



DIGITAL INTERACTIVE MEDIA DESIGN TO INCREASE STUDENT ENGAGEMENT IN LEARNING

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Article Info	Abstract
Article history: Received 17-02-2026 Revised 24-02-2026 Accepted 13-02-2026 Published 28-03-2026 How to cite: Repi, F. T., Setyosari, P., & Kurniawan, C. (2026). Digital Interactive Media Design to Increase Student Engagement in Learning. <i>Journal of Facilitating Learning and Improving Performance</i>, 1(1), 205–217. © The Author(s)  This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License	This study maps the knowledge structure of digital interactive media design in the context of student involvement using a bibliometric approach. The analysis was conducted by co-occurrence of VOSviewer 1.6.20 assisted keywords, based on 200 bibliographic entries published between 2016 – 2026. The mapping results showed 21 items, 4 clusters, 151 links, and a total link strength of 507. The terms engagement and medium are identified as the dominant nodes that connect the concepts of online learning, blended learning, multimedia, e-learning, effectiveness, the role of teachers, and curriculum design. Overlay visualization shows the development of themes from initial to recent publications, while density visualization emphasizes the density of central terms and peripheral themes that still have the potential to be developed. These findings confirm that the literature emphasizes the relationship between digital media and learner engagement, while also pointing to the need for more specific definitions of engagement and media design that supports cognitive, affective, and behavioral engagement. This study provides a conceptual framework for media researchers and developers to understand research trends, thematic directions, and potential for digital interactive media design development. Keywords: <i>Digital Interactive; Media Design; Student Involvement; Online Learning.</i>

INTRODUCTION

The development of digital technology is changing the way educators structure, convey, and evaluate learning messages. These changes aren't just seen in the use of software, platforms, or videos. More important changes are seen in the way students access information, respond, choose learning resources, and build relationships with teachers and peers. In this situation, the media no longer functions as an aid that is placed after the material has been created. Media has become part of a learning design system that organizes the flow of messages, forms of representation, activities, and feedback. An (2020) emphasized that the history of learning media has always moved with learning theory and instructional design theory. This view places media design as a pedagogical decision, not just a technical choice.

This article places media design as a way to increase learner engagement. This focus is important because the use of videos, online quizzes, LMSs, forums, and multimedia does not necessarily result in active learning. Martin & Bolliger (2018) show that engagement strategies in online learning must include students' relationships with instructors, other learners, and content. Therefore, digital media needs to build meaningful interactions, not just beautify the appearance of the material.

Learning engagement is an urgent issue because digital education often creates pseudo-participation. Indicators such as the number of clicks, access duration, and upload frequency do help with initial monitoring. However, these indicators are not enough to explain the quality of students' thinking. Kucuk & Richardson (2019) show that online learner engagement and satisfaction are related to social, cognitive, and teaching presence. These results show that learner engagement does not arise simply because the platform is available. Educators must manage message structure, clarity of instruction, cognitive load, social relations, and opportunity to respond.

Learner engagement includes behavioral, cognitive, emotional, and social dimensions. The behavioral dimension appears in participation, perseverance, and completion of activities. The cognitive dimension is seen in the effort to understand concepts, connect information, and use learning strategies. The emotional dimension arises through interest, belonging, and attitude towards learning experiences. The social dimension is formed when students interact with teachers and friends in the learning community. Bond & Bedenlier (2019) position technology as a factor that influences engagement, but technology does not work alone. Technology works through a learning ecology that includes individuals, task design, educators, groups, and institutions.

In blended learning, Halverson & Graham, (2019) show that engagement must be understood as a layered construction. This concept is not approached enough through attendance figures or task completion. Engagement must be read through mental activity, feelings, relationships, and learning actions. The framework is relevant for interactive media design because the media can lead learners to the activities of observing, choosing, answering, reasoning, trying, receiving feedback, and revising understanding. Therefore, good design always asks about the learning actions that learners must take after they see a digital message.

Interactive media supports engagement if technology features are aligned with learning goals. (El-Sabagh, 2021) found that an adaptive e-learning environment can increase engagement through customization of learning experiences. Muir et al. (2022)

show that an interactive pedagogical approach to online learning can encourage student participation when lecturers combine content, discussion, and facilitation. The two findings confirm that interactivity is not just buttons, animations, or navigation menus. Interactivity has pedagogical value if it encourages students to think, communicate, evaluate, and improve understanding.

