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Motivation to Use Gamification Elements in E-Learning for Formal and Non-Formal Education

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Abstract

The implementation of gamification in e-learning is not new, both within the context of formal and informal. Formal education is a learning activity organized by both public and private parties that refers to the official education system of a country. Meanwhile, informal education is another learning activity that does not refer to the official education system of a country. Not only visually appealing, but gamification elements also have a certain motivation and emotional value for the user. This study seeks to compare the use of gamification elements and their motivation between formal and nonformal education. The method used was a Systematic Literature Review using the Kitchenham method. From the selected databases, 65 articles were obtained that had implemented gamification in e-learning. The gamification elements were grouped by motivation and emotion based on the Octalysis framework. The results showed that ownership and possession were the most prominent motivations for implementing gamification.

A. Introduction

Gamification is the use of game design elements in a nongame context [1]. The purpose of using gamification is to improve user experience and engagement [2]. Many elements can be used in gamification such as storyboards, rewards, badges, leaderboards, feedback, etc. [3][4][5]. Gamification is also starting to be widely used in e-learning. Gamification is a trigger for students to learn online. Attractive gamification elements make users acquire new experiences in learning. There is no negative effect in the use of gamification elements in e-learning [6]. Some feelings can be delivered to the user by using a choice of gamified elements [7] such as feeling of importance, desire to get something done, curiosity, and even anxiety about something.

The use of gamification elements in e-learning has a specific purpose, not only to increase user engagement, but it can also provide particular sensations to users. A sense of belonging, a sense of competition, and a sense of curiosity can also result from the use of gamified elements. There is a framework that studies this in depth. The framework is called Octalysis Core Drivers. Octalysis Core Drives (CD) [8] is a framework that categorizes a person's motivation. The core drivers summarize the feelings given to humans. These core drivers are part of the octalysis framework. The octalysis framework is used to measure how big the positive or negative value of human emotions is. Compared to other gamification frameworks that have been created, this octalysis framework relies heavily on psychological and motivational theories [9]. So that this framework can provide an overview of the motivation for using gamification elements.

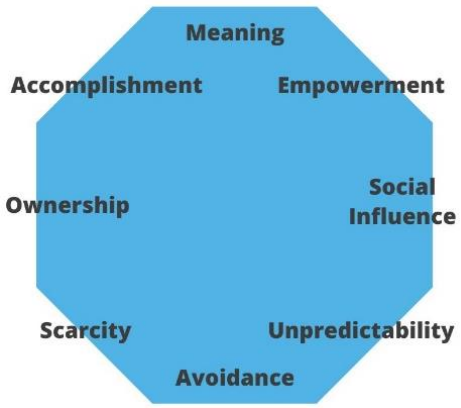

Figure1. Octalysis Core Drivers [8]

The octalysis framework can also describe the types of motivation that exist in humans, intrinsic or extrinsic. This study utilizes eight drivers in the framework to analyze the motivation for implementing gamification in the e-learning system. Table 1 describes the core drivers [8].

Table 1. Explanations of Core Drivers

CD#	Core Drivers	Description
CD1	Epic Meaning and Calling	a way to get people involved in a story in a narrative

CD#	Core Drivers	Description
CD2	Development and Accomplishment	an overview of the achievements that have been achieved by people
CD3	Empowerment of Creativity and Feedback	the user's ability to make choices
CD4	Ownership and Possession	sense of having something
CD5	Social Influence and Relatedness	encouragement or motivation arising from other people
CD6	Scarcity and Impatience	anxiety or worry caused by something that is felt
CD7	Unpredictability and Curiosity	curiosity and everything that is unpredictable
CD8	Loss and Avoidance	the people's feeling of missing something

Epic meaning and calling is the core driver that describes the feeling of someone who is "chosen" to do something important. This makes a person feel that he has a very important role in doing something. For example, user contributions in Wikipedia. We all know that contributing to Wikipedia does not provide a monetary benefit. But there are still many users who want to contribute to it. They feel chosen to explain something to other users.

