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A bibliometric analysis of the use of the Gamification Octalysis Framework in training: evidence from Web of Science

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The Octalysis framework, which systematically organizes gamified elements in non-game settings, such as training, has become one of the most famous persuasive tools for changing user behaviour. The field of Gamification Octalysis Framework research is expanding rapidly, moving beyond elementary questions like "what" and "why" to more complex ones like "how" and "when". However, there remain empirical and theoretical challenges such as demonstrating the effectiveness of the Gamification Octalysis Framework and codifying the principles underpinning effective gamification design. This paper uses bibliometric analysis and scientific mapping to characterize the structure and development of the academic field of the Gamification Octalysis Framework, with the help of intellectual, conceptual, and social network structures of the framework. Our findings provide insight into the field's research frontiers and intellectual structures, the interconnections between articles, authors, and keywords, the current collaborative networks, the hottest themes, and the most cited authors, publications, and sources, for instance, that in recent years, the Gamification Octalysis Framework has attracted significant research attention in the training field. Interestingly, 66.6% of cutting-edge research is done in the social sciences, as compared to science and technology. Researchers, academicians and professionals should be made aware of Octalysis framework gamified method because it has been shown to increase user engagement and motivation outside of social sciences game setting. We recommend that countries outside Europe integrate the Gamification Octalysis Framework in training into their learning programs and launch corresponding research centres and journals.

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Background

Gamification entails strategically incorporating game elements in a distinct manner to successfully captivate users of a system that is not inherently associated with gaming. The approach above exhibits the capacity to be employed in diverse domains within an enterprise, facilitating the execution of organizational processes with decreased expenses, heightened quality, and increased efficiency. Although there is a considerable amount of existing literature on Gamification, there needs to be more research dedicated explicitly to organizational Gamification. Moreover, there needs to be more comprehensive scholarly investigations about the framework and methodology necessary for the development and execution of organizational Gamification (Fathian et al. 2021). Integrating Gamification into activities and behaviours that promote long-term viability holds promise for enhancing awareness and effectively tackling pertinent issues. Organizations strive to maintain financial stability, deliver social benefits, and consistently ensure a healthy environment. Hence, the utilization of Gamification within ecology holds considerable importance. This approach offers a unique alternative by combining principles and techniques derived from the field of game design with insights derived from the discipline of behavioural psychology. Hence, Gamification can be regarded as a substantial strategy for facilitating constructive societal change and fostering increased efforts toward sustainability (Prakash and Manchanda 2021).

Gamification is widely used in the workplace as jargon to describe anything related to games. Academic research has restricted this concept to applying game design elements outside of games (Deterding et al. 2011). This distinction is significant since games have been used for organizational training for millennia (Sitzmann 2011), although Gamification is a much more recent idea. Besides training, Gamification can be applied in various non-game contexts, but it is most prevalent in business, education, and computer science. Gamification, on the other hand, enhances an established teaching approach by incorporating game design elements. In training and development, Gamification is frequently utilized to improve an inadequate training outcome (such as learning or transfer). Numerous game elements could be employed in this process. However, existing research shows that game elements should be selected based on their scientifically established connections to the desired outcome to boost the likelihood of better outcomes. (Garris et al. 2017), for instance, outlined the scientific justification for connecting fantasy and challenge components to positive learning results. In a more recent publication, Rapp et al. (2018) curated a particular issue for the International Journal of Human-Computer Studies, focusing on the contemporary and prospective directions in gamification research (Rapp et al. 2018). These studies exhibit a shared methodology in their treatment of Gamification as a field of academic inquiry. The field of Gamification is experiencing rapid growth and development, transitioning from addressing fundamental inquiries regarding the nature and purpose of Gamification to more advanced inquiries about the methods, timing, and limitations. However, it continues to encounter empirical and theoretical obstacles in substantiating the impacts of gamification practices and establishing the fundamental principles that inform effective gamification designs.

At its most fundamental level, gamifying training is premised on the assumption that any form of existing training methodology is Unsound in some manner and has to be improved. This is the starting point for the concept of gamifying training. As an illustration, consider an enterprise in Information Technology that predominantly employs video lectures and a web-based instructional regimen to impart knowledge on software development. Regrettably, it has been determined that the program is ineffective due to suboptimal software development productivity in the professional setting, both pre-and post-training. The individual responsible for designing the training program has determined that a program redesign is necessary. The improvement of software development can be achieved by modifying the training approach to incorporate behavioural modelling and increase engagement. There are many ways to do this, and Gamification has become a popular choice among traditional training redesign options (Denny 2013).

When using Gamification, one of the most typical ways to reward particular training actions, such as logging into the training program and completing a module, is to provide points or badges. Gamification is also becoming increasingly popular in the workplace. Unfortunately, previous scientific research on Gamification has yielded results indicating that the effectiveness of such approaches is only sometimes guaranteed and may, in some cases, have adverse effects. However, it is essential to note that this must accurately reflect the Gamification methodology's overall reality. When it comes to software development training programs, a few things have the potential to go differently than planned. To begin, people are only motivated to improve their behaviour if their rewards, such as points and badges, have some psychological significance. In a nutshell, adding points to training will not make a difference if the learners are not interested in them. Second, although points and badges are designed to assist and inspire people, it's possible that there needs to be more motivation with the program. People frequently believe that low training motivation is the cause of difficulties with the effectiveness of training; however, there are many other probable factors, such as a lack of supervisor support for learning or an atmosphere that makes it challenging to transfer instruction (Blume et al. 2009). People often believe that low training motivation is the cause of problems with training effectiveness. These are issues that are not likely to be resolved through the use of games. Instead, it should attempt to find solutions to problems using more conventional methods. Training designers should still follow the best practices for effective training redesign that they were provided in the past before attempting to add games to a training program that is not operating correctly. Gamification does not replace any of the other training methods; nonetheless, it is frequently utilized to make those other methods more effective. When a solid design foundation is already in place, Gamification may frequently be leveraged to boost learning outcomes through several specific redesign decisions influenced by video games and psychological research.

Drawing upon these established examples and taking into account the pervasive nature of games and the subsequent assimilation of game mechanics within society, the concept of Gamification emerges as a natural means to extract attributes from games and integrate them into alternative contexts. One initial perspective, proposed by Nick Pelling in 2002, involves using a game-like accelerated user interface design to enhance the speed and enjoyment of electronic transactions. Nevertheless, the term has evolved significantly since then, encompassing various facets of game experience and design. The definition most commonly cited in scholarly literature is provided by Deterding et al. (2011), which characterizes Gamification as "the incorporation of game design elements into non-game contexts." Marczewski (2014) provides a clear differentiation between the design of games and Gamification, along with their respective characteristics. The primary initiation point for game design typically revolves around the fundamental concept of providing entertainment, whereas Gamification is oriented toward achieving business objectives. Furthermore, it is imperative to establish the definition of metrics or game lines at various stages of the design process.

Notably, most frameworks are founded upon principles of Human-Focused Design, wherein the individual is regarded as the

primary objective of the design. Psychological factors are frequently emphasized and considered highly significant in most proposed frameworks. Therefore, Self-Determination Theory (SDT) is widely recognized as a prominent framework for understanding intrinsic motivation needs. This perspective aligns with Zichermann's (2011) theory, which posits that Gamification comprises 75 per cent of psychology and 25 per cent of technology. Moreover, specific frameworks exhibit interdependence, as explicitly indicated in their respective definitions or discernible through meticulous examination.

In their seminal work, Deterding et al. (2011) delineate the requisite game design actions essential for cultivating gamefulness, presenting them in a hierarchical structure comprising multiple levels. This study explores various aspects of game design, including game interface design patterns, game design patterns and mechanics, game design principles and heuristics, and game models and design methods. Considering this, the objectives of this article are to adhere to the adoption of gamified learning theory within training and to show how it may be applied through the Octalysis framework. In addition, the article will adhere to the adoption of gamified learning theory within training.

This paper aims to give a more thorough bibliometric analysis of the growth of the Gamification Octalysis Framework in training in WoS-indexed journals from 2017 to 2023 (June), which is seven years. This study is new and up-to-date because it includes significant new information. Findings from this study will help the Training organization because they will give them important information that can be used to shape their policies. It will also discuss how the industry can help with this research. In particular, the study wants to answer these research questions:

RQ1: What are the emerging trends in the Gamification Octalysis Framework in training during 2017–2023 (June)?