Studies on digital media, multimedia, e-learning, blended learning, and student engagement are growing very quickly. The development provided an opportunity, but also posed conceptual problems. The terms medium, multimedia, digital medium, interactive multimedia, tools, online learning, e-learning, learner engagement, and engagement often appear together. However, the proximity of the terms does not necessarily mean the same focus. Some studies emphasize technology as a tool. Others put engagement as a result. Some other research links the two through activity design and interaction. This situation requires mapping that can display the structure of the relationship between terms in a more systematic manner.

Bibliometric analysis provides a way to read such patterns. This method helps researchers recognize dominant themes, relationship density, conceptual positions, and direction of development of publications. Donthu et al. (2021) explain that bibliometrics are useful for mapping the structure and dynamics of research fields through publication data. VOSviewer also provides a visual map that helps readers understand the proximity of keywords, clusters, and relationship strengths (van Eck & Waltman, 2010). Therefore, bibliometric studies are appropriate to examine how the literature on digital interactive media design and student involvement builds knowledge structures.

Several previous reviews have discussed educational technology and student engagement. Bedenlier et al. (2020) found that educational technology supports engagement, but the behavioral dimension is more often researched than the affective and cognitive dimensions. These findings show the risk of narrowing the concept of engagement. If researchers only measure actions that are easy to observe, then the involvement of thoughts, feelings, and social relations can be ignored. This article places the bibliometric results as a basis for reading the direction of the study as well as criticizing instrumental tendencies in the use of digital media.

This study aims to map the knowledge structure of digital interactive media design to increase student involvement based on 200 bibliographic metadata in RIS files. This study did not test the effectiveness of the media through experiments. This study reads the conceptual patterns formed from keyword relationships. The research questions asked are what are the characteristics of the analyzed bibliographic corpus, how is the structure of keyword clusters on the VOSviewer map, how are the temporal tendencies of the research theme, and what are the implications of bibliometric findings for the development of engagement-oriented digital interactive media design.

METHODS

This study uses a bibliometric approach with keyword co-occurrence analysis techniques. This approach was chosen because the article aims to read the structure of the theme in the corpus of publications, rather than examining group differences or causal relationships between variables. Co-occurrence analysis allows researchers to see terms that often appear together, the distance between terms, and concept clusters.

The map helps readers find out the position of engagement, medium, multimedia, online learning, and related terms in the literature analyzed.

Method reporting follows the principle of transparency in line with PRISMA 2020. Page et al. (2021) emphasize that literature-based studies need to clearly report data sources, selection processes, and synthesis methods. This article is not a systematic review that assesses the quality of each study individually. This article is a bibliometric study that interprets metadata and keyword maps. However, the principle of traceability is still used so that readers can understand the data corpus, inclusion criteria, analysis stages, and interpretation limitations.

The research data is sourced from the RIS file entitled Digital Interactive Media Design to Increase Student Engagement in Learning.ris. Metadata checks show that the file contains 200 bibliographic entries in the period 2016 to 2026. All entries have URLs. A total of 198 entries had abstracts, 191 entries had source names, and 84 entries had DOIs. Title checks find no duplication. This pattern suggests that the corpus can be used to map the theme, even if the completeness of the DOI is not evenly distributed.

The inclusion criteria include documents containing digital media themes, interactive multimedia, instructional design, online learning, blended learning, e-learning, learning management systems, learning videos, and student involvement. Exclusion criteria include documents that are not relevant to education, documents that do not have core metadata, and general terms that do not aid interpretation. Since the analyzed VOSviewer map is derived from processed metadata, this study focuses on the interpretation of the final output, rather than on the reconstruction of the entire search strategy from the database.

Table 1. Characteristics of Bibliographic Data in RIS Files

Aspects	Examination Results	Methodological Meaning
Number of entries	200	Becoming the initial corpus of bibliometric analysis
Year range	2016 to 2026	Shows the coverage of the latest and historical publications
Entries with URL	200	All data has a source link
Entries with abstracts	198	The majority of data supports context reading
Entries with source names	191	Most documents have a source identity
Entries with DOI	84	The completeness of the DOI needs to be noted as a data limitation

The analysis was carried out through four stages. The first stage is to check the RIS file for the number of entries, year of publication, completeness of the abstract, availability of DOIs, URLs, source names, and potential duplication. The second stage is to map keywords with VOSviewer 1.6.20 using occurrence weights. The third stage is to read three visual outputs, namely network visualization, overlay visualization, and density visualization. The fourth stage is to interpret the mapping results by linking them to the literature on multimedia learning, online learning, self-regulated learning, and student engagement.