Development and Accomplishment describes a sense of wanting to compete with other users. This core drive can take the form of progress competition, skill development, achievement of a certain award, etc. Users have their own satisfaction when they beat other users.

Empowerment of creativity and feedback is someone's pleasure when they can make something of their own creation and get appreciation from others. For example, users can create avatars by combining different shapes of hair, clothes, glasses, beards, etc. The avatar is the result of each user's creation and becomes their own pride. Feedback from other users on the avatar is also a pleasure they get.

Ownership and possession is a sense of belonging to every user. All forms of virtual items that they own become a motivation for the users, for example avatars, money, houses, cities, playgrounds, clothes, and many other forms. The items they have will always be maintained or developed for the better. Users invest a lot of time doing this.

Social influence and relatedness is a feeling that is closely related to the social world. Everything that is closely related to the social world includes feedback, comments, chat, friendship and even envy. Meanwhile, relatedness provides a picture of a situation similar to what has been experienced by the user. For example, users who have memories of certain items have a higher sense of belonging.

Scarcity and impatience gives the user a sense of anxiety because of certain thing. For example, a user wants to get an item he likes, but the stock of the item is very limited, while many other users have viewed the item page. This feeling cause the user to spend a lot of time making sure he will get the item he wants.

Unpredictability and Curiosity arises when things go beyond the usual pattern. When presented with something different than usual, a person's brain will pay more attention. Movies or novels use this concept a lot so that the audience or readers keep following the continuation of the story. Another example is the use of ice breaking in learning activities. Ice breaking can increase students' attention because it has a different atmosphere from the usual learning process.

Loss and avoidance is the fear given to someone because of the possibility of losing something. For example, discount clothes that only last for 15 minutes. Everyone wants the opportunity to get clothes at low prices. This method can increase people's desire to buy the clothes, even though they have never thought about buying clothes before. They will buy the clothes because they do not want to lose the opportunity to get a discount.

According to Sochor et al. [7], the core drivers can be linked to gamification elements. In other words, each gamification element can provide motivation or feelings according to the respective core drivers. One gamification element can be linked to more than one core drivers. Mapping Between Game Elements and Core Drivers can be seen in Table 2 below.

Table 2. Mapping Between Game Elements and Core Drivers

Game Elements	Example	CD
1. Points are rewards player for successful completion of tasks.	experience points	CD2, CD3, CD4
2. Levels and scores are the progress a user has already achieved in a game	leveling system	CD4, CD6
3. Badges and achievements are trophies granted for accomplishments	Trophy	CD4, CD5
4. Counters and timers are passage of time towards a specific event	Countdown timers	CD3, CD6, CD8
5. Quests are parts of the overall telling of a story	Daily quests	CD4, CD6, CD8
6. Performance graph/progress bar display user or team performance graphically and progress on a bar	Performance graphs	CD2, CD3, CD8
7. Leaderboards are lists of users, which are usually ordered by achievements	Anonym leaderboard	CD2, CD7
8. Crowning honors a user for exceptional behavior or performance during a pre-defined period	Employee of the week	CD1, CD5
9. Multimedia feedback shows results by means of direct visual, acoustic or textual feedback	Traffic light smileys	CD3, CD5, CD8
10. Suggestions/ advice help user to proceed or need choose something	Pick-by-light system	CD2, CD3
11. Metaphorical or fictional representation is the art of illustrating non- game content with metaphors or fiction	Fictional scenario	CD1, CD7
12. Avatars are visual representations of users in form of a chosen character	Customiz-able avatars	CD3, CD4
13. Narratives are the composition of stories with higher meaning which form the telling of an overall story	Open-worlds narrative	CD1, CD7

These motivations and emotions can be described and compared between groups, such as formal and nonformal education. According to UNESCO [10], formal education is a planned and purposeful education carried out by public or private institutions and organizations and refers to the official education system of a country. Formal education has a clear program and curriculum for various levels based on age groups, and each level has different qualifications. Meanwhile the nonformal education is additional education that can be applied to complete formal education. In nonformal education there is no standard level that applies between institutions or groups of providers. In addition, in nonformal education there is no age requirement. Nonformal education is usually done only once or in sporadically [11].

