



PANORAMA
ISSN: 1909-7433
ISSN: 2145-308X
ednorman@poligran.edu.co
Politécnico Grancolombiano
Colombia

APPLYING SERIOUS GAME IN ECONOMIC SCIENCE PROGRAMS: TRENDS AND CHALLENGES

Morales-Sierra, Maria Eugenia; Valencia, Daniel Cardona; Gomez, Eric Castañeda; Uribe-Ortiz, Ana Maria; Rios-Gallego, Paul Alexander

APPLYING SERIOUS GAME IN ECONOMIC SCIENCE PROGRAMS: TRENDS AND CHALLENGES

PANORAMA, vol. 14, núm. 27, 2020

Politécnico Grancolombiano, Colombia

Disponible en: <https://www.redalyc.org/articulo.oa?id=343964051020>

DOI: <https://doi.org/10.15765/pnrm.v14i27.1526>

<https://journal.poligran.edu.co/index.php/panorama/about/submissions#copyrightNotice>
<https://journal.poligran.edu.co/index.php/panorama/about/submissions#copyrightNotice>



Esta obra está bajo una Licencia Creative Commons Atribución-NoComercial-SinDerivar 4.0 Internacional.

APPLYING SERIOUS GAME IN ECONOMIC SCIENCE PROGRAMS: TRENDS AND CHALLENGES

Aplicación del juego serio en programas de ciencias
económicas: tendencias y desafíos

Maria Eugenia Morales-Sierra memorales@poligran.edu.co

Institucion Universitaria Politecnico Grancolombiano, Colombia

Daniel Cardona Valencia danielcardona@itm.edu.co

Instituto Tecnologico Metropolitano, ITM, Colombia

Eric Castañeda Gomez ericcastaneda@itm.edu.co

Instituto Tecnologico Metropolitano, ITM, Colombia

Ana Maria Uribe-Ortiz anauribe144623@correo.itm.edu.co

Instituto Tecnologico Metropolitano, ITM, Colombia

Paul Alexander Rios-Gallego paulrios@itm.edu.co

Instituto Tecnologico Metropolitano, ITM, Colombia

PANORAMA, vol. 14, núm. 27, 2020

Politécnico Grancolombiano, Colombia

Recepción: 08 Octubre 2019

Aprobación: 01 Julio 2020

DOI: [https://doi.org/10.15765/
pnrm.v14i27.1526](https://doi.org/10.15765/pnrm.v14i27.1526)

Redalyc: [https://www.redalyc.org/
articulo.oa?id=343964051020](https://www.redalyc.org/articulo.oa?id=343964051020)

Abstract: This document presents a characterization of international collaborative work on the application of serious game in curricular content in economic sciences programs related to finance, accounting and administration. Information compiled from the Scopus academic database during the 2007-2018 observation window was used as reference, it considered bibliometric indicators, outstanding methodologies, trends in use or application, and challenges of implementation. As a result, it is possible to identify eight main categories of teaching-learning strategies, out of which Adaptive Learning, Collaborative Learning and Gamification are the trends in which the use of serious game has been consolidated. Storytelling (narrative of stories), and Competence-Based Learning are in the process of consolidation. Finally, Flipped Learning, Massive Open Online Course (MOOC), and Challenge-Based Learning are incipient lines in which the use of serious game has not been sufficiently developed. Based on scientific publications, it is possible to highlight the main achievements, orientations and challenges of the application of these strategies in the classroom, particularly those related to finance, administration and accounting.

Education; serious game; administration, finance and accounting; active learning; training by competencies.

Keywords: Education, serious game, administration, finance and accounting, active learning, training by competencies.

