From problem to project: A hybrid Problem-Based Learning (PBL) combined with Project-Based Learning (PjBL) intervention in graphic design teaching

Del problema al proyecto: Una intervención híbrida de Aprendizaje Basado en Problemas (PBL) con el Aprendizaje Basado en Proyectos (PjBL) en la enseñanza del diseño gráfico

http://doi.org/10.17981/cultedusoc.17.1.2026.6822

Received: November 7, 2025. Accepted: January 12, 2026.

Idania Dorta-Rodríguez
Universidad Militar Nueva Granada. Cajicá (Colombia)
idania.dorta@unimilitar.edu.co

Juan J. Cabello-Eras
Universidad de Córdoba. Cordoba (Colombia)
juancabelloe@correo.unicordoba.edu.co

Alexis Sagastume-Gutiérrez
Universidad Militar Nueva Granada. Cajicá (Colombia)
alexis.sagastume@unimiliatr.edu.co

How to cite this article: Dorta-Rodríguez, I. Cabello-Eras, J.J. Sagastume-Gutiérrez, A. (2026). From problem to project: A hybrid Problem-Based Learning (PBL) combined with Project-Based Learning (PjBL) intervention in graphic design teaching. Cultura Educación y Sociedad, 17(1), e6822. http:// doi.org/10.17981/cultedusoc.17.1.2026.6822

Abstract

Introduction: Traditional pedagogy in graphic design education usually lacks the experiential and reflexive dimensions of learning. To address these shortcomings, a sequential implementation of Problem-Based Learning (PBL) combined with Project-Based Learning (PjBL), that articulates problem framing and inquiry with iterative critique and structured production can be useful. **Objective**: To analyze the effects of learning from the hybrid PBL-PjBL implementation and the impact on students' self-perceptions of motivation, process management, and technical self-efficacy. **Methodology**: A quantitative, quasi-experimental study, with pre-test (i.e., a baseline) and post-test measures, was implemented. The study took place in six undergraduate first-year sections of the same graphic design course with 126 students. Sections A-B, defined as control, were instructed with the traditional pedagogy. Moreover, sections C to F, defined as Hybrid, followed the sequential implementation of PBL–PjBL. A dual-rubric (6-30 scale) and a questionnaire (i.e., a 10-item self-report with a 1-5 scale) were used for pre- and post-scoring. **Results**: After adjusting for baseline performance, the hybrid sections resulted in better and more consistent performance on both rubrics and on the questionnaire (i.e., higher means and smaller dispersion) as contrasted to the control. **Conclusions**: In graphic design, combining instructional mediation with multidimensional assessment is a cornerstone for the students' learning process. This highlights the significance of the sequential PBL–PjBL application.

Keywords: Problem-Based Learning, Project-Based Learning; graphic design; pedagogy; student-centered learning; educational innovation.

Resumen

Introducción: La pedagogía tradicional en el diseño gráfico usualmente carece de las dimensiones experienciales y reflexivas del aprendizaje. Para abordar estas deficiencias, puede ser útil una implementación secuencial del Aprendizaje Basado en Problemas (PBL), con el Aprendizaje Basado en Proyectos (PjBL), que articulen el planteamiento de problemas y la indagación con la crítica iterativa y la producción estructurada. **Objetivo**: Analizar los efectos en el aprendizaje de la implementación de un modelo híbrido PBL-PjBL y el impacto en las autopercepciones de los estudiantes sobre la motivación, la gestión de procesos y la autoeficacia técnica. **Metodología**: Se implementó un estudio cuantitativo, cuasiexperimental, con medidas preimplementación (de línea base) y postimplementación. El estudio se llevó a cabo con 126 estudiantes distribuidos en seis grupos de primer año de pregrado del mismo curso de diseño gráfico. Los grupos A-B, definidos como control, recibieron la pedagogía tradicional, mientras que en las secciones C a F, definidas como híbridas, se implement**ó** el enfoque híbrido. Para la calificación pre y post se utiliz**ó** un sistema de doble rúbrica (escala de 6 a 30) y un cuestionario (un autoinforme de 10 ítems con una escala de 1 a 5). **Resultados**: Después de ajustar al desempeño de línea base, las secciones híbridas resultaron en un desempeño mejor y más consistente tanto en las rúbricas como en el cuestionario (medias más altas y menor dispersión) en comparación con los grupos de control. **Conclusiones:** Combinar la mediación instruccional con la evaluación multidimensional en diseño gráfico es fundamental para el proceso de aprendizaje del estudiante. Esto subraya la importancia de la aplicación híbrida del aprendizaje basado en problemas y basado en proyectos.

Palabras clave: Aprendizaje Basado en Problemas; Aprendizaje Basado en Proyectos; diseño gráfico, pedagogía; aprendizaje centrado en el estudiante; innovación educativa.

© The author; licensee Universidad de la Costa - CUC.
Cultura Educación y Sociedad vol. 17 no. 1, pp. e6822. January - June, 2026
Barranquilla. ISSN 2389-7724 Online

INTRODUCTION

Graphic Designers rely heavily on critical and creative thinking to communicate information effectively to a diverse audience. Consequently, graphic designers need to have higher-order cognitive competencies, such as analysis and synthesis, alongside their technical proficiency and mastery of design tools. Such a balance is reflected in the degree of harmonization between the application of conceptual knowledge, such as media theory or semiotics, and concrete design tools, such as typography or color theory. Harmonizing conceptual knowledge and design tools raises a challenge for students in their quest to acquire competencies in message formulation and technical execution (Frascara, 2004; Oo et al., 2025). On the other hand, there is a need for a hands-on experiential dimension, often absent from traditional pedagogy, to effectively promote creativity and innovation through practical applications in graphic design students (Alhajri, 2016; Ferns et al., 2025).

Problem-based learning (PBL) is a student-centered pedagogy in which educators shift from their traditional role as knowledge providers to knowledge facilitators, thereby transferring to students a more proactive role in their learning (Savery, 2019). PBL pedagogy, as a self-directed learning, sets students to address open-ended problems, compelling them to improve their analysis, critical thinking, and interdisciplinary approach (Esparza et al., 2021; Savery, 2006). Graphic design is a disciplinary and curricular domain targeting the intentional conception, organization, and realization of visual messages to inform, persuade, and shape thought or behavior for specific audiences and contexts (O'Shea, 2024). Therefore, graphic design students need to engage in problem framing, interpretation, iteration, and communication-oriented decision-making, which underscores the need for pedagogical approaches to knowing and making that align with pedagogies centered on inquiry, situated action, and reflective practice.

In this view, active methodologies are conceived as mediating strategies that support knowledge construction through authentic problems, collaboration, and iterative solution development. Accordingly, when addressing open-ended problems, PBL increases motivation, enhances problem definition, and improves solution visualization, making it a relevant pedagogy for graphic design (Avcı & Durak, 2025). Furthermore, by maintaining cognitive uncertainty, PBL fosters critical thinking (Ulger, 2018). As a more holistic approach, PBL increases motivation, engagement, and real-world skills compared to traditional pedagogy (Almulla, 2020), thereby closing the gap between academic education and professional practice (Pertiwi et al., 2024).

Moreover, project-based learning (PjBL) promotes extended inquiry and tangible outcomes in the resolution of real-world problems (Bell, 2010; Hananto, 2024). Compared with traditional pedagogy, PjBL fosters a deeper understanding of practical applications (Mutanga, 2024), while its iterative nature aligns naturally with graphic design teaching (Meron, 2021). Like PBL, PjBL also fosters creativity, collaboration, critical thinking, and technical proficiency (Indriati et al., 2024; Rohmaniyah & Asih, 2024). Some studies report that PBL increases motivation, creativity, technical execution, and professional readiness among graphic design students (Adzra et al., 2024; Barus et al., 2023; Farizi et al., 2020; Hananto, 2024). Finally, PjBL strengthens students' essential problem-solving skills (Ning, 2025; Sumantri et al., 2022).

In a more dynamic and technology-driven context, PjBL represents a holistic pedagogy for graphic design education (Duong & Nguyen, 2024) and has gained relevance in higher education as an effective learning approach (Gula et al., 2023). Didactically, PjBL implies developing courses around iterative projects (briefing-researching-ideation-prototyping-testing-refining) supported in clear milestones and checkpoints, where evidence and graphic deliverables are assessed with analytic rubrics. Likewise, PjBL encourages the integration of contemporary digital workflows (collaborative platforms, prototyping and production tools, etc.) and the production of transferable outputs like portfolios that align academic learning with professional design practices. In this context, professors shift from content transmitters to coaching, facilitating inquiry, guiding tool use, and giving formative feedback based on analytic rubrics.