Therefore, this study seeks to identify the use of gamification elements in e-learning. Not only comparing the number of gamification elements used, but this study also tries to measure the motivation of each gamification element. The analysis was carried out on formal and nonformal education to determine the differences in the motivation for the use of gamification elements in the two groups.

B. Research Method

This research is a systematic literature review (SLR) research. This research collected, processed, and analyzed articles that were in accordance with the topic and research objectives. The method that is widely used in SLR is Kitchenham [12]. As shown in figure 2 below, this method begins with the planning stage which consists of identifying needs in conducting a review. Then proceed with developing a research question so that the research has a clear objective. This planning stage ends with the development of a review of the protocol to be used. The second stage is implementation. At this stage, the search, selection, and assessment of articles that match the search criteria was carried out. Then, the articles were extracted and analyzed to answer the predetermined research questions. The final stage of this method is reporting. This stage produced a final report that contains all the SLR processes that have been carried out.

Figure 2. Systematic Literature Review Using Kitchenham Model [12]

Review Questions

In the previous section, the review question used in this study was mentioned. The RQ was generated by analysis using the PICOC method. This method helped researchers in identifying Population, Intervention, Comparison, Outcomes and Context of the study. Table 3 below contains the results of the identification of each PICOC element.

Table 3. Review Question Structure

Structure	Representation
Population	E-learning, online learning, distance learning, learning management system
Intervention	Implementation
Comparison	Formal and non-formal education
Outcome	Patterns and motivations for the use of gamified elements
Context	gamification

The following review questions (RQ) were the basic questions for this study.

RQ1: What elements of gamification are widely used in e-learning for formal and nonformal education?

RQ2: What are the comparisons of the core drivers between formal and nonformal education?

Search Process

This search process was the initial stage which greatly influences the subsequent stages. The selection of databases and keywords were two things that need to be determined first. The selected databases in this research were ACM Digital Library, ScienceDirect and Scopus. These three databases were chosen because they were very relevant to the CS/IS/IT field. The articles collected were articles published from 2017 to January 2023, thus provided an overview of today's e-learning. While the search keywords consisted of "e-learning" and "gamification" groups, in order to produce many suitable articles, the keyword "e-learning" was expanded further with the keywords "online learning", "distance learning", and "learning management system". The following table contains the queries used to search for articles in each database.

Table 4. Database and Boolean Queries

Database	Boolean Search Query
ACM Digital Library	[All: “e-learning” OR “online learning” OR “distance learning” OR “learning management system”] AND [All:”gamification”]
ScienceDirect	TITLE, ABSTRACT OR AUTHOR- SPECIFIED KEYWORD ((“e-learning” OR “online learning” OR “distance learning” OR “learning management system”) AND ”gamification”)
Scopus	ALL ("e-learning" OR "online learning" OR "distance learning" OR "learning management system") AND ALL (gamification)

Inclusion and Exclusion Criteria

The search results in the previous stage produced several articles that matched the search keywords. The articles were then filtered again based on certain criteria. The purpose of the screening was to exclude articles that did not suitable for the scope of this study. An example of the excluded article was the article that did not build its own system, but only used existing applications, such as the using of Kahoot in the learning process. There was also an article that did not explain the gamification features used. This kind of article was excluded from the search. The criteria for each stage to filter articles are described in the following table.

Table 5. Inclusion and Exclusion Criteria

Stage	Inclusion Criteria	Exclusion Criteria
Initiation	Appropriate with *search keyword;* English; Published between 2017 and January 2023; Article or journal, proceeding	Non-English; Not published between 2017 and January 2023
Title and abstract selection	Design and implementation of gamification system on e-learning	Literature review; Framework; Theoretical review
Full-text selection	- Build its own system; Describe what gamification elements are used in e-learning; open access article	Using external system; Does not describe what gamification elements are used in e-learning; Restricted article

C. Result and Discussion

After going through the search and selection stage, 65 articles that correspond to the criteria were obtained. These articles contained the use of gamification in online learning both in formal and nonformal education. The use of gamification also varied. Some articles only used gamification elements in quizzes, or assessments only. However, other articles used gamification elements in all learning processes. The following table contains the number of articles obtained at each step from the selected databases.

