríos Cabrera et al., 2023). From this perspective, research-based education strengthens the connection between teaching and research by engaging students in inquiry and research-oriented activities (Healey & Jenkins, 2009).

The competency-based approach, inspired by the Bologna Declaration, promotes curricula oriented toward modernizing teaching and learning, with continuous and flexible training centered on the student and on the integral development of competencies (Romero et al., 2024). Reading, in turn, is not only a means of acquiring knowledge but an essential practice for strengthening critical thinking, which is indispensable in research training (Mejía et al., 2015). Students who adopt a deep approach to learning and hold a positive view of their future show greater academic persistence than those with a surface approach and negative expectations; since learning approaches can be transformed through teaching practice, active methodologies that promote deep learning are pertinent as a strategy to prevent student dropout (Zamora et al., 2020). Teacher training also strengthens teaching practices and has a multiplier effect on student learning (Gibbs & Coffey, 2004).

In this context, it is necessary to assess how active methodologies can foster research competence in economics students, helping to close the gap between academic training and the research demands of the global environment. The general objective of this study is to analyze the relationship between the application of active methodologies and the strengthening of research competencies in final-year economics students at a public university in the Amazon region. The specific objectives are: (SO1) to identify the active methodologies applied in the training of economics students; (SO2) to assess the level of their research competencies (problem formulation, methodological management, data analysis and communication of results); (SO3) to determine the relationship between the application of active methodologies and the development of these competencies; and (SO4) to derive pedagogical implications for strengthening research training in economics programs in the Amazonian context. Based on the literature, we hypothesize that H1: the application of active methodologies is positively associated with overall research competence; and H2: it is positively associated with each of its dimensions.

2. Materials and Methods

2.1 Study Design

This study adopted a quantitative, nonexperimental, correlational, and cross-sectional design to examine the relationship between the use of active methodologies and the development of research competencies at a specific point in the educational process. This design is appropriate for analyzing associations between variables without experimental manipulation and for examining the phenomenon within a defined period (Creswell & Guetterman, 2019; Ogbonna, 2024).

2.2 Participants and Sampling

Participants were selected through stratified probability sampling, using the academic cycle as the stratification criterion. The sample was proportionally allocated according to the number of students enrolled in each cycle, and participants within each stratum were randomly selected (Pérez-Tejada, 1998).

2.3 Data and Variables

The population consisted of 331 students enrolled in the final four academic cycles of the Economics program at a public university in the Amazonas region. The sample size was estimated using the finite-population formula for proportions, with a 95%

confidence level (Z = 1.96), a 5% margin of error, and p = q = 0.5, resulting in a sample of 178 students. Stratified probability sampling was applied using the academic cycle as the stratification criterion. The population was distributed across cycles VII (n = 86), VIII (n = 84), IX (n = 82), and X (n = 79), with proportional sample allocations of 46, 45, 44, and 43 students, respectively. Participants within each stratum were randomly selected. Students enrolled in the last two years of the program were eligible, whereas those without current enrollment or who did not provide informed consent were excluded.

Data were collected with a structured questionnaire administered in person and online. The first section assessed the frequency of use of active methodologies: problem-based learning, project-based learning, flipped classroom, collaborative work and debates. The second section assessed research competence through 20 items evenly distributed across four dimensions: problem formulation, methodological management, data analysis, and communication of results. Responses were rated on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree), with higher scores reflecting greater research competence. Responses were classified into three levels (efficient, regular and deficient). Content validity was ensured through the judgment of three experts in research methodology and university pedagogy. A pilot test with 30 students then yielded a Cronbach's alpha above 0.80, considered adequate for research purposes (Nunnally & Bernstein, 1994).

2.4 Data Preparation and Analysis

Data were processed with SPSS (v. 26). A descriptive analysis of frequencies, means and standard deviations was carried out first. Normality tests were then applied and, because the variables are ordinal and did not meet the normality assumption, Spearman's rank correlation coefficient was used to determine the relationship between the use of active methodologies and the development of research competencies (Ñaupas et al., 2018). Two-tailed tests were used, and approximate 95% confidence intervals were obtained with the Fisher z-transformation. To support reproducibility, the questionnaire and the anonymized dataset are described in the Data Availability Statement.

