Are There Literature Reviews About Gamification to Foster Inclusive Teaching? A Scoping Review of Literature Reviews About Gamification.

**Annex 1**

**The implementation of automatic context annotation consisted of two steps:**

* 1. Document pre-processing: We divided the documents into papers and Wikipedia subdisciplines and generated a corpus for each document. We obtained the papers' corpus by combining their title and abstracts. In the case of Wikipedia Disciplines, we generated their corpus from the first set of paragraphs in their introductory section. For example, for the subdiscipline Accounting, we went to <https://en.wikipedia.org/wiki/Accounting> and extracted the first section of the page:

*“Accounting, also known as accountancy, is the processing of information about*[*economic entities*](https://en.wikipedia.org/wiki/Economic_entity)*, such as*[*businesses*](https://en.wikipedia.org/wiki/Business)*and*[*corporations*](https://en.wikipedia.org/wiki/Corporation)*.*[*[1]*](https://en.wikipedia.org/wiki/Accounting#cite_note-NP_2013-1)[*[2]*](https://en.wikipedia.org/wiki/Accounting#cite_note-2)*Accounting measures the results of an organization's economic activities and conveys this information to a variety of stakeholders, including*[*investors*](https://en.wikipedia.org/wiki/Investor)*,*[*creditors*](https://en.wikipedia.org/wiki/Creditor)*,*[*management*](https://en.wikipedia.org/wiki/Management)*, and*[*regulators*](https://en.wikipedia.org/wiki/Regulatory_agency)*.*[*[3]*](https://en.wikipedia.org/wiki/Accounting#cite_note-UW_Dept-3)*Practitioners of accounting are known as*[*accountants*](https://en.wikipedia.org/wiki/Accountant)*. The terms "accounting" and "*[*financial reporting*](https://en.wikipedia.org/wiki/Financial_reporting)*" are often used interchangeably.*[*[4]*](https://en.wikipedia.org/wiki/Accounting#cite_note-Ias-4)

*Accounting can be divided into several fields including*[*financial accounting*](https://en.wikipedia.org/wiki/Financial_accounting)*,*[*management accounting*](https://en.wikipedia.org/wiki/Management_accounting)*,*[*tax accounting*](https://en.wikipedia.org/wiki/Tax_accounting)*and*[*cost accounting*](https://en.wikipedia.org/wiki/Cost_accounting)*.*[*[5]*](https://en.wikipedia.org/wiki/Accounting#cite_note-WC_1981-5)*Financial accounting focuses on the reporting of an organization's financial information, including the preparation of*[*financial statements*](https://en.wikipedia.org/wiki/Financial_statement)*, to the external users of the information, such as investors, regulators and*[*suppliers*](https://en.wikipedia.org/wiki/Suppliers)*.*[*[6]*](https://en.wikipedia.org/wiki/Accounting#cite_note-HDF_2006-6)*Management accounting focuses on the measurement, analysis and reporting of information for internal use by management.*[*[1]*](https://en.wikipedia.org/wiki/Accounting#cite_note-NP_2013-1)[*[6]*](https://en.wikipedia.org/wiki/Accounting#cite_note-HDF_2006-6)*The recording of financial transactions, so that summaries of the financials may be presented in financial reports, is known as*[*bookkeeping*](https://en.wikipedia.org/wiki/Bookkeeping)*, of which*[*double-entry bookkeeping*](https://en.wikipedia.org/wiki/Double-entry_bookkeeping)*is the most common system.*[*[7]*](https://en.wikipedia.org/wiki/Accounting#cite_note-L_2009-7)[*Accounting information systems*](https://en.wikipedia.org/wiki/Accounting_information_system)*are designed to support accounting functions and related activities.*