Table 6. Number of Selected Articles

Database	Initiation	Title and abstract selection	Full text selection
ACM Digital Library	172	52	18
Science Direct	261	65	16
Scopus	1.287	166	31
Total	1.720	283	65

Most of the articles described the implementation of gamification in formal education. While 51 articles came from formal education, nonformal education only had 14 articles. The topics of nonformal education articles consisted of governmental, sports, online courses, and medical. Table 7 below lists the articles selected according to the search and selection criteria.

Table 7. Articles Selected

	Title	Scope
1	An Adaptive Learning with Gamification & Conversational UIs [13]	Formal
2	An Assistive Technology Using FSL, Speech Recognition, Gamification and Online Handwritten Character Recognition in Learning Statistics for Students with Hearing and Speech Impairment [14]	Formal
3	Assessing classcraft as an effective gamification app based on behaviorism learning theory [15]	Formal
4	Assistive Gamification and Speech Recognition E-Tutor System for Speech Impaired Students [16]	Formal
5	Blending Gamification and Project-Based Learning with Rapid Prototyping Technologies in Enhancing Students' Learning of Design [17]	Formal
6	Gamification in e-Governance [18]	Non-Formal
7	Increasing Students' Motivation by Using Virtual Learning Environments Based on Gamification Mechanics: Implementation and Evaluation of Gamified Assignments for Students [19]	Formal
8	Let Them Play: Experiences in the Wild with a Gamification and Coaching System for Young Diabetes Patients [20]	Non-Formal
9	Smartly Learning through step decomposition, automation and Gamification [21]	Formal
10	To Enhance Learning Outcome: Cloud-Assisted Gamification in Higher Education Institutions [22]	Formal
11	Using Gamification to Develop Self-Directed Learning [23]	Formal
12	Analyzing the Factors that Influence Learning Experience through Game Based Learning using Visual Novel Game for Learning Pancasila [24]	Formal
13	AntibioGame®: A serious game for teaching medical students about antibiotic use [25]	Formal
14	Collecting Pokémon or receiving rewards? How people functionalise badges in gamified online learning environments in the wild [26]	Formal
15	Design and Development Game Chinese Language Learning with Gamification and Using Mnemonic Method [27]	Formal
16	Developing a gamified AI-enabled online learning application to improve students' perception of university physics [28]	Formal
17	Developing an active-learning app to improve critical thinking: item selection and gamification effects [29]	Formal
18	Gamified learning: A role-playing approach to increase student in-class motivation [30]	Formal
19	Influence of Gaming Elements on Summative Assessment in Engineering Education for Sustainable Manufacturing [31]	Formal
20	Learn+Fun! Social Media and Gamification sum up to Foster a Community of Practice during an Emergency Medicine Rotation [32]	Formal
21	Towards Agile and Gamified Flipped Learning Design models: Application to the System and Data Integration Course [33]	Formal
22	A model driven approach to the development of gamified interactive clinical practice guidelines [34]	Formal
23	A playful approach to fostering motivation in a distance education computer programming course: Behaviour change and student perceptions [35]	Formal
24	An educational network for surgical education supported by gamification elements: Protocol for a randomized controlled trial	Formal