By and large, to stop equating software mastery with creativity, graphic design education must evolve from traditional lecture-based teaching to a combination of theory with hands-on practice instruction (Dongfang & Leizhen, 2021). In fact, graphic design education can be improved with the application of problem and research-based teaching (Toure & Tomc, 2022). Consequently, a sequential implementation of PBL–PjBL (hybrid PBL–PjBL from here on) to connect problem framing with iterative design can improve the learning process in graphic design teaching (Husin et al., 2025; Rodriguez-Sanchez et al., 2024). Sequencing the implementation of the hybrid PBL–PjBL assigns complementary functions to each pedagogy (i.e., PBL and PjBL). On the one hand, PBL supports inquiry and criteria building in ill-structured design problems. On the other hand, PjBL operationalizes the previous criteria through prototyping, testing, and delivery.

The hybrid PBL–PjBL implementation requires phase-specific milestones, critique checkpoints, and a multidimensional evaluation framework to assess process evidence and graphic products. Within the hybrid PBL–PjBL approach, digital tools are means to realize the design rationale rather than a replacement for creativity. Therefore, the implementation of PBL to promote inquiry, critical analysis, and evidence-based decision-making in early design stages is complemented with the sequential application of PjBL to focus on critical thinking, iterative design, technical execution, and tangible outcomes. In this way, the solution process of open-ended problems harmonizes theory and practice, fostering structured creative production and permitting students to tackle complex design problems.

This sequence challenges software-first habits by requiring justification before execution, thereby reconnecting theory with practice in a visible way in students' decisions and iterations, making it particularly relevant for graphic design. Consequently, this approach permits addressing open-ended problems, giving students the capacity to tackle complex design challenges. However, the value of this approach depends on capturing process evidence and product quality in the assessment, thus needing a multidimensional framework (Giloi & Du Toit, 2013). Accordingly, this study aims to quantify the impact of implementing the hybrid PBL–PjBL approach in graphic design education by examining measurable changes in both process- and product-related performance.

METHODOLOGY

This study adopts a quantitative, quasi-experimental pre–post design to estimate the impact of the hybrid PBL–PjBL approach. A quantitative approach is needed in this case to quantify learning-related changes using standardized measures that enable statistical comparisons across time and sections.

This is based on some key concepts:

- Binding-constraints rule: criteria and selected alternatives from Phases 1–2 are locked and govern Phase 3 execution.
- Dual rubric assessment: PBL Process Rubric and the PjBL Product Rubric. PBL Process Rubric: Evaluates analysis, evidence use, ideation breadth, iteration, and reflection.
- PjBL Product Rubric: Assesses creativity/originality, visual hierarchy, technical execution, and rationale quality.
- Critique cadence: weekly formative critique aligned to rubric criteria; explicit checklists for low process management profiles.
- Reliability & ethics: rater training with anchors, ≥20% doublescored; ICC(2,k) with 95% CIs; informed consent and anonymization.
- Operational rule: decisions made in Phases 1–2 become binding design constraints for Phase 3 (so inquiry actually drives the project).

Intervention context

The study was conducted in an undergraduate multimedia program at a public university in Colombia (the institution is anonymized for review). The approach was implemented in six undergraduate graphic design sections identified in this study as sections A to F. These sections used the same syllabus, learning outcomes, and calendar. Sections A and B were selected as the control (i.e., traditional lecture-based pedagogy is implemented). Moreover, sections C to F were selected as hybrid (i.e., the hybrid PBL–PjBL pedagogy was implemented).

The syllabus aims at training students to analyze real contexts of intervention, with strong emphasis on ergonomics, usability, accessibility, teamwork, research, and communication The course is organized to develop a project during one semester, making it ideal to implement the approach discussed in this study. Consequently, this study spanned over one academic semester. To address the need for a multidimensional framework to evaluate “process” and “product”, a dual rubric is used to assess project-based deliverables within a problem-based design framework. Additionally, a questionnaire was implemented to measure students’ perceptions related to the learning experience (e.g., motivation, process management, and technical self-efficacy). Importantly, questionnaire data were treated as quantitative indicators, enabling pre–post comparisons alongside rubric scores.

To optimize cognitive development and practical execution, the hybrid PBL–PjBL sequence was implemented in three phases. Integration across measures followed a complementarity and convergence logic where rubrics captured observable performance (process/product), whereas the questionnaire captured perceived learning. Finally, it is assessed if there is convergence in direction and magnitude between the results from the rubrics and the results from the questionnaire.

The methodology outlined here intends to determine the impact of the hybrid PBL–PjBL pedagogy in graphic design education.

PARTICIPANTS

The study was implemented in six first year sections (identified as A, B, C, D, E, and F) with 126 students in total. All of the students completed the baseline and post-sessions evaluations (see Table 1). Enrollment was defined by institutional scheduling, avoiding random assignment. The inclusion criteria used were active enrollment and the completion of the baseline and post evaluations within defined windows of time. Students were offered no incentive beyond the course credits they received from regular assessments.

Table 1

Sample size by section

Section	A	B	C	D	E	F
n	22	20	22	24	11	27

Sections A and B served as the control (i.e., the traditional teaching approach was used), while the hybrid PBL–PjBL approach was implemented in sections C to F. The traditional teaching approach followed a professor-centered, lecture-and-demonstration format. Class sessions typically initiated with professor-led explanations of concepts and examples, followed by step-by-step software demonstrations and short guided exercises. Afterwards, the students completed assignments, largely through individual practice focused on technical execution and adherence to given specifications like applying predefined layouts, typographic rules, or tool procedures. Feedback mainly consisted of corrective comments on submitted deliverables. On the other hand, the assessment emphasized compliance with the assignment requirements. This operational definition of the traditional teaching provided the baseline against which the hybrid PBL–PjBL implementation (sections C–F) was compared.

The impact of the hybrid approach was defined by comparing control vs implementation/hybrid:

- Group 1 (Control): Sections A & B (traditional approach)
- Group 2 (Implementation/Hybrid): Sections C, D, E & F

Procedural systematization

The PBL–PjBL hybrid model, structured to inquiry, critique, and iterate to anchor production and externalization, was implemented through three instructional phases:

1. Baseline diagnostic,

2. Guided exploration and prototyping,
3. Refinement and public presentation.

Students completed studio tasks, reflective checkpoints, and deliverables aligned to the rubrics below. To standardize dosage, all sections adhered to identical briefings, milestones, and critique rubrics, with shared asset packs and time-on-task guidance. Decisions made during the PBL phases became binding constraints for the subsequent PjBL production phase to ensure traceability. The three phases of the PBL–PjBL approach are as follows:

* Phase 1 — PBL Problem Framing (Weeks 1–2): Students submitted a brief presentation of the design, then they built a problem tree, a stakeholder map, and defined success criteria. Finally, students produced low-fidelity probes and an initial rationale.

* Phase 2 — PBL Inquiry & Prototyping (Weeks 3–5): Students submitted research sprints, also they developed an alternatives matrix, created rapid prototypes with critiques, and updated criteria and rationale with evidence.

* Phase 3 — PjBL Production & Dissemination (Weeks 6–9): Students derived a specification from the binding constraints, completed versioned builds (alpha à beta à release), conducted formal critiques, and delivered the final poster plus the rationale.

Phases 1 and 2 focus on PBL, which includes problem understanding through structured inquiry (problem tree, stakeholders, criteria, alternatives, quick tests). Moreover, Phase 3 focused on PjBL, integrating outputs from phases 1 and 2 into the project development and the final product (alpha, beta, release). Instructor and peer critiques aligned with the rubric.

Measurement schedule

The measuring schedule was organized as follows:

1. Baseline (Pre-intervention): a diagnostic design task (poster brief) scored with the Product rubric.
2. The Process rubric was applied to the initial workflow.
3. The dispositions questionnaire (Post-intervention): The same rubrics and dispositions were administered on the capstone deliverable after the intervention.

Operationalization of the design

The design predictors, and the primary and secondary outcomes included are depicted in Table 2.