RQ2: What are the most productive countries, authors, journals, and Affiliations?

RQ3: Which paper received the highest citations?

RQ4: What are the most productive document types, research areas, and domains?

RQ5: What are the most frequently used keywords in Gamification Octalysis Framework research?

Literature review

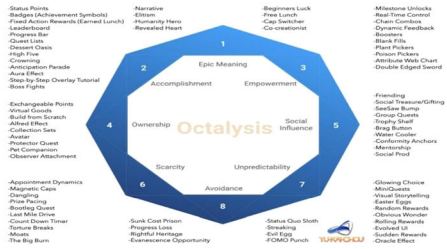
This study provides a significant contribution to the current corpus of literature by investigating the thorough incorporation of the Octalysis framework in training through the implementation of Gamification. The study's conclusions are predominantly based on quantitative data analysis, with less emphasis on qualitative analysis. The current study presents the research conducted by Costa et al. (2017), which focuses on developing a gamification ecology. The study explicitly emphasizes the MDA framework, encompassing game mechanics, dynamics, aesthetics, principles, elements, and components. However, he briefly mentioned the Octalysis framework for Gamification. Therefore, this study focuses on the Gamification Octalysis Framework, which previous researchers overlooked. The study examines the trends, citations, and affiliations associated with the Gamification Octalysis Framework. In a recent study by Riar et al. (2022), the authors discuss the gamification framework and highlight the Octalysis framework as a prominent theoretical model.

Concept of Gamification in Octalysis Framework. According to Chou, Gamification is "the art of putting the entertaining and addicting elements of games to work in the real world or to create something beneficial" (Chou 2019). Gamification employs game features and rules, but it is not a game. Businesses in various industries, such as healthcare, information technology, hospitality, and finance, increasingly utilize Gamification. S&H Green Stamps began selling stamps to retailers in the nineteenth century to honour loyal customers. This was the first time the idea of "gamification" was employed. According to Nelson (2012), Gamification began in the early to mid-20th century in the Soviet Union to entice people to labour for free. Modern Gamification was made possible by airline loyalty programs that reward customers' loyalty with free "air miles." (Chou 2019).

Depending on the industry where it is used, different theories of Gamification give different views on what Gamification is and how it works. One idea is that Gamification is better than branding because it makes people feel something, which leads to a long relationship with the audience. Another idea is that games raise dopamine levels in the brain, which leads to a natural reward-compulsion loop. Even though the origins and mechanics may differ, the idea is simple: users are rewarded for doing certain things based on how well they do (Chou 2019).

Gamification involves incorporating games' enjoyable and captivating aspects into real-world or productive endeavours. This approach is commonly referred to as "Human-Focused Design" in contrast to "Function-Focused Design." The design process in question focuses on optimizing the human element within a system instead of solely prioritizing system efficiency (Chou 2019). His Octalysis Framework (shown in Fig. 1) comprises eight core drivers that can inspire, empower, manipulate, or make us obsess over something but ultimately lead us to do something. These are the eight drivers:

1. Epic Meaning and Calling: This core drive leads users to look for a higher purpose or meaning beyond their own goals.
2. Development and Accomplishment: Users are driven to take on challenges to reach a goal they want to reach. This drive also makes users want to work harder to get better at things and make progress.
3. Creative Expression and Feedback: This core drive explains why users look for ways to learn and express themselves creatively. This motivation lets employees enjoy "play," where they get lost in the joy of the activity itself. Feedback is also a big part of the creative process because it helps employees try out new ideas and ways to express themselves.
4. Ownership: This driver comes into play when users believe that they own something they have. This plays on their natural desire to be proud of what they have, and they want to get more things.
5. Social Influence and Relatedness: Social influence is linked to a user's natural need to find mentors, get approval from others, and find friends. This also makes employees think about how they compare to others and how competitive they are. Relatedness means that users want to connect with people and groups with whom they share things.
6. Scarcity and impatience: Users always want things that they cannot get. This is the thing that makes users want something just because it is rare, unique, or hard to get right away.
7. Unpredictability and Curiosity: It is a user's nature to find excitement in the unknown. Their brain's reward centre lights up when they feel something new or unexpected. This is why they like to be surprised and why users want to try new things.
8. Loss & Avoidance: This core drive is a user who dislikes losing things they have worked hard to get. It also explains why they try to reduce potential loss or risk whenever and wherever possible.



Source- http://yukaichou.com/gamification-examples/octalysis-complete-gamificati on-framework/.

A

Octalysis Framework	Gamification Elements	Training
Epic Meaning and Calling	Narrative, Elitism, Humanity Hero, Revealed Heart, Beginners Luck, Destiny Child, Creationist.	Create Epic Meaning with Exciting Quests & Rewards
Development and Accomplishment	Status Points, Badges, Fixed action rewards, Leaderboards, progress Bar, Quest list, High Five, Crowning, and Boss fight	Celebrate Accomplishments with Points, Badges & Scorecards
Creative Expression and Feedback	Milestone Unlocks, Real-time control, Boosters, Blankfils, and Instant Feedback	Stimulate Creative Expression & Feedback with Levels, Clubs & Quizzes
Ownership	Avatar, Virtual goods, exchangeable points, protection, Alfred effect, build from scratch.	Drive Ownership with In-Game Possessions & Customised Learning
Social Influence and Relatedness	Tout Flags, Brag Button, Group quest, and Mentorship	Stir Up Social Connections & Influence Clubs
Scarcity and Impatience	Last Mile drive, The Big Burn, Moats, Dangling, Appointment dynamics, and Prize pacing	Simulate Scarcity with Hidden Game Functionalities
Unpredictability and Curiosity	MiniQuest, Easter Eggs, Oracle effect, and Visual Storytelling	Inject Unpredictability & Curiosity with Gamified Micro modules
Loss and Avoidances	FOMO Punch, Sunk Cost Prison, Progress Loss, Rightful Heritage, and Visual Grave	Magnify Loss & Avoidance with Goal Re-Framing & Dynamic Game Elements

Source- http://yukaichou.com/gamification-examples/octalysis-complete-gamificati on-framework/.

Fig. 1 Octalysis Gamification Framework. A Octalysis Framework Towards Training- Eight Octalysis frameworks are described with the gamification elements and related training. http://yukaichou.com/gamification-examples/octalysis-complete-gamification-framework/.

The Octalysis Framework permits staff to utilize a variety of incentive drivers. Gamification of Significant Challenges and Rewards Research users before designing a training program. This will enhance the learning of content. Purpose can be added to business learning programs with real-world benefits that help users do good. Learners can donate badges or points to charitable organizations. These awards may recognize business sustainability or philanthropy. Training increases business productivity. Task-oriented employees are more efficient. XP encourages children by fostering self-assurance. Badges are awarded for the completion of modules and platform actions. Progress indicators and awards for personal achievements may inspire this motivation. The development of online students is reflected in real-time. This signal urges personnel to finish training. Scorecards allow users to monitor their accomplishments. This allows them to track and celebrate their experience points, badges, and medals, encouraging them to work more. Clubs, Tiers, and Tests Encourage creative expression and feedback. Users seek feedback on their performance. Their creative energy is maintained by generating new ideas in response to feedback. This Core Drive's strength keeps workers engaged throughout training (Chou 2019).

Organizations distribute information to create anticipation. These modules can also include rich media to engage learners. Unpredictability is increased with flash awards and hidden quests. Add quests that can be unlocked and examined in unexpected ways. This excites the users to discover new learning treasures. Throughout their training, learners may discover surprise awards or badges. Thus, gamified micromodules can amuse and educate learners throughout the training program. Learning objectives teach users about the advantages of training.

