

# Unleashing the Hidden Potential of Mobile Application Engagement in Contemporary Business: A Bibliometric Analysis and Future Research Agenda

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## Abstract

The advancements in mobile application development technology have led to an increased focus on Mobile Application Engagement (MAE) studies over the past decade. It is important to uncover the knowledge stock of such surging studies. Therefore, this study aims to uncover potential themes for future researchers in mobile application engagement. This study involved 1001 documents from the Scopus and Web of Science databases from 2002 to 2022 and then deployed the SPAR-4 technique to retrieve appropriate documents. The study used the Bibliometrix R package to conduct performance analysis, thematic analysis, word cloud, and source impact. Thematic analysis shows that technology and mobile applications are emerging themes but need further development to generate stronger links with user engagement. By presenting a comprehensive overview of research themes, thematic focus, and future directions, the study delivers a useful contribution to the area of MAE. The findings can help researchers, particularly those just starting research in MAE. Specific research fields and features of mobile app engagement can be investigated in the future.

**Keywords:** Bibliometrix R, Biblioshiny, Mobile application engagement, Performance analysis, Thematic analysis, word cloud.

## Introduction

In the fourth industrial revolution, called Industry 4.0, mobile applications have emerged as valuable tools that streamline work processes and exhibit user-friendly features catering to diverse users (1). The COVID-19 pandemic (2) has significantly influenced the rapid advancement of digital transformation in multiple industries, encompassing areas such as retail, education, health care, e-commerce, and finance. Numerous enterprises have been pushed to emphasize digital solutions to ensure their existence in the market (3). As a result, many organizations have implemented mobile applications within various industries to enhance the efficiency of customer-business interactions. Mobile applications provide users with advantages such as increased efficiency in time management and enhanced accessibility regardless of geographic location, thereby effectively addressing the diverse needs of users (4). In general, mobile applications provide advantages to both customers and companies by enhancing customer interaction.

Although mobile apps provide numerous benefits, there are situations in which specific apps cannot fulfill the worldwide requirements of users owing to various factors such as inadequate design, restricted response, bugs, and technical difficulties. These limitations can potentially cause a decrease in user involvement, leading to unfavorable electronic word-of-mouth (e-WOM) and decreased conversion and client retention rates. To gain insights into the determinants of customer engagement, organizations must assess the level of consumer app engagement. Identifying factors contributing to consumer engagement or disengagement is of utmost importance, as it offers significant insights for app developers in the business context. The number of research on mobile apps is growing, garnering the interest of both consumers and scholars. There has been a growing interest among scholars in bibliometric analysis in recent years. This approach enables the quantitative analysis of enormous datasets, allowing researchers to identify knowledge gaps and

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provide valuable insights for future studies. The utilization of bibliometric analysis has become a well-recognized approach for managing and evaluating enormous volumes of scientific information (5). Numerous bibliometric studies have been conducted across multiple specialized domains, such as mobile technologies (6), mobile health applications (7), and smart learning (8). A few studies have conducted retrospective analyses on papers published in specific academic journals, like the Journal of Business & Industrial Marketing (9) and the Journal of Business Research (10).

Most bibliometric studies have conducted analyses on certain fields utilizing a singular database. An instance of this may be observed in the study undertaken by (7), wherein a bibliometric analysis of mobile health applications was carried out exclusively utilizing the Web of Science database, relying solely on a single database for doing bibliometric analysis, which has inherent biases. This study integrates Scopus and Web of Science datasets covering 2002 to 2022 to mitigate bias. This approach offers a comprehensive viewpoint and offers insights into further investigation.

This paper represents one of the first bibliometric analyses of Mobile application Engagement (MAE). We use the Bibliometrix R program for analysis. This study aids researchers in the identification of knowledge gaps and the exploration of novel research topics. To gain a comprehensive understanding of the research about MAE, we employ academic journals sourced from reputable databases such as Scopus and Web of Science. This bibliometric analysis paper aims to comprehend the topic thoroughly, ascertain prominent researchers and institutions, assess the research's impact, detect developing trends, and determine potential avenues for future research. The primary focus of this study is to accomplish the following three objectives:

### Research questions

RQ1: What are the Research hotspots in the MAE?

RQ2: What are the most significant journals and who are the most prolific contributors in MAE research?

RQ3: What could be the direction for future research on MAE?

## Materials and Methods

This paper presents a comprehensive review of prior scholarly investigations on Mobile application engagement, suggests topics for further research, and provides a valuable contribution by graphically demonstrating emerging trends and patterns in the field. The data collection was conducted using Scopus and Web of Science, widely recognized as reputable sources for scholarly research. The terms "Mobile application Engagement" OR "App Engagement" were used as keywords in the search sections titled "Article title, Abstract, keyword." The research was carried out by analyzing data from many sources, including the document title, publisher name, document type, author's keyword, year, cited references, and other relevant sources.

The present study utilized the Systematic Performance Analysis And Review Technique (SPAR-4). The SPAR-4 methodology evaluates the efficacy of various systems and procedures. The process encompasses the establishment of objectives, the gathering of data, the analysis of performance, and the provision of recommendations for enhancement. One of the key advantages of SPAR-4 lies in its prioritization of decision-making based on empirical evidence.

### SPAR-4 - SLR

This study adopts SPAR-4-SLR a three-stage protocol developed by (11) as mentioned in the above structure.

### Assembling

The process of collective assembly involves the identification and acquisition of publications for the purpose of review. The Scopus and Web of Science databases are commonly utilized for the purpose of gathering bibliographic data pertaining to scholarly articles. The investigation was carried out covering the period 2002 to 2022, employing the phrase "Mobile application engagement" OR "App engagement." A total of 9526 publications were retrieved.

### Arranging

The next step in the process involves the organization and categorization of the articles through arranging and filtering. The articles were classified based on the following criteria: article

title, source title, author's name, author's country of affiliation, author and index keywords, sponsorship information, total number of citations, total number of publications, and h-index value. The scope of refining was limited to specific publishing types, namely English language articles published in journals.

### Assessing

The final phase of assessment involves the process of evaluation and report writing. The

SPAR-4 SLR Protocol, as depicted in Figure 1, provides valuable guidelines that can assist scholars in justifying the rationale behind their review conclusions (11). In this study, a rigorous bibliometric review was conducted using the R tool Biblioshiny and Microsoft Excel. This review employed various techniques, such as co-citation analysis and keyword-occurrence analysis. The narrative synthesis method was utilized to identify gaps in the literature and propose future research areas.