*Accounting has existed in various forms and levels of sophistication throughout human history. The double-entry accounting system in use today was developed in medieval Europe, particularly in*[*Venice*](https://en.wikipedia.org/wiki/Venice)*, and is usually attributed to the Italian mathematician and Franciscan friar*[*Luca Pacioli*](https://en.wikipedia.org/wiki/Luca_Pacioli)*.*[*[8]*](https://en.wikipedia.org/wiki/Accounting#cite_note-jkdiwan-8)*Today, accounting is facilitated by*[*accounting organizations*](https://en.wikipedia.org/wiki/Category%3AAccounting_organizations)*such as standard-setters,*[*accounting firms*](https://en.wikipedia.org/wiki/Accounting_networks_and_associations)*and*[*professional bodies*](https://en.wikipedia.org/wiki/Professional_accounting_body)*. Financial statements are usually audited by accounting firms,*[*[9]*](https://en.wikipedia.org/wiki/Accounting#cite_note-Parliament_Auditors_1-9)*and are prepared in accordance with*[*generally accepted accounting principles*](https://en.wikipedia.org/wiki/Accounting_standard)*(GAAP).*[*[6]*](https://en.wikipedia.org/wiki/Accounting#cite_note-HDF_2006-6)*GAAP is set by various standard-setting organizations such as the*[*Financial Accounting Standards Board*](https://en.wikipedia.org/wiki/Financial_Accounting_Standards_Board)*(FASB) in the United States*[*[1]*](https://en.wikipedia.org/wiki/Accounting#cite_note-NP_2013-1)*and the Financial Reporting Council in the*[*United Kingdom*](https://en.wikipedia.org/wiki/United_Kingdom)*. As of 2012, "all major economies" have plans to*[*converge*](https://en.wikipedia.org/wiki/Convergence_%28accounting%29)*towards or adopt the*[*International Financial Reporting Standards*](https://en.wikipedia.org/wiki/International_Financial_Reporting_Standards)*(IFRS).*[*[10]*](https://en.wikipedia.org/wiki/Accounting#cite_note-globalcon-10)[*[11]*](https://en.wikipedia.org/wiki/Accounting#cite_note-11)” (Wikipedia, 2024)

The paper's title, abstract, and Wikipedia subdisciplines introductory sections were processed using the Count and Term Frequency Inverse Document Frequency (TFIDF) vectorizers from the sci-kit learn library (Pedregosa et al., 2011). In this step, we obtained a vector of word frequency and TFIDF scores for each of the papers and Wikipedia subdisciplines. Next, we used the cosine similarity method from the Scikit-learn library and the vector of similarities between each paper and the Wikipedia subdisciplines to create a similarity matrix. Finally, we selected the subdiscipline with the highest similarity value to the paper and used it as our automatically assigned context.

* 1. Final context annotation: One of the authors read the title and abstract the papers again, assisted by the annotations obtained in the explorative and automatic stages, and assigned a tag to the papers considering one of the broader disciplines described in the Wikipedia list of disciplines.

**Operationalization of the Multimode network analysis**

We did two descriptive analyses, one for a network including all documents in the dataset to provide a general overview and another dividing the dataset by years for each year in the dataset to give a detailed vision. The descriptive analysis consisted of three steps: 1) keyword generation for each document, 2) network creation, and 3) network analysis.

Document keyword generation: We used several keyword generation methods on each document's combined title and abstract and used the keywords to create an adjacency matrix of documents vs. keywords. The keyword generation methods used were TopicRank (Bougouin and Boudin, 2014), TextRank (Mihalcea and Tarau, 2004), PositionRank (Florescu and Caragea, 2017), KeyBert (Sharma and Li, 2019), PatternRank (Schopf et al., 2022), and rapidraker (Rose et al., 2010) in a custom field that combined the documents' title and abstracts. We combined the results of each keyword generation method into one custom keyword field, eliminated repeated keywords, and used it to create an adjacency matrix of documents and keywords.

Network creation: In this step, we created multimode networks and calculated their nodes' centrality measures for each projection (documents and keywords). Using the adjacency matrix obtained in the previous step, we generated word co-occurrence multimode networks (documents and keywords), one for all the data and one for each year in our dataset. The nodes of the multimode networks are keywords and papers; the edges are the co-occurrence of a keyword between two papers. Furthermore, we did their two projections, documents, and keyword networks for each of the networks.

Document projection: The document projection is a network with documents as nodes and keyword co-occurrence between them as edges. It helps to see the connections between papers given their co-occurring keywords, allowing us to identify papers that cover similar topics and are central to the networks.

Keyword projection: The keyword projection is a network that has keywords as nodes and co-occurrence between keywords in a document as edges. I.e., if a keyword co-occurs in a document, an edge is drawn between them. The keyword projection helps us identify the specific themes explored by literature reviews. Furthermore, identifying the more central keywords in the networks helps us to have a general idea of the central theme of a given network.

Centrality: We calculated the nodes' eigenvector centrality for each of the multimode networks' projections. Furthermore, we organized the words into quartiles according to their eigenvector centrality when possible. We formed four divisions Q3 (max>x>=q3), Q2 (q3>x>=q2), Q1 (q2>x>=q1) and Q0 (q1>x) being q1, q2, q3 and q4 the 25th, 50th and 75th quartiles of the eigenvector centrality values.