Cheng and Ebrahimi (2023) conducted a study that examines the regulatory focus orientations of individuals involved in Gamification. They examine the impacts of reward-seeking and loss-avoidance orientations within gamification systems. This statement illuminates the significant role that design elements play and the resulting emotional outcomes. The results of this study indicate that the psychological consequences of experiencing loss are more significant than those associated with winning. To address this issue and mitigate its impact, Chou (2019) proposes a strategic approach that enables participants to comprehend the potential consequences of failing to complete designated workout routines. Streak incentives and leaderboards can be used to emphasize and gamify prospective detriments. Battles, Leaderboards, and Streaks Learners who finish a set of activities within a particular time range win streak prizes. Learners could be awarded for using the training app three times or completing five courses in five days. Users may suffer if they do not maintain these actions. Breaking streaks may be communicated to users. It is painful to lose the reward. Streak alerts use this essential motivation to encourage positive learner behaviour. Leaderboards motivate employees to learn. Users risk losing points and badges if they do not use the training materials. They could lose their top spot on the leaderboards. Battles may appeal to learners' dislike of losing. Battles are penalty-shootout knowledge tests between players. They are effective because they are knowledge-based conflicts between peers rather than managers or form submissions. Users are encouraged to study to reduce risk. Quiz "countdowns" can also add stress. Students who finish a quiz on time will earn points. These gamification elements aid in creating a sense of urgency for your online training session (Chou 2019).

Concept of training. Training in a business context means getting new skills, ideas, or ways of thinking that help people do their jobs better. Business training is the process of spreading knowledge within a group or society. This kind of training helps people get better at the jobs they already have; it also helps them prepare for future roles and responsibilities. Users can learn new skills through training provided by their businesses. Business training also teaches users about the specific systems, processes, and tools that the group or society uses. (Bhatt 2020) did a study on training and development in organizations and found that it helps an organization reach its ultimate goal: to make its employees happier. When employees are happy, they do their best work,

which leads to quality work and a healthy organization. In a study (Diamantidis and Chatzoglou 2014), it became clear that training has become a popular topic, which makes one company different from another is its human capital. Training and development efforts help organizations reach both short-term and long-term goals. Employees need to be always open to learning and keep their skills and knowledge up to date, taking into account changes in technology, the environment, and society. Training is a planned way for companies to help their new and current employees grow and improve their skills. It gives a helping hand toward learning and growth, which is suitable for the individual, the group, and the organization (Goldstein 1989). Training and development should be based on what each employee needs. It has been shown to positively affect employees, encouraging them to use their skills and potential and improving their technical and social skills (Hutchings et al. 2009).

When training courses function well, they provide participants with the resources and information they require to assist an organization in achieving its objectives, which are carried out via various training programs, which may include everything from building technical abilities and work practices to providing training sessions for new users. For instance, a large organization might show its employees and customers how to create spreadsheets and conduct performance evaluations. It may also require training on how the organization secures information (Waters et al. 2021).

Recent trends in training. To build an efficient workforce, organizations do everything they can during training and development, as today's workforce is goal-oriented and self-motivated. However, the organization must contribute to its output, which depends on its offerings. Employees leave their employers if they do not have growth and development possibilities. Therefore, using the latest learning and development trends is essential. Over the past few years, training and development methods have changed drastically. New trends like Artificial Intelligence, Need-based training, personalized training, augmented reality, experiential learning, microlearning, mobile learning applications, and Gamification have been implemented.

This article, it has been has focused on the gamification strategy, which is using gaming tactics in user training, and users are motivated by recognition and awards. One of the main characteristics is that the users compete for the highest score in games; thus, organizations seek a competitive workplace to improve employee productivity. Leaderboards, badges, certificates, and incentive points for course module completion can gamify employee training programs. Businesses use this trend to boost involvement, motivation, engagement, and productivity. An engaging work atmosphere inspires employees to work harder. Training providers should prioritize staff development as emerging technologies can skill and boost productivity. Creating an efficient employee training program will boost employee productivity and help to achieve the organization's goals.

Gamified learning theory and its relevance to training. The discipline of turning non-game circumstances into game-like contexts by applying traits and functions inherited from gaming technology is called "Gamified Learning Theory"; the phrase is sometimes spelt "Gamification". Gamification's primary goal is to get people emotionally involved, which makes it more effective than traditional ways of getting people involved.

In the simplest form, gamification theory says that people are more likely to enjoy and remember what they learn when game-like elements exist. This has been shown to work well in many fields, like service and manufacturing sectors, and it has become the standard structure for many businesses, like those that sell programs or services for learning a language (Rodrigues et al. 2019). Gamification adds value to each course through point values, scores for different lessons or materials, and other awards. Educational research has shown that people will remember what they learn better and do better in the long run if they can connect it to something real. This is why teachers often look for ways to add more value to their lessons and get their students more interested. Users get this value from game rewards, encouraging them to continue with the chosen course. Formal education is one of many places where these systems are helpful. The same good results were seen when gaming elements were added to workplace competitions, sales goals, or performance goals. Even though the basic idea is simple—in general, people do better when they're having fun—the implementation and method can be a little more complicated. Gamified learning helps users get the most out of the experience on several levels. These two goals—work performance and learning—are often tied together, which makes gamification theory very useful. By making learning more fun and rewarding, employees can improve their skills and get more work done while having a good time. Employers can also get something out of it (Rodrigues et al. 2019).

Researchers (Chou 2019; Narayanan 2014) say that Gamification can encourage workers to improve their jobs and be more productive. It is essential to remember that different gamification mechanisms address different aspects of user preferences (Xi and Hamari 2019) and that gamification implementations are as unique as the specific needs they address. Also, (Lopez Tucker 2019) says that the effect of gamifying mechanics on individual motivation can vary when they are used in real applications, and the results may be very different from what was expected. Researchers (Lopez and Tucker 2019) stress the importance of good design in Gamification, while others (Rapp et al. 2018) say that implementing gamification mechanics like points, badges, and leaderboards without a consistent model hurts the user's experience. In the last ten years, enterprises have become more interested in Gamification. They see it as a way to get their employees involved, change their attitudes, and make work more fun and worthwhile (Koivisto and Hamari 2019). Also, Gamification is seen as a catalyst that creates win-win situations for both employers and employees (Baptista and Oliveira 2019). This is especially true when Gamification is combined with social networking. Using Gamification for corporate training is an essential thing for businesses to do. Game-based motivation can be an excellent way for people and teams to work together and interact in social settings. The Gamification 2020 Report (Burke 2012) says that by 2020 when new technologies are combined, they will have a significant effect on corporations as a whole, as well as on how well employers do their jobs and how engaged customers are, according to a report-by-Report Linker in 2023, the gamification market experienced a compound annual growth rate (CAGR) of 25.3%, increasing from $14.87 billion in 2022 to $18.63 billion in 2023.

Research methodology

Unit of analysis. To address the research inquiries and achieve the established objectives, a systematic review of the literature was conducted by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al. 2020). Given the specific nature of the topic under analysis, encompassing empirical studies, case studies, reviews, proposals, and theoretical papers, adopting a systematic literature review was deemed appropriate. The PRISMA statement was chosen as the preferred approach due to its rigorous guidelines and established a reputation as a successful method employed across

