# Architectural Stories: A Card Game for Architectural Patterns Education

**Maria Clara de Menezes**[1], **Pedro Henrique Valle**[2], **Alessandreia de Oliveira**[1]

[1]Departamento de Ciência da Computação - UFJF - Juiz de Fora, MG – Brasil
[2]Universidade de São Paulo - (IME-USP) - Brasil

mariaclara.ribeiro@estudante.ufjf.br, pedrohenriquevalle@usp.br, alessandreia.oliveira@ufjf.br

## 1. Introduction

Software Architecture (SA) plays a key role in software development, as it defines the structures and relationships that support system reasoning [Bass et al. 2021]. Architectural decisions affect requirements and business goals [Sousa and Marques 2020]. A key activity is selecting architectural patterns, which offer reusable solutions to common design problems and guide system organization [Bass et al. 2021]. Despite its importance, Software Architecture Education (SAE) presents significant challenges [Galster and Angelov 2016, Araújo et al. 2024]. Architectural concepts are often abstract, making them hard to learn through lectures [Ouh and Irawan 2019, Oliveira et al. 2022, Castro 2023]. In addition, these methods offer limited practice in skills like decision-making and negotiation [Montenegro et al. 2017]. A challenging skill is identifying appropriate architectural patterns from a narrative problem, which requires technical knowledge and diagnostic reasoning [Lago et al. 2019].

To address these challenges, active learning strategies such as project-based learning, gamification, and educational tools have been explored [Vidoni et al. 2018, Carvalho et al. 2025, Menezes et al. 2026]. Among them, educational games stand out for promoting engagement, critical thinking, and learning in a more interactive way [Souza et al. 2023, Feichas et al. 2021, Lelis and Marques 2024]. However, there are approaches that often focus on predefined choices or the application of specific methods, rather than encouraging students to infer architectural patterns directly from problem narratives [Cervantes et al. 2016, Montenegro et al. 2017, Lago et al. 2019].

In this context, this work investigates the use of a narrative-based educational game to support SAE. The research question is: *How does the use of a narrative-based investigative game influence motivation, player experience, and perceived learning in the identification of architectural patterns?* To answer this question, this work proposes Architectural Stories, a non-digital card game designed to help students interpret narrative scenarios and map them to appropriate architectural patterns. The game adopts a collaborative and investigative format, encouraging players to analyze situations, discuss possibilities, and reach solutions collectively. The aim is to support the development of diagnostic reasoning and improve student engagement in learning architectural patterns.

## 2. Methodology

We adopted a research methodology organized into 5 phases (Figure 1): (1) Identification of Existing Approaches, (2) Definition of Learning Objectives, (3) Game Design and Development, (4) Evaluation Planning and Execution, and (5) Data Collection and Analysis.

## 3. Related Work

We conducted a Systematic Mapping Study (SMS) on Software Architecture education to identify pedagogical strategies and game-based approaches [Menezes et al. 2026]. The

results revealed a key gap: few approaches support inferring architectural patterns from narrative problem descriptions, as most games rely on predefined options, limiting investigative reasoning. For example, Smart Decisions [Cervantes et al. 2016], ATAM-RPG [Montenegro et al. 2017], DecidArch [Lago et al. 2019], and the LEARN board game [Sousa and Marques 2020] focus on design, evaluation, decision-making, or conceptual knowledge, but do not emphasize diagnosis in open-ended scenarios. To address this gap, Architectural Stories adopts a narrative-driven approach where players infer patterns without predefined options, fostering diagnostic reasoning and contextual interpretation.

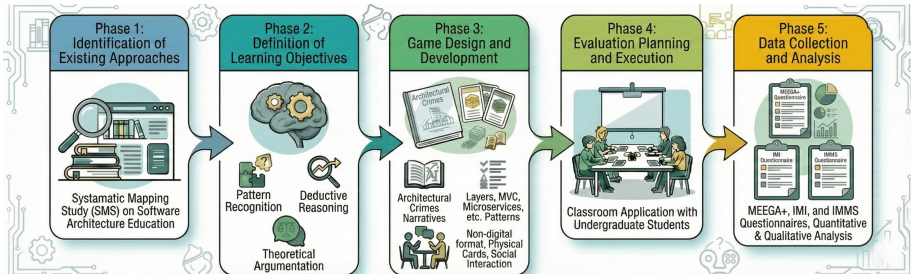
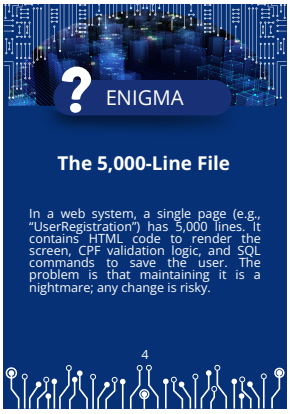