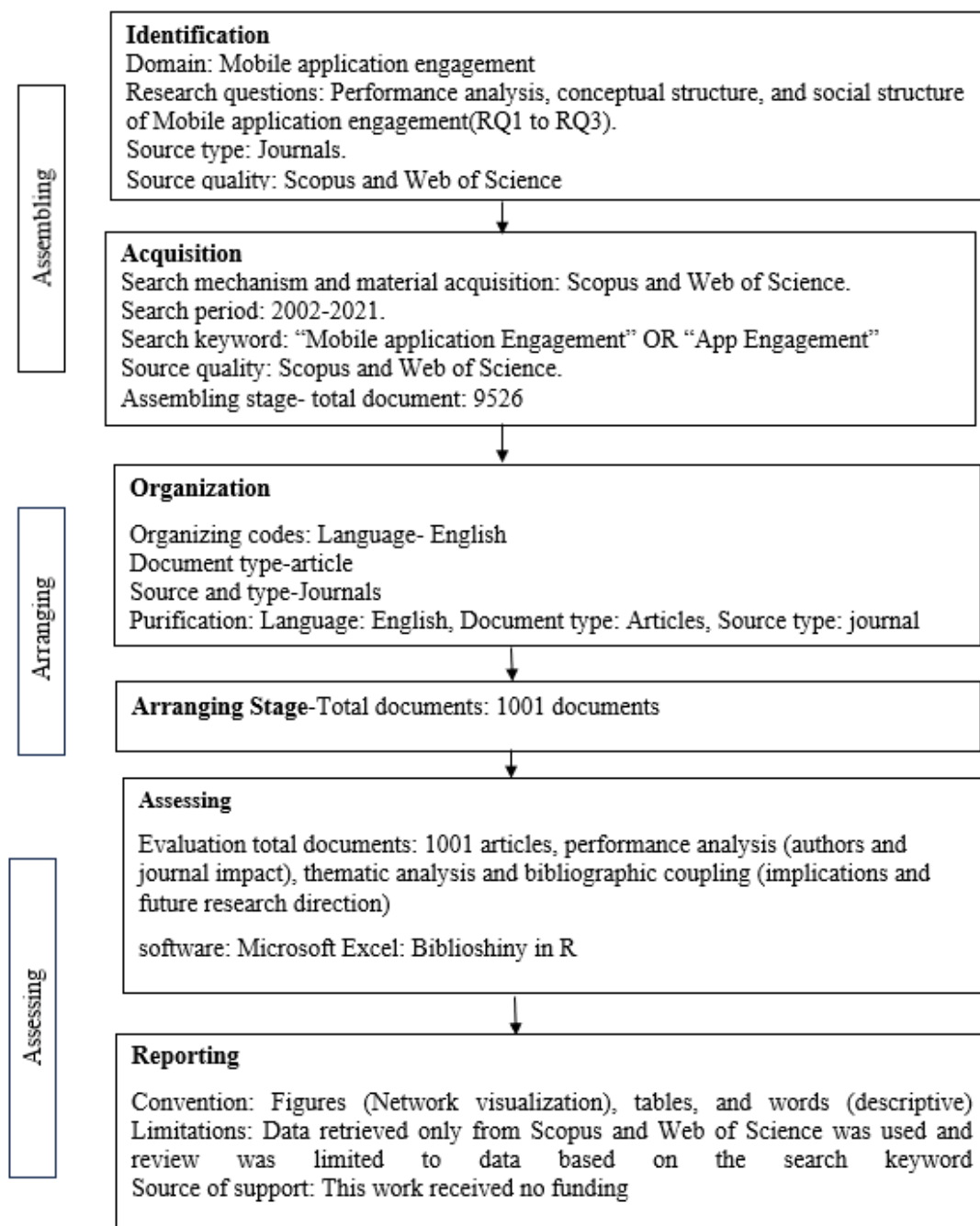


Figure 1: SPAR-4 structure

## Results

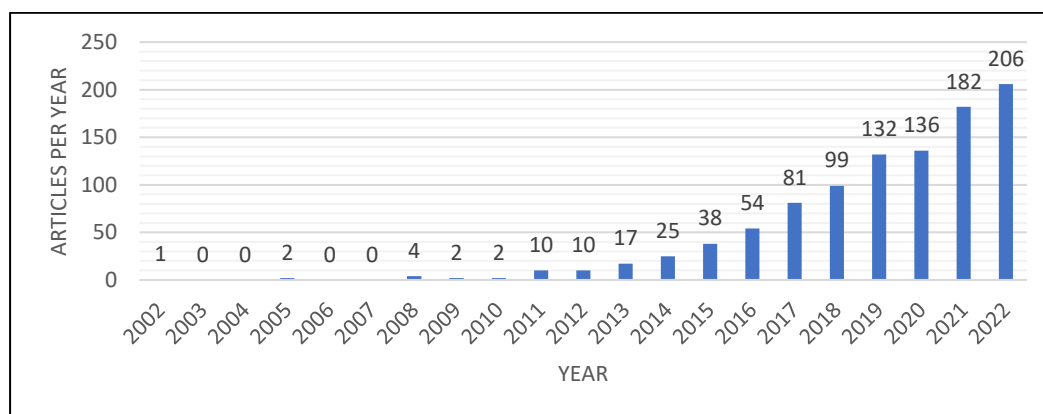
Table 1 depicts the main facts about the explored articles using the keyword search. We included 1001 documents (Table 1) published from 580 sources and published in journals alone for the analysis. Most articles have multiple authors, and only 157 papers have one author. On an average, each document has co-authorship of 3.42 and internationally co-authorship of 0.60. The average number of citations per document (13.47) is moderate, which means less familiarity with the field of research and the two units of co-

occurrence analysis is author’s keywords and keywords plus. The author’s keyword is 3421, while the keyword plus is 2486.

We conducted longitudinal analysis using the annual scientific production data with two-time frames (2002-2012 and 2013-2022). Figure 2 shows the increasing popularity of the MAE research. Publications on MAE have grown annually at 30.52% (2002 to 2022). Macdonald F was one of the first authors in this MAE research field.

**Table 1:** Summary Statistics

Description	Results
<b>Basic Information</b>	
Timespan	2002:2022
Sources(journals,book,etc)	580
Documents	1001
Annual Growth Rate %	30.52
Average years from publication	3.96
Average citations per documents	13.47
References	52832
Document Types	
Article	1001
Document contents	
Keywords Plus (ID)	2486
Author’s Keywords(DE)	3421
Authors	
Authors	3160
Authors of single-authored documents	158
authors collaboration	
Single-authored documents	158
Co-Authors per documents	3.4
International co-authorships%	0.60



**Figure 2:** Number of articles published per year

**Table 2:** Growth of Publications

Year	No of publications	Mean TC Per Article	Mean TC per Year
2002	1	33.00	1.57
2003	0	0	0
2004	0	0	0
2005	2	37.5	2.08
2006	0	0	0
2007	0	0	0
2008	4	19.5	1.30
2009	2	26.00	1.86
2010	2	7.00	0.54
2011	10	57.40	4.78
2012	10	35.60	3.24
2013	17	26.88	2.69
2014	25	29.68	3.30
2015	38	27.89	3.49
2016	54	19.96	2.85
2017	81	22.75	3.79
2018	99	17.39	3.48
2019	132	14.75	3.69
2020	136	13.10	4.37
2021	182	6.90	3.45
2022	206	2.03	2.03

TC = Total Citation

In 2017, there were 81 articles published, however growth has been steadily increasing with 206 articles published in the year 2022 (Table 2). An average number of citations per year indicates that in 2002, when the field was just emerging, only one article received a mean of 1.57 citations. The quantity of citations was volatile from 2003 to 2010. However, the mean citations increased by 4.78 in 2011, which is a record number of citations per year.

### Performance analysis of MAE

Performance analysis evaluates the contributions of research constituents of a given field (5) Important performance indicators are the number of publications and citations per year. While publication numbers are proxy for productivity, citation is a measure of impact and influence.

### Journal classification based on their impact

The journal and author impact respectively based on the h-index, g-index, and total number of journal citations are presented in Table 4 and 5. The number of citations a publication receives is used to determine its impact, which aids in

identifying the most important publications. The journal's impact is qualified by the h-index, unlike the g-index,

Both the h-index and the g-index are author-level metrics, but the h-index helps to determine the journal's impact factor and how much it has contributed. Hirsch-index is determined by a researcher's most-cited publications and the number of citations they have received for other authors' works (12). For instance, if an author has an h-index, that means they have a h number of citations for each, and if author x has a h index of 10, that means he has 10 citations. This has to do with context rather than numbers. The more cited articles will provide more in-depth insights on the research area. Based on this, the researcher can identify the most productive journal and its impact factor that assist in choosing the appropriate article. G -index (13) is the same as h-index in order to give more cited publications the most weight possible; for example, if an author has index g, condition g must be the largest whole number so that his or her top g paper receives at least g<sup>2</sup> citations (13). The impact of a research subject is evaluated more thoroughly by the g-index.