Network visualization is used to read the structure of a cluster. The size of the node indicates the weight of the occurrence of the term. The distance between nodes

indicates the proximity of the relationship. The line shows the links between keywords. Colors indicate the theme group. Overlay visualization is used to read temporal progression. Darker colors indicate an average of earlier appearances, while lighter colors indicate newer themes. Density visualization is used to read the density of terms. The yellow area indicates the region with the highest intensity of occurrence and relationship.

Interpretation is done critically. Large nodes are indirectly considered the most pedagogically important concepts. Large nodes only show dominance in the corpus. Therefore, the visual results need to be read together with the theory. This approach prevents overly simplistic conclusions, such as the assumption that the themes that come up frequently must be more conceptually mature. Interpretation also pays attention to peripheral terms because they can indicate research opportunities that have not been widely developed.

RESULTS

Characteristics of Bibliographic Data

The research corpus contains 200 bibliographic entries. The publication is spread from 2016 to 2026. The highest number of publications appeared in 2020 with 34 entries. In 2019 it occupies the second position with 31 entries, while in 2023 it has 27 entries. This pattern shows that the study of digital media, online learning, and student engagement had developed before the pandemic, then strengthened when education underwent a major change towards an online and mixed format.

The number of publications in 2021 and 2022 remained high. This trend suggests that the research focus is starting to shift from emergency response to evaluation of the quality of digital learning experiences. The researchers not only asked whether online learning could work, but also how learners were engaged, how media influenced motivation, and how activity design facilitated interaction. This shift can be seen through the emergence of the terms learner engagement, effectiveness, teacher, digital medium, and curriculum design on the map.

Table 2. Distribution of Publications by Year in the RIS File

Year	Quantity	Year	Quantity	Year	Quantity
2016	14	2017	12	2018	22
2019	31	2020	34	2021	20
2022	18	2023	27	2024	14
2025	7	2026	1		

General Structure of Keyword Networks

The VOSviewer mapping yielded 21 items, 4 clusters, 151 links, and a total link strength of 507. The high number of links indicates that the terms in the map have dense relationships. This structure shows that the study of digital interactive media design does not stand on a single path. The theme connects the concepts of media, multimedia, digital medium, interactive multimedia, online learning, e-learning, blended learning, teacher, curriculum design, effectiveness, impact, and engagement.

The two largest nodes are engagement and medium. The engagement position is at the center of the network. This term is connected to online learning, blended learning,

learner engagement, higher education, teaching, covid, and medium. This position shows that student involvement is a core issue in the literature. The term medium also has a large node and strategic position because it connects multimedia, interactive multimedia, tools, e-learning, effectiveness, impact, research, and roles. These two nodes form an axis that explains the relationship between learning messages and learners' learning experiences.

Table 3. Summary of VOSviewer Mapping Results

Indicator	Results	Interpretation
Items	21	Number of keywords appearing on the map
Clusters	4	Four main theme groups are formed in the network
Links	151	The relationship between keywords is very dense
Total link strength	507	Cumulative relationship strength indicates high connectivity
Dominant nodes	Engagement and Medium	Two terms are central to the knowledge structure