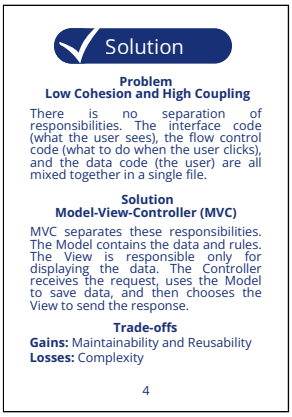

**Figure 1. Research Methodology**

## 4. Architectural Stories

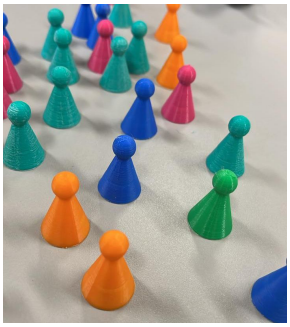
We present Architectural Stories, a non-digital investigative deduction game that adapts the "Black Stories" format to the software design domain, operationalizing the concept of "Architectural Crimes". The game aims to bridge the gap between abstract knowledge and the practical ability to identify architectural patterns from contextualized narratives. The game is played in groups of three to five participants and includes a scoreboard, 20 Mystery Cards, pawns, an instruction manual, and pattern cards. Each Mystery Card has two sides (Figure 2(a)): the Enigma, accessible to all players and describing a failure scenario, and the Solution, restricted to the Architecture Master (AM), providing the explanation.




(a) The Enigma.




(b) The Solution.



(c) Colored Pawns.

**Figure 2. Examples of game cards and colored pawns used in the activity.**

The Insight Points Board tracks player progress using colored pawns, supported by an Instruction Manual and Pattern Reference Cards that reinforce theoretical understanding and promote analytical reasoning during gameplay. The materials are available for replication and adoption by other instructors in an online repository[1]. The game follows an asymmetric, rotating-role structure with one Architecture Master and multiple

[1]https://github.com/MariaClara11/Architectural-Stories-Material.git

investigators in a hybrid competitive–cooperative model: the Master presents enigmas, and answers closed questions, while players propose solutions (diagnosis + pattern) to earn points, and rounds continue until a time limit or an end condition.

## 5. Evaluation of Architectural Stories

The evaluation adopted a multi-instrument approach combining MEEGA+ [Petri et al. 2019], IMI [Ryan et al. 1991], and IMMS [Keller 2009] to assess game quality, usability, player experience, intrinsic motivation, and instructional effectiveness. A single 30-minute gameplay session was conducted, followed by 40 minutes for data collection through a consolidated questionnaire. MEEGA+ was adapted for non-digital games (32 items), while IMI and IMMS provided complementary perspectives on experience and motivation. The study involved 34 undergraduate students working in groups, who learned and played the game autonomously. Multiple rounds enabled participants to experience different roles while minimizing the researcher's intervention. Data collection followed strict ethical procedures, ensuring anonymity, voluntary participation, and informed consent. Quantitative data were statistically analyzed, and qualitative responses were examined to identify recurring perceptions and areas for improvement.

## 6. Results

This section summarizes data from 34 participants ($N = 34$) who evaluated Architectural Stories using the MEEGA+, IMI, and IMMS. All responses are publicly available[2]. The results indicate a consistently positive perception across usability, player experience, motivation, and instructional design. MEEGA+ findings reveal high levels of usability and engagement, with strong scores in Accessibility, Social Interaction, and Relevance, suggesting the game is intuitive and inclusive. Social Interaction emerged as the most prominent factor, highlighting the importance of collaborative reasoning and group discussion in sustaining engagement. The IMI and IMMS results further reinforce these findings by demonstrating high motivation, especially in Interest/Enjoyment and Value/Usefulness, indicating that students not only enjoyed the experience but also recognized its educational relevance. Moderate-to-high scores in Perceived Competence and Effort/Importance suggest that participants felt capable and invested in the activity, while low Pressure/Tension indicates a psychologically safe learning environment. From an instructional perspective, high Attention, Relevance, and Satisfaction scores confirm the game design's effectiveness, though lower Confidence scores indicate opportunities for improved scaffolding. The triangulated results indicate that the game positively impacts motivation, engagement, and perceived learning of software architectural patterns.

## 7. Conclusion

This work addresses a gap in SAE by proposing Architectural Stories, a non-digital game designed to foster the ability to infer Architectural Patterns from narrative descriptions. Grounded in a comprehensive SMS, the approach emphasizes higher-order cognitive skills such as diagnostic reasoning, justification, and collaborative decision-making. The empirical evaluation with undergraduate students, supported by validated instruments, indicates strong acceptance, high engagement, and positive perceptions of learning and instructional value. Overall, the results suggest that Architectural Stories is an effective and reusable approach that bridges the gap between abstract architectural knowledge and practical reasoning, contributing to both research and practice in SAE.