**Table 3:** Source Impact

Journal Name	h-index	g-index	Total citation
Computers And Education	10	12	674
Journal Of Retailing And Consumer Services	10	12	538
British Journal of Educational Technology	8	11	197
New Media and Society	7	7	183
International Journal of Human Computer Studies	7	8	141
JMIR Aging	6	11	138
JMIR Human Factors	6	11	128
Sustainability (Switzerland)	7	9	109
Proceedings of the ACM On Human Computer Interaction	6	9	89
Convergence	5	6	58

Table 3 shows the top 10 sources that published MAE research. Computers and Education received a higher number of citation (674), followed by the Journal of Retailing and consumer services. The British Journal of Educational Technology, New Media and Society and the International Journal of

Human Computer Studies are the most preferred journals based on parameters such as h-index, g-index and total citations. The top 20 ranked journals by Bradford's law were selected because they are important sources for MAE research, have made the most contributions, and are

### Most relevant sources

**Table 4:** Bradford's law

Source	Rank	Freq.
JMIR Human Factors	1	29
Sustainability (Switzerland)	2	18
JMIR Aging	3	15
Proceedings of the ACM on Human-computer Interaction	4	14
Computers and Education	5	13
Journal Of Retailing and Consumer Services	6	13
British Journal Of Educational Technology	7	12
Education Sciences	8	8
International Journal of Human Computer Studies	9	8
British Journal Of Educational Technology	7	12
Education Sciences	8	8
International Journal of Human Computer Studies	9	8
Journal Of Surgical Education	10	8
Games For Health Journal	11	7
International Journal of Human-Computer Interaction	12	7
Journal of Technology in Behavioural Science	13	7
New Media and Society	14	7
Convergence	15	6
Cyberpsychology, Behavior, and Social Networking	16	6
Interaction Design and Architecture(S)	17	6
Journal of Computer Assisted Learning	18	6
Sage Open	19	6
Techtrends	20	6
Freq.-Frequency of Publication		

therefore, regarded as the core journals in this field. When conducting research on MAE in the marketing field, researchers can consult these 20 journals. Researchers can also consult other

journals, such as Games for Health Journal, British Journal of Educational Technology, and International Journal of Human Computer Studies (Table 4).

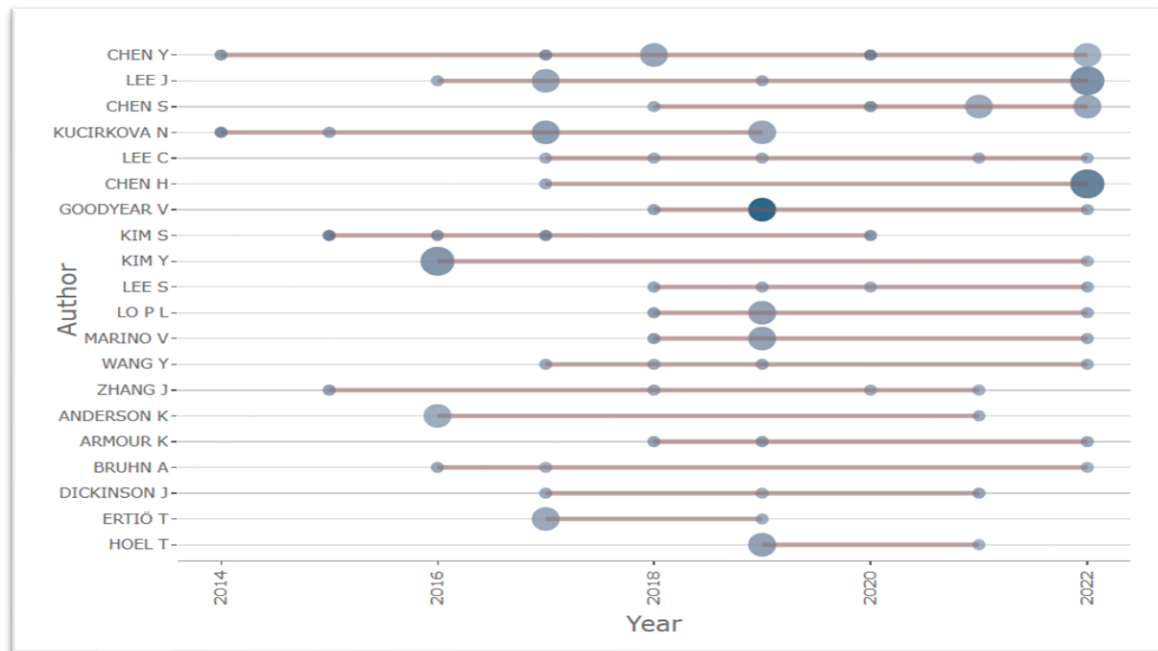


Figure 3: Authors’ production over time

Table 5: Author impact

Author Name	h-index	g-index	Total Citation	NP	PY_start
Kim S	4	4	332	4	2015
Kucirkova N	5	6	220	6	2014
Chen Y	5	5	218	5	2014
GoodYear V	4	4	179	4	2018
Johnson P	3	3	167	3	2014
Kim Y	3	3	76	3	2016
Lee J	6	6	68	6	2016
Lo P L	4	4	68	4	2018
Marino V	4	4	68	4	2018
Armour K	3	3	65	3	2018
Chen S	4	6	59	6	2018
Chen H	3	3	55	3	2017
Li Y	3	4	54	4	2022
Light B	3	3	51	3	2014
Liu Y	3	3	50	3	2019
Lee S	4	4	38	4	2018
Dickinson J	3	3	31	3	2017
Lee C	3	4	26	4	2017
Ertio T	3	3	25	3	2017
Anderson K	3	3	17	4	2018

NP-Number of Publication, PY-Publication Year

### Authors Impact

The most prolific authors (top 20) are shown in Figure 3. The larger circle size indicates that greater number and darker colour represents higher citations.

Major contributors in MAE research include authors Lee J (3 articles), Chen H (3 articles) and Chen Y (2 articles) in year 2022.

Table 5 lists the top 20 authors in order of total citations, indexes (h index, g index, total citations (TC), publications (NP), and year of publication (PY start). Based on the quantity of publications, the order of the writers is decided. Both the h-index and the g-index aid researchers in selecting the best author research article to obtain a detailed understanding of MAE by measuring the impact factor of authors.