Table 2

Study variables, measurement, and analytical role

Component	Variable	Type	Measurement / Instrument	Time point(s)	Analytical treatment (summary)
Study design	Time	Predictor (within-subject)	Pre vs Post	Pre, Post	Pre–post change () and/or pre–post comparisons

Grouping	Group	Predictor (between-subject)	Control (A–B) vs Hybrid (C–F)	—	Main contrast: Hybrid vs Control
Context	Section	Context factor	Sections A–F	—	Descriptive and/or sensitivity models (optional)
Primary outcome	Product quality (poster)	Outcome	PjBL Product Rubric (score)	Post	ANCOVA: Post ~ Group + Pre (baseline-adjusted)
Adjustment	Baseline product	Covariate	Baseline product score	Pre	Covariate in product ANCOVA
Secondary outcome	Process quality	Outcome	PBL Process Rubric (score)	Pre, Post	ANCOVA: Post ~ Group + Pre; and/or Δ comparisons
Adjustment	Baseline process	Covariate	Baseline process score	Pre	Covariate in process ANCOVA
Self-report (perceptions)	Motivation	Outcome	Likert questionnaire (subscale)	Pre, Post	ANCOVA: Post ~ Group + Pre (baseline-adjusted)
	Process management	Outcome	Likert questionnaire (subscale)	Pre, Post	
	Technical self-efficacy	Outcome	Likert questionnaire (subscale)	Pre, Post	
	Collaboration	Outcome	Likert questionnaire (subscale)	Pre, Post	
	Ideation	Outcome (single item)	Likert questionnaire (single item)	Pre, Post	Post/Δ comparisons; ANCOVA optional
	Audience orientation	Outcome (single item)	Likert questionnaire (single item)	Pre, Post	

In this case, Pre refers to pre-intervention, and Post refers to post-intervention, while Δ is the difference between Post and Pre:

$$\Delta_i = P_{Post\,i} - BP_i \quad (1)$$

where:

- i - Product, process, or self-report subscales
- P_{Post} - Post-intervention
- BP_i - Baseline of obtained at the preintervention

Baseline (Pre-Intervention): Learning in Graphic Design

To improve readability and traceability of the baseline procedure, Tables X–Y summarize the standardized baseline task, deliverables, constraints, measurement instruments, and the mapping between questionnaire items and constructs, as well as each measure's analytical role. A total of 126 students from the six sections (A–F) completed:

(i) standardized poster design task.
(ii) self-report questionnaire (see Fig. 1).

No PBL scaffolds (e.g., problem tree, alternatives matrix) are provided at the baseline. Work was completed individually, timed, and proctored; external assets were restricted to those provided with the brief. Submissions were uploaded as PDFs, along with a rationale, using an anonymized code schema shared across sections.

Table 3

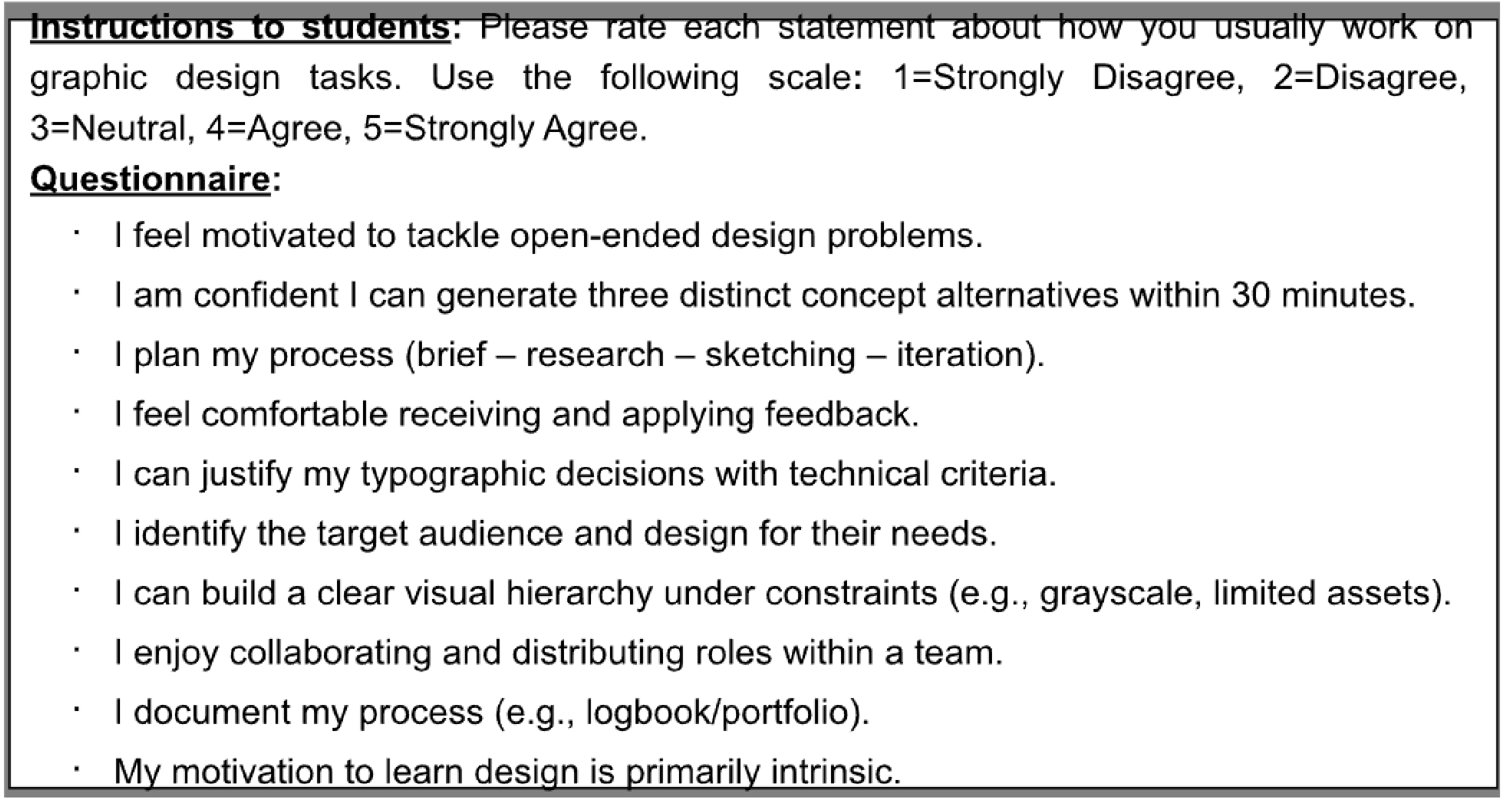
Baseline (pre-intervention) procedure and evidence map

Baseline component	Standardized conditions	Student evidence / deliverable	Recorded measure	Analytical role
Standardized poster task (Week 1; 90-120-min session)	Produce one-page A4 grayscale poster for a campus talk ("Diseño que comunica") under identical constraints: 1 image and 1 logo, 1 headline 1 subhead (≤ 12 words total), 60–80 words of body copy.	Poster submitted as PDF. Brief with the poster rationale (including: concept, target, hierarchy) of less than 100 words.	Baseline product score (rubric total)	Covariate for post product ANCOVA (used to check baseline equivalence)
Self-report questionnaire (administered immediately after task)	Likert 1–5 (Strongly disagree → Strongly agree)	Questionnaire responses (items 1–10)	Construct scores (subscales + single items)	Baseline descriptives; covariate for post self-report ANCOVAs (if baseline-adjusted)
Rater scoring & reliability	Trained raters; subset double-scored	Score sheets / rating records	Inter-rater reliability (e.g., ICC)	Quality control; supports validity of rubric scores

To establish the baseline, a one-way ANOVA was applied to the product rubric obtained for the different sections.

Figure 1

Questionnaire implemented to measure students' perceptions of the assignment.



Instructions to students: Please rate each statement about how you usually work on graphic design tasks. Use the following scale: 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree.

Questionnaire:

- I feel motivated to tackle open-ended design problems.
- I am confident I can generate three distinct concept alternatives within 30 minutes.
- I plan my process (brief – research – sketching – iteration).
- I feel comfortable receiving and applying feedback.
- I can justify my typographic decisions with technical criteria.
- I identify the target audience and design for their needs.
- I can build a clear visual hierarchy under constraints (e.g., grayscale, limited assets).
- I enjoy collaborating and distributing roles within a team.
- I document my process (e.g., logbook/portfolio).
- My motivation to learn design is primarily intrinsic.