	Title	Scope
	[36]	
25	Design of a Software System to Support Value Education in Sports through Gamification Techniques [37]	Non-Formal
26	Evaluation of Gamification in E-Learning Systems for Elementary School Students [38]	Formal
27	Exploring the impact of gamification on student engagement and involvement with e-learning systems [39]	Formal
28	Gamification in corporate training to enhance engagement: An approach [40]	Non-Formal
29	Gamification in MOOCs: Engagement Application Test in Energy Sustainability Courses [41]	Non-Formal
30	Gamification of an asynchronous HTML5-related competency-based guided learning system [42]	Formal
31	Gamification of courses in the e-learning environment [43]	Formal
32	Gamification in inclusive elearning [44]	Non-Formal
33	We Play and Learn Rhythmically: Gesture-Based Rhythm Game for Children with Intellectual Developmental Disabilities to Learn Manual Sign [45]	Non-Formal
34	Implementing Microlearning and Gamification Techniques in Teaching Software Project Management Concepts [46]	Formal
35	Gamification-Based UML Learning Environment in Virtual Reality	Formal
36	Smart E-Badge (Gamification) for Learning Experience When Using Learning Tools for High School Student [47]	Formal
37	Gamification of Learning as a Supplementary Learning Support for Mapua IT Students [48]	Formal
38	SQL Scrolls - A Reusable and Extensible DGBL Experiment [49]	Formal
39	Respond to Change or Die: An Educational Scrum Simulation for Distributed Teams [50]	Formal
40	Who trains the trainers? Gamification of flight instructor learning in evidence-based training scenarios [51]	Non-Formal
41	Digital badges affect need satisfaction but not frustration in males in higher education [52]	Formal
42	Can gamification improve the virtual reality tourism experience? Analyzing the mediating role of tourism fatigue [53]	Non-Formal
43	Education in Focused Lung Ultrasound Using Gamified Immersive Virtual Reality: A Randomized Controlled Study [54]	Formal
44	Gamification of virtual reality assembly training: Effects of a combined point and level system on motivation and training results [55]	Formal
45	Investigating how gamified syllabic literacy impacts learning, flow and inappropriate behaviors: A single-subject study design [56]	Non-Formal
46	A gamified app for supporting undergraduate students' mental health: A feasibility and usability study [56]	Formal
47	An Educational Arabic Sign Language Mobile Application for Children with Hearing Impairment [57]	Non-Formal
48	BioIntegrada Game Application: An Instrument for the Systemic Teaching from Cells to the Environment [58]	Formal
49	Crossquestion game: A design of a group-based assessment tool to enhance student motivation during pandemic [59]	Formal
50	Design, development and use of a digital badges system in higher education [60]	Formal
51	Development of Android Based Educational Games to Enhance Elementary School Student Interests in Learning Mathematics [61]	Formal
52	Development of Gamification-Based Wordwall Game Platform on Reaction Rate Materials [62]	Formal
53	Effectiveness of a Gamification Application in Learning Mandarin	Formal

	Title	Scope
	As A Second Language [63]	
54	Examining Students' Behavior in a Digital Simulation Game for Nurse Training [64]	Formal
55	Gamification Approach towards Engineering Students' Engagement in Online Learning [65]	Formal
56	Gamification as a Teaching Method to Improve Performance and Motivation in Tertiary Education during COVID-19: A Research Study from Mexico [66]	Formal
57	Gamified Digital Game-Based Learning as a Pedagogical Strategy: Student Academic Performance and Motivation [67]	Formal
58	Housie: A Multiplayer Game for Cybersecurity Training and Evaluation [68]	Non-Formal
59	Hybridization Gamified: A Mobile App for Learning about Hybridization [69]	Formal
60	Implementation of Gamification in Mathematics m-Learning Application to Creating Student Engagement [70]	Formal
61	Improvement of Student Learning Motivation through Word-Wall-based Digital Game Media [71]	Formal
62	Managing Gamified Programming Courses with the FGPE Platform [72]	Non-Formal
63	Personalized Gamification for Learning: A Reactive Chatbot Architecture Proposal [73]	Non-Formal
64	The Effectiveness of Gamification for Students' Engagement in Technical and Vocational Education and Training [74]	Formal
65	Using Gamification to Facilitate Students' Self-Regulation in E-Learning: A Case Study on Students' L2 English Learning [75]	Formal