* Q3: will group the most central keywords, which we expect will describe the central themes of a network.
* Q2: Group words with their eigenvector centrality in the middle, providing information about themes often in the papers but not "popular."
* Q1 and Q0: Show the words that are peripheric to the network. In this set, we expect to find rare themes or detailed information about the central themes.

**Network analysis by year (2014-2022)**

Gamification Literature Reviews in 2014: This year starts with papers about gamification in education, health, and libraries and whether gamification works or not. This year's network is comprised of 5 papers and 2 keywords. We present them in Table 1.

Table 1. Top five central papers and keywords in 2014.

|  |  |
| --- | --- |
| **Paper title**  | **Paper code** |
| A Review of Gamification for Health-Related Contexts  | 1 |
| Gamification and Education: A Literature Review  | 3 |
| Does Gamification Work? - A Literature Review of Empirical Studies on Gamification  | 0 |
| Gamification for mHealth - A Review of Playful Mobile Healthcare  | 2 |
| Gamification in Libraries the State of the Art  | 4 |
| **Central keywords** |
| gaming  |
| game  |

We can see from the paper's titles in Table 1 the application of gamification in education and health. Furthermore, we see papers looking into gamification's efficacy and the application of gamification in rare contexts (considering rare as low frequency in our dataset) such as libraries, mobile, and healthcare. The two keywords in Table 1 show us that the central theme of this year was gamification (game and gaming).

Gamification Literature Reviews in 2015: We could not get a network for this year because only one literature review was published in 2015; the paper title was "A literature review of gamification design frameworks." However, it marks the first time a literature review on gamification design appears.

Gamification literature reviews in 2016: This year was about the application of gamification in various contexts, such as education and cognitive training. The network for this year had eight papers and four keywords. The most eigenvector central papers and all keywords are shown in Table 2.

Table 2. Top five central papers and keywords in 2016.

|  |  |
| --- | --- |
| **Paper title**  | **Paper code** |
| What's the Point? A Review of Reward Systems Implemented in Gamification Interventions  | 6 |
| Methods and Techniques for Gamification Educational Software: A Systematic Review  | 2 |
| Gamification in Crowdsourcing: A Review  | 1 |
| Gamification of Cognitive Assessment and Cognitive Training: A Systematic Review of Applications and Efficacy  | 7 |
| The Introduction of Gamification A Review Paper about the Applied Gamification in the Smartphone Applications  | 0 |
| **Central keywords**  |
| gamified  |
| *gamifie*  |
| Motivation  |
| Education  |

*Note.* The keyword “gamifie” in italics is an incorrect lemmatization of the word gamified. Therefore, it was not included in the analysis. See more about this in the limitations described in the discussion section of the paper.

In Table 2, from the top five eigenvector central paper titles, we can see that most of them describe literature reviews about gamification in a context such as educational software, crowdsourcing, cognitive training, and smartphone application. Furthermore, the most central paper touches upon reward systems; this paper is part of gamification design. From the central keyword, we can see that this year's central theme is gamification (gamified) and education and motivation emerge as central themes.

Gamification literature reviews in 2017: Overall, the central theme of this year's literature reviews was the use of gamification and its design in various contexts, such as education and mobile devices. The network for this year contains 14 papers and 18 keywords. We can see the top five eigenvector central papers and the top five eigenvector central keywords organized by quartiles in Table 3.

Table 3. Top five eigenvector central paper and keywords, with keywords organized by quartiles in 2017.

|  |  |
| --- | --- |
| **Paper title**  | **Paper code** |
| Gamification and Learning Performance: A Systematic Review of the Literature  | 7 |
| Gamification: A Systematic Review of Design Frameworks  | 2 |
| Affluent Gaming Experience Could Fail Gamification in Education: A Review  | 3 |
| Gamification strategies for Mobile Device Applications: A Systematic Review  | 9 |
| A Conceptual Framework Review of Gamification Elements on Mobile Marketing Outcomes  | 8 |
| **Central keywords by quartiles** |
| **Q3 (x>75%)**  | **Q2 (75%<x>50%)\***  | **Q1 (50%<x>25%)\***  | **Q0 (25%<x)**  |
| game  | learning  | game mechanic  | game element  |
| motivation  | gamified  | mobile  | pedagogy  |
| study\*\*  | paper\*\*  | work  | physical activity  |
| education  | motivate  | pedagogical  | *gamifie*  |
| gaming  |   |   | engagement  |

*Note.* \*Less than five keywords were available in this quartile, so we list all of them. For the keyword “gamifie” in italics, see the notes in Table 2. \*\* In this table and the following, the keywords "paper" and “study” were omitted from the analysis. The keyword “paper” was often found in paper abstracts describing the study, such as "this paper…" "we obtained 50 papers..." Etc. Furthermore, the keyword "study" was present in the abstracts in the form of "A study about...," "A study to...." Therefore, these two keywords were omitted from analysis.