Note: The 10-item Self-report questionnaire rates on a scale of 1 (strongly disagree) to 5 (strongly agree). In addition, the questionnaire captures motivation (items 1 and 10), process management (items 3 and 9), technical self-efficacy (items 5 and 7), collaboration (items 4 and 8), ideation (item 2), and audience orientation (6).

Rubrics

Two performance rubrics were analyzed and six disposition subscales. This PBL phases implementation is depicted in Table 4 and the rubric used to evaluate PjBL phases is depicted in Table 5.

- PjBL Product Rubric: An analytic rubric scoring overall product quality (e.g., concept communication, hierarchy & composition, typographic control, image use, rationale). The total rubric score (i.e., the sum of every item score) represents the product score. In this case, higher total scores indicate higher product quality.
- PBL Process rubric: Analytic rubric scoring the process quality (e.g., problem framing, iteration discipline, evidence use, etc.). Similarly, the total rubric score is the sum of every item score and represents the process score, with higher total scores indicating higher process quality.
- Questionnaire (self-report): Subscales in the questionnaire (i.e., motivation, process management, technical self-efficacy, and collaboration are computed as the mean values of their items, while ideation and audience awareness have the value of their single item. In this case, each item is evaluated on a 1–10 scale.

Table 4

PBL Process rubric

Criterion	1. Unsatisfactory	2. Weak	3. Adequate	4. Proficient	5. Exceptional
Problem / brief articulation	• Missing or inaccurate brief • Unclear problem, audience, or constraints.	• Vague problem statement • Audience or constraints are mentioned but not operationalized.	• Clear statement of the basic problem • Identifies audience and key constraints • Limited prioritization.	• Well-defined problem with actionable requirements • Articulates audience needs and success criteria.	• Insightful framing • Synthesizes constraints into a compelling design challenge • Defines measurable criteria and scope boundaries.
Use of evidence	• No research or unsupported claims • Arbitrary decisions.	• Minimal evidence (e.g., 1–2 sources) with weak relevance • Evidence not linked to decisions.	• Uses relevant sources or observations • Some linkage to design choices • Basic documentation.	• Triangulates multiple sources (e.g., users, benchmarking, literature) • Evidence clearly informs decisions • References documented.	• Rigorous, purposeful evidence strategy • Synthesizes insights into design principles • Transparent traceability from evidence → decisions.
Ideation breadth	• Single solution path • Little divergence • No alternatives.	• Few variations • Minor superficial differences • Limited exploration.	• Several distinct ideas • Explores at least two directions • Some rationale for selection.	• Diverse ideation (multiple directions + variations) • Uses structured methods • Clear criteria for narrowing options.	• Extensive, creative exploration • Demonstrates strategic divergence/convergence • Selection justified with evidence and constraints.
Iteration	• No iteration • First solution carried out unchanged.	• Small tweaks only • Unjustified changes.	• At least one meaningful revision • Some rationale • Limited testing and feedback use.	• Multiple iteration cycles • Versioning documented • Revisions linked to the criteria and feedback.	• Systematic iterative workflow • Tests assumptions • Documents iterations and trade-offs • Continuous improvement aligned to success criteria.
Reflection	• No reflection or purely descriptive • Lacks learning insights.	• Superficial reflection • Blames external factors • Little connection to outcomes.	• Describes what worked and failed • Identifies basic lessons • Limited action planning.	• Analytical reflection • Links process choices to outcomes • Propose concrete improvements.	• Critical, transferable insights • Anticipates risks • Connect evidence + feedback to learning • Clear next-step actions grounded in criteria.

Note: criteria: problem/brief articulation; use of evidence; ideation breadth; iteration; reflection.

Table 5

PjBL Product rubric

Criterion	1. Unsatisfactory	2. Weak	3. Adequate	4. Proficient	5. Exceptional
Creativity & Originality	• Off-brief or derivative • No clear idea.	• Germinal idea • Tenuous link to the brief and the audience.	• Clear, relevant concept with some originality.	• Creative, thoughtful concept with clear intent and audience fit.	• Highly original, compelling concept • Novel associations anchored to the brief.
Visual Hierarchy & Layout	• Disorganized • No focal point • Poor alignment and spacing.	• Inconsistent hierarchy • Weak grid • Clutter or empty holes.	• Functional layout, basic hierarchy, and alignment • Minor conflicts.	• Clear reading path • Consistent grid/alignment • Effective white-space and rhythm.	• Sophisticated layout • Masterful control of hierarchy, balance, and spatial rhythm.
Technical Execution	• Visible errors (artifacts, misalignment, ragging) • Inconsistent edges and bleeds.	• Basic execution with recurring flaws (resolution, export, spacing).	• Technically sound • Meets standards • Minor, non-distracting issues.	• High quality • Refined details (precision, consistency, clean exports).	• Error-free at print/100% zoom • Professional precision across all elements.
Typography	• Illegible or inappropriate choices • Erratic kerning, leading, and scale.	• Basically legible • Weak control of contrast, hierarchy, and consistency.	• Appropriate families • Functional hierarchy • Acceptable spacing/ alignment.	• Refined pairings • Consistent microtypography (kerning/tracking/leading) • Hierarchy supports message.	• Expert typography • Precise microtypography • Hierarchy enhances clarity, tone, and brand.
Image Integration	• Irrelevant or low-quality image • Poor crop or mismatch • Weak integration.	• Loosely related image • Technical issues • Limited integration with text/grid.	• Image supports the concept • Technically acceptable Integration is adequate.	• Image reinforces the message • High technical quality • Strong text–image synergy.	• Image is a concept anchor • Exceptional text–image interplay advancing meaning.
Rationale & Justification	• No rationale.	• Vague or superficial (describes what, not why).	• It justifies key decisions using the brief's basic criteria.	• Clear, persuasive links to the audience • Brief • Outcomes • References • Tests • Feedback.	• Insightful, evidence-based argument • Anticipates misinterpretation • Ties choices to constraints and data.

Note: (current craft/production criteria)

Statistical Analysis

The primary outcome was the post-intervention product score (poster), assessed using an ANCOVA. The statistical analysis was conducted in Statgraphics Centurion 19. This analysis tests whether the hybrid PBL–PjBL model improves product quality (primary) and process/dispositions (secondary), and whether process gains predict product gains after controlling for baseline performance and section differences (A–F; N=126).

A primary ANCOVA model (product quality at post) is used. Post product score (poster rubric total) as the dependent variable, Baseline product score as covariate, and Section (A–F) as a fixed effect is:

$$PP_i = \beta_0 + \beta_1 \bullet BP_{P-i} + \sum_{s=B}^{F} \beta_s I[Section = s]_i + \varepsilon_i \qquad (2)$$

where:

PP_i– i-th post-product
BP_{P-i}– Baseline product score for student i
β_0 – Intercept
β_1 – Regression coefficient for baseline product score
β_s – Section effect for section s relative to control section
$I[Section = s]_i$– indicator (=1 if student i is in section s, 0 otherwise).
εi – Residual error term (variation not explained by the predictor).

Report adjusted means (per section and overall), 95% CIs, F, p, and partial η^2. Check homogeneity of regression slopes (Baseline X Section). If violated, retain the interaction and interpret per section, or fit a linear mixed model with Time (Pre/Post) as a within-subject factor and student random intercepts (robust SEs).

To test whether the mean change (Δ) is significantly different from zero, paired tests were developed. Within-student change was tested using paired t-tests on the Product, Process, and Self-report rubrics and totals/subscales. Report Δ = Post − Pre, mean Δ with 95% CI, t, df, p, and Cohen's dz (paired-samples effect size). A nonparametric Wilcoxon signed-rank test is also reported when normality is doubtful.

$$d_z = \frac{t}{\sqrt{n_{pairs}}} \qquad (5)$$

d_z – Cohen's d_z (paired-samples effect size)
t – Paired t-test statistic
n_{pairs} – Number of paired observations
df – Degrees of freedom (n – 1 for paired samples)
p – p-value (significance

To assess the Process–Product linkage, multiple regressions examined whether process/disposition gains relate to product outcomes:

$$PP_i = \gamma_0 + \gamma_1 \bullet BP_i + \gamma_2 \cdot \Delta P_i + \gamma_3 \bullet \Delta TSE_i + \gamma_4 \bullet \Delta PM_i + \sum_{s=B}^{F} \gamma_s I[Section = s]_i + \varepsilon_i \qquad (6)$$

where:

ΔTSE – Technical Self-Efficacy variation
ΔPM – Process management variation
P_i – i-th process

Robustness specification using change scores:

$$\Delta P_{d_i} = \delta_0 + \delta_1 \cdot \Delta P_i ++ \delta_2 \cdot \Delta TSE_i + \delta_3 \cdot \Delta PM_i + \sum_{s=B}^{F} \delta_s I[Section = s]_i + \varepsilon_i \qquad (7)$$

P_d – Product d
δ_0 – Intercept (baseline expected change when all predictors are zero).
δ_1, δ_2, δ_3 – Regression coefficients for ΔP_i, ΔTSE_i, and ΔPM_i.
$\sum_{s=B}^{F} \delta_{s_i}$– Dummy-coded section effects (B–F vs reference A).

