# From ICT-Based Learning Media to Gamification Optimalization: Learning Media Research Projection Based on Bibliometric Analysis

Gallant Karunia Assidik[1(✉)], Firstya Evi Dianastiti[2], Shindy Tresna Vinansih[1], and Erry Widya Kustanti[1]

[1] Faculty of Teacher Training and Education, Universitas Muhammadiyah Surakarta, Kartasura, Indonesia
`gk215@ums.ac.id`

[2] Faculty of Teacher Training and Education, Universitas Tidar, Magelang, Indonesia

**Abstract.** Learning media is an integral part of the learning system and occupies an important position. Given the significance of media in learning, this paper examines the bibliometric analysis from published research articles on learning media evaluation. It aims to describe research topics that were extensively studied and to find gaps in either research topics or approaches, or both, that were hardly ever done. This paper utilized a quantitative descriptive method in the form of bibliometric data, with the help of the VOSViewer app, and the data source in the form of research articles collected from the Dimension.ai page. Based on the results of bibliometric data analysis with the keyword 'learning media evaluation', the author concluded that research on learning media develops over time and is contextual concurrence with the existing situation and condition. As evidence, during the Covid-19 pandemic, studies on learning media also adjusted, namely the use of online learning media in distance learning. Research topics that can still be developed include learning media development and testing related to smartphones, including online ICT-based media and gamification.

**Keywords:** Learning Media · Information and Communications Technology · Gamification · Bibliometric

## 1 Introduction

Education is important in advancing a country and is a learning process [1]. The more advanced education in the country, it will print the younger generation who are able to advance their country [2]. The learning process is the interaction between teachers and students that occurs in two directions through active communication. Learning is a communication process that takes place within a system [3]. In this case, learning media becomes an integral part of the learning system and occupies an important position. Thus a medium is needed to convey messages, in the form of learning materials, to students.

The use of appropriate learning media will have an impact on an effective and efficient learning process. Learning media is anything that can convey learning messages using tools to improve the implementation of the teaching and learning process [4]. Therefore, attractive and interactive learning media is needed to optimize learning processes.

Experts have been developing a variety of learning media [5]. Choosing suitable learning media is essential in the learning or instructional design process. Utilizing a systematic approach to learning media can ensure that using appropriate learning media can support the desired learning objectives [6]. Along with the development of information and communication technology, learning media is also developing towards technology utilization, especially the internet. Internet technology utilization in learning media can eliminate many difficulties that occur today. Moreover, the digital world demands graduates who are familiar with technology [7].

An educator (teacher or lecturer) must initially create a comfortable environment or condition so the learning process can go smoothly [8]. Educators play a significant role in educating students facing the Disruption Era [9]. In addition to the Disruption Era, educators are preparing students for the VUCA era (Volatility, Uncertainty, Complexity, and Ambiguity). It is an era where the world is rapidly changing, unpredictable, influenced by many factors that are difficult to control, and truth and reality are highly subjective.

The rapid change in the use of learning media was also triggered by distance learning implementation during the Covid-19 pandemic [10]. The Learning From Home (LFH) implementation makes teachers and students have to adapt as soon as possible. Learning that initially took place in person within the classroom immediately turned into distance learning through online media or other methods adjusted to the infrastructure and conditions of each region. The LFH implementation, afterward, creates various challenges that teachers must overcome and require effective and efficient handling, one of which is the use of learning media. The biggest constraint is the teacher's ability and skills in creating and using learning media [11].

Given the significance of media in learning, this research examined the bibliometric analysis from published research articles on learning media evaluation. It aimed to describe research topics that were extensively studied and to find gaps in either research topics or approaches, or both, that were hardly ever done.

## 2   Method

This research used a quantitative descriptive method in the form of bibliometric data from published articles, with the VOSViewer app to analyze the bibliometric. VOSViewer is a software that can analyze bibliometric data and visualize the results using several options, namely network, overlay, and density analysis [4, 12].