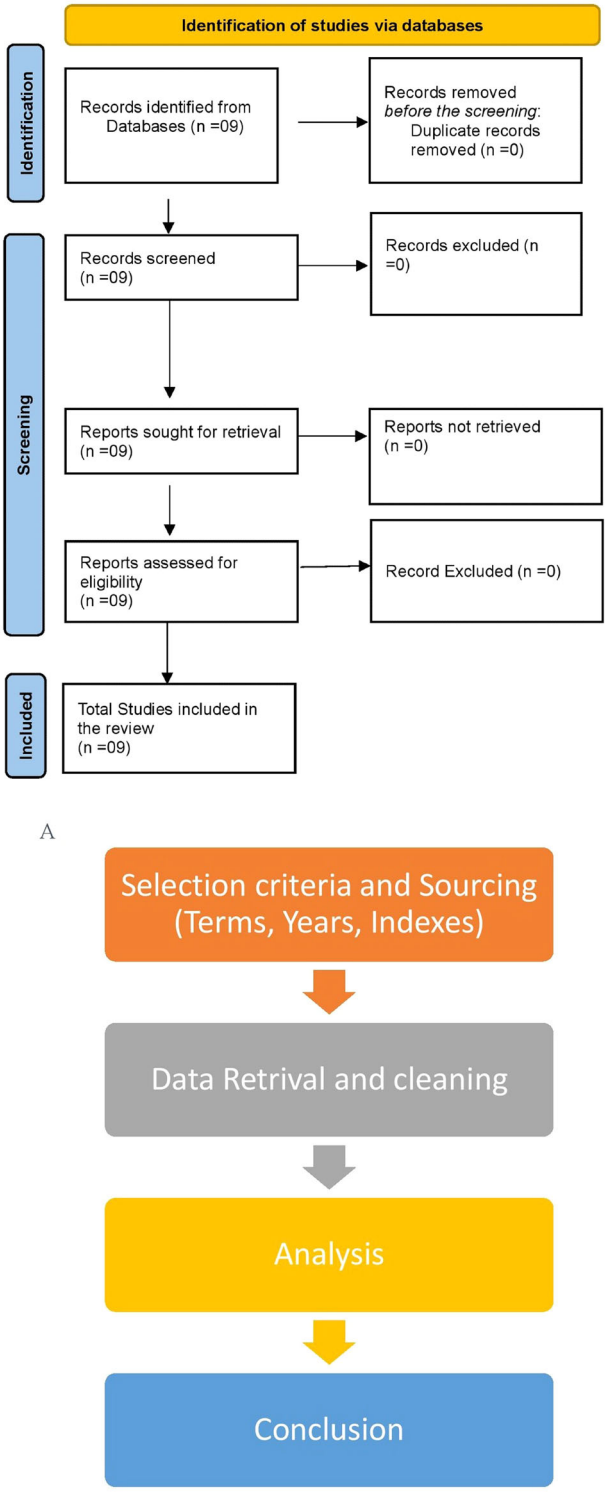


Fig. 2 PRISMA- It describes the process of review of the articles. **A** Methodology- It describes the process of the research. Source: Author Creation.

various fields, including education, to provide comprehensive insights (Liberati 2009; Watson and Webster 2020). Figure 2 explains the PRISMA Analysis.

The bibliometric analysis examines bibliographical elements quantitatively. We chose journal articles because they are considered "certified knowledge" and result from an evaluation process, which gives credibility to the results (Ramos-Rodriguez and Ruiz-Navarro 2004). Citation and co-occurrence citation analysis was used. Citation analysis is based on the weight given to a publication by researchers when citing it as a source. As a result, the more frequently an article is cited, the more influential it will be for the research community in developing that area (Ramos-Rodriguez and Ruiz-Navarro 2008).

Database sourcing and management. We gathered article data from the Clarivate Analytics Web of Science database from journals. The initial search was limited to articles that included "training" and "Gamification Octalysis Framework" in the title, keywords, or abstract. The goal was to examine the various approaches and structures of contributions. As a result, it was made to include all possible word combinations that investigated the subject. Following continuous checking, we filtered articles, removing those classified under unrelated categories, primarily those from medical disciplines. We also searched the remaining articles for relevant ones. Before diving into specific key intellectual nodes, subtopics, or publications, we obtained the primary figures and research configuration on boards of directors. The registers were then systematically filtered to ensure author and citation consistency. The articles obtained were slated for publication in 2023 (June). We considered each publication as a potential contribution to research in this field. After the dataset was generated, we examined it with several software packages. In the case of specific bibliometric data management, we used VOSviewer software to graphically build and visualize relationships and perform analyses based on the networks underlying the research topic (Van Eck et al. 2010).

Indicators and result visualization. For the study, we selected descriptive and relational bibliometric indicators and tools. Languages, countries, and institutions all contribute to the explanation of sociodemographic context. The publication year frequency aids in visualizing and establishing stages in the history of research into this topic. Keywords help readers understand the assessment of how concepts and studies are classified and related in this context. This identifies which of these concepts has yet to be thoroughly investigated. Main contributors and journals show who conducted most of the research and which publications compiled most of those studies. Author co-occurrence provides structure to research communities, and citation co-occurrence aids in understanding the intellectual framework. Finally, maps aid in clarifying what has been done and the communities involved and point to potential future research directions.

Data analysis process. The figure below (Fig. 2A) depicts the various stages of data analysis that we went through. Before retrieving and cleaning the information, we first established the selection criteria for terms, years, target indexes, and specified databases. It examined the data retrieved to apply consistent criteria that would allow the proposed goal to be met. Capital letter standardization, author initial checks, removing duplicate references, data completion, and so on were all part of the data cleaning process. This is usually accomplished through an iterative process in which the researcher obtains the correct information registers, which are then analyzed and cleaned. The outcomes are then obtained by analyzing the indicators above and the maps. Some final remarks and conclusions are made based on the results. Limitations and future research directions are stated at the end of the process.

Results

The emerging trends in the Gamification Octalysis Framework in training during 2017–2023. Figure 3 and Table 1 show that the first publication on the Gamification Octalysis Framework in training was published in 2017. However, the hype of the

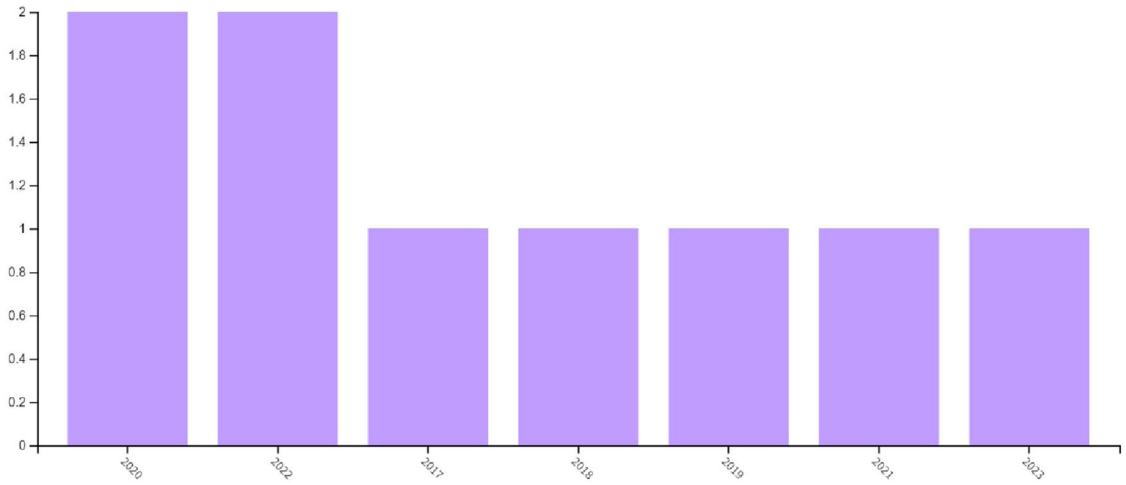


Fig. 3 Emerging trends. The emerging trends in the Gamification Octalysis Framework in training during 2017–2023. Source: Web Of Science.

Table 1 The emerging trends in the Gamification Octalysis Framework in training during 2017–2023 (June).

Publication Years	Record Count	% Of 9
2023 (June)	1	11.11
2022	2	22.22
2021	1	11.11
2020	2	22.22
2019	1	11.11
2018	1	11.11
2017	1	11.11

Source- Web of Science.

Table 2 Productive Countries.

Countries/Regions	Record Count	% of 9
PORTUGAL	2	22.222
USA	2	22.222
BELARUS	1	11.111
ENGLAND	1	11.111
ESTONIA	1	11.111
FINLAND	1	11.111
JAPAN	1	11.111
RUSSIA	1	11.111
SOUTH KOREA	1	11.111

Source - Web of Science.

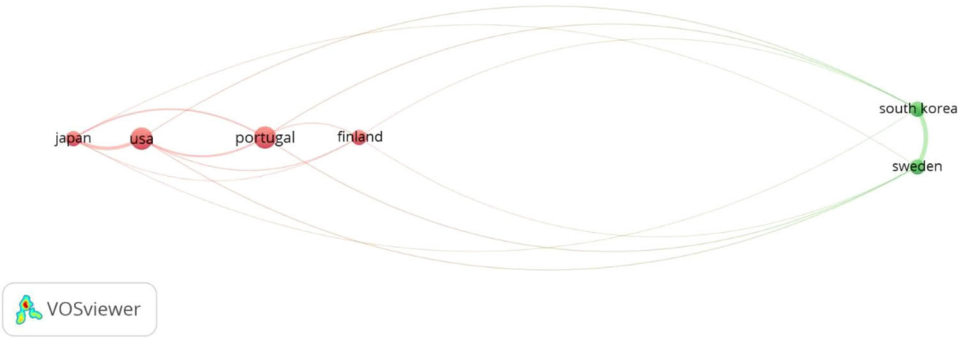


Fig. 4 Countries. Productive countries publishing in the area of Octalysis gamification framework. Source: VOSviewer.

publication trend has taken in 2022 with three numbers of publications.