Resumen: Este documento presenta una caracterización del trabajo colaborativo internacional sobre la aplicación del juego serio en contenidos curriculares de programas en ciencias económicas relacionadas con las finanzas, la contabilidad y la administración. Se tomó como referencia información compilada de la base de datos académica Scopus durante la ventana de observación 2007-2018, teniendo en cuenta indicadores bibliométricos, metodologías destacadas, tendencias de uso o aplicación y desafíos o retos de la implementación. Como resultado, se logra identificar ocho principales categorías de estrategias de enseñanza-aprendizaje en las cuales Aprendizaje adaptativo, Aprendizaje colaborativo y Gamificación se ubican como las tendencias en las que el uso del juego serio se ha consolidado. *Storytelling* (narrativa de historias), y el Aprendizaje basado en competencias están en proceso de consolidación. Finalmente, Aprendizaje invertido, *Massive Open Online Course* (MOOC), y Aprendizaje basado en retos son

líneas incipientes en las que el uso del juego serio no se ha desarrollado lo suficiente. De igual manera, se logra destacar, a partir del seguimiento de publicaciones científicas, los principales logros, orientaciones y desafíos de la aplicación de estas estrategias en el aula de clase; particularmente, las relacionadas con las finanzas, la administración y la contaduría.

Palabras clave: Educación, juego serio, administración, finanzas y contaduría, aprendizaje activo, Formación por competencias.

INTRODUCTION

A permanent challenge in education, which transcends disciplinary aspects and different areas of knowledge, is associated with updating classroom methodologies and didactics in order to attain active learning and improve achievement of academic objectives (Motiejunaite & Žadeikaite, 2009).

According to the generalities of current higher education, teaching and learning are fulfilled when an adequate response by the student is verified based on an instruction model; thus, evaluation determines the accomplishment of minimum established standards and allows identifying stimuli or reinforcements that could be more effective (Ertmer & Newby, 1993). The development of teaching-learning activities and of serious game in the classroom enables students to develop working competences based on scenario simulation, case studies and multigrade environments (Abad et al., 2018).

This has driven didactic actions that foster an improvement of education's communicative action, as well as the development of creativity, imagination, personality and innovation at cognitive, psychological and social levels (Von Graevenitz, Harhoff, & Weber, 2010).

Based on these actions and on its combination with information and communication technologies (ICT) tools, more complex and sophisticated schemes have been promoted, commonly known as didactic strategies, which are a set of methods and sequences intended to fulfill the teaching-learning goal, these comprise (in different proportions) master lectures, debate workshops and online forums, virtual classrooms, social networks, design or simulation programs and videogames; the application of these new models is currently becoming a trend (Lozano-Abad et al., 2019), stressing that the incorporation of didactic activities in the classroom helps students advance different abilities and strategies typical of each learning style or inclination used to consolidate learning (Ocampo et al., 2014).

THEORETICAL FRAMEWORK

Active learning has two meanings, one in the field of education and another one in the computer context. The first one focuses on a series of didactic strategies that place students at the core of the educational process, encouraging them to be aware of their function in learning,

thus creating a bond with knowledge and its application in real contexts (Christie & de Graaff, 2017). The second one concentrates on the development of artificial intelligence and machine learning algorithms, which are capable of conducting creative search actions, verification, evaluation and storage of experiences (Settles, 2010). The first meaning will be considered for the purpose of this research.

Diverse initiatives have been applied in classrooms and reported in scientific literature; one of the aspects reported in the areas of accounting, finance and management has to do with the application of games in the training process (Bodnar & Clark, 2017).

The following are other emerging phenomena that intend to positively affect the teaching-learning process, which go hand in hand with the relevance acquired by ICT in different everyday aspects: the concept of microworlds explained by Mavrikis et al., (2008) and Marin et al., (2015); application of games (Xinogalos et al., 2015) and gamification (Villalustre & Del Moral, 2015), which converge towards meaningful learning, incorporating a space for simulated practice into the training process (in the case of microworlds and game application) and into schemes of stimulus and recognition to foster motivation (in the case of gamification) (Acevedo, 2019).

Serious or formative game is a category that clusters applications of game in training processes, these are applied not just in schools and universities but also in fields such as military training, health certifications and financial sector simulations, with the aim of improving personnel and teams' dexterity in controlled environments. Methods have been designed to analyze and design serious game to evaluate its articulation with defined educational goals (Carvalho et al., 2015). Formative game has been addressed from different approaches, including cybernetic, to understand it as a controllable process targeting the expected curricular objectives (Westera, 2013).