The purpose of this research was to systematically describe the literature review by following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [13]. Based on the PRISMA method, the research data screening was carried out in stages, which included (a) identification, (b) screening, (c) eligibility, and (d) inclusion. The data source was published research articles collected from the Dimension.ai page, using the keyword 'learning media evaluation'. Afterward, data screening
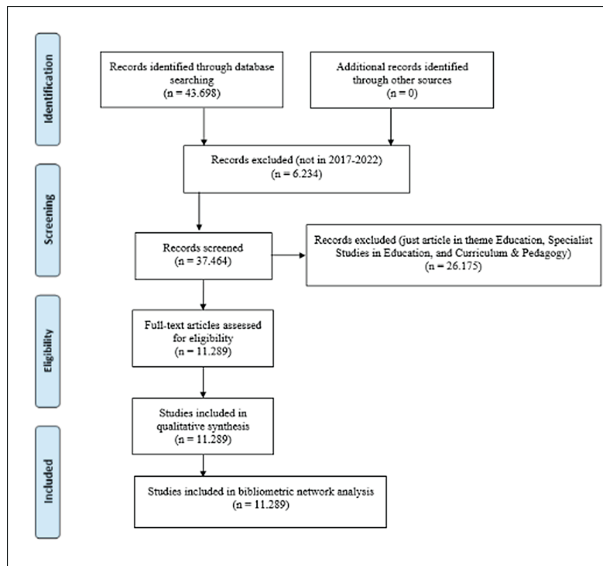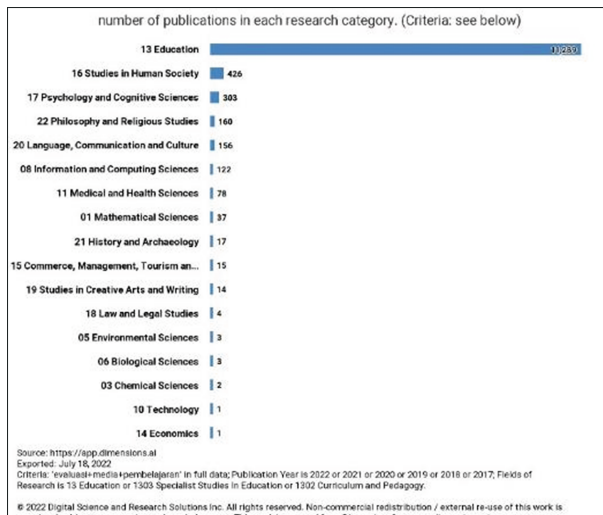
**Fig. 1.** PRISMA flow diagram



**Fig. 2.** Recapitulation of Data Search Results

was done by adding the "2022 OR 2021 OR 2020 OR 2019 OR 2018 OR 2017" specifi-cation. The next step was narrowing the data by adding theme selection limitations from the journal 13 Education OR 1303 Specialist Studies in Education OR 1302 Curriculum and Pedagogy. After conducting limitations, the author obtained 11.289 articles of final data. The data collected using the PRISMA method is shown in Fig. 1 (Fig. 2).
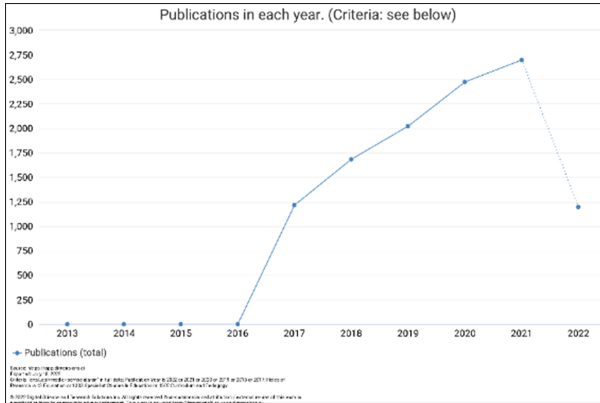
**Fig. 3.** Number of Publications per Year

The data analysis in this research, which turned into a bibliography, used Microsoft's VOSviewer app version 1.16.18. Data export came from data search results on the Dimension.ai page. Bibliometric analysis is a quantitative study for cross-disciplinaries that allows researchers to find research gaps based on the results of published literature databases in specific search engines (Masduki et al., 2022; Sweileh et al., 2017). The 11,289 articles from the Dimension.ai database were further processed using the VosViewer application.

Figure 3 shows that over the past five years, publications related to learning media have increased annually. The entire metadata exported from Dimension.ai was, afterward, analyzed with the help of VOSViewer. With ten terms of the *minimum number of occurrences of a term*, the author obtained 281 *meet the threshold*. Furthermore, out of the 281 terms, only 60% were the most relevant terms, which was only 169 *number of terms to be selected*. However, from 169 terms, some of them were the main keywords, like conjunctions. Therefore, the author manually eliminated 70 of them, leaving 99 shown in the bibliometric map (Table 1).
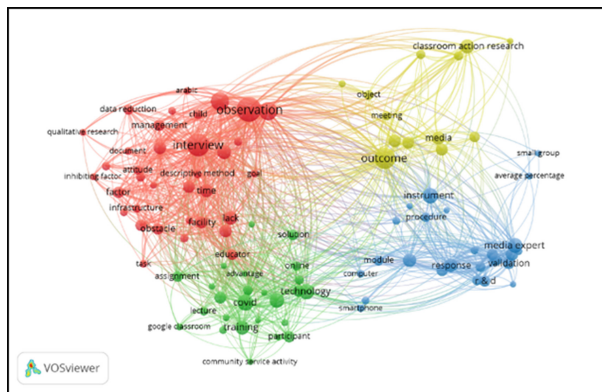
## 3 Result

The results were analyzed based on three categories, namely (a) *network visualization*, (b) *overlay visualization*, and (c) *density visualization.* Afterward, followed by a discussion based on the data analysis results.