Report standardized ß, R^2, and 95% CIs. If mediation is explored, treat it as exploratory, given only two time points (Pre/Post).

Multiple comparisons for families of tests across self-report subscales, control the false discovery rate with Benjamini–Hochberg (BH) at $q = 0.05$; report both raw p and BH-adjusted p_{adj}.

Inter-rater reliability was assessed with an Intraclass Correlation Coefficient (ICC) double-scoring ≥20% double-scored work, computing ICC(2,k) (absolute agreement) with 95% CIs; report n double-scored and calibration notes. These estimates are used to justify combining rater scores (raters' mean values) for all analyses. This inter-rater reliability approach helps determine agreement among instructors who score student work using a rubric and assess whether different raters assign similar scores to the same set of items.

For all models, assumptions and diagnostics include residual QQ-plots and Shapiro tests (large-sample tolerant), Breusch–Pagan/White tests for heteroscedasticity, and influence diagnostics (Cook's D, studentized residuals; flag $|r| > 3$). If heteroscedasticity or mild non-normality is present, report heteroscedasticity-consistent SEs (HC3); for outliers, present sensitivity analyses with/without influential cases. ANCOVA-specific: verify linearity of Baseline–Post relation and homogeneity of slopes.

Later, the assumptions were inspected (normality, homoscedasticity, influence) to determine if assumptions were met. Given potential heteroscedasticity, the HC3 robust standard errors were used. Moreover, missing data was handled by first reporting the number of participants with complete pre- and post-intervention pairs. When missingness was 5% or lower and considered plausibly Missing Completely at Random (MCAR) or Missing at Random (MAR), the primary analyses were presented using complete cases, complemented by a sensitivity analysis based on either a mixed-effects model with Time specified as a within-subject factor or multiple imputation using predictive means matching for the secondary outcomes.

Furthermore, the statistical significance was evaluated using a two-tailed significance threshold . Analyses may be conducted in R, using packages such as afex, emmeans, sandwich, or in Python with statsmodels, with all procedures supported by reproducible scripts.

Finally, for baseline group comparisons across the six sections (A–F; N = 126; group sizes = 22, 20, 22, 24, 11, and 27), the appropriate ANOVA degrees of freedom are F(5, 120). Any legacy reporting based on a four-group structure, such as F(3, 99), should therefore be revised to maintain consistency with the actual six-section sample configuration.

Validation

To ensure the use and reliability of the notes, the following criteria are used:

- Two instructors double-score around 20% of the sample and calibrate using ICC (Intraclass Correlation Coefficient), which is used to assess the reliability of the scoring process.
- For post-intervention, use a parallel task to avoid itemmemory effects.
- ICC(2,k) 95% CI [0.74, 0.88], on ≥20% double-scored work for consistency.

The baseline product score serves as the covariate in the primary ANCOVA predicting post-product quality. Additionally, it also anchors pre- and post-intervention within-student comparisons. Section (A–F) is treated as a fixed factor in models to control for cohort/instructor differences (details in Statistical Analysis).

Scoring

The questionnaire (see Fig. 1) captures:

- Motivation (items 1,10),
- Process/Management (3,9),
- Technical self-efficacy (5,7),
- Collaboration (4,8),
- Ideation (2)
- Audience orientation (6).

The questionnaire was scored on a 1–5 scale where:

- 1 = Strongly disagree
- 2 = Disagree
- 3 = Neutral
- 4 = Agree
- 5 = Strongly agree

Higher scores indicate more adaptive dispositions. Items were derived from course outcomes and expert-reviewed (two assessment specialists) for content validity; prior piloting supported clarity and face validity. Subscales with two items from the questionnaire are computed as item means rather than their total sums. The scoring bands for the subscales are interpreted as follows:

- Low (20% – 40%): 10–25, the student needs a strong learning framework
- Mid (50% – 70%): 26–38, the student is at the typical starting point
- High (80% – 100%): 39–50, the student is ready to stretch goals

Planned covariates/controls (as available): Baseline product score (primary covariate: the students' baseline product score is used as the main adjustment variable)

Section (fixed effect): the model also accounts for differences among sections (e.g., A, B, C, D, E, and F), which is important because some variation in results might come from the section rather than from the teaching method. Optional baseline self-report if pre-specified (i.e., the totals/subscales can be used as controls).

Each criterion in the rubrics (see Table 4 and Table 5) is evaluated on a scale of 1 to 5 points, grading from Unsatisfactory (1) to Exceptional (5). In total, each rubric assessment grades students between 6 and 30 points in four bands. Each band is interpreted as follows:

1. Low: 6–14
2. Developing: 15–21
3. Proficient: 22–26
4. Advanced: 27–30

On the other hand, the ICC scores range between 0 and 1. In this case, 0 indicates no agreement beyond chance, while 1 indicates perfect agreement. The interpretation of the ICC score band is as follows:

- < 0.5: Poor reliability
- 0.5–0.75: Moderate reliability
- 0.75–0.9: Good reliability
- 0.9: Excellent reliability

ICC ensures that the scoring process is fair, consistent, and replicable, especially when multiple instructors evaluate creative work. Furthermore, the ICC helps to validate that observed improvements in student performance are not a result of subjective differences in the application of the rubric by different instructors.

RESULTS

This section depicts the results obtained from the study. In total, 126 first-year students, distributed in sections A to F, were included in this study. Sections A and B formed the Control cohort (n = 42), whereas Sections C to F formed the Hybrid cohort (n = 84). Measured data included complete pre-test and post-test observations for the variables used in the primary and secondary outcome models. Therefore, complete-case estimation was sufficient, and no imputation procedure was required (i.e, to replace missing data values with estimated ones).

Baseline equivalence

In line with the methodological plan, the baseline comparability was assessed before examining the intervention effects. A one-way ANOVA across the six sections showed no statistically significant differences in baseline product scores, $F(5, 120) = 0.30$, $p = .912$, indicating that the sections started from similar levels before the pedagogical sequence was implemented. Table 6 presents the baseline equivalence test for pre-intervention product quality.

Table 6

Baseline equivalence for pre-intervention product quality

Result	Control	Hybrid
Baseline mean (SD)	20.31 (3.06)	19.77 (3.20)
Group comparison	-	$F(1,124) = 0.82$, $p = .368$

Note. Values for Control and Hybrid are observed pre-intervention means. The non-significant group effect indicates no evidence of baseline imbalance between cohorts.

Baseline product scores did not differ significantly between the Control and Hybrid cohorts, . The observed means were similar across groups (, ; ,), with a difference of 0.54 points. This indicates that both cohorts started from comparable levels before the intervention and supports the interpretation of subsequent post-test differences as baseline-adjusted contrasts within the quasi-experimental design.

Primary and secondary outcomes

In line with the methodological plan, the rubric-based outcomes were examined through baseline-adjusted ANCOVA models. Table 7 presents the primary outcome, Product quality, together with the secondary rubric outcome, Process quality.

Table 7

Baseline-adjusted ANCOVA results for Process and Product Quality

Result	Process	Product
Group effect	$F_{1,123}=84.02$, $p<.001$ Partial: $\eta^2=.41$	$F_{1,123}=90.25$, $p<.001$ Partial: $\eta^2=.42$
Control	14.16 [13.90, 14.42]	20.34 [20.08, 20.61]
Hybrid	15.63 [15.45, 15.81]	21.89 [21.70, 22.08]
Δ	1.48 points 95% CI [1.16, 1.79]	1.55 points 95% CI [1.23, 1.87]
Homogeneity of regression slopes	$F_{1,122}=3.24$, $p=.074$	$F_{1,122}=0.13$, $p=.718$

Note. Values for Control and Hybrid are estimated marginal means (EMMs) adjusted for baseline. . Homogeneity of regression slopes was evaluated using the Pre × Group interaction term.