According to Kark (2011), game and gamification have been key in the development of learning, which is used to attain desired results in students' training processes with different educational levels; also, Pasin and Giroux (2011), through an implementation of a simulation game to manage operations, show that this type of strategies are more effective than traditional strategies, and enable the development of faster decision-making skills. In fields such as medicine in Europe (Garrido et al., 2018), there are conclusive findings concerning the use of unconventional methodologies, consequently, courses that follow online methodologies and multimedia activities increase the level of analysis and synthesis competences compared with the initial level (Florez-Romero, R.#; Castro-Martinez, J. A.#; Martelo Martinez, Fernando; Salazar-Montenegro, I.#; Camelo-Cabuya, 2019)

According to Sironi (2016), areas such as finance and its rising intersection with technology (Fintech), must steer educational entities towards the evolution of their academic processes, making adaptations aimed at ICT and creative strategies to encourage students. Also, authors such as Hamari, Huotari and Tolvanen (2015), stress the use of game

to teach economic topics and its appeal with teachers and students (Norman-Acevedo, 2019). The aforementioned can be supported by the experiment conducted on students enrolled in the master's degree of Economics at Universidad de Granada, the experiment implemented a gamification platform and it can be concluded that the use of game built up students' motivation (Zamora & Aranda, 2017).

METHOD

This work has a qualitative approach, it arises from the results of a bibliometric study that applied a search equation in Scopus which identified traits of quantity, quality and structure of academic and scientific production in the topic of game-based learning in higher education programs, including the areas of accounting, finance and administration, taking place the last decade (2007-2018). The resulting information helped identify emerging didactic strategies referred by the Educational Innovation Observatory (*Observatorio de Innovacion Educativa*) at Tecnologico de Monterrey (Observatorio de Innovacion Educativa, 2017), and the search is expanded to other areas of knowledge, keeping the educational an engineering aspect associated with the design and development of serious game as extensive criteria, in order to identify the frequency with which these emerging didactic strategies are featured in journals and peer-reviewed events that have been approved by the scientific community.

With this in mind, the most relevant texts and the impact index are inquired into to describe aspects that stand out, such as participants' profile, scope, relationship with serious game, and finally, main challenges faced by each of these emerging didactic strategies that can be found in the literature's review.

RESULTS

Bibliometry: the outcome of the bibliometric study shows that the increase of academic production pertaining this topic is significant, each year it increases by 10%, according to the trend. 816 records were featured in the 2007-2018 decade, this means that the interest in the topic is expanding and is consistent with the digital transformation processes occurring in other spheres such as technification, production and finance.

Works in the formats of papers amount to a fourth of the total production, while conference texts are predominant with over half of the indexed academic production, this means there is extensive interest in dissemination, mostly of documents that are reflexive and that are applied to specific contexts. In its majority, these works are written by two or three authors.

Moreover, the topic's production is concentrated on developed countries, namely: United States, United Kingdom, China, Germany, Spain, Canada, the Netherlands, among others. Universities that have

contributed eight or more papers on the topic throughout the last decade include: Delft University of Technology, the Netherlands; University of Ontario Institute of Technology, Canada; Universidad Complutense de Madrid, Spain; National Central University Taiwan, China; and CNRS Centre National de la Recherche Scientifique, France.

The most representative authors and papers throughout the decade, with over 100 citations, include: Proserpio and Gioia, with a review paper oriented towards teaching the generation of virtuality, a collaborative initiative between the Universities of Bocconi, Italy, and State, Pennsylvania, USA, which provides reference elements to design virtual objects and environments; it is cited by different authors as a guidebook to design learning activities (Proserpio & Gioia, 2007).