### 3.1 Network Visualization Analysis

Network visualization analysis will show the network between terms visualized through the VOSViewer app. Based on the mapping, the author found four clusters of terms distinguished by four line colors. The first cluster (red) consisted of 35 items. Some keywords in cluster one with occurrences were interview, observation, management, obstacle, factor, lack, educator, and infrastructure. The second cluster (green) had 25 keyword items,

**Table 1.** Data Keywords with High Accuracy Level

| Keywords/ terms | Occurrences | Relevance Link Strength |
| --- | --- | --- |
| Classroom action research | 49 | 2.84 |
| Google classroom | 14 | 1.83 |
| R&D | 32 | 1.79 |
| Qualitative research | 14 | 1.69 |
| distance learning | 13 | 1.18 |
| Evaluation process | 11 | 1.12 |
| Lesson plan | 23 | 1.11 |
| Strategy | 36 | 0.75 |
| e-learning | 25 | 0.61 |



**Fig. 4.** Network Visualization

including covid, technology, google classroom, training, lecturer, assignment, advantages, and participant. The third cluster (blue) consisted of 25 keyword items, including media expert, R & D, response, computer, smartphone, instrument, and procedure. While in the fourth cluster (yellow), it contained 13 items. Keywords with high occurrences were classroom action research, outcome, media, meeting, and object. The bibliometric visualization results of the four clusters are presented in Fig. 4.

Furthermore, an analysis was conducted based on the suitability of each cluster, starting from the first cluster in Fig. 5. The keywords classified in the first cluster include *interview, observation, management, obstacle, factor, lack, educator, infrastructure, data reduction, qualitative research, lesson plan, time,* and *factor*.

The various keywords that appeared in cluster one represented the strength of keywords that interconnected with other clusters. In cluster one, most of the keywords were
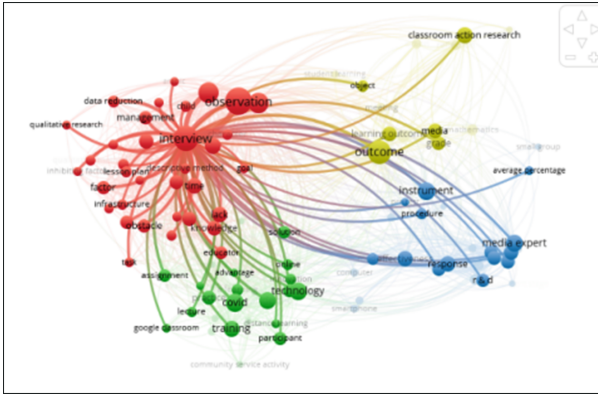
**Fig. 5.** Network Visualization Cluster 1

related to the approach to the research methods used. The keywords *interview* and *obser-vation*, a data collection technique, were connected to keywords in other clusters, namely *classroom action research*, and *R&D.*

In cluster 2 (Fig. 6), there was a network for keywords *technology* and *e-learning*. Figure 6 shows that over the past five years, research on learning media with technology-specific topics had mostly been conducted using classroom action research and R & D (research and development) approaches. From the visualization in cluster 1, technology-based learning media research was conducted during the Covid-19 pandemic, which was followed by the presence of keywords like *online, computers,* and *smartphones.* These studies were related to *participant, lecturer,* and *community service activities* and how various training was conducted.

Moreover, the visualization in cluster 3 (Fig. 7) shows the data of the correlation between keywords in cluster 3 and other clusters. In the instrument keyword, there was a correlation between studies that use various instruments, namely instruments used for media assessment by experts (media experts), related to R&D research, and responses. Those intertwined with other clusters were instruments used in observation, interviews, outcomes, and classroom action research. When looking at the R & D terms, the main keywords were *response*, *media expert*, *instrument*, *outcome*, *grade*, *technology*, *educa-tor*, and *interview*. These keywords described the variables and research techniques in the structure of the R & D approach. In addition, it can also be concluded that the current R & D research is closely related to technology-based learning media development to achieve optimal learning outcomes.

