

Reducing Technological Complexity through Canvas-Based Learning in Higher Education

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Resumo / Abstract

Higher Education institutions increasingly face the challenge of preparing students from diverse disciplinary backgrounds to engage with emerging technologies and innovation processes. Students enrolled in management, tourism, and other non-technical programs are often expected to participate in interdisciplinary innovation projects, despite having limited technological expertise. This creates a pedagogical challenge:

how to reduce technological complexity while fostering active learning in interdisciplinary collaboration, and innovation-oriented thinking?

Addressing this challenge requires appropriate learning resources that structure student engagement, collaboration, and problem-solving in authentic innovation contexts. In this pedagogical approach, the Canvas was used as a scaffolding and visualization tool rather than as a teaching methodology in itself. Its role was to support project-based and collaborative learning by structuring students' understanding and facilitating the integration of management and technological perspectives. In sum, the Canvas provided a visual and collaborative framework for effectively enacting teaching strategies, project-based tasks, peer interaction, and pedagogical mediation.

Background and information

Canvas-based learning approaches are relevant in project-based education because they provide simple, visual, and structured frameworks for organizing complex problems, supporting collaboration, and making project development more transparent. In educational settings, canvas models can help students structure ideas, identify key components, plan tasks, and connect conceptual understanding with practical application [1].

In this work, two canvas-based adaptations are considered.

The Information Systems Management Canvas (ISMC) adapts the logic of visual project modelling to support students in understanding the stages and components of information systems development.

The Print2Serve Canvas adapts the Business Model Canvas to integrate additive manufacturing, service logic, and sustainability considerations supporting students in analysing product-service configurations enabled by 3D printing [2].

Methodological approach

This work presents and reflects on two complementary pedagogical experiences developed at the University of Aveiro that involve canvas-based teaching and learning frameworks designed to support technological literacy in non-engineering contexts. The first experience was developed between March 23 and June 23. Two classes of 24 undergraduate Management students were engaged in implementing the ISM canvas at the University of Aveiro. The student's perceptions of the usefulness of the canvas model were assessed at the end with a survey.

The second experience introduces the Print2Serve Canvas, an active learning framework designed to promote additive manufacturing literacy, servitization thinking, and sustainability-oriented reasoning among Industrial Engineering and Tourism Management students. The Print2Serve Canvas was presented and discussed with the operational staff of the university's 3D printing laboratory. Then, students were required to identify a documented real-world case in which 3D printing played a significant role in supporting or transforming a product-service offering. To guide the search process, written guidelines were provided specifying the use of credible academic, technical, or institutional sources.

Results and Discussion

The first experience was inspired by Sattinger, Jackson, and Burd's approach [3] to project management principles for information systems; a six-core process description was adopted, as partially illustrated in Figure 1. Based on the students' responses, it is evident that the participants generally perceived the various aspects of the Information Systems Canvas positively.

The correlation between Visual Presentation success and overall General Evaluation scores suggests that students' positive response to the methodology's visual organization The Print2Serve Canvas serves not only as a tool for additive manufacturing education but also as a transferable pedagogical approach for innovation-oriented curricula.

significantly influences their overall learning experience.

In the second experience, the Print2Serve Canvas was designed as an adaptation of the Business Model Canvas to support the structured analysis of additive manufacturing within product-service configurations (Fig.2).



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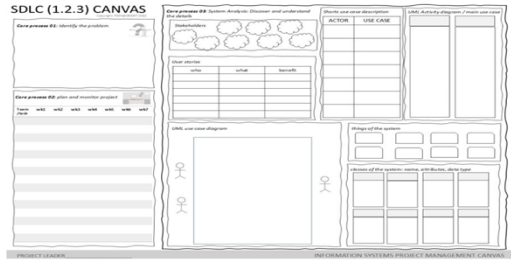


Fig.1 Adapting the CANVAS to Information System Planning (ISM).

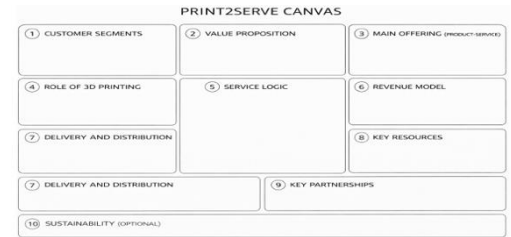


Fig.2 Print2Serve Canvas

The canvas maintains core business model components while incorporating specific dimensions that foreground the technological and service implications of additive manufacturing positioning. The comparative overview of the cases prepared by the students reveals several consistent patterns across the analyzed cases. Canvases serve as visual and conceptual boundary objects: they reduce ambiguity, structure discussion, and facilitate shared reasoning among participants with different expertise.

Conclusions

Both approaches use visual canvases as cognitive scaffolds to help students structure complex technological concepts, collaborate, and interpret real-world problems through value-oriented and service-oriented perspectives. These findings highlight the potential of canvas-based learning as a transferable pedagogical approach for innovation-oriented Higher Education.

References

- [1] D. C. Ferreira-Herrera, "El modelo CANVAS en la formulación de proyectos," *Cooperativismo & Desarrollo*, vol. 23, no. 107, 2016.
- [2] To, T. T., Al Mahmud, A., & Ranscombe, C. "Opportunities and challenges of 3D printing integration into engineering education in developing countries." *Educational Technology & Society*, 27(4), 191-217, 2024.
- [3] J. W. Sattinger, R. B. Jackson, and S. D. Burd, *Systems analysis and design in a changing world*. CENGAGE Learning, 2016.

Educational Insights

A key insight emerging from both experiences is that visual scaffolds do not eliminate all learning difficulties. Rather, they make those difficulties more visible: in the ISMC experience, students struggled when moving from conceptual planning to technical system components; in the Print2Serve experience, the main challenge was translating technological potential into revenue logic and long-term service continuity.

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