The papers' titles in Table 3 show a constant presence of gamification in education in papers 7 and 3. Also, in the titles of papers 2, 3 and 8, we can see the emerging trend of gamification design. Furthermore, Papers 3 and 8 show an interesting combination of two trends merging (gamification in education and gamification design for education) in paper 3 and gamification in mobile devices and gamification design in paper 8. Moreover, papers 8 and 9 are examples of gamification applications in the context of mobile devices and marketing, respectively.

From the central keywords, we can see in:

* Q3: The central theme of this network is using gamification in education to impact motivation (game, motivation, education, and gaming).
* Q2: This set of keywords adds more detail to the central theme (learning, gamified, and motivate).
* Q1: This quartile adds about what in gamification, such as analyzing game mechanics, a sub-theme of gamification design. Furthermore, it expands on the themes explored by the literature reviews, such as mobile apps and workplace (mobile and work); and gamification, such as game mechanics which is part of gamification design (game mechanics); and details of the research on pedagogies in the thematic of education (pedagogical).
* Q0: This keyword set expands on what is being reviewed in the central themes, such as gamification, gamification design, and game elements (game element). In education (pedagogy), in healthcare (physical activity), and in motivation (engagement).

Gamification literature reviews in 2018: This year shows a contraction in gamification literature reviews, probably the end of a growing trend. However, the literature reviews in education continue to dig deeper into different topics, such as Massive Online Open Courses (MOOCs) and early childhood education. The network is composed of 11 papers and 6 keywords. Table 4 shows the top eigenvector central papers and all keywords.

Table 4. Top five central papers and keywords in 2018.

|  |  |
| --- | --- |
| **Paper title**  | **Paper code** |
| Gamification in MOOCs: A Review of the State of the Art  | 3 |
| State of the Art and Approach to the Concept of Gamification in Learning in Early Childhood  | 10 |
| A Systematic Review of Gamification Research: In Pursuit of Homo Ludens  | 0 |
| Elements of Gamification in Virtual Learning Environments: A Systematic Review  | 5 |
| Exploring the Benefits of Using Gamification and Videogames for Physical Exercise: A Review of State of Art  | 6 |
| **Central keywords** |
| motivation  |
| qualitative  |
| education  |
| *study*  |
| educational  |
| context\*\*  |

*Note.* \*\*The keyword "context" appears as a noun accompanied by other words modifying its meaning, such as academic or learning contexts. Therefore, it did not add information to the themes this year, and we did not include it in the analysis. See the note in Table 3 of this annex, for information about the keyword in italics.

From Table 4, the titles of the top five eigenvector central literature reviews about gamification, in its majority, three out of five (papers 3,10,5) refer to education. Paper 0 covers gamification research, and paper 6 gamification for physical exercise.  The central keywords in Table 5 show that the central theme is motivation in education (motivation, education, educational). Furthermore, from the keywords, we can learn details about the methods used in this year's literature reviews, such as qualitative studies (qualitative).

Gamification literature reviews in 2019: This year showcases literature reviews on applications of gamification in various contexts, the appearance of a literature review about adaptative gamification, and evidence of the constant focus over the years of gamification literature reviews on education. Furthermore, this network comprises 15 papers and 13 keywords. We show the top five eigenvector central papers and all keywords organized by quartiles in Table 5.

Table 5. Top five eigenvector central paper and keywords, with keywords organized by quartiles in 2019.

|  |  |
| --- | --- |
| **Paper title**  | **Paper code** |
| Adaptive Gamification in Education: A Literature Review of Current Trends and Developments  | 9 |
| Gamification of E-Participation: A Literature Review  | 6 |
| Serious Games and Gamification in the Corporate Training Environment: A Literature Review  | 12 |
| The Rise of Motivational Information Systems: A Review of Gamification Research  | 0 |
| Problem Based Learning Using Gamification: A Systematic Literature Review  | 4 |
| **Central keywords by quartiles** |
| **Q3 (x>75%)\***  | **Q2 (75%<x>50%)\***  | **Q1 (50%<x>25%)\***  | **Q0 (25%<x)\***  |
| motivation  | game  | *study*  | participation  |
| gamified  |   | *gamifie*  | educational  |
| education  |   |   | motivate  |

*Note.* \*Less than five keywords were available in this quartile, so we list all of them. For an explanation of the keywords in italics, please see the notes in Table 2 of this annex.