The ANCOVA adjusted for baseline showed a significant Group effect for both process and product quality, favoring the hybrid cohort. The estimated marginal means (EMMs) represent adjusted post-test means at a common baseline level, allowing direct comparison between groups. The Pre × Group interaction was not statistically significant for either outcome, indicating no evidence against the homogeneity of regression slopes assumption and supporting the use of the parallel-slopes ANCOVA model.

Secondary self-report outcomes

In line with the methodological plan, the self-report secondary outcomes were examined after the rubric-based outcomes. Table 8 presents the baseline-adjusted ANCOVA results for the six questionnaire dimensions using HC3-robust standard errors.

Table 8

Baseline-adjusted ANCOVA results for secondary self-report outcomes

Secondary outcome	Adjusted Hybrid–Control difference	Significance
Motivation	0.32	$p < .001$
Process/Management	0.35	$p < .001$
Technical Self-Efficacy	0.38	$p < .001$
Collaboration	0.22	$p < .001$
Ideation	0.32	$p < .001$
Audience Orientation	0.43	$p < .001$

Note. Secondary outcomes were analyzed using baseline-adjusted ANCOVA models with HC3-robust standard errors. Reported values correspond to adjusted Hybrid–Control differences on the 1–5 scale. Positive values indicate higher adjusted post-test scores for the Hybrid cohort.

Baseline-adjusted analyses showed a consistent advantage for the Hybrid cohort across all six self-report dispositions. The adjusted differences ranged from 0.22 to 0.43 points, with the largest effect observed in Audience Orientation and the smallest in Collaboration. Overall, these results indicate that students in the Hybrid cohort reported more favorable motivational, procedural, technical, collaborative, and audience-centered learning dispositions than those in the Control cohort.

Within-student change over time

In line with the methodological plan, within-student change over time was examined after the baseline-adjusted between-group analyses. Table 9 presents the paired pre/post results for the two rubric-based outcomes.

Table 9

Within-student change overtime for Product and Process Quality

Result	Control	Hybrid
Product quality	Δ=2.18, 95% CI [1.32, 3.03] t(41)=5.14, $p < .001$ dz=0.79	Δ=2.77, 95% CI [2.18, 3.35] t(83)=9.41, $p < .001$ dz=1.03
Process quality	Δ=2.02, 95% CI [1.24, 2.80] t(41)=5.25, $p < .001$ dz=0.81	Δ=2.45, 95% CI [1.86, 3.05] t(83)=8.18, $p < .001$ dz=0.89

Note. Δ = Post − Pre. Positive values indicate improvement from baseline to post-intervention. Cohen's *dz* is the paired-samples effect size.

Within-student change analyses showed statistically significant improvement in both cohorts for both rubric-based outcomes. In the Control cohort, product quality increased by 2.18 points and process quality by 2.02 points. On the other hand, in the Hybrid cohort, product quality increased by 2.77 points and process quality by 2.45 points. The effect sizes were moderate to large in both cohorts, with the largest gain observed for product quality in the Hybrid cohort ($dz = 1.03$). Overall, these results indicate clear improvement over time in both instructional conditions.

Process–product linkage

In line with the methodological plan, the process–product linkage was examined after the baseline-adjusted outcome analyses and the within-student change analyses. Table 10 presents the regression results testing whether process-related gains predicted product performance.

Table 10

Process–product linkage models

Predictor	Post-product model	Change-score model
Baseline product	B=0.715, 95% CI [0.542, 0.888] β=0.665, p < .001	—
Process change	B=0.001, 95% CI [-0.211, 0.212] β=0.001, p = .994	B=0.036, 95% CI [-0.179, 0.251] β=0.036, p = .737
Technical self-efficacy change	B=0.128, 95% CI [-0.387, 0.643] β=0.037, p = .624	B=0.112, 95% CI [-0.429, 0.652] β=0.041, p = .683
Process management change	B=0.416, 95% CI [-0.097, 0.928] β=0.114, p = .111	B=0.428, 95% CI [-0.105, 0.962] ß=0.147, p = .115
Model fit	R^2=0.460 adjusted R^2=0.418	R^2=0.050 adjusted R^2=-0.015

Note. *The post-product model used post-intervention product quality as the dependent variable while controlling for baseline product score and section membership. The robustness model used the product change score as the dependent variable. Coefficients are HC3-robust estimates. Positive coefficients indicate that larger gains in the predictor are associated with higher product performance or greater product improvement. Full models included section fixed effects.*

The process–product linkage analyses showed limited evidence that gains in process-related variables independently predicted product performance. In the post-product model, the overall model explained 46.0% of the variance in post-test product quality, but only baseline product score emerged as a reliable predictor, $B = 0.715$, 95% CI [0.542, 0.888], ß = 0.665, $p < .001$. None of the focal change variables—process change, technical self-efficacy change, or process-management change—reached statistical significance.

The robustness specification using product change as the dependent variable led to the same conclusion: the model explained only 5.0% of the variance, and none of the focal predictors were statistically significant. Taken together, these results suggest that, in the current evidence package, product performance was primarily associated with baseline product level rather than with independent gains in the measured process-related variables. This suggests that Product performance was influenced by variables other than those considered in the linkage model. Although the hybrid sequence was associated with stronger Process and Product outcomes overall, the final quality of the Product likely depended on multiple interacting variables, including prior performance, instructional mediation, iterative feedback, and other design-related competencies not isolated in the present model.

Reliability, diagnostics, and robustness checks

In line with the methodological plan, reliability, model assumptions, and robustness provisions were examined to support the interpretation of the main outcome analyses. Table 11 summarizes the principal quality-control and diagnostic checks reported for the study.

Table 11

Reliability, diagnostics, and robustness checks

Aspect	Evidence reported	Interpretation
Inter-rater reliability	on double-scored work	Supports acceptable-to-good agreement and the use of averaged rater scores for analysis
Data completeness	126 students completed both baseline and post-intervention sessions	Complete pre/post cases were available for the planned analyses
Product ANCOVA slope homogeneity	$F(1,122) = 0.13, p = .718$	No evidence against the homogeneity of regression slopes assumption
Process ANCOVA slope homogeneity	$F(1,122) = 3.24, p = .074$	Borderline but non-significant; the parallel-slopes ANCOVA was retained
Self-report robustness	Baseline-adjusted ANCOVAs were estimated with HC3 robust standard errors	Inference for questionnaire outcomes was made more robust to potential heteroscedasticity
Diagnostics framework	Residual QQ-plots, Shapiro tests, Breusch–Pagan/White tests, and influence diagnostics were specified in the analytical plan	The study incorporated an explicit assumption-checking strategy for model evaluation
Additional robustness provisions	Mixed-effects or multiple-imputation sensitivity analyses were pre-specified if missingness was low; change-score robustness was also specified for process–product linkage	The analytical plan included alternative specifications to assess the stability of conclusions

Note. *ICC = intraclass correlation coefficient. HC3 = heteroscedasticity-consistent standard errors. Homogeneity of regression slopes was evaluated through the Pre × Group interaction in the ANCOVA models. The diagnostics framework and robust provisions were declared in the statistical analysis plan, while the reported slope tests and ICC interval provide the directly stated evidence available in the study.*

Inter-rater reliability was supported by double-scoring at least 20% of the work and by an confidence interval of , which is consistent with acceptable-to-good agreement for rubric-based scoring. Additionally, the analytical plan incorporates a diagnosis for residual distribution (i.e., differences between observed and model-projected values), heteroscedasticity (i.e., assess if the level of errors is evenly distributed), influence (i.e., to check for outliers), robustness provisions for missing data (i.e., check for missing data and address them), and alternative model specification (i.e., to try other model versions to check the findings under different analytical choices).

At the model level, the reported Pre × Group tests indicated no evidence against slope homogeneity for product quality and only borderline but non-significant evidence for process quality, supporting retention of the parallel-slopes ANCOVA specification. For the self-report outcomes, HC3 robust standard errors were used to strengthen inference under potential heteroscedasticity. Taken together, these checks support the technical credibility of the reported results and indicate that the principal findings were evaluated within a structured reliability and diagnostic framework.

DISCUSSION

This study discusses whether a sequential hybrid PBL–PjBL model improved process and product quality in undergraduate graphic design students. On the other hand, the study discusses whether this pedagogical sequence strengthened students' self-perceptions of learning, particularly motivation, process/management, and technical self-efficacy.

