Microlearning as an Educational Technology: Information Requests and Bibliometric Analysis

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1 Introduction

Digital technologies are not only changing our lives but also our traditions, particularly those related to communication and learning. According to Digital 2021: Global Overview Report, a user of modern gadgets spends more than 4 h a day on a smartphone, and a user of social networks spends 2 h and 25 min every day on these platforms (Digital 2021: Global Overview Report). Most young people use TikTok, which contains entertaining content. It is easier for company employees to spend 10–20 min a day on training than to spend a few days on training. Students use more videos and infographics to learn the basics of a given subject. Most Internet users do not read large texts but watch up to 10 min of video (Digital 2021: Global Overview Report). All these features are related to micro-learning technologies, which has become one of the most popular pedagogical trends, especially during the introduction of e-learning (Alqurashi, 2017).

Microlearning, as a set of educational technologies defines three main characteristics (Buchem & Hamelmann, 2010): short duration of units of educational content; focus on a specific learning outcome, content granulation; multiformat and multiplatform. The peculiarities of the implementation of microlearning include

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(Pandurov, 2021): the division of educational materials into micro-modules of 5–10 min, which uses modern digital tools and technologies in the process of mastery, the student goes through phases of reflection, processing and evaluation of data and information. The latter makes it possible to gain knowledge faster and respond to changing educational requirements (flexibility); to study at a convenient time and convenient place (mobility); maintain motivation and involvement in learning (simplicity, short time, confidence); improving learning ability and performance (Wang et al., 2021). As MarketsandMarket forecasts that the global microlearning market will grow by $2.7 billion by 2024 (Churbanova, 2021), this technology can be confidently attributed to current educational trends.

Although micro-learning was mainly used in the corporate sector via nonacademic providers and non-formal education, in particular on MEP platforms, the COVID-19 outbreak highlighted the need to provide quality university education in uncertain times, especially considering the form of educational organization (Gill et al., 2020). The flexibility of microcredentials—which can be offered online, in person, or hybrid models combining in-person and online instruction—may also be a contributing factor to the growing microlearning trend in HEI (EDUCAUSE Horizon Report is a registered trademark of EDUCAUSE, 2021), as evidenced by some successful practices (Bannister et al., 2020) within various industries (technical, educational, engineering, etc.).

A good example of the practical implementation of microlearning as an educational technology is the FITPED project (www.fitped.eu). "The project was focus[ed] on activities which support innovative methods and pedagogical approaches, as well as develop digital educational resources and tools. Applied approaches can be considered innovative because they have not been researched yet in detail" (Drlik et al., 2019). The project researchers stressed that „an implemented educational model was utilized [as one of] the positive features of microlearning, [along with] automated programming code assessment, interactivity and immediate feedback. Consequently, the innovative strategy based on the application of the WBL approach to the advanced educational topics was applied" (p. 13).

It should be noted that any scientific knowledge has not only substantive but also methodological content, as it is associated with a critical review of the existing conceptual framework, prerequisites and approaches to the interpretation of the material being studied. For this purpose, in particular, the methods of bibliometric analysis are used (Wormell, 2000).

The purpose of this study—the study is based on the analysis of information needs and scientific publications to determine the state of development of the problem of microlearning as an educational technology and promising areas of further research.

We asked the following research questions:

– What is the trend in the information needs of scientists and educators regarding the concept of microlearning and its use?
– Is the publishing activity of scientists from different countries and organizations on microlearning technologies different?

Task:

1. Carry out a bibliometric analysis to identify trends and patterns of publishing activity on the use of microlearning by scientists from different countries. The obtained quantitative data can be used by researchers to determine the state of development of a particular subject area in general and the following different Research Areas, countries of publication and qualitative analysis of research to determine their effectiveness.
2. To determine the thematic focus of research in a particular subject area of microlearning. The obtained results can be used by both individual researchers and project managers to plan areas for further research.

2 Research Design

In the study, we relied on the methodological foundations of the literature review process as a research method (Creswell, 2014); research on a systematic literature review of personalized learning terms (Shemshack and Spector, 2020), review of the trend of microlearning (Leong et al., 2021); Bibliometric Analysis of COVID-19 across Science and Social Science Research Landscape (Aristovnik et al., 2020), as well as experience using VOSviewer for science mapping (Smyrnova-Trybulska et al., 2018, 2019).

To implement the first task of the study to identify existing trends and patterns in the publishing activity of scientists from different countries, we used the method of bibliographic analysis, which was used both in the context of educational sciences (consider microlearning as an educational technology) and more broadly—in the context of interdisciplinary research, for the following keywords: “microlearning“, “micro-learning” and “micro learning”.

To determine the dynamics of the studied objects, scientific publications in scientometric databases Scopus (https://www.scopus.com) and Web of Science Core Collection (www.webofknowledge.com) were analyzed. In order to select the most up-to-date and relevant research, it was decided to introduce additional restrictions, namely: articles in periodicals and scientific conference proceedings published over the past 10 years, i.e. from 2010 to 2021. For a more thorough analysis, we searched the fields “TITLE-ABS-KEY” (Scopus) and “Topic” (Web of Science), as well as in the field TITLE, which produced eight data sets. Below are their characteristics.