Productive countries, authors, journals, affiliation, and citations. Figure 4 and Table 2 show that Portugal and the United States have two publications on the Gamification Octalysis Framework in training, with two each. The rest of the countries have only one publication in the same field. This means that countries like Portugal and the U.S. are putting gamified training systems into their research communities. As already said, Portugal and the U.S. are the most productive countries. The most productive organization is the University of Coimbra in Portugal, as shown in Fig. 5 and Table 3, and the most productive authors are Araujo I and Carvalho AA, who both work at the University of Coimbra (Fig. 6). Table 4 shows that most research articles have been published in conference proceedings, and only two journals, Education Science and JMIR Serious Games, have been as productive as they could be. The citation topic titled "Enablers and Difficulties in the Implementation of Gamification: A Case Study with Teachers" has been recorded as a more cited article (Fig. 11) in the Gamification Octalysis Framework in training, and other articles did not receive any citations.

The most productive document type, research area, and research domain. In the Gamification Octalysis Framework in training, research has been done in education, computer science, and telecommunications. From these categories, Education Educational Research is the most productive research area, with six

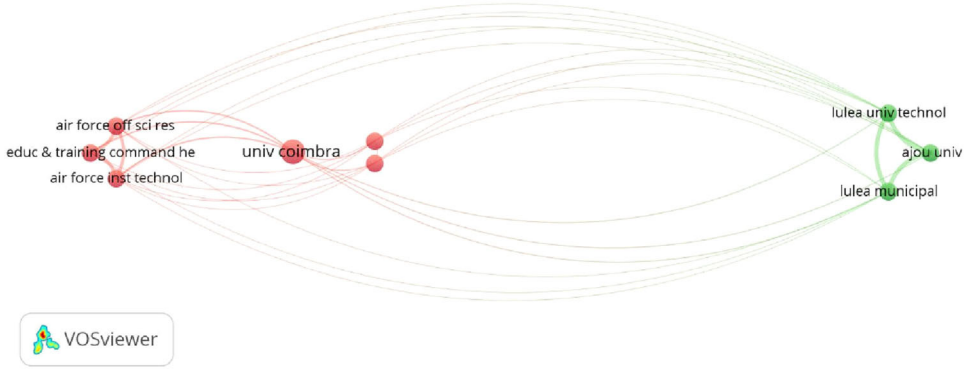


Fig. 5 Affiliation. Productive affiliation or institutions publishing in the area of Octalysis gamification framework.

Table 3 Productive Affiliation.

Affiliations	Record Count	% of 9
UNIVERSIDADE DE COIMBRA	2	22.222
AIR EDUC TRAINING COMMAND HEADQUARTERS	1	11.111
AIR FORCE INSTITUTE OF TECHNOLOGY	1	11.111
AIR FORCE INSTITUTE OF TECHNOLOGY AFIT	1	11.111
AIR FORCE INSTITUTE OF TECHNOLOGY GRADUATE SCHOOL OF ENGINEERING MANAGEMENT	1	11.111
AIR FORCE OFF SCI RES	1	11.111
AJOU UNIVERSITY	1	11.111
IVAN PETROVSKY BRYANSK STATE UNIVERSITY	1	11.111
LULEA UNIVERSITY OF TECHNOLOGY	1	11.111
MARIST COLLEGE	1	11.111

Source - Web of Science.

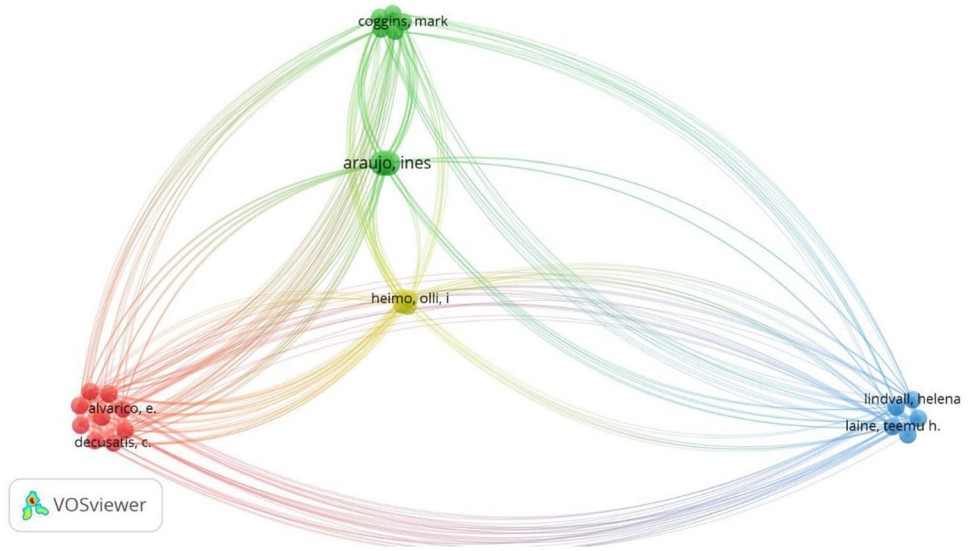


Fig. 6 Source. Productive authors publishing in the area of Octalysis gamification framework.

publications. This is followed by Computer Science, with five publications (Fig. 7 and Table 5). During the bibliometric analysis, it was found that there were more conference proceedings than articles. There were six conference proceedings for every two articles (Fig. 8 and Table 6). In the research domain, there are six publications in the social science field, 5 in the science technology field, and 5 in the technology field (Fig. 9 and Table 7).

The most frequently used keywords in Gamification Octalysis Framework research. In Fig. 10 and Table 8, readers can see the most-used keywords in the Gamification Octalysis Framework. Gamification and the Octalysis framework were the most popular keywords, appearing five times. Aside from Gamification, the Octalysis framework keyword, and serious games, other vital keywords in this field include cyber security, awareness, education, and teacher training.

Citation analysis. A disciplined intellectual map can be made by looking at both the keywords and the citations in the articles.

Table 4 Productive Sources.

Publication/Source Titles	Record Count	% Of 9
19TH INTERNATIONAL CONFERENCE ON INTELLIGENT GAMES AND SIMULATION GAME ON R 2018	1	11.111
2017 INTERNATIONAL SYMPOSIUM ON COMPUTERS IN EDUCATION SIIE	1	11.111
2022 IEEE 12TH ANNUAL COMPUTING AND COMMUNICATION WORKSHOP AND CONFERENCE CCWC	1	11.111
EDUCATION SCIENCES	1	11.111
IEEE TRANSACTIONS ON GAMES	1	11.111
INTERNATIONAL CONFERENCE ON CYBER WARFARE AND SECURITY	1	11.111
INTERNATIONAL SYMPOSIUM ON COMPUTERS IN EDUCATION	1	11.111
OBRAZOVANIE I NAUKA EDUCATION AND SCIENCE	1	11.111
PROCEEDINGS OF 2020 6TH INTERNATIONAL CONFERENCE OF THE IMMERSIVE LEARNING RESEARCH NETWORK ILRN 2020	1	11.111
PROCEEDINGS OF THE 14TH INTERNATIONAL CONFERENCE ON CYBER WARFARE AND SECURITY ICCWS 2019	1	11.111
PROCEEDINGS OF THE 20TH EUROPEAN CONFERENCE ON E-LEARNING ECEL 2021	1	11.111
PROCEEDINGS OF THE EUROPEAN CONFERENCE OF E-LEARNING	1	11.111

Source - Web of Science.