2.5 Ethical Considerations

The study was institutionally authorized and classified as minimal risk; therefore, formal ethics committee approval was not required. Participation was voluntary, informed consent was obtained, and confidentiality and anonymity were ensured.

3. Results

The results are presented in the order of the specific objectives.

3.1 Active Methodologies Applied (SO1)

Figure 1 shows the distribution of the level at which active methodologies are applied (n = 178). Project-based learning stood out, with the highest share of students at the efficient level (50.0%; n = 89), followed by collaborative work (45.5%; n = 81) and the use of ICT and digital tools (44.4%; n = 79). Academic debates (40.4%; n = 72) and the flipped classroom (38.8%; n = 69) had the lowest shares at the efficient level; in both cases the regular level was the most frequent (46.6% and 47.8%, respectively), which suggests that their integration in the training process is not yet systematic. Collaborative work had the highest share at the deficient level (16.9%; n = 30), whereas project-based learning had the lowest (10.7%; n = 19). Possible explanations, such as limited teacher training, scarce digital resources or resistance to changing traditional structures, were not measured in this study and are discussed in Section 4 as hypotheses.

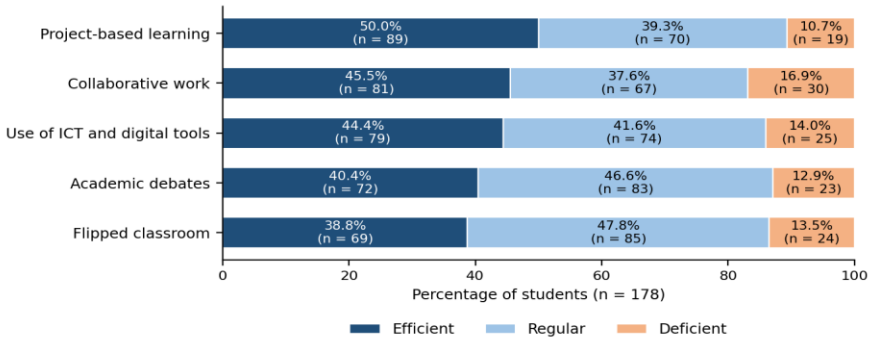


Figure 1. Level of application of active methodologies among economics students (n = 178). Percentages and number of students (n) by level: efficient, regular and deficient.

3.2 Research Competencies (SO2)

Figure 2 summarizes the level of research competencies. Communication of results had the highest share of students at the efficient level (47.8%; n = 85), followed by problem formulation (44.9%; n = 80), methodological management (39.9%; n = 71) and data analysis (38.8%; n = 69). In no dimension did more than half of the students reach the efficient level. Problem formulation combined 39.9% of students at the regular level (n = 71) and the highest share at the deficient level (15.2%; n = 27), which points to gaps in the precision and depth with which research questions are formulated. In methodological management, half of the students (50.0%; n = 89) were at the regular level and 10.1% (n = 18) at the deficient level, which suggests a general command of methodological tools but a need to strengthen their practical application and rigor in research design. Data analysis was the weakest dimension: 48.9% (n = 87) were at the regular level and 12.4% (n = 22) at the deficient level, which indicates limitations in interpreting and processing quantitative information, a core competency for economists with a research orientation. Finally, communication of results was the most consolidated dimension, with 40.4% (n = 72) at the regular level and 11.8% (n = 21) at the deficient level.