[2] https://tinyurl.com/4vbwb3ts

## References


Araújo, A., Coelho, A., Rodrigues, M. E., Viana, W., and Marques, A. B. (2024). Todo esforço será recompensado: Gamificaçao no ensino de arquitetura de software com o uso de badges. In *Workshop sobre Educação em Computação (WEI)*, pages 341–352. SBC.

Bass, L., Clements, P., and Kazman, R. (2021). *Software architecture in practice*. Addison-Wesley Professional.

Carvalho, E., Barbosa, J., Neto, R. B., Neto, V. G., and Valle, P. (2025). Decora: Um sistema de apoio ao ensino de decisões de projetos arquiteturais. In *Anais do V Simpósio Brasileiro de Educação em Computação*, pages 719–729, Porto Alegre, RS, Brasil. SBC.

Castro, L. M. (2023). Role-playing software architecture styles. In *2023 IEEE 20th International Conference on Software Architecture Companion (ICSA-C)*, pages 171–174. IEEE.

Cervantes, H., Haziyev, S., Hrytsay, O., and Kazman, R. (2016). Smart decisions: an architectural design game. In *Proceedings of the 38th International Conference on Software Engineering Companion*, pages 327–335.

Feichas, F. A., Seabra, R. D., and de Souza, A. D. (2021). Gamificação no ensino superior em ciência da computação: Uma revisão sistemática da literatura. *Revista Novas Tecnologias na Educação*, 19(1):443–452.

Galster, M. and Angelov, S. (2016). What makes teaching software architecture difficult? In *Proceedings of the 38th International Conference on Software Engineering Companion*, pages 356–359.

Keller, J. M. (2009). *Motivational design for learning and performance: The ARCS model approach*. Springer Science & Business Media.

Lago, P., Cai, J. F., de Boer, R. C., Kruchten, P., and Verdecchia, R. (2019). Decidarch: Playing cards as software architects. In *Proceedings of the 52nd Hawaii International Conference on System Sciences (HICSS)*, pages 7815–7824. Hawaii International Conference on System Sciences (HICSS).

Lelis, M. and Marques, A. (2024). Learn 2.0: Evolução de um jogo de tabuleiro para o ensino de arquitetura de software. In *Anais do XXIII Simpósio Brasileiro de Jogos e Entretenimento Digital*, pages 1397–1408, Porto Alegre, RS, Brasil. SBC.

Menezes, M. C. R. d., Valle, P. H. D., and Oliveira, A. M. (2026). Two decades of software architecture education: State of the art, challenges, and future directions. In *Proceedings of the 48th International Conference on Software Engineering*, ICSE-SEET '26, Rio de Janeiro, Brazil. IEEE/ACM. Accepted for publication.

Montenegro, C. H., Astudillo, H., and Álvarez, M. C. G. (2017). Atam-rpg: A role-playing game to teach architecture trade-off analysis method (atam). In *2017 XLIII Latin American Computer Conference (CLEI)*, pages 1–9. IEEE.

Oliveira, B. R., Garcés, L., Lyra, K. T., Santos, D. S., Isotani, S., and Nakagawa, E. Y. (2022). An overview of software architecture education. In *Congresso Ibero-Americano em Engenharia de Software (CIbSE)*, pages 76–90. SBC.

Ouh, E. L. and Irawan, Y. (2019). Applying case-based learning for a postgraduate software architecture course. In *Proceedings of the 2019 ACM Conference on Innovation and Technology in Computer Science Education*, pages 457–463.

Petri, G., Von Wangenheim, C. G., and Borgatto, A. F. (2019). Meega+: Um modelo para a avaliação de jogos educacionais para o ensino de computação. *Revista Brasileira de Informática na Educação*, 27(03):52–81.

Ryan, R. M., Koestner, R., and Deci, E. L. (1991). Ego-involved persistence: When free-choice behavior is not intrinsically motivated. *Motivation and emotion*, 15(3):185–205.

Sousa, T. A. and Marques, A. B. (2020). Learn board game: A game for teaching software architecture created through design science research. In *Proceedings of the XXXIV Brazilian Symposium on Software Engineering*, pages 834–843.

Souza, A. C. C., Souza, F. C. M., Vilela, R. F., and Valle, P. H. (2023). Pmbok game ii: Um jogo educacional para apoiar o ensino de gestão de projetos de software. In *Workshop sobre Educação em Computação (WEI)*, pages 454–464. SBC.

Vidoni, M., Montagna, J. M., and Vecchietti, A. (2018). Project and team-based strategies for teaching software architecture.