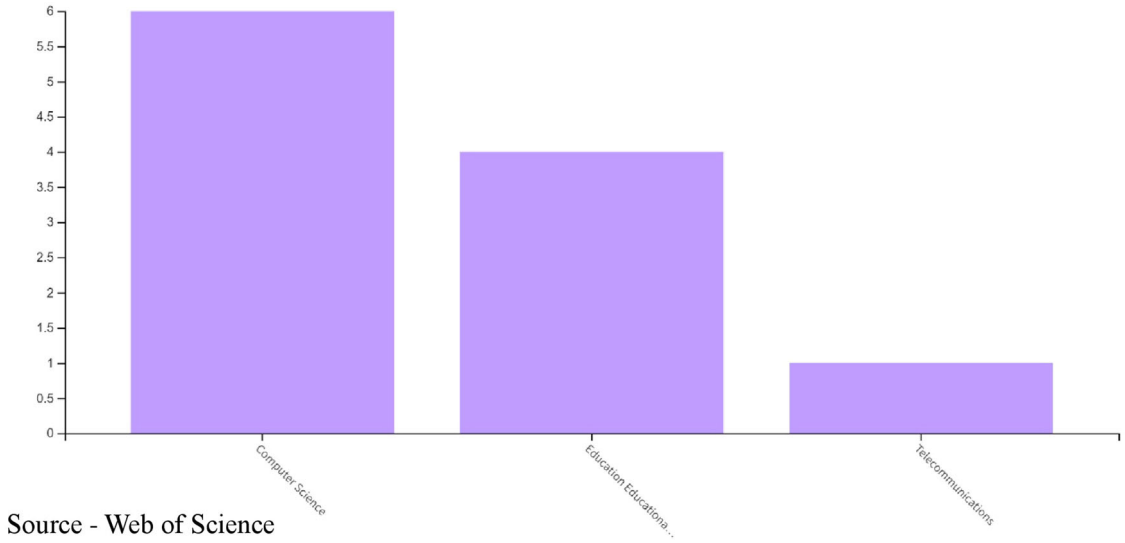


Fig. 7 Research area. Productive Research Area published in the area of Octalysis gamification framework. Web Of Science.

Table 5 Productive Research Areas.

Research Areas	Record Count	% of 9
Computer Science	6	66.667
Education Educational Research	4	44.444
Telecommunications	1	11.111

Source - Web of Science.

There are four citations out of eight articles, and a summary of the citations is shown in Fig. 11.

The most-cited article is "Enablers and Difficulties in Implementation of Gamification: A Case Study with Teachers." It refers to the articles that evaluate the link between implementing a gamified teaching environment and the Octalysis framework. It also says that using a gamified environment in digital tools increases students' motivation. "A Reusable Multiplayer Game for Promoting Active School Transport: Development Study" is the second most-read article after this one. The study shows that the Gamification Octalysis Framework has dramatically impacted the training field. It also shows that users' motivation, engagement, and performance can be improved with the help of the gamification tool.

Discussion

Based on the analysis of research questions 1 to 5, it was observed that the year 2022 witnessed a significant increase in the number of published research works focused on the Gamification Octalysis Framework in the context of training. This trend indicates a growing interest in this area of study. Furthermore, the examination of the trend in 2023 (June) suggests that the popularity of this framework continues to rise, as evidenced by its inclining stage. The research work conducted in Portugal in the social science domain has been identified as the most productive country with the highest citation count. The primary focus of this research revolves around utilizing the "gamification" concept and the "Octalysis framework", the most frequently employed keywords in this field.

This research aims to present a bibliometric analysis of the evolution of the Gamification Octalysis Framework in Training literature published in WoS-indexed journals from 2017 to 2023(June), encompassing six years of data. The data reported in this section uncovered several intriguing findings. In the seven years covered by this study, there has been a significant increase

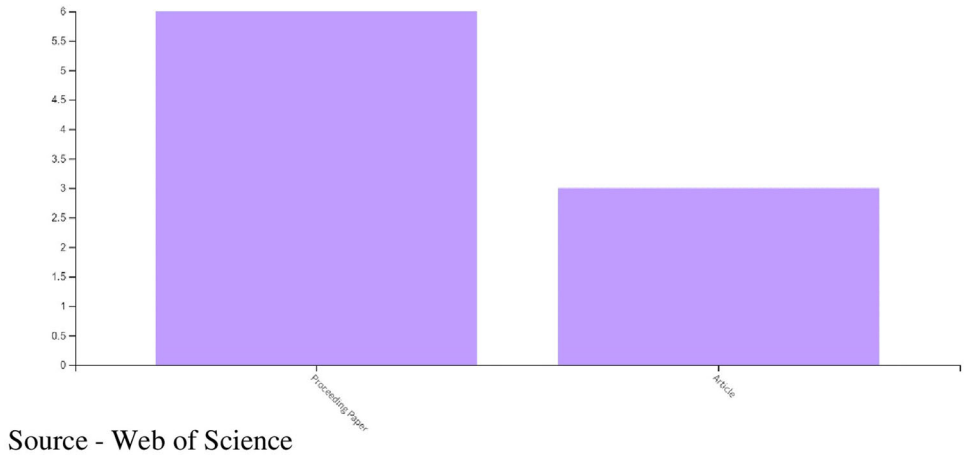


Fig. 8 Document type. Productive type of documents published in the area of Octalysis gamification framework.

Table 6 Productive Document Types.

Document Types	Record Count	% Of 9
Meeting	6	67
Article	3	33

Source - Web of Science.

in the number of articles about the Gamification Octalysis Framework in Training.

The favourable environment generated by the government and research and training institutes within the country is a second aspect that helps to explain the large number of publications produced by universities in Portugal and the United States. The development of the Gamification Octalysis Framework in Training in Portugal and the United States has always been significantly driven by government backing. Japan, the United Kingdom, South Africa, Finland, Estonia, and England should be encouraged to produce more articles on the Gamification Octalysis Framework in Training research and training centres. Universities in Portugal, particularly Universidade de Coimbra, are at the forefront of the Gamification Octalysis Framework in Training research and should be encouraged and supported to generate further research on the topic in Portuguese and English.

Thirdly, one of the eight most-cited articles regarding the Gamification Octalysis Framework in Training was published recently. The publication of these papers in 2022 demonstrates that the field of Gamification Octalysis Framework in Training is gaining traction.

The primary objective of this study is to examine the utilization of the Octalysis framework in the context of Gamification for training purposes. It is imperative to acknowledge that the results of this study may differ from those of other studies that exclusively employ Gamification without incorporating the Octalysis framework. For instance, by utilizing the Web of Science database and employing keywords such as "Gamification" and "Training," one may discover that Spain is the most prolific country in this domain. At the same time, Turkey garners the highest number of citations. Notably, these countries are situated within Europe. The current research reveals a commonality: non-European countries must catch up in implementing these effective training strategies.

The nascent stage of Gamification in India is currently underway. The phenomenon above may be ascribed to insufficient consciousness among human resources practitioners throughout the Indian corporate landscape. Gamification is frequently misconstrued and conflated with alternative methods or practices for promoting employee engagement, which may contribute to this phenomenon. Despite this, specific organizations have begun implementing gamification strategies and integrating them into various aspects of their operations, such as human resources practices. Deloitte's leadership training programs exhibit a comparable approach. Through the implementation of gamification techniques, the level of engagement in the training program was enhanced.

Conclusion

This study presents a bibliometric analysis that examines the expansion of the Gamification Octalysis Framework in Training articles published in journals indexed by the Web of Science (WoS) from 2017 to 2023 (June). The utilization of the Gamification Octalysis Framework in training has garnered significant attention and momentum in recent years within the realm of research. However, this upward trend is particularly prominent in Portugal and the United States, as these countries possess an environment conducive to adopting technology, which is more suitable for facilitating this type of research. There is a need for increased support from Japan, the United Kingdom, South Africa, Finland, Estonia, and England in the Gamification Octalysis Framework in Training research. The birth of the Gamification Octalysis Framework in Training as a field of study was influenced by universities in Portugal, particularly Universidade de Coimbra. Several universities and research institutes, namely Air Educ Training Command Headquarters, Air Force Institute of Technology Graduate School of Engineering Management, Marist College, and the University of Westminster, are actively involved in developing and applying the Gamification Octalysis framework in training.