The paper's titles in Table 5 show that papers 9 and 4 refer to education. Among these two papers, we highlight paper 9, which mentions adaptative gamification, a possible evolution of gamification to fit different learners' needs. Papers 6 and 12 explain gamification applications, and paper 0 is a literature review on gamification research.

From the central keywords in Table 5, we see:

* Q3: This year's central theme of the literature reviews is gamification and education to motivate (motivation, gamified, and education).
* Q2: shows more detail about gamification (game).
* Q1: The two words in this quartile did not provide relevant information.
* Q0: Extends detail about what education, such as educational content (educational), more detail about motivation, such as motivate students (motivate), and that at the very edge of this network, papers about citizen participation are present (this keyword connects to papers such as paper 6 in Table 5)

Gamification literature reviews in 2020: During this year, healthcare makes its entry as a central theme, tailored or adaptative gamification persists over time (signaling an emerging research path), and a variety of peripherical themes such as civic engagement and gamification design are reported. Furthermore, the network describing this year comprises 24 papers and 23 keywords. We show the top five eigenvector central papers and the top five eigenvector central keywords organized by quartiles in Table 6.

Table 6. Top five eigenvector central paper and keywords, with keywords organized by quartiles in 2020.

|  |  |
| --- | --- |
| **Paper title**  | **Paper code** |
| The Impact of Gamification on Learning and Instruction: A Systematic Review of Empirical Evidence  | 17 |
| Gamification of Health Professions Education: A Systematic Review  | 15 |
| A Systematic Review of Gamification Techniques Applied to Elderly Care  | 1 |
| Serious Games, Gamification, and Serious Mental Illness: A Scoping Review  | 19 |
| Tailored Gamification: A Review of Literature  | 0 |
| **Central keywords by quartiles** |
| **Q3 (x>75%)**  | **Q2 (75%<x>50%)**  | **Q1 (50%<x>25%)\***  | **Q0 (25%<x)**  |
| *gamifie*  | use*\*\**  | participation  | game element  |
| game  | motivation  | *study*  | knowledge  |
| learning outcome  | health  | serious game  | design  |
| learning  | empirical study  | motivate  | bibliometric  |
| gaming  | learner engagement  |   | citation  |

*Note.* \*Less than five keywords were available in this quartile, so we list all of them. \*\*The keyword "use" was removed from the analysis because it did not provide thematic information. For an explanation of the keywords in italics, please see the notes in Tables 2 and 3 of this annex.

In Table 6, we can see from the titles that most of them refer to applications of gamification in healthcare 15, 1 and 19. From this set, paper 15 shows us a combination of education, healthcare, and gamification to improve health education. Paper 17 continues the trend of reviewing gamification for education, and paper 0 adaptative or tailored gamification. From the keywords, we can see in:

* Q3: As a central theme, education, and gamification (game, gaming, learning outcome, and learning).
* Q2: shows the increasingly central role of healthcare in the network compared to previous years (healthcare). Furthermore, it provides details about the methods used (empirical study) and details about what researchers wanted to improve by using gamification (motivation, learner engagement)
* Q1: During this year, researchers also looked at how gamification (serious game) was used to motivate (motivate) civic participation (participation).
* Q0: The words in this quartile expand on the methodologies used (knowledge, bibliometric, and citation) and more detail on what of gamification in specific gamification design was investigated (game elements and design).

Gamification literature reviews in 2021: The central theme of this network is gamification and education in various contexts, including online education. Furthermore, the network describing this year comprises 29 papers and 28 keywords. We show the top five eigenvector central papers and the top five eigenvector central keywords organized by quartiles in Table 7.