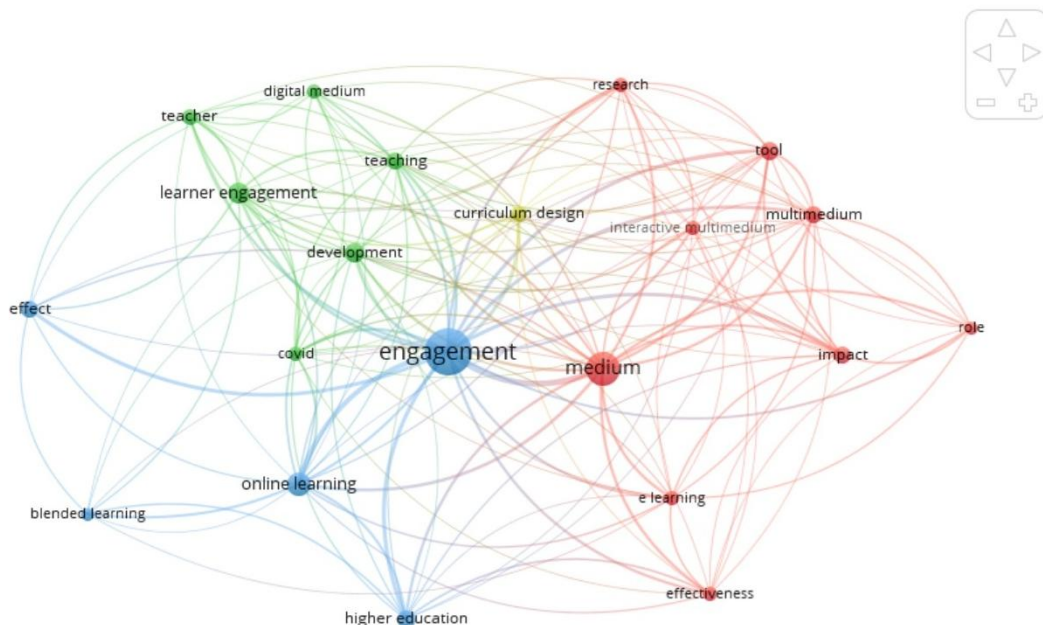


Figure 1. Visualization of the network, keywords, digital interactive media design, and learner engagement

Research Theme Cluster

The network map forms four clusters. The first cluster is centered on the medium and contains multimedia, interactive multimedia, e-learning, effectiveness, impact, role, tools, and research. This cluster shows studies that place media as a design tool, a means of interaction, and factors related to learning effectiveness. Alobaid (2020) shows that intelligent multimedia can affect the language learning experience. Afify (2020) also shows that the length of interactive videos is related to cognitive load, cognitive achievement, and retention. Both studies show that media design influences the

learning process through the structure of messages and the way learners interact with content.

The second cluster connects learner engagement, teacher, teaching, development, digital medium, and covid. This cluster shows that student involvement in digital learning still depends on the role of teachers. The teacher sets goals, chooses the form of the message, organizes activities, gives feedback, and maintains communication. Hollister et al. (2022) show that students' attitudes and behaviors during online learning during COVID-19 are related to learning experiences and activity design. The term covid in the map not only designates a crisis situation, but also marks a change in the way educators understand media, interactions, and learning supports.

The third cluster is centered on engagement and includes online learning, blended learning, higher education, and effects. This cluster shows that engagement is widely studied in the context of higher education and online learning. Morton et al. (2016) show that blended learning needs to be optimized so that students are more involved in the learning process. Zen et al. (2022) also found a relationship between project-based online learning, student engagement, and academic achievement. The position of this cluster reinforces the view that engagement should be designed from the beginning, not just measured at the end of learning.

The fourth cluster has a liaison position through the term curriculum design. This term is among media groups and engagement groups. This position shows that curriculum design can be a bridge between learning objectives, materials, activities, media, and assessment. Gameil & Al-Abdullatif (2023) show that digital learning platforms can improve instructional design competencies and teacher engagement. These findings are relevant because interactive media needs to move within the framework of the curriculum, not in the logic of applications that are separate from learning outcomes.

Table 4. VOSviewer keyword cluster interpretation

Cluster	Dominant Keywords	Theme Focus	Implications for Media Design
Cluster 1	medium, multimedia, interactive multimedia, e-learning, effectiveness, impact	Media and learning effectiveness	The media needs to be a messaging system that supports learning outcomes
Cluster 2	learner engagement, teacher, teaching, digital medium, covid	Digital pedagogy and the role of teachers	The teacher determines the quality of interaction, direction, and feedback
Cluster 3	engagement, online learning, blended learning, higher education, effect	Engagement in online and blended learning	Engagement needs to be designed as a process, not just an end indicator
Cluster 4	Curriculum Design	Bridge between objectives, media, activities, and assessments	Media must be in line with learning outcomes and order of material

Temporal Development and Theme Density

Overlay visualization shows that the terms online learning, blended learning, higher education, and effect are identified earlier than other terms in the VOSviewer map. These findings indicate that the initial study in the dataset focused more on online

learning, blended learning, and its impact in the context of learning. This pattern can be understood because digital media was initially widely used to support the implementation of online learning and blended learning. Halverson & Graham (2019) explain that student involvement in blended learning needs to be read through the relationship between learning activities, technology, interaction, and learning context. Martin & Bolliger (2018) also affirm that engagement strategies have an important role in online learning. Thus, the terms online learning and blended learning are strong initial themes in the bibliometric map because they represent the main space for the use of digital media in learning.