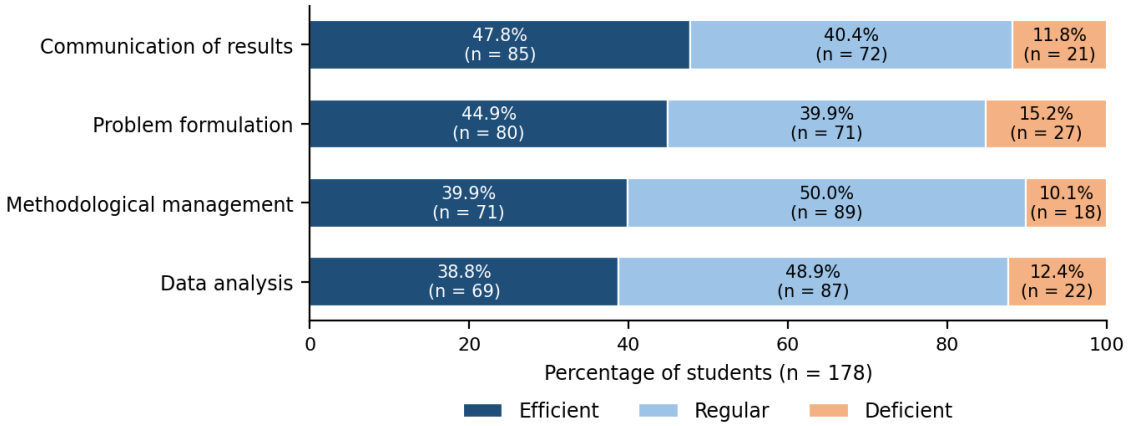


Figure 2. Level of research competencies among economics students (n = 178). Percentages and number of students (n) by level: efficient, regular and deficient.

3.3 Relationship between Active Methodologies and Research Competencies (SO3)

Spearman's correlation analysis showed positive and significant associations between the application of active methodologies and all dimensions of research competence (Table 1). The coefficients were moderate in magnitude: problem formulation (ρ = 0.481), scientific information review and analysis (ρ = 0.498), methodological design and data collection (ρ = 0.429), and results analysis and interpretation (ρ = 0.524). The association with overall research competence was ρ = 0.569 ($p < 0.01$ in all cases). These associations indicate that students who report a more effective application of active methodologies also tend to show higher research competence; they do not allow causal inference.

Table 1. Spearman's rank correlation between the application of active methodologies and research competence (n = 178).

Research competence dimension	Spearman's ρ	95% CI (approx.)	Sig. (two-tailed)	n
Problem formulation	0.481**	[0.352, 0.592]	0.000	178
Scientific information review and analysis	0.498**	[0.371, 0.607]	0.000	178
Methodological design and data collection	0.429**	[0.293, 0.548]	0.000	178
Results analysis and interpretation	0.524**	[0.401, 0.628]	0.001	178
Overall research competence	0.569**	[0.453, 0.666]	0.000	178

Source: Fieldwork data (2025), processed in SPSS v. 26. ** Correlation is significant at the 0.01 level (two-tailed). 95% confidence intervals are approximate (Fisher z-transformation).

4. Discussion

The findings show that active methodologies are positively associated with research competence among economics students at a public Amazonian university, particularly in a peripheral context. Regarding the first objective, project-based learning and collaborative work showed the highest shares of efficient application, whereas the flipped classroom and academic debates showed the lowest. This is consistent with Røe et al. (2022), who argue that active pedagogies tend to consolidate first in traditional group dynamics before evolving toward models that demand deeper changes in teaching practice.

Regarding the second objective, the profile of research competencies showed that communication of results was the strongest dimension and data analysis the weakest, while problem formulation concentrated the largest share of students at the deficient level. No dimension had more than half of the students at the efficient level. These findings are in line with Canavesi and Ravarini (2024), who note that active methodologies strengthen not only conceptual understanding but also research competencies. The weakness in data analysis is consistent with Sekwena (2023), who points to the persistence of lecture-based teaching in economics and the limited practice of empirical research. Polo Escobar et al. (2022) add that methodologies that consider the diversity of learning styles favor more inclusive and meaningful educational experiences, widening opportunities to consolidate stronger research competencies.

The third objective showed positive and significant associations between active methodologies and research competence, particularly high for results analysis and interpretation ($\rho = 0.524$) and for overall research competence ($\rho = 0.569$). A plausible interpretation, to be tested in future designs, is that active methodologies create conditions for higher-order cognitive processes in the training of critical and autonomous economists. This is consistent with Arcos-Alonso and Arcos Alonso (2021), who underline that shared responsibility between students and teachers fosters professional development sensitive to social and labor changes. Zamora et al. (2020) show that deep approaches to learning increase academic persistence; because our study did not measure persistence or dropout, this link remains a line for future research.

These associations should be interpreted with caution. Reverse causality is possible (students with greater research competence may engage more in active learning tasks), both variables were self-reported, which may inflate the association through common-method bias, and the analysis did not control for covariates such as sex, cycle, age or academic performance.