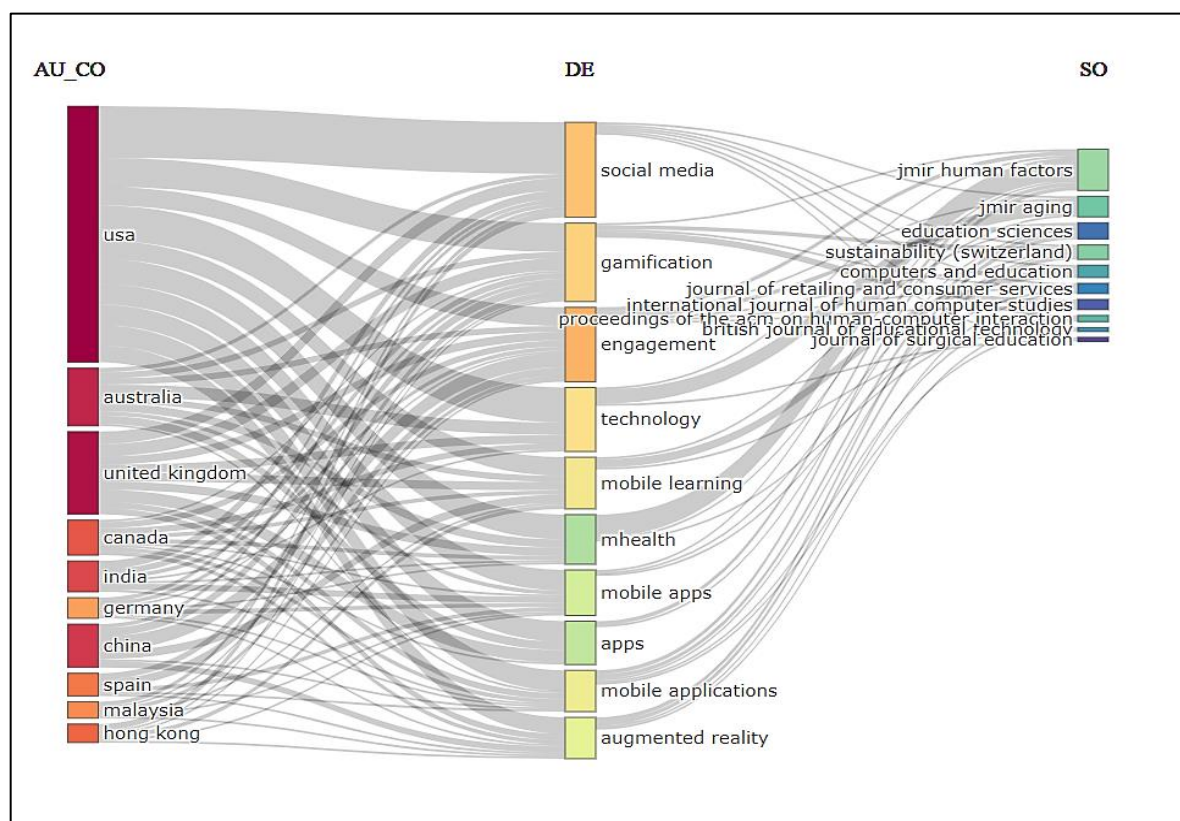
### Keyword analysis

#### Three fields Plot

Visual representation of prolific Scholars in respect to their nations and areas of interest is displayed in the three-field plot. The 3 fields in this analysis are countries (left), authors (middle) and keyword (right).

Three-field plot help identify research hotspots that assist future researcher to identify their research topics.

Figure 4 shows the three-plot for the country, keywords, and Journal. This figure is drawn based on more familiar Sankey diagrams and the size of the boxes is proportional to the number of events, so we can say that the USA has the largest number of MAE publications its researchers publish more on “social media”, “mobile application” and “engagement”, while in China the MAE researchers’ favorite theme is “engagement”. Australian researchers also publish about engagement, keyword engagement is popular in the USA, and Australia. If we see, in the journal-wise the term “mobile apps” and “engagement” are well accepted by the international journal of human-computer studies, mHealth is popular among USA scholars and is published in JMIR human factors, gamification prevails among USA scholars and is published in the Journal of Retailing and Consumer Services, Computers and education.



**Figure 4:** Three fields Plot

Note: AU\_CO-Author Countries, DE-Author Keywords, SO-Sources

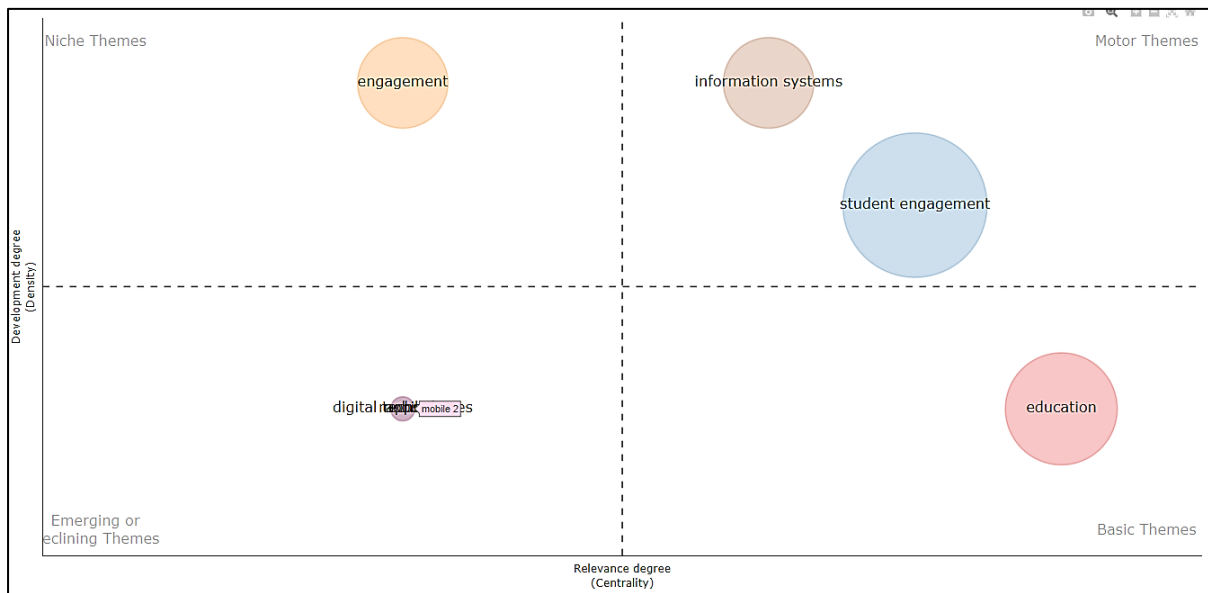


### Thematic evolution

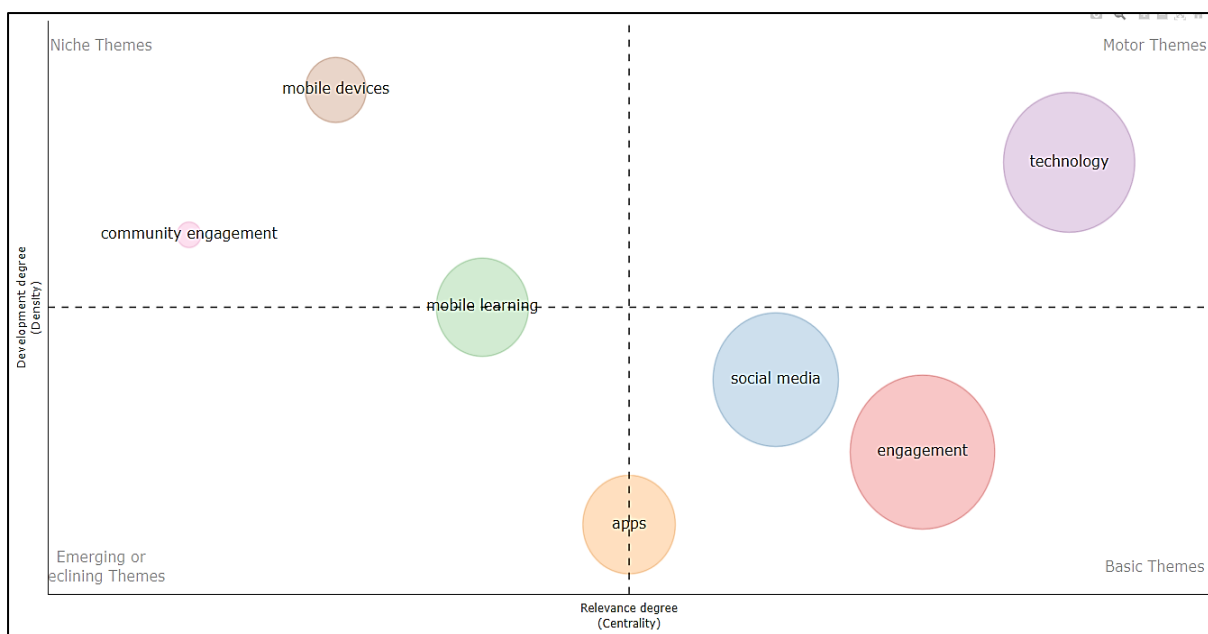
Thematic evolution is a type of science mapping that blends production analysis with other methods to quantify and visualize topic evolution. It enables researchers to assess and view the thematic development of a research field. Thematic evolution aids in the identification of research interests and their evolution over time and prospective research directions. Biblioshiny software was employed to understand the thematic evolution. The two time periods

were split as follows 2002-2012 (31 documents), 2013-2022 (970 documents).

Bibliometrix R was used to select the author's keywords, which were limited to 250 words, a minimum cluster frequency of 5 per thousand documents, and a minimum weight index of 0.1. We ran the analysis with labels that are 0.3 by 1 pixels in size for each cluster (Figure 5 and 6) with the 1 cutting points, cutting year is 2012.