The bibliometric analysis conducted in this study is constrained to a single abstracting and indexing database, namely Web of Science (WoS). The study's focus is restricted to scholarly literature published until 2023 (June), specifically examining the application of the Gamification Octalysis Framework within the training context. Moreover, the study's scope is limited to document types, including articles, proceedings, reviews, and book chapters. A potentially captivating avenue for exploration is conducting additional research to evaluate the productivity and quality of publications related to the utilization of the Gamification Octalysis Framework in Training and conventional Gamification training that does not incorporate the Octalysis framework.

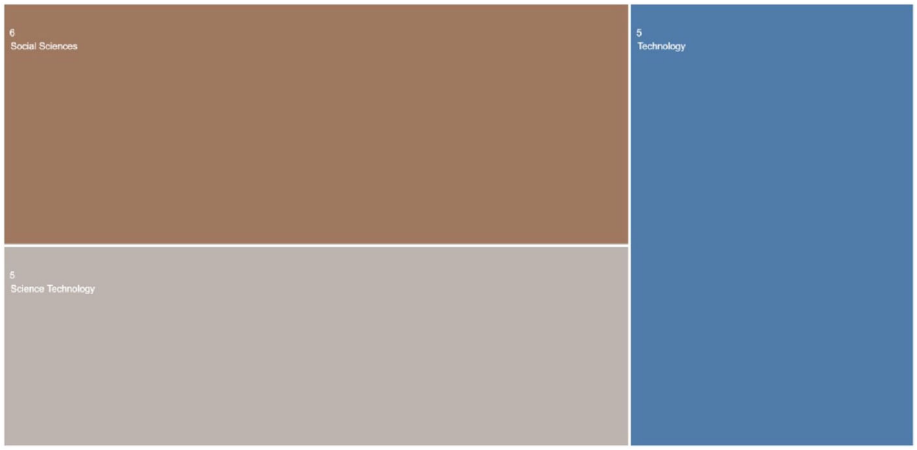


Fig. 9 Research domain. Productive research domains published in the area of the Octalysis gamification framework.

Fig. 10 Keyword occurrence. Number of keywords occurred in research of Octalysis gamification framework. VOSviewer.

Table 7 Productive Research Domains.

Research Domains	Record Count	% Of 9
Social Sciences	6	66.6
Science Technology	5	55.5
Technology	5	55.5

Source - Web of Science.

Table 8 Keywords Used.

Keywords	Frequency
Gamification	5
Octalysis and Octalysis framework	5
Cyber Security	3
Awareness	2
Serious Games	2
Education	2
Teacher Training	2
Game-Based Learning	1
Simulation	1
Maritime	1
Simulation for E-learning	1
Public Sector Capacity Building	1
Deep Learning	1
Digital tools	1
Andragogy	1

Source - Web of Science.

This study aims to assess the current state of the literature on the Gamification Octalysis Framework in the context of training. Specifically, it aims to analyze publication trends, identify the leading nations, authors, organizations, and journals in this field, and determine the most frequently used keywords in studies related to gamification training. The literature on the application of the Gamification Octalysis Framework in training has experienced substantial growth, as evidenced by the research findings. Hence, it becomes incumbent upon developed nations to assume the duty and mandate of promoting awareness regarding the Gamification Octalysis Framework in Training by incorporating it into their programs and fostering additional research in multiple languages. Nations must provide backing for creating additional scholarly journals dedicated to the Gamification Octalysis Framework in Training. This measure is crucial to augment the available platforms for disseminating research within this domain. In the present context, the allocation of financial resources by the government and the active involvement of the academic community will be crucial.

The primary focus of this article is to examine the influence of the Gamification Octalysis Framework on training, as observed in previous studies and extending to current research. Specifically, the article analyses the conference proceedings from 2017 to 2023 (June), encompassing various authors' contributions to the field of education. Additionally, it explores the integration of education with other sectors, such as computer science, engineering, social issues, and telecommunication, all falling within the domain of sociability. Based on the published proceedings, this study serves as a basis for empirical research on the effects of the Gamification Octalysis Framework in Training. The research was conducted in 2022 by two emerging authors in the fields of education and computer science. The social sciences, technology, and science sectors are prominent areas for investigating the Gamification Octalysis Framework in Training. Furthermore, it is apparent that futurism is a viable approach, as demonstrated by the publication of the article "A Reusable Multiplayer Game for Promoting Active School Transport: Development Study."

SL NO	Octalysis (All Fields) and Training (All Fields) Time Span- 2017-2023 Result Found 9 Sum of Time Cited 7 Average Citation Per Items 0.78 H-Index 2 Publications Title/Author/Year/Source	2017	2018	2019	2020	2021	2022	2023	Average per Year	Total
1	Enablers and Difficulties in the Implementation of Gamification: A Case Study with Teachers Araujo, I and Carvalho, AA March 2022 EDUCATION SCIENCES 12 (3)	0	0	0	0	0	2	2	2	4
2	A Distributed Multiplayer Game to Promote Active Transport at Workplaces: User-Centered Design, Implementation, and Lessons Learned Laine, TH; Normark, J; Rutberg, S Dec 2020 IEEE TRANSACTIONS ON GAMES 12 (4) , pp.386-397	0	0	0	0	1	1	1	0.75	3
3	GAMIFICATION RESOURCES IN EDUCATION: A THEORETICAL APPROACH Astashova, NA; Bondyreva, SK and Popova, OS Jan 2023 OBRAZOVANIE I NAUKA-EDUCATION AND SCIENCE 25 (1) , pp.15-49	0	0	0	0	0	0	0	0	0
4	A Cybersecurity Awareness Escape Room using Gamification Design Principles DeCusatis, C; Gormanly, B; Mah, B 2022 IEEE 12th Annual Computing and Communication Workshop and Conference (CCWC), pp.765-770	0	0	0	0	0	0	0	0	0
5	Game-Based Learning for Cybersecurity Awareness Training Programmes in the Public Sector Bacud, ML and Mases, S 2021 PROCEEDINGS OF THE 20TH EUROPEAN CONFERENCE ON E-LEARNING (ECEL 2021) , pp.50-58	0	0	0	0	0	0	0	0	0
6	Doctoral Colloquium-A Methodology to Evaluate the Use of Serious Games in Achieving Deep Learning: An Application for Andragogy in Human Resource Development. Gemade, MT; Mentzelopoulos, M and Economou, D 2020 PROCEEDINGS OF 2020 6TH INTERNATIONAL CONFERENCE OF THE IMMERSIVE LEARNING RESEARCH NETWORK (ILRN 2020) , pp.399-402	0	0	0	0	0	0	0	0	0
7	Applying Game Elements to Cyber eLearning: An Experimental Design Tomcho, L; Lin, A; Reith, M 2019 PROCEEDINGS OF THE 14TH INTERNATIONAL CONFERENCE ON CYBER WARFARE AND SECURITY (ICCWS 2019) , pp.422-430	0	0	0	0	0	0	0	0	0
8	GAMIFYING LEARNING OF MARITIME STANDARD OPERATIONAL PROCEDURES Heimo, OI; Joelsson, TN; Makila, T 2018 19TH INTERNATIONAL CONFERENCE ON INTELLIGENT GAMES AND SIMULATION (GAME-ON(R) 2018) , pp.133-137	0	0	0	0	0	0	0	0	0
9	Empowering teachers to apply gamification Araujo, I and Carvalho, AA 2017 2017 INTERNATIONAL SYMPOSIUM ON COMPUTERS IN EDUCATION (SIIE)	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	1	3	3	2.33	7

Source - Web of Science

Fig. 11 Citation summary. Citation summary of the published research papers. Web Of Science.

Theoretical and practical implications

From the above discussion, the author has pointed out this study's theoretical and practical consequences. This study contributes to the theoretical implications of the Gamification Octalysis Framework in training inside instructional procedures at multiple stages, providing helpful information to the scientific community. This study presents the most important theoretical contributions to bibliometrics from a fresh approach. WOS indexes the documents utilized in the analysis, demonstrating their relevance. In addition, we may use the results of this research to create a profile of the typical presentation materials for the Gamification Octalysis framework in learning environments. Emerging trends, productive nations, productive affiliations, productive sources, productive research areas, document

types, research domains, keywords, and citation analysis are some of the significant data that can be gleaned from this study. Researchers can use this data to narrow their focus better. This study also uncovered the most critical discussions surrounding the phrases and revealed the most prominent research trends of the past few years. Finally, from a practical consequences perspective, the study's findings offer helpful information for educators concerning the relationship between gaming and education. This is because the findings of this study can be directly applied to their everyday tasks.