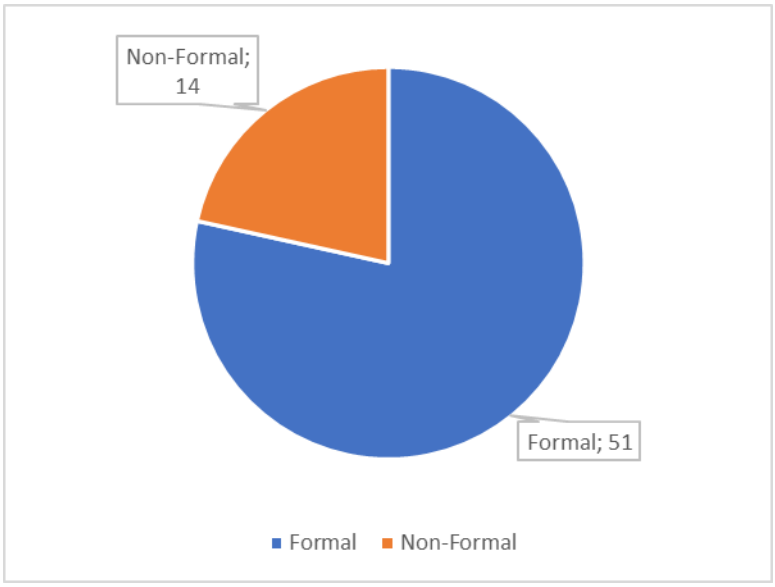

Figure 3. Comparison of articles regarding formal and non-formal education

The implementation of gamification in formal education also consistsed of several levels. Can be seen in figure 4, most of them came from higher education level, with as many as 38 articles. The remaining, 5 articles were from senior high school level and 8 other articles were from primary school (see Fig. 4).

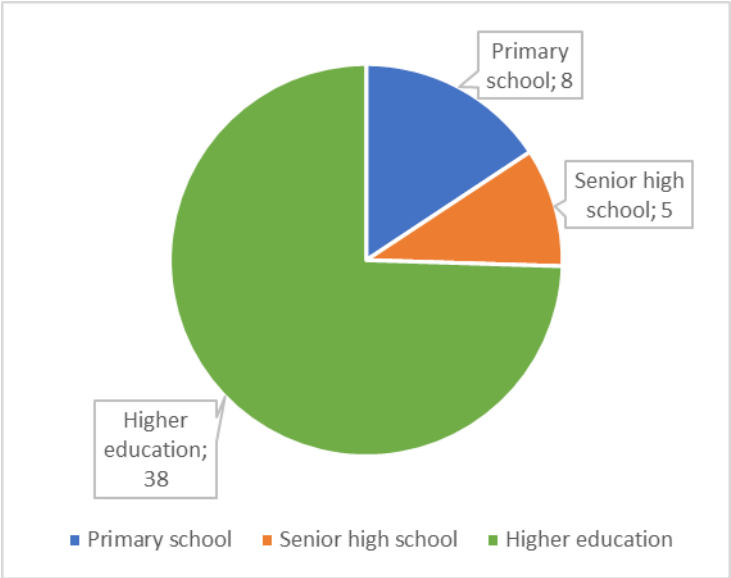

Figure 4. Implementation of gamification in formal education

Many factors lead to the need for gamification implementation at the higher education level. As previously stated [2], gamification has a role to increase user engagement with the system. The pattern of learning at the higher education level is different from the lower level. Students in higher education level are required to be more independent and have high awareness to be able to follow the learning material. Meanwhile, students in senior high and primary school still get high attention from teachers. Gamification plays a role in keeping students in higher education active in using online learning.

Addressing Review Question 1: The Elements of Gamification

To answer RQ1, the following graphic is an overview of the use of gamification elements in formal and nonformal education.