**Figure 5:** Time period: 2002-2012  
 Note: Pink Label-Digital technologies(mobile)



**Figure 6:** Time period:2013-2022

The development of different MAE themes (Figure 5 and 6) show the strategic map of different periods. The strategic map for 2002-2012 shows that information systems and student engagement have attracted attention in the beginning. Various studies related to the engagement in education have been carried out to increase student learners engagement and growth of information systems. Both the themes have high density and centrality at the initial stage. An engagement theme evolved gradually, digital technologies were emerging theme in the period 2002-2012 and education is a basic theme, few studies related to education in the concept of engagement have been found. Such as, student engagement.

From 2013 to 2022, technology has become a well-developed theme and has received a lot of attention. Themes such as mobile devices and civic engagement have not evolved much during this period. Mobile learning-related studies have begun to emerge and social media, m-health, and engagement are fundamental themes. The theme of engagement was a niche theme during 2002-2013 and now become a basic theme of 2013-2022 as shown in Figure 5.

### Subthemes of MAE research field

To identify subthemes of the MAE research field this study conducted Word Cloud, thematic map Co-citation network analysis and co-occurrence network analysis.

### Word Cloud

Word cloud is a unique visualization technique that provides users with a broad overview of a specific research subject. It helps future researchers find emerging keywords in a specific research area on which to focus. It also introduces users to topics that help them spot potential areas for further research (14). The keyword size is determined by how frequently it appears. Larger keywords are seen to be more significant. We performed the analysis using author keywords with a word limit of 100.

The most important future research hotspots (Figure 7) in MAE are mobile apps, social media, gamification, engagement, and mobile applications. Research on gamification has been conducted in the marketing context, including studies on customer loyalty and engagement, and

on mobile applications, including studies on fitness apps, shopping apps, and e-learning. research on social media that focus on customer engagement, such as how customers engage with brands. Studies on customer engagement have been conducted in relation to mobile apps, such as travel apps. The research topic of e-commerce and mobile learning apps is still in its infancy stage, so future research can contribute to more research work in this field.

### Thematic map

An improved knowledge of the study field, its position right now, and what the future holds for its sustainability is the major objective of creating a thematic map (15). In this analysis, the vertical axis is represented by density and the horizontal axis by centrality. When determining whether or not a topic has developed and is still relevant, both density and centrality are helpful. Both centrality and density help to show whether or not a certain issue has developed. MAE research was mapped using thematic analysis, the author keyword field was selected, along with the following parameters—250 words, a minimum cluster frequency of 5, and number labels selected at 3. The themes are shown in 4 quadrants using the Louvain clustering algorithm. Driving themes are in the upper right quadrant (Q1), underlying themes are located in the lower right quadrant (Q4), extremely specialized themes are located in the upper left quadrant (Q2), and emerging or vanishing themes are located in the lower left quadrant (Q3) (15).

Social media, customer engagement, and mobile apps are well-developed themes in MAE, with customer engagement being the main theme within the mobile application engagement area of research (Figure 8) Engagement, gamification, mobile apps, mobile learning, and mobile health apps are just a few of the topics that are essential for the development of this study field.

Although key themes in Q2 were specialized, they did not significantly advance the study of MAE. The results imply that themes in Q2 like technology, education, collaborative learning, mobile applications, civic engagement, etc., are potential study topics that call for being more linked to engagement and mobile apps.



Figure 7: Top MAE themes 2002 to 2022

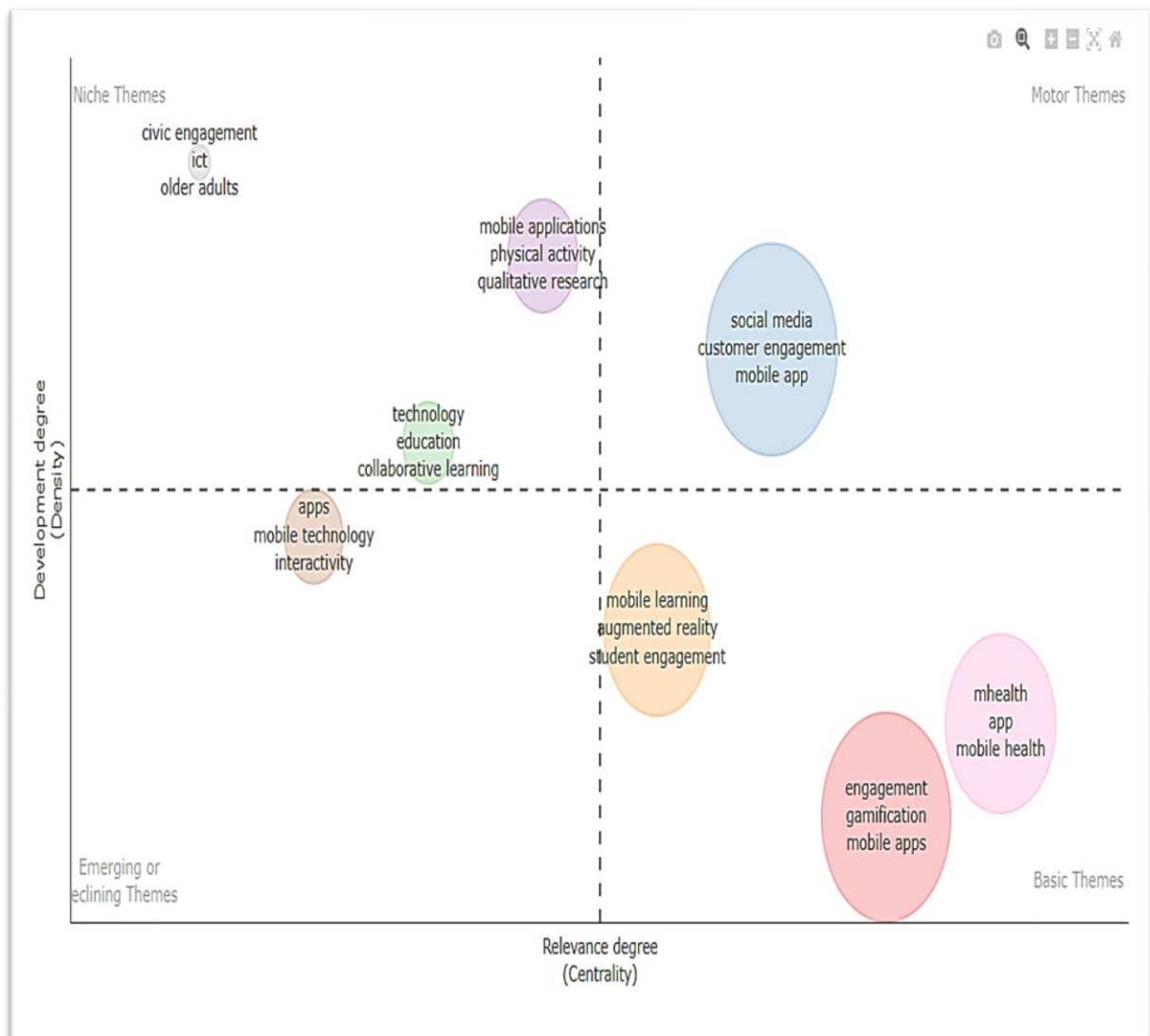


Figure 8: Thematic map

Because there hasn't been much research in this area, academics may look into quantitative views and innovation to contribute to MAE research.

The themes in Q3 are "mobile technology," "apps," and "interactivity," but it is clear that only a few of its components are fundamental and essential for advancing the field of MAE. According to this thematic map, more effort is needed to improve themes like "technology" and its related components, such as education, collaborative learning, and community involvement, to establish more connections with MAE. Technology is an existing field that can make a major structural, long-term, and sustainable improvement to MAE research, so this effort is necessary.