From a broader perspective, these findings coincide with the view of Biggs and Tang (2011), who argue that meaningful learning depends on aligning learning outcomes, teaching activities and assessment; active methodologies may help to achieve this alignment in research training. In the same direction, Jara (2025) stresses that teachers must understand their role as active agents of change, able to generate learning experiences that go beyond the simple transmission of content, and Gibbs and Coffey (2004) show that teacher training has a multiplier effect, improving both teaching practices and student learning.

From a territorial perspective, the results suggest that Amazonian universities could move beyond the lecture-based model toward teaching that promotes research competencies relevant to the local and global context. If the use of active methodologies is sustained and linked to local research problems, it could contribute to more inclusive, critical education and to reducing gaps in historically neglected contexts; these potential implications were not measured in this study and should be tested in future research.

Practical implications (SO4). Based on the findings, the following measures are proposed: (1) integrate active methodologies systematically into the curriculum, especially project-based learning, problem-based learning and the flipped classroom, linked to real Amazonian problems (project-based learning showed the highest efficient application, while the flipped classroom and debates are less consolidated); (2) strengthen data analysis, the weakest dimension, with applied workshops using regional databases, statistical software and local research cases; (3) strengthen problem formulation, which concentrated the highest share at the deficient level, through idea laboratories where students debate and refine research questions under the guidance of experienced teachers and researchers; (4) foster scientific communication through research seedbeds, student congresses and local academic journals; (5) use interculturality and territory as pedagogical input by incorporating Amazonian issues into research projects; and (6) provide continuous pedagogical and digital training to faculty, with emphasis on active methodologies and research tools. These are the authors' proposals derived from the results and have not been empirically tested.

This study has limitations. First, the cross-sectional design does not allow causal inference, which suggests the need for longitudinal or experimental studies. Second, the study was limited to a single university, so the findings are not generalizable; future research should include inter-institutional and regional comparisons. Third, the self-reported questionnaires may have introduced bias, so complementing them with mixed methods is advisable. Fourth, the levels of application and competence are ordinal categories and the analysis did not include control variables. Future studies could also explore emerging variables such as digital transformation and interculturality in the consolidation of research competencies. Despite these limitations, this study contributes empirical evidence on the relationship between active methodologies and research competence in economics education within an underrepresented Amazonian university context. Its social relevance lies in providing evidence to strengthen research training, promote more equitable educational

opportunities, and reduce territorial gaps in the development of research capacities among university students.

5. Conclusion

This study analyzed the relationship between the application of active methodologies and research competence in final-year economics students at a public university in the Amazon region. Active methodologies were positively and significantly associated with problem formulation, methodological design, data analysis and results interpretation, and with overall research competence ($\rho = 0.429$–0.569; $p < 0.01$). Project-based learning and collaborative work showed the highest levels of efficient application, while the flipped classroom and academic debates remain less consolidated. Research competencies were more consolidated in communication of results and weaker in data analysis, and problem formulation concentrated the highest share of students at the deficient level.

These findings suggest reorienting pedagogical practices toward consolidating critical competencies, particularly data analysis and problem formulation, and integrating digital transformation and interculturality into training processes. Future research should consider longitudinal, quasi-experimental and comparative designs across programs and regions of the country that allow the relationships observed here to be examined in greater depth.

Overall, the evidence supports the pertinence of embedding active methodologies in economics programs as a path toward research-based education in the Amazon region, while stressing that the associations observed are correlational and not evidence of causal effects.

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Author Contributions

Conceptualization, B.R.P.E.; methodology, B.R.P.E. and P.E.O.; software, R.W.O.A.; validation, B.R.P.E.; writing—original draft preparation, P.E.O.; writing—review and editing, B.R.P.E. and P.E.O.; visualization, M.T.F.L.; supervision, B.R.P.E.; project administration, B.R.P.E. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

The study was institutionally authorized in 2025. Given its noninterventional and minimal-risk nature, formal ethics committee approval was not required under the institution's applicable procedures.

Data Availability Statement

The anonymized dataset and questionnaire used in this study are available from the corresponding author upon reasonable request at benjamin.polo@untrm.edu.pe.

Use of Artificial Intelligence Tools

Artificial intelligence tools were used only to support the linguistic refinement and translation of selected passages; all outputs were reviewed and approved by the authors.

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Conflicts of Interest

The authors declare no conflicts of interest.