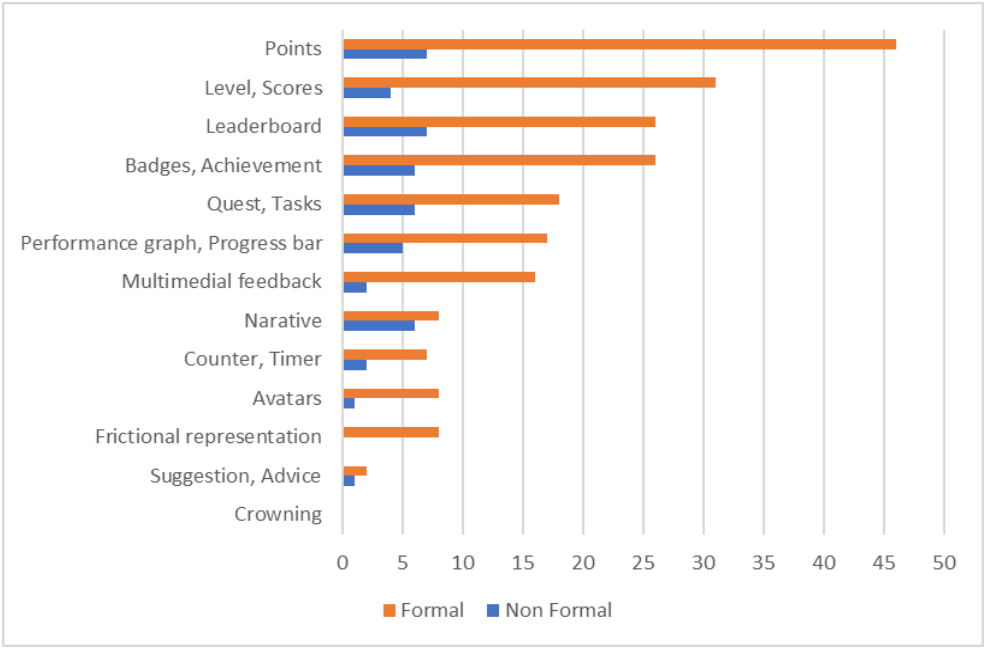

Figure 5. Use of Gamification Elements

In the implementation of gamification in e-learning, not all elements needed to be included. Developers could determine which elements would be included, depending on the needs and the design of the gamification created. Based on the results of the article extraction, the point element was the most widely used. Almost all articles used points as a calculation of student learning achievement. There were few articles that did not use point counting [33], [42], [75], [76], [44], [50], [52], [53], [57], [58], [64], [68]. In these articles, students only collected badges that can be obtained at each level completed. There was no point counted in this gamification system. The use of points in formal and nonformal education was not different. This was in line with learning needs to provide student assessments.

The leaderboard element is widely used in nonformal e-learning. The difference in usage between the two groups can be seen in Figure 5. The use of the leaderboard does have a specific purpose, such as increasing the motivation of participants to get a higher score. But in formal education, the leaderboard is not widely used. One of the articles [37] does not use the leaderboard element because it has a specific purpose. This is intended so that students do not have access to their peers's grades, avoiding comparisons that could be motivational determination.

The use of level elements in e-learning for formal education is also greater than nonformal education. This is because learning materials without gamification have been sorted from the easiest to the most difficult. When gamification is used, it is translated into levels in the form of games.

The use of the performance graph or progress bar looks the same in both groups. This element is used to describe student learning progress in both groups.

A significant difference also occurs in the use of badges and achievements elements. Nonformal education uses this element more than formal education. This element is used to reward participants who have completed quests in e-learning.

Another interesting fact is that none of the e-learning utilizes the crowning element. Whereas this element is very suitable for nonformal education, for example determining "employee of the week" who has good achievements during the learning process. This element is replaced by badges, which are widely used in both formal and nonformal education.

Addressing Review Question 2: Comparisons of the core drivers between formal and non-formal education

The calculation results of the gamification elements were then mapped with the appropriate core drivers. Figure 6 illustrates a comparison of the core drivers between formal and nonformal education. It also answers the first research question that asks for different motivations for using gamified elements.