### Co-occurrence network analysis

To gain a deeper understanding of MAE research trends in the area, this study analyzed the keywords co-occurrence network (KCN). KCN helps in gaining a deeper understanding of the field's knowledge structure, the co-occurrence network analysis links terms in literature (16). Fewer keywords appear to have a stronger impact on the network. For instance, a detailed examination of these keywords based on their color coding indicates that larger keywords, as indicated by their breadth, are logically related to smaller ones. We used author's keywords and

nodes (50) and the Louvain algorithm to undertake co-occurrence network analysis.

Co-occurrence analysis aims to demonstrate the patterns in MAE research between 2002 and 2022 and to provide details on the trends in research topics. Six clusters were found (Figure 9). Figure 9 shows that the most common words in each cluster are "engagement," "social media," "mobile learning," "mhealth," "apps," and "technology." Cluster 1 (red) shows that engagement, gamification, mobile apps, and motivation are all strongly connected. Which means that previous studies have looked at how engagement, gamification and motivation work together. There is a strong connection between social media, Instagram, and user engagement (blue) in cluster 2. Instagram is one of the social media apps that have been studied in terms of user engagement during the time frame of this study. Cluster 3's green color shows that there is a connection between technology, mobile apps, customer engagement, and augmented reality. During this time, previous studies have been done that combined augmented reality, mobile apps, and customer interaction. Cluster 4's (purple) shows that mobile learning, student engagement, and game-based learning are positively connected. Game-based mobile learning apps have been looked at engagement context in previous research.

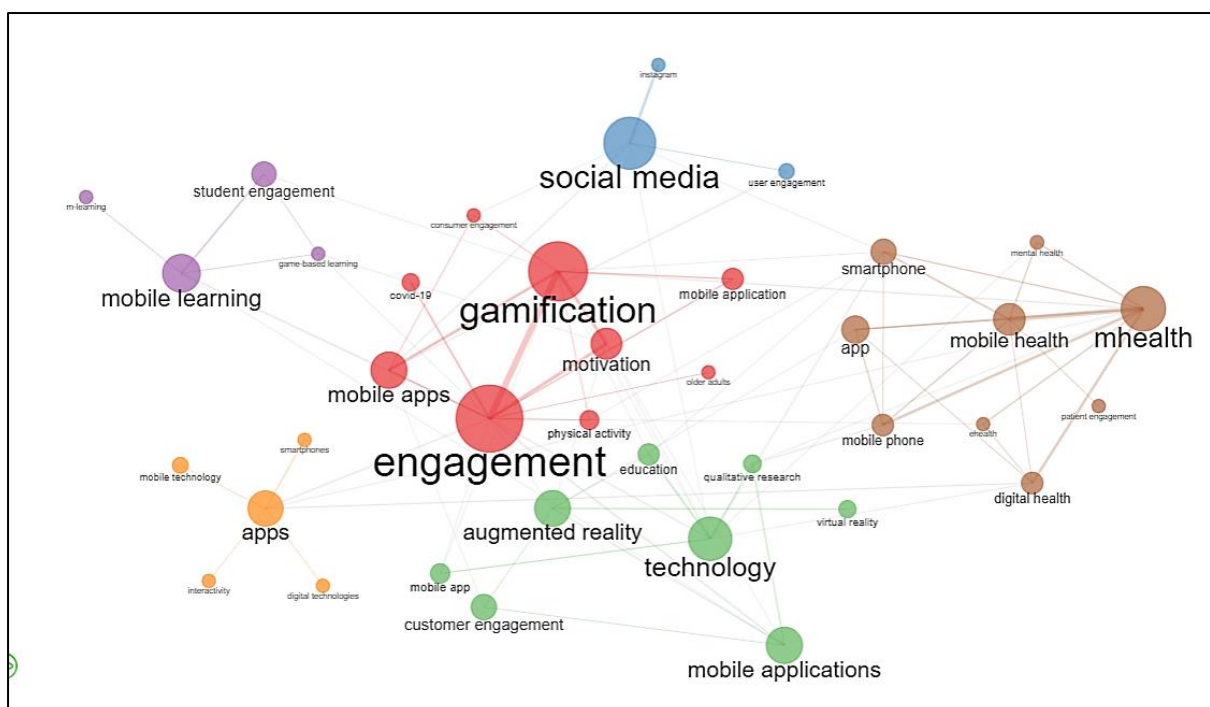
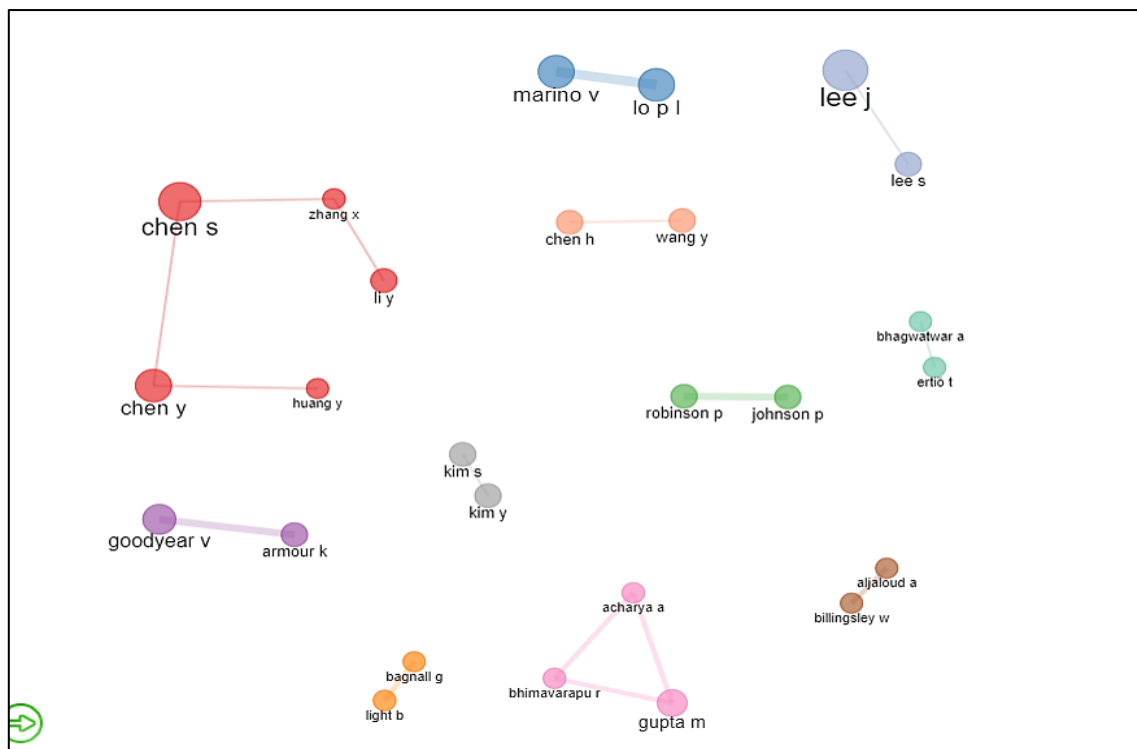


Figure 9: Co-occurrence network analysis



**Figure 10:** Authors Collaboration network analysis

These are the main themes: Cluster 5 (orange) portrays that apps, mobile technology, and interactivity are all closely linked, and studies have been done by combining these themes during this time. Cluster 6 (brown) shows that themes like mobile health, apps, ad patient engagement are closely associated. Existing studies looked at how patients interact with fitness mobile apps.

### Co-citation Network analysis

Co-citation analysis assist to discover existing themes whereas co-occurrence analysis to discover emerging ones (17). Co-citation analysis also helps to identify influential author in that field. Co-citation represent the two-author cited together third author or documents. This study used cited reference as a unit of analysis. By employing co-citation analysis we identified most influential themes in MAE and these are the following i) mHealth apps, ii) User engagement in mobile apps, iii) Customer Engagement.

#### Cluster1(Red)M-health

This cluster consists of two publications that concentrate mainly on mobile health apps that assist individuals who would like to receive digital psychological therapy, such as "Slowmo"(18). Additionally, this research addressed the main

difficulties and constraints posed by modern digital technologies, which was followed by (19) contributions regarding healthcare engagement.