Trends: as part of this analysis, and considering the typology proposed by the Educational Innovation Observatory at Tecnológico de Monterrey (Observatorio de Innovación Educativa, 2017), some emerging didactic strategies are detected in the literature associated with game-based learning, pertaining academic communities that cluster around each topic in different countries and universities. These include: collaborative-based learning, challenge-based learning, adaptative learning, flipped learning, competency-based education, Massive Open Online Course (MOOC), gamification and storytelling.

After the initiatives in these eight categories were classified, the aim was to identify the impact as per a reasonable share of its papers, number of citations, use and scope described by the most relevant authors in terms of applications and results. Three categories were defined based on this share:

| Methodologies | Type of impact | Generalities |
|---|----------------|--|
| <ul style="list-style-type: none"> Gamification Collaborative learning Storytelling | High impact | This category includes didactic strategies that stand out as educational trends with the greatest visibility in the context and that have outstanding academic production and research. Educational trends in this category are topics of interest and relevance for the scientific community due to correlation between impact and student motivation, longer retention of knowledge, better understanding of complex topics. |
| <ul style="list-style-type: none"> MOOC (Massive Open Online Course) Adaptative learning | Medium impact | This category groups didactic strategies that are considered emerging educational trends: MOOC and adaptative learning; these are topics that are beginning to register experiences, application reports and scientific papers in which the core topic is technological (related to software and hardware), and to a lesser extent, methodological and didactic aspects pertaining education. This category does not express overall conclusions, it is a developing area that explores different technological and methodological alternatives. Most mentions refer to the development of MOOC, but a lack of standardization or main characteristics to attain impact results in this category compiling adequate, innovative and impactful applications and virtual courses without proper structure and methodologies, which overall decrease the average of scope of the methodology in terms of adaptative learning. |
| <ul style="list-style-type: none"> Competence-based learning Flipped learning Challenge-based learning | Low Impact | This category includes didactic strategies which, regardless of academic production in SCOPUS as educational trends in the last two decades, relate to serious game equally or below 5%. It includes competence-based learning, flipped learning, and challenge-based learning. The first one has a high frequency of publications but with large dispersion, the range of topics includes epistemology, administration and politics, papers on architecture and design of classroom spaces, critical papers on the theory of education, methodology and didactics; overall, the connection with serious game is incipient. Flipped learning and challenge-based learning are outlined as topics of growing interest that are initially exploring methodological alternatives and ICT implementations, the main topics on the consulted papers. |

Table 1.

Frequency with which the trends are featured

Source: compiled by the authors based on information obtained in Scopus, 2019.

Challenges: this description is a conceptual construction that is typical of results obtained in the bibliometric study; trends contain information related to: definition, association of each trend with the use of game, connection of each trend with economic sciences, the role of students and teachers, as well as trials in its implementation.

| Methodology | Challenges |
|------------------------|---|
| Gamification | The challenges of implementing gamification in education and in the learning process comprise increasing competences of teachers and institutions to develop and apply the concepts in the training processes, planning the stimulus schemes, progress and acknowledgement, as well as learning evaluation (Hamari, 2013). Nevertheless, while the interest in gamification has grown in recent years, there is lack of evidence regarding its effect on users' behavior (Antonaci et al., 2017). Gamification is a scheme that can be adapted to other academic models, in it, students and teachers' roles vary depending on the typical conditions of each pedagogical model, including the traditional mode, or diverse didactic strategies in which it is applied. Students must learn to assume one or several roles according to the context (Garcia. et al., 2017), and teachers must assume the role of facilitators (Dias, 2017). |
| Collaborative learning | The challenges of collaborative learning focus on improving teachers' motivation and stimulating their propensity to get permanent feedback from their students; streamlining technical and technological conditions to gather students around collaborative learning actions and to the need of establishing mechanisms to guarantee adequate time allocation that enables collaborative activities (Muuro, Wagacha, Oboko, & Kihoro, 2014). In this strategy, it is necessary for teachers to assume the role of instructors, steering towards the required academic objectives to facilitate the conditions that benefit collaborative learning (Qi, Qi, Sang, & Sun, 2010), whereas the student's role needs to be of receptor – builder, willing to permanently interact with his/her classmates to question, discuss and build the concepts tackle to attain its assimilation. |
| Storytelling | Challenges lie in its widely creative use intended to build new and improved learning environments where teachers and students interact more confidently through didactics that assist narrative dialogues based on academic content. The storytelling strategy has a conceptual approach that differs from the others insofar that most applications of game in education entail a narrative introduction, which is used to present environments and situations that define the context of the game, as well as its rules, limits and goals. The student's role is to be the stories' receptor and interlocutor (Schmoelz, 2018), the teacher is the sender, narrator and creator of environments of closeness, and is in charge of applying knowledge through a plausible recreation of realistic situations. |