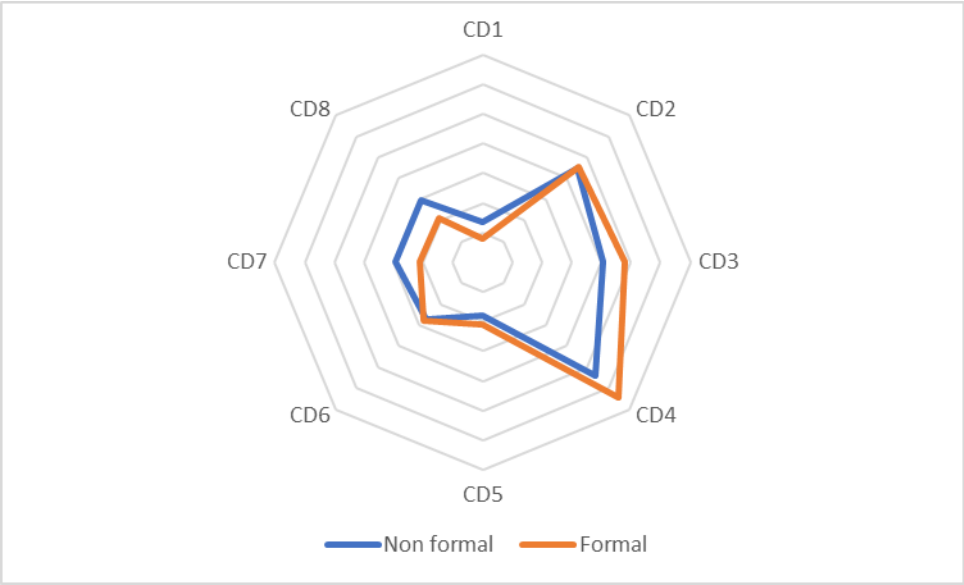

Figure 6. Core drivers in formal and non-formal education

The pattern of these two groups is quite similar. CD1 is the core driver with the lowest value when compared to the others. Calling to students is not widely applied in e-learning, both in formal and nonformal education. CD2 has moderate scores, both for for nonformal and formal education. This value describes that the atmosphere of competition in nonformal education is the same as in formal education. The gamification elements that describe these developments and competencies include point counting, performance graphs, leaderboards, and suggestions. Similar to CD2 values, CD3 also had moderate values in both groups. However, formal education scores slightly higher than nonformal education. CD3 describes that the creativity provided for participants can be incorporated into e-learning. This core driver is strong enough to build student engagement with e-learning. CD4 (ownership and possession) is the most prominent core driver compared to others. Both groups want to increase user engagement in e-learning by increasing the sense of belonging. Gamification elements such as avatars, badges, levels, and quests are widely used for this purpose. E-learning in formal education has a higher CD4 score than in nonformal education. This shows that e-learning in formal education requires a higher sense of belonging compared to nonformal education. CD5 has a low score, slightly more than the CD1. Gamification elements related to social relations between users are not widely used, such as crowning and feedback. Nonformal education has relatively the same value than formal education. This shows that there is no difference in two groups in terms of social relationship. Scarcity and impatience (CD6) also do not have a large value. The values in the two groups were not much different. That is, there is no difference in e-learning to give a sense of anxiety and fear. There was a slight difference in CD7 between the two groups. Nonformal education has a higher CD7 score than the formal education. Or in other words, non-formal education gives more curiosity to students in participating in learning activities. Much like CD7, the CD8 value in the nonformal group was also higher than formal education.

D. Conclusion

There is a certain motivation behind the implementation of these gamified elements. The motivation or core drivers must be in accordance with the goals and users who will use the e-learning. The most widely used gamification elements in formal education are points, levels, leaderboards, and tasks. Meanwhile, in nonformal education, points, badges, and leaderboards are the most widely used gamification elements.

However, the two groups have similarities in the core drivers brought by the gamification element. Ownership and possession are the most prominent motivations for implementing gamification. This is in line with the purpose of using gamification, to increase user engagement. The higher the sense of belonging to something, the closer the bond that appears. Meanwhile, the comparison of other core drivers is relatively the same between the two groups.

This study has a limited number of databases used as a search source. Increasing the number of databases as a search source can result in more articles being collected. This can provide more representative results for the use of gamification elements. In addition to adding databases, future research can also add surveys to students to find out their perceptions of the gamification elements that they often use in e-learning. This method can provide another perspective on the motivation behind the use of gamified elements, apart from referring to the theory of octalysis.

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