#### Cluster 2(blue): user engagement in mobile apps

Twenty articles in cluster 2 explain the subthemes of MAE, which paper receive more citations, how these are related. User acceptance of information technology, which has been cited 11 times and developed the UTAUT model to test user acceptance, is the most cited research paper in this cluster and followed by Seaborn's paper on gamification from a multidisciplinary perspective". Venkatesh's research focuses on the development of a unified model (UTAUT-Unified Theory of Acceptance and Use of Technology) by compiling elements in eight models and also empirically verifying the model. The eight models are the Theory of Reasoned Action, the Technology Acceptance Model, the Motivation Model, the Theory of planned behavior, the model that combines the Technology Acceptance Model with the Theory of planned behavior, the Model of Pc utilization, the Innovation Diffusion theory and Social Cognitive theory. To adopt these theories, this study co-cited the paper of previous authors. For this, Venkatesh cited Podsak for methodology and Ajzn for the theory of planned behavior. In

addition, the author Venkatesh cited Bhatacherjee for SEM.

Yang Y then conducted research to determine the impact of gamification from an engagement perspective. To do this, Yang Y co-cited research studies by Henseler J for methodology and Seaborn K for the identification of gamification theory and conceptualization. Additionally, Yang Y cited (Huotari K) for conceptualization. Finally, Yang Y cited (Zicherman G) papers to understand the gaming mechanics. Ryan RM co-cited Deci paper for adopting theory of self-determination and intrinsic motivation and Cohen paper to adopt methodology for his research paper. Zicherman co-cited Seaborn research article for conceptualization of gamification and Ryan RM article for adopting Motivation theory (intrinsic motivation) for his research paper Gamification on by design: Implementing game mechanics in web and mobile apps. For methodological reasons in his research work A New Criterion for Assessing Discriminant Validity in Variance-Based Structural Equation Modelling, Henseler cited research papers by both authors Podsakoff and Bagozzi RP.

### **Cluster 3: Green color: customer engagement**

The third cluster, which comprises 21 articles, focuses on customer engagement, customer brand engagement, different types of consumer engagement, customer engagement behaviors, and theoretical contributions to customer engagement. Consumer brand engagement in social media (18 times) which is a scale development paper is the most cited paper in this cluster out of the 21 articles. This is followed by Effectiveness of Branded Mobile Phone Apps, which examined how mobile phone apps impact brand purchase intention and has been cited 16 times.

There is a close relationship between the studies Hollebeek, Van Doorn, and Vivek SD. In her article, Consumer Brand Engagement in social media: Conceptualization and Scale, Hollebeek co-cited research papers by Van Doorn for conceptualizing engagement basis concepts and Vivek SD for understanding the relationship theory perspective. Development, validation, and application of the concept of customer engagement were carried out by author Brodie RJ, who followed the work of co-authors Van Doorn

and Hollebeek. Hollebeek also served as the second author for this paper's section on the paper's customer engagement: conceptual domain, fundamental propositions, and research implications.

Pansari developed the theory of engagement and the framework for customer engagement after Dwivedi co-cited research papers by Van Doorn and Brodie for conceptualizing customer engagement for his research paper on A Higher-Order Model Of Consumer Brand Engagement And Its Impact On Loyalty Intentions. For this paper, Kim S co-cited a research article by Pansari for adopting the antecedents and consequences of customer engagement as well as a research article by Dwivedi for conceptualizing customer engagement. Kim S examined the antecedents and consequences of MAE. For the concept of consumer engagement in his research work on mobile travel app engagement, Fang cited Tarute and Hollebeek. In his research article on engaging customers using online branded mobile apps, Kim E co-cited research papers by Calder to examine the concepts of online customer engagement and Brodie RJ to conceptualize customer engagement. In his research paper on the role of customer engagement behavior in value creation, author Jakkola E co-cited research papers by Van Doorn, which examined the antecedents and consequences of customer engagement behavior, and Vivek, which referred to the antecedents (participation and involvement) and consequences (value, trust, and commitment) of customer engagement.

### **Collaboration network analysis**

The main goal of collaboration network analysis is to reveal which authors have collaborated on a research publication in a specific field of study. The author could be the first, second, corresponding, or third author, for example. The first author has always made a significant contribution to the field of research, and the size of the circle can be used to determine who has contributed more to this study. In Figures 10 and 11, this is graphically represented as authors and countries. In order to conduct a network analysis of the collaboration we have chosen the field as author and for country collaboration we have chosen country and Louvain algorithm was used.