The terms digital medium, teacher, impact, and curriculum design were identified in a more recent period. This pattern shows a shift in the focus of the research. In the initial phase, the research mainly discusses the use of digital platforms and the impact of online learning. In the next phase, the researcher's attention began to move towards the problem of design, namely how digital media is designed, how teachers manage media-based learning, how media has a pedagogical impact, and how media is integrated into curriculum design. In other words, the study no longer only highlights the feasibility of using digital learning, but begins to examine the quality of digital media design in supporting student involvement in a more meaningful way. Spatioti et al. (2022) support this direction by showing that the ADDIE model remains relevant in distance education because it helps designers carry out the analysis, design, development, implementation, and evaluation stages systematically.

Density visualization shows that the terms engagement and medium are central to the density of the theme. The yellow color in the two terms indicates a high intensity of emergence and relationship with other terms. The terms learner engagement, online learning, multimedia, e-learning, effectiveness, digital medium, and teaching are in the green area. This area shows that these terms have a fairly strong level of connectivity, although not yet as dense as engagement and medium. Meanwhile, the terms role, effect, blended learning, and several other special terms are in a more subtle area. This condition shows that the term has become part of the study, but the intensity and relationship are not as strong as the main theme. Overall, the results of density visualization confirm that the relationship between digital media and student involvement is the center of attention in the research. However, themes such as curriculum design, role, and impact still have opportunities for further development because they can clarify how digital media is designed, implemented, and evaluated in the learning process.

DISCUSSION

Engagement and Medium as the Focus of the Study

The main findings of this study show that engagement and medium are two core concepts in the study structure. This result has a strong conceptual meaning. Engagement refers to the learning process and outcomes. Medium designates a means of organizing messages and interactions. When these two terms are at the center of the map, the literature confirms that technology needs to be judged by its ability to build active learning experiences. Bond & Bedenlier (2019) emphasized that technology affects engagement through students' relationships with content, teachers, friends, and

the learning environment. Therefore, media that only conveys information is not enough to be called pedagogically interactive.

The dominance of engagement also needs to be analyzed more critically. Although the term is often used in various studies, its definition is not always consistent. Bedenlier et al. (2020) The analysis shows that research in the field of educational technology often emphasizes behavioral engagement rather than affective or cognitive engagement. These findings are important because they highlight that most of the literature assesses learner engagement in terms of behavior, while emotional and cognitive aspects are still underpaid. The VOSviewer map places engagement as the central node in the keyword network. However, the map does not provide clarity on whether engagement is measured through clicks, attendance, motivation, self-regulation, participation in discussions, or conceptual understanding. This gap becomes an important note for bibliometric interpretation. Therefore, further research is recommended to use a more specific definition of engagement so that the evaluation of digital media is not limited to external activities, but also includes the cognitive and affective involvement of learners.

The medium as the dominant node shows that literature places digital media as the center of students' learning experiences. However, the media is not passive. Each type of media brings an organization of the material, a navigational flow that governs participant interaction, and the focus of learners' attention, as well as a feedback mechanism that shapes understanding and engagement. Schneider et al. (2022) explain that digital learning involves cognitive, affective, and social processes. This view requires designers to see media as a learning environment that regulates the way students think, feel, and interact. Thus, the choice of buttons, colors, images, sounds, questions, and screen sequences must have pedagogical reasons.

Criticism of Superficial Interactivity

The results of the media cluster and effectiveness show that multimedia and interactive multimedia are close to medium, e-learning, effectiveness, and impact. This proximity presents opportunities as well as risks. Multimedia can explain abstract concepts through text, images, animations, videos, and simulations. However, overly dense features can distract, make navigation more difficult, and add to the cognitive load. Skulmowski & Xu (2022) affirm that additional elements in digital learning must be relevant to the information processing process.

Interactive videos provide a clear example. Afify (2020) showed that video length is related to cognitive load and retention. Lackmann et al. (2021) show that video formats can affect engagement and performance in online learning. The two findings show that video quality doesn't stop at eye-catching visuals. Designers must define duration, segmentation, breakpoints, trigger questions, feedback forms, and the relationship of the video to the study assignment.