Figure 8 is the result of network visualization from one of the keywords in cluster 4, namely *improvement*. Figure 8 represents that over the past five years, the most researched learning media was learning media with the topic of Mathematics. In the cluster, the words were *outcome, object, meeting, grade*, and *classroom action research*. In conclusion, research about learning media in cluster 4 is related to its utilization to improve learning outcomes in the classroom.
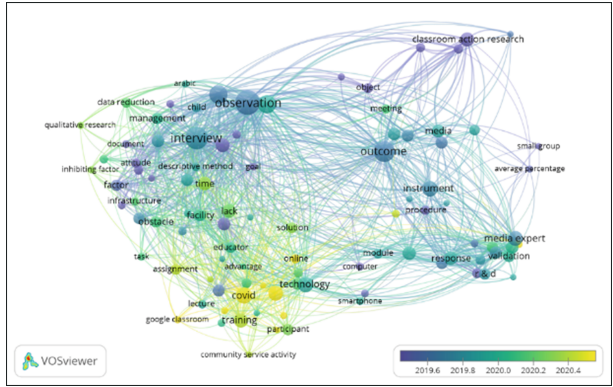
**Fig. 6.** Network Visualization Cluster 2

## 3.2 Analysis Overlay Visualization

Overlay visualization displays an analysis of research novelty based on existing meta-data. In the VOSViewer app, the research novelty analysis is visualized with lighter colors on the mapping, namely from purple and dark green to the final color, bright yellow. The bibliometric analysis results of the keyword "learning media evaluation" in the Dimension.ai search page for the last five years (2017–2022) are shown in Fig. 9.

Figures 9 and 10 shows that the current research topic regarding learning media is the learning media used during the Covid-19 pandemic. During the Covid-19 pandemic, the realm of education also experienced instant drastic changes, especially in terms of learning media efficiency and utilization. Therefore, it is not surprising that the keywords that appeared and had a connection with Covid-19 were *online*, *distance learning*, *training*, and *assignment*. The data results showed that during the Covid-19 pandemic, academics were also working to mobilize research to find the best learning media that can be used online during the learning process from home.

**Fig. 7.** Network Visualization Cluster 3



**Fig. 8.** Network Visualization Cluster 4

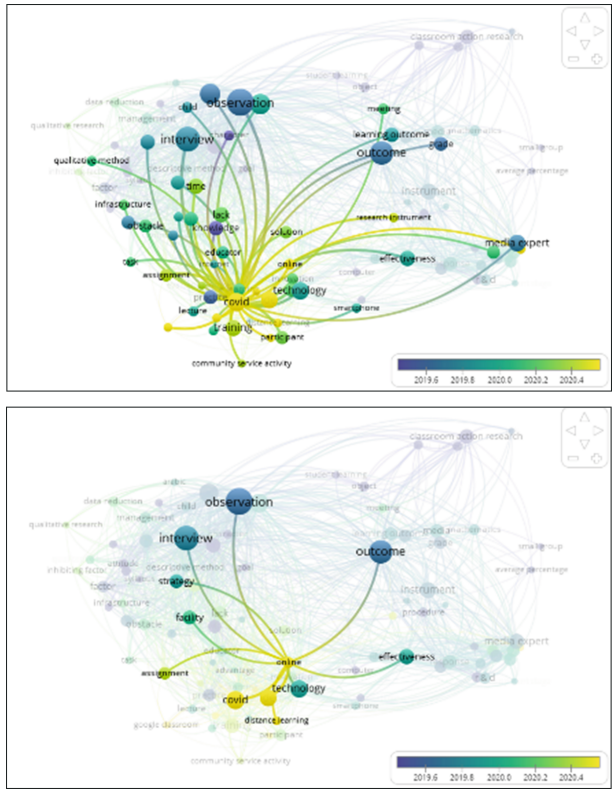**Fig. 9.** Overlay Visualization



**Fig. 10.** Terms of Recent Research in Overlay Visualizatio*n*

**Fig. 11.** Density Visualization

### 3.3 Analysis Density Visualization

Density visualization is used to understand the density of researched topics based on the occurrence of keywords in the mapping. Contrary to the color interpretation in overlay visualization, in density visualization, the lighter the color means a lack of research on the topic (Fig. 11).

The density visualization analysis results from the keyword "learning media evaluation" showed many research topics that have been carried out, namely learning media related to Covid-19 and technology with research data collection techniques in the form of interviews and observations. Moreover, there was much research on the correlation between learning media and outcomes, namely outcomes in the form of impacts, benefits, and expected changes after the use of learning media. From the mapping results, the author found that although there was various research on learning media technology, only a few have examined smartphone and computer-based learning media.