Limitations and future study

This study thoroughly examines various vital factors, including language, place of publication, document type, authorship, publication sources, geographic regions, and corporate affiliations. The information mentioned above has the potential to aid researchers in improving the organization of their work. In addition, the study's findings provide relevant insights for trainers regarding using the Gamification Octalysis Framework as a tool for training purposes. The underlying justification for this is that this study's outcomes can assist individuals in making well-informed choices in their daily endeavours.

We addressed the stated goal by conducting a bibliometric study of relevant literature from one of the most popular databases, namely the Web of Science (WoS). The current study utilized bibliographic analysis to identify and clarify the state of research on the Gamification Octalysis Framework in the context of training and to forecast future trends. This article provides the first bibliometric study of the topic, which might prove helpful in planning future studies in this area of research. Using bibliometric analysis, scholars can assess the current state of study on a topic and identify promising new avenues of inquiry. The study is limited in several ways because the WoS database was used for analysis. The thoroughness of the analysis could be improved by including Scopus or similar databases in future investigations focusing on document retrieval.

Data availability

The data for this study's conclusions were acquired from databases in the public domain of the Web of Science core collection, and the key terms "Training" and "Gamification Octalysis Framework" can be used in data extraction searches.

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References

Baptista G, Oliveira T (2019) Gamification and serious games: A literature meta-analysis and integrative model. Computers Human Behav 92:306–315

Bhatt D (2020) (PDF) Training and Development in Work Organizations, ResearchGate, 4 April, available at: https://www.researchgate.net/publication/341111235_Training_and_Development_in_Work_Organizations

Blume BD, Ford JK, Baldwin TT, Huang JL (2009) Transfer of training: A meta-analytic review. J Manag 36(4):1065–1105. https://doi.org/10.1177/0149206309352880

Burke B (2012) Gamification 2020: What is the future of Gamification? Gartner. https://www.gartner.com/en/documents/2226015

Cheng C, Ebrahimi OV (2023) A meta-analytic review of gamified interventions in Mental Health Enhancement. Comput Hum Behav 141:107621. https://doi.org/10.1016/j.chb.2022.107621

Chou Y-K (2019) Actionable Gamification: Beyond Points, badges, and leaderboards. Octalysis Group

Costa CJ, Aparicio M, Aparicio S, Aparicio JT (2017) Gamification usage ecology. Proceedings of the 35th ACM International Conference on the Design of Communication. https://doi.org/10.1145/3121113.3121205

Denny P (2013) The effect of virtual achievements on student engagement. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. https://doi.org/10.1145/2470654.2470763

Deterding S, Sicart M, Nacke L, O'Hara K, Dixon D (2011) Gamification. Using game-design elements in non-gaming contexts. CHI '11 Extended Abstracts on Human Factors in Computing Systems. https://doi.org/10.1145/1979742.1979575

Diamantidis AD, Chatzoglou PD (2014) Employee post-training behaviour and performance: Evaluating the results of the training process. Int J Training Develop 18(3):149–170. https://doi.org/10.1111/ijtd.12034

Fathian M, Sharifi H, Nasirzadeh E, Dyer R, Elsayed O (2021) Towards a comprehensive methodology for applying enterprise Gamification. Decision Sci Lett 10(3):277–290. https://doi.org/10.5267/j.dsl.2021.3.002

Garris R, Ahlers R, Driskell JE (2017) Games, motivation, and learning: A research and practice model. Simulation in Aviation Training, 475–501. https://doi.org/10.4324/9781315243092-25

Goldstein IL (1989) Training and development in organizations. Pfeiffer

Hutchings K, Zhu CJ, Cooper BK, Zhang Y, Shao S (2009) Perceptions of the effectiveness of training and development of 'grey-collar' workers in the People's Republic of China. Hum Res Develop Int 12(3):279–296

Koivisto J, Hamari J (2019) The rise of Motivational Information Systems: A review of Gamification Research. Int J Inform Manag 45:191–210. https://doi.org/10.1016/j.ijinfomgt.2018.10.013

Liberati A (2009) The Prisma statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. Ann Internal Med 151(4). https://doi.org/10.7326/0003-4819-151-4-200908180-00136

Lopez CE, Tucker CS (2019) The effects of player type on performance: A gamification case study. Comput Hum Behav 91:333–345

Marczewski A (2014) Gamification design vs. game design. Gamified U.K. - #Gamification Expert. https://www.gamified.uk/2014/03/25/gamification-design-vs-game-design/

Narayanan A (2014) Gamification for employee engagement: Strategize, design, and implement Gamification to engage your employees successfully—impact Publishing

Nelson M (2012) Soviet and American precursors to the Gamification of Work. In Proceeding of the 16th international academic MindTrek conference (pp. 23–26)

Page MJ, McKenzie J, Bossuyt P, Boutron I, Hoffmann T, Mulrow CD, Shamseer L, Tetzlaff J, Moher D (2020) Updating Guidance for Reporting Systematic Reviews: Development of the Prisma 2020 Statement. https://doi.org/10.31222/osf.io/jb4dx

Prakash D, Manchanda P (2021) Designing a comprehensive Gamification Model and pertinence in an organizational context to achieve sustainability. Cogent Business & Management, 8(1). https://doi.org/10.1080/23311975.2021.1962231

Rapp A, Hopfgartner F, Hamari J, Linehan C, Cena F (2018) Strengthening gamification studies: Current trends and future opportunities of gamification research, International J Human-Computer Stud 127, available at: https://doi.org/10.1016/j.ijhcs.2018.11.007

Rodrigues LF, Oliveira A, Rodrigues H (2019) Main gamification concepts: A systematic mapping study. Heliyon 5(7):e01993

Ramos-Rodríguez AR, Ruíz-Navarro J (2004) Changes in the intellectual structure of strategic management research: A bibliometric study of the Strategic Management Journal, 1980–2000. Strategic Manag J 25(10):981–1004

Ramos-Rodríguez AR, Ruíz-Navarro J (2008) Base intelectual de la investigación en creación de empresas: un estudio biométrico. Revista europea de dirección y economía de la empresa 17(1):13–38

Riar M, Morschheuser B, Zarnekow R, Hamari J (2022) Gamification of cooperation: A framework, literature review, and future research agenda. Int J Inform Manag 67:102549. https://doi.org/10.1016/j.ijinfomgt.2022.102549

Sitzmann T (2011) A meta-analytic examination of the instructional effectiveness of computer-based simulation games. Personnel Psychol 64(2):489–528. https://doi.org/10.1111/j.1744-6570.2011.01190.x

Van Eck NJ, Waltman L, Dekker R, Van Den Berg J (2010) A comparison of two techniques for bibliometric mapping: Multidimensional scaling and VOS. J Am Soc Inform Sci Technol 61(12):2405–2416

Watson RT, Webster J (2020) Analyzing the past to prepare for the future: Writing a literature review and a roadmap for release 2.0. J Dec Syst 29(3):129–147. https://doi.org/10.1080/12460125.2020.1798591

Waters PS, Flynn J, Larach JT, Fernando D, Peacock O, Foster JD, Flood M, McCormick JJ, Warrier SK, Heriot AG (2021) Fellowship training in robotic colorectal surgery within the current hospital setting: An achievable goal? ANZ J Surg 91(11):2337–2344. https://doi.org/10.1111/ans.16677

Xi N, Hamari J (2019) Does Gamification satisfy needs? A study on the relationship between gamification features and intrinsic need satisfaction. Int J Inform Manag 46:210–221

Zichermann G (2011) Gabe Zichermann: How games make kids smarter, PsycEXTRA Dataset, available at: https://doi.org/10.1037/e728362011-001

Author contributions

The entire manuscript was written and conceptualized by SM, the first author, with input from PCB, the corresponding author; the article's research question was developed through their collaboration; this will allow for future studies. When the article was finished, PCB vetted it before publication.

Competing interests

The authors declare no competing interests.

Ethical approval

This manuscript does not contain any studies with human participants performed by any of the authors.

Informed consent

Since there were no human subjects involved in this review study, no consent was required.

Additional information

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