The findings showed that the Hybrid cohort outperformed the Control cohort on both rubric-based outcomes, with statistically significant and substantively large differences in product and process quality. Overall, it showed higher adjusted scores across all six self-report dimensions. These findings indicate that the hybrid sequence was associated not only with stronger final deliverables but also with a stronger design process and more favorable learner dispositions.

Graphic design, concerned with the intentional conception and realization of visual messages for specific audiences and contexts, needs to harmonize conceptual knowledge and concrete design tools, which are frequently treated as software-driven activities. The observed gains in product and process quality suggest improvement in both design execution and the underlying pathway by which students arrived at that execution. This distinction is particularly relevant in students' learning to align concept development, audience interpretation, iteration, and technical realization.

Students in the Hybrid cohort produced stronger outcomes through a structure that appears to have made inquiry decisions operative in later production stages. Therefore, results, in agreement with (Avcı & Durak, 2025), show that PBL improves students' motivation, problem definition, and solution visualization in open-ended tasks. On the other hand, in agreement with (Bell, 2010; Hananto, 2024; Mutanga, 2024), PjBL promotes extended inquiry, tangible outcomes, and a deeper understanding of practical applications.

Moreover, the results show a connection between active methodologies and creativity, technical execution, and professional readiness in graphic design, in agreement with improvements induced by PjBL in technical execution and learning outcomes (Farizi et al. 2020), creativity and professional preparation (Adzra et al., 2024; Barus et al., 2023), and strengthening design-oriented problem-solving (Ning, 2025).

The present study extends previous results by showing not simply that PBL or PjBL works better than lecture-based pedagogy in graphic design, but that the deliberate sequencing of PBL into PjBL can make early inquiry, criteria-building, and problem framing carry forward into the quality of the final product.

Results, in agreement with (Almulla, 2020), show that PBL is increases motivation and engagement compared with traditional pedagogy, while both PBL and PjBL foster collaboration, critical thinking, creativity, and technical proficiency (Indriati et al., 2024; Rohmaniyah & Asih, 2024). Therefore, higher scores in motivation, process/management, technical self-efficacy, collaboration, ideation, and audience orientation are in line with what can be inferred from the literature review.

This study specifically highlights the gains that can emerge from a pedagogical sequence explicitly separating problem framing from project production, while still linking them through milestones, constraints, and rubric-guided checkpoints. These results suggest that learner dispositions not only improve because students are "more active," it requires to structure activities in ways that make the criteria, purpose, and audience visible throughout the design process.

Moreover, this study supports the need for an assessment framework that can capture multiple dimensions of performance rather than rely only on assessing the final product, as pointed by (Giloi & Du Toit, 2013). Furthermore, it supports the need to evaluate students through projects more closely resembling the work professionals face in real-life contexts rather than just artificial tests like multiple-choice exams or isolated theoretical questions (Indriati et al., 2024). These perspectives support the use of the dual-rubric framework to assess the process evidence and product quality. These results suggest that the benefit of the hybrid model may lie in how it distributes different learning demands across phases:

- PBL supports the analytical and interpretive work of understanding a design problem,
- PjBL consolidates that work into production discipline, critique cycles, and deliverable quality.

This adds a practical and didactic contribution to the literature by showing how two active methodologies can be sequenced rather than merely combined.

In this way, the dual-rubric framework, rather than just measuring outcomes, operationalizes a pedagogical distinction between process and product that is often blurred in graphic design teaching. Therefore, these results support the value of separating process criteria from product criteria, since both were sensitive to the intervention. In addition, they suggest that rubric transparency may be part of the educational mechanism by which the hybrid model worked, because students were not only asked to produce artifacts but also to make their reasoning, iteration, and decision-making visible and assessable.

A critical interpretation of the results shows that, while there is a coherent pattern in the gains quantified by the rubrics and the self-report, that coherence by itself does not establish causality from higher self-perception to better product quality. Therefore, caution must be exercised in interpreting the results, avoiding claims such as "audience orientation and technical self-efficacy contributed to higher product quality," which cannot be supported by this study. More accurately would be to conclude that "these dimensions contributed more to the hybrid sections and are pedagogically consistent with the observed product gains. Although a clearer discussion of their precise role in these gains must be purposefully examined in future studies. The latter interpretation reflects a better critical stance and avoids exaggerating the role of the mechanism implied in the results.

Furthermore, it is also important to acknowledge the limitations of this study. This is a quasi-experimental study, which is based in a single institution context. Therefore, our findings cannot be automatically generalized to every higher education graphic design program. Additionally, the study discusses one implementation of the hybrid PBL–PjBL, based on its milestones, rubrics, and instructional mediation. Accordingly, the results support the value of its implementation rather than an abstract claim that any PBL–PjBL sequencing will necessarily lead to the same results. This point is underscored by some literature supporting a more widespread use of project-centered learning, although differing in context, population, etc.

This study contributes to the discussion of using PBL and/or PjBL by implementing a more tightly structured model specifically for graphic design teaching, which is a tested pedagogical configuration, and cannot be considered a universal transferable formula. The results presented in this study suggest that, in graphic design education, the effectiveness of pedagogies depends on how they are sequenced and applied to target different aspects of the learning process. Therefore, the main implication from this study, beyond stating that PBL–PjBL outperform lectures in graphic design teaching, is that adequately sequencing inquiry, constraints, critique, iteration, etc., as mutually dependent design stages rather than as disconnected design activities, improves the learning process for students.

CONCLUSION

The results permit concluding that the pedagogical value of the hybrid PBL–PjBL model for graphic design lies in the use of active methodologies, as well as in the deliberate sequencing of these methodologies to harmonize problem framing, inquiry, critique, and project development in a single pedagogy. Moreover, this study approaches graphic design teaching, treating process and product as distinct, although pedagogically connected dimensions of teaching, evaluating, and feedback, thus contributing didactically and empirically. This underscores the significance of authentic assessment frameworks in the capacity to highlight the process and the product in the evaluation process.

These conclusions must be interpreted within the scope of this study, avoiding grandiose general conclusions that this approach is a universal solution. In general, this study stresses the importance of pedagogical structure, assessment frameworks, and instructional mediation in graphic design. Future research should focus on implementing this approach in different institutional settings and design domains, with special attention to the mechanism through which the different dimensions of process and product interact over time. All in all, this study indicates that the strength of the sequenced implementation of PBL–PjBL in graphic design resides less in methodological novelty and more in the sequenced organization of the learning process in a harmonized progression from inquiry, making, and assessing.

FINANCING

No funding was used in this study

CONFLICT OF INTEREST

The submitted work does not represent any conflict of interest with the authors, the journal, or the publishing entity.

ACKNOWLEDMENTS

The authors acknowledge the use of ChatGPT and Copilot to translate the paper into English and Grammarly to review the grammar.

AUTHORS' CONTRIBUTION

Idania Dorta-Rodríguez: Writing - Original Draft, Conceptualization, Visualization, Investigation.

Alexis Sagastume-Gutiérrez: Methodology, Formal analysis, Conceptualization, Writing, review and editing.

Juan Cabello-Eras: Formal analysis, Methodology, Visualization, Writing, review and editing.

REFERENCES

Adzra, A., Mastur, M., & Utama, A. H. (2024). Utilization of Adobe Creative Cloud Media to Support Project-Based Learning for Internship Students in the Digitaliz Unit at the Hasnur Centre Foundation. *EduLine: Journal of Education and Learning Innovation*, *4*(3), 426–433. https://doi.org/10.35877/454RI.EDULINE2933

Alhajri, S. (2016). The Effectiveness of Teaching Methods Used in Graphic Design Pedagogy in Both Analogue and Digital Education Systems. *Universal Journal of Educational Research*, *4*(2), 422–425. https://doi.org/10.13189/ujer.2016.040216

Almulla, M. A. (2020). The Effectiveness of the Project-Based Learning (PBL) Approach as a Way to Engage Students in Learning. *SAGE Open*, *10*(3). https://doi.org/10.1177/2158244020938702

Avcı, Ü., & Durak, H. Y. (2025). Pair or Group-Design Activities: The Effect of Design Activities on Problem-Solving, Design Thinking Disposition, and Design Thinking Traits. *Psychology in the Schools*, *62*(3), 834–852. https://doi.org/10.1002/PITS.23356

Barus, I. R. G., Fami, A., & Rahayu, K. S. (2023). CULTURAL HERITAGE DIGITIZATION OF BOROBUDUR AREA TOURISM: A PROJECT-BASED LEARNING. *JADECS*