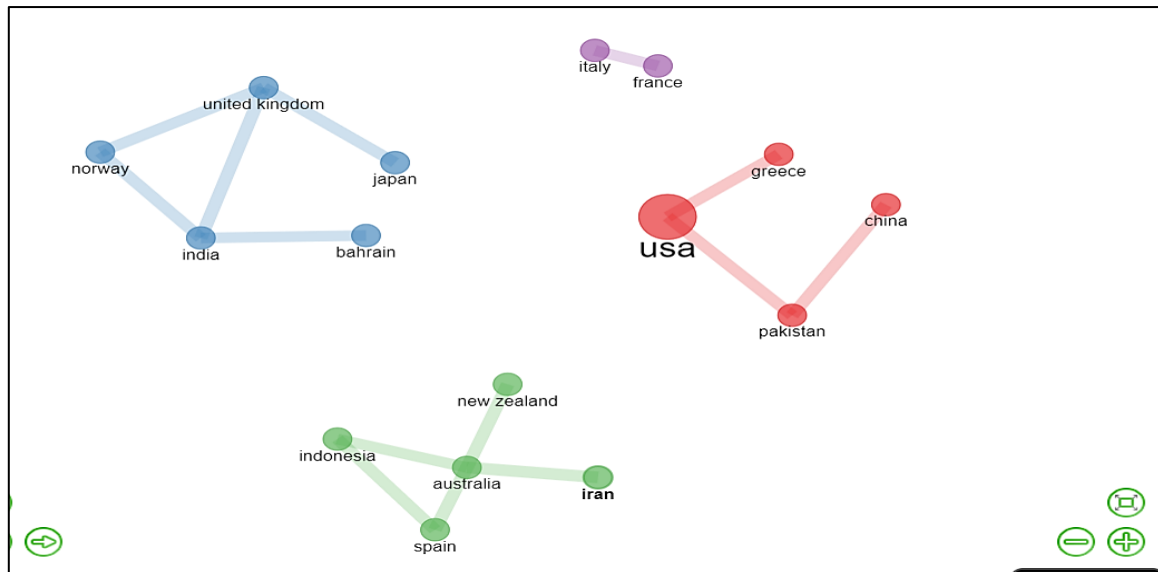


Figure 11: Countries

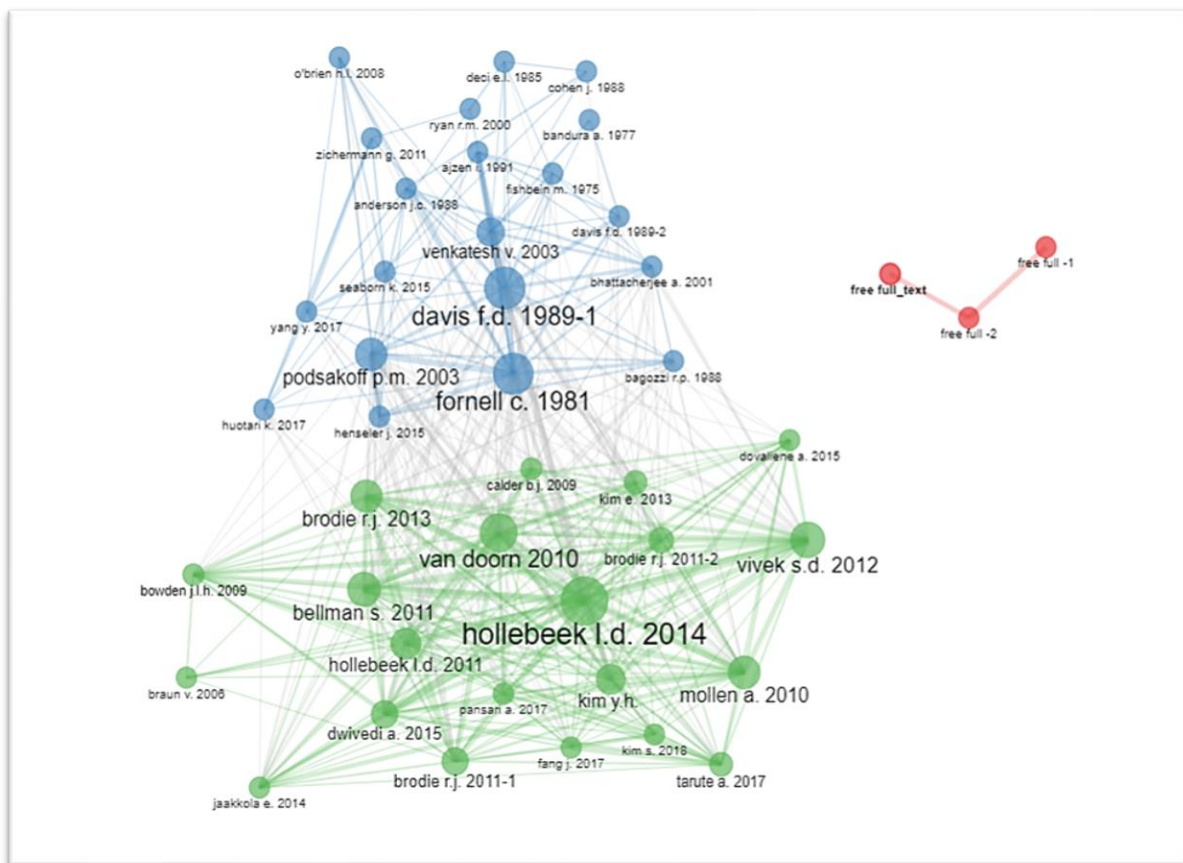


Figure12: Co-citation Network analysis

**Authors and institutional analysis**

Chen S, Marino V, and Lee J, with Zhang X serving as the third author have significantly influenced MAE research, Figure 10 and 11. Ash colored node draws attention to how equally both authors Kim S and Kim Y contributed. The pink color node

indicates that author Gupta M contributed significantly more to MAE than Bhimvarapu R and Acharya A. Compared to author Lee S (light blue), Lee J significantly contributed to MAE. The brown color node shows how both Billingsley W and Ajaloud A contributed equally to the MAE study

field, whereas the purple color node shows how author Good Year V significantly contributed to MAE compared to Armour K. Bagnall G. and Light B. both contributed equally to the field of MAE research, as indicated by the orange color node.

According to Figure 12, researchers from the USA contributed far more to the field of MAE study than researchers from Greece, Pakistan, and China, who are represented by red color nodes. Researchers from France and Italy collaborated on a study in the field of MAE, as indicated by the purple color node. Researchers from Norway are represented by a blue node. They have collaborated with researchers from the United Kingdom and Japan, but they have also worked with researchers from India and Bahrain. In Cluster Green, researchers from New Zealand collaborate on MAE research with researchers from Australia and Spain, while researchers from Indonesia collaborate with researchers from Australia and Iran.

## Discussion

This study investigated the research hotspots, the most prolific authors and sources, and the future direction of research on MAE between 2002 and 2022 through the Scopus and WOS databases using bibliometric analysis. The main objective of the study is to identify knowledge gaps, the most influential authors and sources, cited topics, keyword density (thematic map), countries, and author collaboration in research to enable understanding of the field over the defined period. By conducting a bibliometric analysis combining the Scopus and WOS databases, whereas previous studies have conducted bibliometric analyses on a given research area using only the Scopus database (20), the study contributes to the previous by providing an overview of existing research over a 21-year period and helping other researchers track growth in research. From the results of the study MAE, it appears that the research has grown greatly through the evaluation of various characteristics, with the highest publication recorded in 2022 (20). Second, the increase in publications could be due to the fact that MAE covers a wide range of topics, including health, education, entertainment, social media, and finance, and researchers are trying to find solutions and make suggestions to help

businesses and digital marketers make decisions. The results also show that Kim S, Kucirkova N, and Chen Y are the authors who have written the most on MAE. However, based on Table 5, we can say that the topics are relevant, and different authors cover different aspects of MAE. The U.S. has had the most articles, followed by the U.K., which could be due to the increasing use of mobile technology (21).

Third, regarding the most cited articles (22), (23), (24) were the three most cited articles. As an implication for MAE, (22) discovered that informative/user-centered apps are more effective for purchase intention and high levels of user engagement. (23) have extended previous work on mobile app engagement. This study examined the factors that drive mobile travel app engagement using the stimulus-organism response (S-O-R) framework and found that app design and app performance stimulate travel app engagement. These two studies highlight the extensive scope of research in this area as researchers have discovered the factors that influence mobile app engagement.

In conclusion, research on mobile app engagement is growing. It is still an evolving field that academics, digital marketers, and app developers are trying to improve as practical issues arise. Overall, the bibliometric results show that the number of studies on MAE has increased over time, while it fluctuated greatly in the first decade (2002-2012). In addition, there are several themes that are pointed in future directions by the previous analysis. This study provides an overview of the current work and suggests avenues for future study.

## Future Research Direction

The most promising future direction of MAE research is mobile learning apps, which require a lot of new theoretical and methodological contributions. Based on the thematic evolution of the last period 2013-2022, topics such as M-health, social media and engagement are basic themes that need a great deal of concentration from future researchers, they can contribute to these areas by adopting or developing new theories and can be empirically investigated to confirm the importance and validity of the research. In addition, future research can contribute to the scale development of



engagement in social media and the context of mHealth. Further studies are needed to investigate the determinants of mobile app engagement. Mobile learning is a new field of research, as shown in Figure 5. Future researchers can conduct qualitative or experimental research in developed countries.

Gamification studies are an emerging research area, but there is still a lack of theoretical understanding from researchers. Therefore, future research may address this problem through a systematic literature review of gamification in specific research domains such as marketing, finance, HR, and IT (information technology). In addition, there is a need to develop a scale for gamification from a marketing perspective. Virtual reality-based apps are a new technology, and future research can be conducted on customer or consumer experiences. E-commerce is another field of research that is developing in the field of MAE. More research can be carried out on e-commerce in various areas such as value co-creation, brand love and brand loyalty of users. MAE's emerging themes based on thematic analysis include interactivity, applications, and mobile technology, as shown in Figure 7. Future studies may use new variables to evaluate these areas empirically. Further studies can examine the role of mobile applications in mHealth apps through qualitative research. Gamification in educational applications is emerging, and considering this future can investigate this research field, there is more rigorous theoretical contributions are required in this field.

## Conclusion and Limitations

This study has some flaws as well. First, this study used only the Scopus and WoS databases for analysis. Since this research field is still new, future researchers can collect data from different databases like PubMed and Google Scholar to get a different view of MAE. The subject requirements are the second limit. This study only looked at a few topics, like business, management, accounting, economics, and the social sciences. Since mobile apps are linked to computer studies, more research can be done with other subject areas. The bibliometric paper analysis presents the conceptual and intellectual structure of MAE research papers and discovers the main themes of

MAE. The future direction has been presented using these analyses.

## Abbreviations

Nil

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Not Applicable

## Author's contribution

Study Conception and Design: Dr Sivakumar Alur ; Data Collection: Dinesh VJP; Analysis and Interpretation of Results: Dinesh VJP & Dr Sivakumar Alur; Draft Manuscript Preparation: Dinesh VJP; Both Authors Reviewed the Results And Approved the Final Version of the Manuscript.

## Conflict of interest

None

## Ethical approval

Not Applicable

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