| | |
|----------------------------|---|
| MOOC | <p>One of the great perspectives of this technology is the possibility of providing training tools outside the classroom, in which attendance is not a limitation to access education. However, the main challenges of this trend include ensuring students can adapt to the model and finalize their training since MOOC has high rates of desertion and attrition (Youssef et al., 2019). It is also a challenge to overcome difficulties to rigorously and justly evaluate students' work, such as promoting students' participation in the online forums (Hew & Cheung, 2014); as well as the creation of content to appeal students, that is not a reproduction of the traditional model in order to guarantee genuine adhesion that is based on taste and learning (Berrococo, 2014).</p> <p>The scant evidence of scientific about the use of serious game in training processes in the accounting field is a result of teachers' low motivation, despite the fact that they are aware of the benefits these offer; the lack of research on serious game in accounting compared to other disciplines suggests that this is a technique instead of a useful tool for corporate decision-making processes (Calabor, Mora, & Moya, 2018).</p> |
| Adaptive learning | <p>The challenges of this strategy include: a. configuration and provision of courses that are adequate for different students with different knowledge (Kardan, Imani, & Ebrahim, 2013); b. obtaining useful and precise student information in order to make the correct adaptative decisions; c. maximizing student benefits while minimizing cost associated with investment, which requires a configuration and adaptation of adaptative technologies; d. solving the problem pertaining the amount of relevant student data that can be acquired in different moments (Shute & Zapata, 2012); and e. defining the degree of difficulty of the activities to be assigned (Gallego, Molina y Llorens, 2018).</p> <p>Data analysis based on artificial intelligence calls for a modification of the ways of communication and behavior; one of those ways has to do with the methods used in education and considered innovative, which allow an improved dialog between teachers and students, alternating teaching methods ranging from guided activities to the use of robots as educational strategy; this need implies a change on the way in which instructions are delivered to each student; entities such as the Ohio State University in the US intend to implement 20% of artificial technology in adaptative programs by 2019 (Chassignol et al., 2018).</p> |
| Competence-based education | <p>CBE's greatest challenges are: a. lack of clarity in terms of guidance and definitions in the overall educational system, which generate difficulties defining what are the competences and how they will integrate to the evaluative practices and cultures in educational institutions (Rios & Herrera, 2017); and b. and adequate evaluation design, since the level attained by students and educational programs' effectiveness become aspects of frequent discussion in academic spaces (De la Orden-Hoz, 2011).</p> <p>In the case of competence-based education it is noteworthy that, being one of the emerging strategies with significant academic production, out of 20.3%, less than 1% of the papers relate to serious game or gamification, since it has been one of the initiatives inclined towards active learning in its speeches.</p> |
| Flipped learning | <p>Challenges associated with this strategy have to do with: a. planning activities outside the classroom and proper student preparation (Akçayır & Akçayır, 2018); b. limited preparation of students who have been trained in the traditional model (Al-Zahrani, 2015); c. problems of implementation and increased students and teachers (Khanova, Roth, Rodgers, & McLaughlin, 2015) and teachers' workload (Sage & Sele, 2015); d. perception of some students who believe the method is unfair and irrational (Wilson, 2013); e. instructors' suitability and training and their capacity to conduct a flipped learning classroom (Zainuddin & Halili, 2016); also, f. the tendency of some students and teachers to prefer traditional approaches (Hamdan, McKnight, McKnight, & Arfstrom, 2013)</p> |
| Challenge-based learning | <p>Its main challenges are: a. difficulty in planning activities around challenges; b. interaction of different professionals and students of different areas, insofar as knowledge required to address most challenges is multidisciplinary; c. the fact that usually these courses or components need to be implemented outside the study plan due to the uncertainty of its length and scope; d. results' effectiveness, these often do not appear immediately (Fidalgo, Sein, & Garcia, 2016); some of the described limitations are that global projects often steer away from specific content of academic subjects (Gaskins, Johnson, Maltbie, & Kukreti, 2015), and, on the other hand, the method's monitoring is costly and wearing (Binder, Nichols, Reinehr, & Malucelli, 2017).</p> |