## 4   Discussion

The bibliometric data analysis showed research topics published within the last five years (2017–2022). Research developments on learning media correlate with technology development and the Covid-19 pandemic, which appeared from 2019 until 2022. Learning media research trends in the last five years has been to examine the utilization of various kinds of learning media to improve students' abilities using classroom action research. Along with technology developments, there is also a lot of developmental research (R & D) to produce adaptive learning media.

### 4.1   ICT-Based Learning Media

The rapid growth of technology and the internet's widespread use have led to changes in communications [14]. The higher the basic ICT skills, the higher the utilization of one's social media activities [15]. The current use of smartphones encourages the digital

literacy trend. Digital literacy is the comprehension of information based on digital devices [16]. It correlates with the ICT utilization level, like social media, as a learning medium. The high use of gadgets among millennial teenagers allows teachers to optimize the role of these devices, not only as a means of entertainment but also as a learning medium.

Other initiatives related to media utilization by people in the educational realm are the optimization of websites, Twitter, Facebook Live, Instagram, and videos on Youtube [17]. During the Covid-19 pandemic, lecturers utilized various e-learning media, but e-learning only focused on assignments, making it less attractive to students [18]. Aside from social media, teachers/lecturers can also use movies or movie trailers as learning media to achieve their expected indicators. Movie trailers can be used as a learning media to foster students' resolution in telling stories in writing based on the imagination that appears after watching the movie [19].

As a projection, future studies can optimize smartphones with all the applications and internet networks as the learning media. Moreover, since the Covid-19 pandemic, students have become accustomed to distance or online learning. During the pandemic, some apps used were Zoom Meeting, Google Meet, Bandicam, Kahoot, Mentimeter, and other apps adapted to the learning characteristics. With the demands of learning from home, like it or not, lecturers/teachers and students are starting to familiarize themselves with various online learning apps, both in the form of conferences and others [20].

## 4.2 Fostering Joyful Learning with Gamification

Learning media research which is rarely done based on bibliometric analysis, is of the keywords *smartphone, computer, task,* and *assignment.* Of the four topics, gamification is one type of learning media that is still rarely researched. As a research discipline, gamification is rapidly growing. The rapid growth of publications in the gamification field in education took place over at least the last seven years, from 2014–2021 [21]. Research developments on gamification are in the form of fundamental questions, like "what and why gamification, how gamification works, and when not to use it. Gamification still faces empirical and theoretical challenges to prove its effectiveness in learning, practicing, and consolidating the principles that guide gamification design to make it a meaningful learning medium [22].

Gamification is a general trend that promotes modern education [23]. Gamification uses game elements so that when used as a learning medium, the fun is still present and creates an ideal learning environment to increase learners' motivation, engagement, and performance (Khaleel et al., 2015; Hallifax et al., 2019). Gamification in the educational realm consists of game elements and design technique utilization within the context of education [24]. A significant factor in the success of educational games is their ability as a learning media to maintain students' motivations and interests by adapting the learning and playing experiences based on the needs, preferences, goals, and abilities of each student [25]. One aspect of this gamification approach is rewarding, which is one of the elements in the game that can attract learners to engage in an activity [26]. However, it is worth noting that gamification must still refer to learning indicators and educational content. One of the reasons for the failure of gamification as a learning medium is generalizing game elements for students without understanding the context

of the educational institution or the background of the user [27]. When looking at the various benefits and accompanying aspects, there is still room for future research on gamification as a learning media.

## 5   Conclusion

Based on the results of bibliometric data analysis with the keyword "learning media evaluation" using metadata from Dimension.ai, the author concludes that research on learning media develops over time and is contextual concurrence with the existing situation and condition. As evidence, during the Covid-19 pandemic, studies on learning media also adjusted, namely the use of online learning media in distance learning. Research topics that can still be developed include learning media development and testing related to smartphones, including online ICT-based media and gamification. The limitations of this research include data sources that only came from Dimension.ai, so it is still possible that the data obtained will be different and complementary if the bibliometric analysis is conducted with data sources from Scopus, Web of Science, PubMed, and Google Scholar.

**Authors' Contributions**
All researchers have contributed in conducting this research. The following is the author's contribution. Gallant Karunia Assidik contributed to the drafting of the concept, methodology, and analysis. Firstya Evi Dianasti contributed to data search, discussion of findings. Shindy Tresna Vinansih contributed to the writing of the article. Erry Widya Kustanti contributed in writing the article.

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