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Uncharted Dimensions, Gaps, and Future Trends of Serious Games in Software Engineering*

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Resumen(Abstract). Objective: Serious Games (SG) are a rising trend in Software Engineering (SE) education, for this reason, and since this topic is still immature and further research was encouraged, it is important to investigate how SGs are integrated into SE education. In this line, this study explores the landscape of SGs in SE) education, focusing on their categorization according to their addressed SWEBOK areas and Bloom's levels, extracted their key elements, mechanics and dynamics, exploring in depth their most portrayed player profiles, finding what makes them successful SGs in this field, and last addressing their resulting challenges in the realm of SE education. Methodology: A systematic search was conducted across prominent databases: Science Direct, IEEE Xplore, ACM, Scopus, and Wiley. Initially, 125 papers met our initial inclusion criteria, from which 46 remained after rigorous full-text review. Utilizing snowball sampling, we added 28 additional studies, resulting in a total of

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74 selected papers for comprehensive analysis. Results: Among the selected papers, which spanned from the early 2000s to May 2021, a notable increase in publications on SGs in SE was observed, particularly since 2010. The majority of these studies focused on validation research (60 %), followed by solution proposals (17.56 %) and evaluation research (13.51 %). Publication channels predominantly included conferences (79.73 %), underscoring the emerging nature of SGs in SE research, with a smaller proportion appearing in journal articles (20.27 %). Specific focus areas within SE, such as Software Engineering Management (33.78 %) and SE Professional Practice (13.51 %), received significant attention, while others, like SE Models and Methods, showed minimal representation. Furthermore, SGs were found to effectively target higher-order cognitive skills based on Bloom's Taxonomy, with notable implementations of game dynamics such as Teams and Realism to enhance learning experiences. Despite these advancements, there remains a predominant focus on player profiles like Achievers (48.64 %) and Players (47.30 %), suggesting potential gaps in addressing a broader spectrum of learner types within SGs designed for SE education. Conclusion: This study underscores the evolving role of SGs in SE education, emphasizing the need for diverse approaches to enhance engagement and educational outcomes. Future research should focus on optimizing SG potential across educational and industrial settings by expanding publication visibility, integrating artificial intelligence (AI), and conducting comprehensive evaluations of SGs tailored to SE contexts.

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