Table 7. Top five eigenvector central paper and keywords, with keywords organized by quartiles in 2021.

|  |  |
| --- | --- |
| **Paper title**  | **Paper code** |
| Between Level Up and Game Over: A Systematic Literature Review of Gamification in Education  | 1 |
| Gamification Applications in E-learning: A Literature Review  | 10 |
| A Systematic Review of the Use of Gamification in Flipped Learning  | 15 |
| Motivational Effects of Gamification Apps in Education: A Systematic Literature Review  | 16 |
| Gamification in Teaching and Learning Languages: A Systematic Literature Review  | 25 |
| **Central keywords by quartiles**  |
| **Q3 (x>75%)**  | **Q2 (75%<x>50%)**  | **Q1 (50%<x>25%)**  | **Q0 (25%<x)**  |
| motivation  | game element  | online education  | *use*  |
| *study*  | language  | online learning  | high education  |
| motivate  | educational  | serious game  | *gamifie*  |
| education  | learner  | software engineering  | gaming  |
| game  | motivational  | learning process  | user  |

*Note.* For the keyword “study” and “gamifie” in italics, see the notes in Tables 2 and 3 of this Annex and the keyword “use” in the notes in Table 6 of this annex.

The titles column in Table 7 shows that all papers refer to education with a twist: technology used in education, such as in papers 16 and 10. It is not the first year that this happened, but this is the first year where all the top five central papers focus on gamification in education. From the keywords in Table 8, we can see that in:

* Q3: This quartile shows us that the central theme of this year is gamification and education to impact motivation (motivation, motivation, education).
* Q2: The words in this quartile expand the detail on where gamification and education are used and the themes about gamification being explored or implemented, such as gamification design (game elements). Furthermore, it expands on education, for example, educational contents or software (educational) and the object of education (learners). Finally, it gives us more details about motivation, such as motivational content or activities (motivational).
* Q1: This quartile expands in detail about what type of gamified activities, such as serious games, which is a concept relatively close to gamification (serious games). Also, it provides details about what is in education, for example, online education and the learning process of students (online education, learning and learning process). Finally, it gives us more examples of the contexts in which gamification and education are applied (software engineering).
* Q0: This quartile shows more detail about what is in gamification (game), what is in education (high education), and the detail about the object of applying gamification, which is the users (user). Interestingly, the word game was part of the most central keywords in 2014, and in 2021, they are in the far periphery.

Gamification literature reviews in 2022: This year shows us the core and a potential future for gamification research, as in most of the years, the focus is on applying gamification in the education of various contexts. As a context appearing only this year, we had service research. Also, the growth in central papers related to adaptative or tailored gamification poses it as a growing field of gamification research. However, the number of total papers and keywords decreased this year.  Furthermore, the network describing this year comprises 18 papers and 17 keywords. We show the top five eigenvector central papers and the top five eigenvector central keywords organized by quartiles in Table 8.

Table 8. Top five eigenvector central paper and keywords, with keywords organized by quartiles in 2022.

|  |  |
| --- | --- |
| **Paper title**  | **Paper code** |
| The role of learners' characteristics in educational gamification systems: a systematic meta-review of the literature  | 14 |
| Gamification in Physical Education: A Systematic Review  | 2 |
| Gamification, Motivation, and Performance in Education: A Systematic Review  | 13 |
| Gamification for Behavior Change: A Scientometric Review  | 4 |
| Tailored Gamification in Education: A Literature Review and Future Agenda  | 1 |
| **Central keywords by quartiles**  |
| **Q3 (x>75%)**\* | **Q2 (75%<x>50%)\*** | **Q1 (50%<x>25%)\***  | **Q0 (25%<x)\***  |
| motivation  | *gamifie*  | result*\*\**  | service  |
| educational  | student  | game element  | game  |
| *study*  | learning  | gamified  | engagement  |
| learning outcome  |   |   | motivate  |

*Note.* \*Less than five keywords were available in this quartile, so we list all of them. \*\*The word "result" was removed from the analysis because it did not provide thematic information. See the notes in Tables 2 and 3 of this Annex, for an explanation about the words "gamifie" and "study" in italics.

The paper titles in Table 8 show how this last year ended with a peculiar style. Education continues to be the focus, but education has different "flavors," for example, performance, tailored gamification, and the role of learners. Furthermore, adaptative or tailored gamification increases with two papers, 14 and 1, indicating that this topic gained momentum as a research path. Lastly, a scientometric review of gamification itself. From the keywords in Table 8, we can see in:

* Q3: This set of words shows that the central theme of this year is motivation and education (motivation, educational, learning outcome).
* Q2: In this set, we can see more detail on what parts of education (students and learning).
* Q1: We can see here that the gamification and gamification design themes are less central than in previous years (game elements, gamified).
* Q0: In the periphery, a new context for applying gamification is service research (service). Also, we can see again that gamification-related words are now part of the periphery (game). Finally, we find details about motivation (engagement, motivation).

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