Table 2.
Methodology and challenges
Source: compiled by the authors, 2019.

CONCLUSIONS

Curricular and didactic update is a topic of exploratory interest for academia in diverse disciplinary areas, it has started coming out of the classrooms of education departments to become the responsibility of professions that need to undertake training processes' streamlining. It is worth mentioning that interdisciplinarity is not possible if the areas fail to venture into the fields of other areas, with the genuine interest of enhancing training processes of their own competence or of intersecting disciplinary fields.

Current education makes an invitation to review methodological processes in order to encourage teachers to assume significant changes in their teaching processes, awarding students a leading role as they are fundamental part of their training process; inclusion of tools that differ from conventional learning eases the teaching process, allowing generations of the technological era to live meaningful experiences by strengthening their competences, specially their soft skills; with the aim of evolving skills such as self-control, collaborative work and communication, necessary to conduct independent work steered by a tutor in environments other than classrooms (Trujillo-Florez et al., 2019).

Gamification seems to be the strategy with the greatest scope and impact, due to its capacity of adaptation with other strategies and to the generation of mental processes that are based on graphic images that affix concepts in memory and relate to pleasant and fun memories deriving from the interaction with the game as social expression. Nevertheless, opinions by some authors and results of experiments with gamification as an educational tool subtract credibility to the process and drive dispersion among stakeholders (Daza-Orozco, 2015; Trujillo-Florez et al., 2018; Velandia Vargas et al., 2019).

Teaching-learning pedagogical tools will contribute to the academic process in areas such as finance, economics and administrative after content development may represent situations that can be replicated, decision-making and mathematical and statistical applications.

Despite the fact that this review focuses on the administrative and financial field, the application of these strategies is not discriminatory. An approach to generalization aimed at contributing to educational innovation is introduced from disparate views.

DISCUSSION

Although this document introduces some structures, these are not the only ones explored in the proposed educational areas and/or in other areas. Different schemes to foster efficiency and efficacy of global education and students' accomplishment of basic competences have been researched. For instance, organizations of international cooperation, such as the OECD, lead the Programme for International Student Assessment (PISA) (Vaillant & Zidan, 2016), intended to measure students' performance in different areas, which has driven an objective measurement model of all educational levels in some countries. Other local phenomena, such as Project-Based Learning, Prince and Felder (2006), work with methodological trends that can achieve successful results, and its variations such as Problem and Challenge-Based Learning, Hmelo (2004), which follow lessons and good practices learned in countries such as Finland, Singapore and South Korea. Other cases have implemented more subtle pedagogical innovations with less radicalness, such as curricular transformations in the reorganization of content that does not affect methodological nor evaluative models. Likewise, Pico et

al. (2018) and Villa et al. (2020), present an important reflection on the advantages and disadvantages of using teaching-learning strategies, explaining the importance of framing challenges in contexts based on cultural ideas, and teacher training as the foundation to improve its scope. Also, a differentiation between the in-person campus and the digital campus has been suggested, as well as the training role of computing tools.

To further this paper, it is recommended to review other concepts associated with and validated in cases of specific study, which may add more tools to the construction of quality and adaptative education in diverse contexts.