

Data Analysis

1 Quantitative Analysis

Responses obtained through the structured interviews (closed questions) were organized by cohort (2022, 2023, and 2024) and coded according to the defined response options for each item. A manual count of responses per alternative was conducted, calculating absolute and relative frequencies (percentages) for each question and cohort, as declared in the study.

2 Qualitative Analysis

The qualitative component of the study was developed as a pedagogical interpretation of the quantitative patterns obtained through frequency analysis of the interview responses, articulating these results with the theoretical framework supporting theory–practice integration and ICT-mediated learning in engineering education. The discussion aimed to explain the educational meaning of the observed trends (e.g., perceived usefulness of the virtual laboratory and simulation) in relation to the formative purposes of the didactic design, rather than conducting a content analysis by coding. Nonetheless, a methodological limitation is acknowledged: the absence of open-ended questions or systematic narrative records, which restricts deeper exploration of nuances, arguments, and individual experiences that could complement the understanding of the studied phenomenon.

3 Simulation Results Analysis

The simulation results in the proposed Scilab software were analyzed based on the numerical and graphical outputs generated by the application for each virtual laboratory variant, such as curves and comparative indicators. These results were used as evidence of system behavior under the defined scenarios and as support to discuss the theory–practice linkage promoted in the course.

4 Methodological Triangulation

Triangulation was based on:

- Simulation results with Scilab (evidence of technical performance and scenario analysis)
- Structured interviews (perceived usefulness and achievement)
- Methodological meetings reported to agree on exercises and didactic guidelines

This integration supports inferences about the improvement of the teaching–learning process by linking intervention evidence (simulation/scenarios) with student evaluation evidence and faculty implementation decisions.