App-based interactive media also requires a clear instructional foundation. Daryanes et al. (2023) developed a case method-based Articulate Storyline media to train problem-solving skills. Astuti et al. (2020) develop web-based learning with interactive media for science materials. The two studies show that media is more powerful when content, cases, activities, and assessments move in a single flow. In other

words, digital media must be a learning workspace, not just a material display room. This criticism is important because many media designs fail not because the technology is weak, but because the learning activities are unclear.

The Role of Teachers in the Digital Media Ecosystem

The cluster of teachers, teaching, learner engagement, and digital mediums shows that teachers remain important actors in the digital ecosystem. These findings reject the notion that interactive media can replace teachers' pedagogical functions. The teacher designs the sequence of messages, selects representations, provides context, monitors learners' difficulties, and adjusts strategies. Bradley (2020) emphasizes that the use of LMS requires instructional management, not just platform mastery. The presence of teachers in the digital space helps shape autonomy, motivation, and a sense of direction in students.

The context of the pandemic clarifies this role. Abou-Khalil et al. (2021) identify effective engagement strategies in emergency learning in the context of limited resources. Hollister et al. (2022) show that students' attitudes and behaviors during online learning are influenced by the experiences they receive. These two studies show that platforms cannot guarantee engagement if learners do not have structure, communication, and support. Teachers need to be present as interaction designers who ensure the media works for learning purposes.

However, teachers don't have to be complex software developers. Teachers need to have message design literacy and the ability to choose features according to their goals. Cavanagh & Kiersch (2023) show that commonly available technologies can be used to create online multimedia lessons when the principles of Cognitive Theory of Multimedia Learning are applied. The practical implications are clear. Improving media quality does not always require expensive applications. Design quality relies more on decisions such as breaking down materials, eliminating irrelevant information, juxtaposing visuals and text appropriately, and placing feedback when needed.

Curriculum as a Media Direction Controller

The position of curriculum design as a liaison shows that digital media must be subject to curriculum logic. Media should not be developed just because a particular application is popular. The media needs to answer learning outcomes, student characteristics, sequence of concepts, learning models, and assessments. Spatioti et al. (2022) emphasized that ADDIE helps the design of distance education through systematic stages. The model can prevent designers from jumping directly into media production before analyzing learning needs.

The curriculum also helps prevent cosmetic design. Gameil & Al-Abdullatif (2023) show that digital learning platforms can strengthen the instructional design competencies of prospective teachers. These findings suggest that technology should train how to design, not just move material from the classroom to the screen. If the curriculum demands problem-solving, the media should provide cases, data, and feedback. If the curriculum demands collaboration, the media should provide a space for discussion and a mechanism for joint work. If the curriculum demands reflection, the media should provide prompts that help students assess the learning process.

Theoretical and practical implications

Theoretically, the results of this study strengthen the relationship between multimedia learning, self-regulated learning, and student engagement. Multimedia learning helps explain how learners process text, visuals, audio, and animation. Self-regulated learning describes how learners plan, monitor, and evaluate their learning. Student engagement describes the energy, attention, emotions, and participation of students in the learning process. These three perspectives need to be integrated so that media design is not trapped in technology alone.

Practically, educators and media developers can use these results as the basis for drafting design principles. The design should depart from a specific engagement issue. Features need to be selected based on the expected learning action. Messages should be concise, structured, and easy to navigate. Interactions should generate cognitive responses, not just clicks. Feedback needs to be quick, clear, and in line with purpose. This principle helps educators avoid visually crowded media but poor learning activities.

CONCLUSION

This bibliometric research shows that the design of digital interactive media to increase student engagement forms a dense knowledge structure. Analysis of 200 RIS entries yielded a VOSviewer map with 21 items, 4 clusters, 151 links, and a total link strength of 507. The two most dominant concepts are engagement and medium. Engagement connects online learning, blended learning, learner engagement, higher education, and effect. Medium connects multimedia, interactive multimedia, e-learning, effectiveness, impact, role, and tools. These results confirm that digital media needs to be designed as a pedagogical system that regulates messages, interactions, feedback, motivation, and learning regulation.

The limitations of the study lie in the use of a single RIS file and keymap-based interpretation. Subsequent research needs to expand the database, clarify search strategies, and add co-citation and bibliographic coupling analysis. Follow-up studies also need to test media design on behavioral, cognitive, emotional, and social engagement. For practitioners, media development must start from the problem of learning engagement, not from the appeal of the application alone.

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