(Journal of Art, Design, Art Education & Cultural Studies), *8*(1), 14–27. https://doi.org/10.17977/UM037V8I12023P14-27

Bell, S. (2010). Project-Based Learning for the 21st Century: Skills for the Future. *The Clearing House*, *83*(2), 39–43. https://doi.org/10.1080/00098650903505415

Dongfang, L., & Leizhen, S. (2021). Research on Teaching Method of Graphic Design Software. *Frontiers in Educational Research*, *4*(5), 4–5. https://doi.org/10.25236/FER.2021.040502

Duong, K. H., & Nguyen, L. T. (2024). Technology and Graphic Design: Building a STEM Education Ecosystem for the Future. *9th International STEM Education Conference, ISTEM-Ed 2024 - Proceedings*. https://doi.org/10.1109/ISTEM-ED62750.2024.10663156

Esparza, N., Guerrero, M., Hoyos, O., Restrepo, D., Jiménez, A., & Mayor, S. (2021). La interdisciplinariedad en la construcción de Eru, un videojuego educativo. *Arte, Individuo y Sociedad*, *33*(1), 71–85. https://doi.org/10.5209/ARIS.67028

Farizi, M. Y., Maryono, D., & Liantoni, F. (2020). The effectiveness of the application of project based learning with video content toward students' interests and learning outcomes in graphic design printing subject. *Journal of Informatics and Vocational Education*, *3*(3), 82–86. https://doi.org/10.20961/JOIVE.V3I3.47568

Ferns, S. J., Zegwaard, K. E., Pretti, T. J., & Rowe, A. D. (2025). Defining and designing work-integrated learning curriculum. *Higher Education Research and Development*, *44*(2), 371–385. https://doi.org/10.1080/07294360.2024.2399072

Frascara, J. (2004). *Communication Design Principles, Methods and Practice*. Allworth Press.

Giloi, S., & Du Toit, P. (2013). Current Approaches to the Assessment of Graphic Design in a Higher Education Context. *International Journal of Art and Design Education*, *32*(2), 256–268. https://doi.org/10.1111/J.1476-8070.2013.01758

Gula, I., Maznichenko, O., Kutsenko, A., Osadcha, A., & Kravchenko, N. (2023). Methods of Teaching Graphic Design in HEIs for Art. *Journal of Curriculum and Teaching*, *12*(2), 154–165. https://doi.org/10.5430/jct.v12n2p154

Hananto, B. A. (2024). Cardgame Design Project-Based Learning for a Graphic Design Course. *International Journal of Designs for Learning*, *15*(2), 54–64. https://doi.org/10.14434/IJDL.V15I2.35895

Husin, M., Usmeldi, Masdi, H., Simatupang, W., Fadhilah, & Hendriyani, Y. (2025). Project-Based Problem Learning: Improving Problem-Solving Skills in Higher Education Engineering Students. *International Journal of Sociology of Education*, *14*(1), 62–84. https://doi.org/10.17583/rise.15125

Indriati, L., Mai, N., & Yeen-Ju, H. T. (2024). Enhancing Authentic Assessment in Large-Class Design Education Through Authentic Project-Based Learning. *International Journal of Learning, Teaching and Educational Research*, *23*(9), 432–452. https://doi.org/10.26803/IJLTER.23.9.22

Meron, Y. (2021). “What’s the Brief?”: Building a Discourse around the Graphic Design Brief. *M/C Journal*, *24*(4). https://doi.org/10.5204/mcj.2797

Mutanga, M. B. (2024). Students’ Perspectives and Experiences in Project-Based Learning: A Qualitative Study. *Trends in Higher Education 2024, Vol. 3, Pages 903-911*, *3*(4), 903–911. https://doi.org/10.3390/HIGHEREDU3040052

Ning, Y. (2025). Integrating Design Thinking into Higher Education: Enhancing Student Creativity and Critical Thinking. *Journal of Higher Education Research*, *5*(6), 564. https://doi.org/10.32629/JHER.V5I6.3389

O’Shea, M. (2024). Graphic Design Needs to Take Responsibility: Embedding Social Awareness and Ethics Through Social Science Knowledge and Pedagogical Change. *Design Issues*, *40*(2), 15–27. https://doi.org/10.1162/desi_a_00752

Oo, T. Z., Kadyirov, T., Kadyjrova, L., & Józsa, K. (2025). Enhancing design skills in art and design education. *Frontiers in Education*, *10*, 1521823. https://doi.org/10.3389/feduc.2025.1521823

Pertiwi, A. B., Masunah, J., Prawira, N. G., & Karyono, T. (2024). Implementation of the teaching industry as a strategy for developing digital marketing competencies for diploma in graphic design students at the malaka hotel. *Jurnal EDUCATIO: Jurnal Pendidikan Indonesia*, *10*(2), 311–322. https://doi.org/10.29210/1202425264

Rodriguez-Sanchez, C., Orellana, R., Fernandez Barbosa, P. R., Borromeo, S., & Vaquero, J. (2024). Insights 4.0: Transformative learning in industrial engineering through problem-based learning and project-based learning. *Computer Applications in Engineering Education*, *32*(4), e22736. https://doi.org/10.1002/cae.22736

Rohmaniyah, N., & Asih, S. W. (2024). Project-Based Learning Design in Secondary Schools: Enhancing Students’ Collaborative and Creative Skills. *International Journal of Post Axial: Futuristic Teaching and Learning*, 274–287. https://doi.org/10.59944/POSTAXIAL.V2I4.395

Savery, J. R. (2006). Overview of Problem-based Learning: Definitions and Distinctions. *Interdisciplinary Journal of Problem-Based Learning*, *1*(1), 3. https://doi.org/10.7771/1541-5015.1002

Savery, J. R. (2019). Comparative Pedagogical Models of Problem-Based Learning. In M. Moallem, W. Hung, & N. Dabbagh (Eds.), *The Wiley Handbook of Problem-Based Learning* (pp. 81–104). John Wiley & Sons. https://doi.org/10.1002/9781119173243.ch4

Sumantri, M. S., Gandana, G., Supriatna, A. R., Iasha, V., & Setiawan, B. (2022). Maker-Centered Project-Based Learning: The Effort to Improve Skills of Graphic Design and Student’s Learning Liveliness. *Journal of Educational and Social Research*, *12*(3), 191. https://doi.org/10.36941/jesr-2022-0078

Toure, M., & Tomc, H. G. (2022). Didactic Methods for Achieving Improved Creativity in Teaching Graphic Design in Secondary School Formal Education. *International Symposium on Graphic Engineering and Design*, 581–591. https://doi.org/10.24867/GRID-2022-p64

Ulger, K. (2018). The effect of problem-based learning on the creative thinking and critical thinking disposition of students in visual arts education. *Interdisciplinary Journal of Problem-Based Learning*, *12*(1), 3–6. https://doi.org/10.7771/1541-5015.1649

AUTHOR´S INFORMATION

Idania Dorta-Rodríguez holds a degree in Graphic Design from the Instituto Superior de Diseño Industrial (ISDI), Havana, Cuba and a Master's degree in Digital Graphic Design from the Universidad Internacional de La Rioja (UNIR), Logroño, Spain. She is currently an associate professor in the Multimedia Engineering Program, Faculty of Engineering, Universidad Militar Nueva Granada, Campus Nueva Granada, Cajicá, Colombia. ORCID: 0000-0002-4611-0278.

Juan Cabello-Eras holds a degree in Mechanical Engineering from Universidad de Cienfuegos, Cienfuegos, Cuba, and a Ph.D. in Technical Sciences from Universidad Central de Las Villas, Santa Clara, Cuba. He is currently an Associate Professor in the Mechanical Engineering Program at the Faculty of Engineering, Universidad de Córdoba, Montería, Colombia, where his research focuses on mechanical design and Energy Efficiency. ORCID: 0000-0003-0949-0862.

Alexis Sagastume-Gutiérrez holds a Mechanical Engineer and a Master's degree in Energy Efficiency, both from the University of Cienfuegos, Cienfuegos, Cuba. Additionally, he holds a Ph.D. in Technical Sciences from the University of Cienfuegos, Cienfuegos, Cuba. He currently serves as Director of Graduate Studies at FAEDIS in the Universidad Militar Nueva Granada in Cajicá, Colombia. ORCID: 0000-0003-0188-7101.