By searching for prominent keywords in the titles of publications in the Web of Science Core Collection and Scopus, we form two sets: W1 and S1, respectively. Because the Scopus and Web of Science Core Collection web services provide powerful search functionality, two other datasets were created by filtering data from W1 and S1 sets by subject area/category to provide data for microscience analysis in education: W2 as a narrowing of the subject area to the category of Education Educational Research Area, and S2—selection of publications from the Social Sciences Area. The following query was used to select metadata from the Scopus database to form the S2 dataset (given as an example): TITLE (microlearning) OR TITLE (micro-learning) OR TITLE (micro AND learning)) AND (LIMIT-TO, PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015) OR LIMIT-TO (PUBYEAR, 2014) OR LIMIT-TO (PUBYEAR, 2013) OR LIMIT-TO (PUBYEAR, 2012) OR LIMIT-TO (PUBYEAR, 2011) OR LIMIT-TO (PUBYEAR, 2010))) AND (LIMIT-TO (PUBSTAGE, "final")) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "cp")) AND (LIMIT-TO) (SUBJAREA, "SOCI")).

The next four groups were formed from sets of publications selected for similar queries, but the search was not by name, but by:

– "Topic" in the Web of Science Core Collection (search query: https://www.webofscience.com/wos/alldb/summary/4659821d-f7aa-4edc-a2c3-bba0806c75f9-010d57a0/relevance/1), resulting in a data set—W3 and its subset W4 containing publications from the Educational Research Area;
– "TITLE-ABS-KEY" in Scopus created a data set S3 and its subset of the Social Sciences Area—S4.

Based on the collected data sets under certain approaches to the quantification of information flows as a method of bibliometric analysis, we determined the dynamics of the studied objects by the time of publication, countries and affiliation of their authors, types of publications, Research Area, open access initiative, etc. This allowed for a comprehensive study of a particular subject area from the standpoint of the effectiveness of the research (evaluated quantitative indicators of publication activity of researchers) and contributed to the transparency and reproducibility of our research. And the reproducibility of the research and the reuse of the obtained results are among the key features of the systematic review of the literature in scientific and business research (Fisch and Block, 2018).

We used science mapping to determine the relationships between objects, their classification, and to study the structure and dynamics of a particular subject area (Smyrnova-Trybulska et al., 2017). The analysis was performed separately for each of the eight datasets using VOSviewer (https://www.vosviewer.com/), the functionality of which allows for clustering and network analysis of bibliometric data.

To prepare data for analysis by VOSviewer, metadata—the results of the selection of data sets of groups W and S were exported from the relevant scientometric databases to files with the extension .txt (Web of Science) and .csv (Scopus).

The co-occurrence method was chosen as the main method of data analysis using VOSviewer as a method of clustering keywords by frequency of use in one work. Thus, thematic clusters are formed from sets of keywords. On "science maps", clusters are marked in different colours, the size of each keyword is determined by the indicator "total link strength", i.e. the strength of the link of this keyword with all others, and the lines reflect the links between two separate keywords (Van Eck et al., 2010; Van Eck & Waltman, 2010). To build scientometric maps (built separately for each of the eight selected data sets W1-W4, S1-S4), we took only those keywords that occur in the sample at least five times (standard "suggestion" VOSviewer) for all sets and additionally for sets W3, W4, S3, S4–15 times, deliberately excluding query terms, because they are present in almost all documents and distort clustering. A comparison of thesauri and analysis of the created maps forms the basis for determining the directions of research (relevant and promising), both in the field of educational sciences and in the context of interdisciplinary research.

3 The Results of the Study

3.1 Findings Related to the Analysis of Publication Trends of Microlearning

Analysis of data from sets W1-W4, S1-S4 shows the prevalence of this area in recent years (Table 1): there is a tendency to increase the number of scientific publications indexed in two leading scientometric databases.

Although there is a slight decline in publication activity in 2020 according to the analysis of sets W3 and W4 as well as its subsets, this does not affect the general trend. Moreover, the growing number of citations (Fig. 1) indicates a stable scientific interest in the topic of microlearning.

Moreover, if in the publication (Leong et al., 2021) the authors identified that conference proceedings were the main source of publications for "micro-learning" and on this basis suggested that "micro-learning" is a relatively new topic, the analysis of publications in this study, is a reason to assume that this topic has already been researched more fully, as the number of publications in scientific journals and conference proceedings is about the same: 54% are articles in the set W1, 43%–W2, 67%–W3, 58%–W4, 52%–S1, 48%–S2, 56%–S3, 49%–S4. It should be noted a slight decrease in the percentage of scientific publications in the category of educational sciences, which is observed in the analysis of data selected from both scientometric databases. The latter may indicate a lack of development of this topic as educational technology, as the journal article is usually a more comprehensive and in-depth study than the conference proceedings, or fewer journals indexed in

Table 1 The number of related publications over time

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
W1 (582)	12	11	12	23	23	39	67	71	77	89	96	62
S1 (633)	22	16	13	23	25	28	51	55	80	117	129	74
W2(138)	2	2	3	11	1	10	21	20	21	14	21	12
S2 (148)	7	1	3	7	6	10	20	14	14	20	28	18
W3 (9161)	287	349	341	481	538	735	889	980	1172	1404	1321	664
S3 (8643)	301	336	331	426	480	465	643	760	1032	1428	1630	815
W4 (1843)	50	85	69	107	110	181	226	232	236	254	201	92
S4 (1937)	80	90	100	130	124	127	201	173	219	260	309	124

Source: Own research

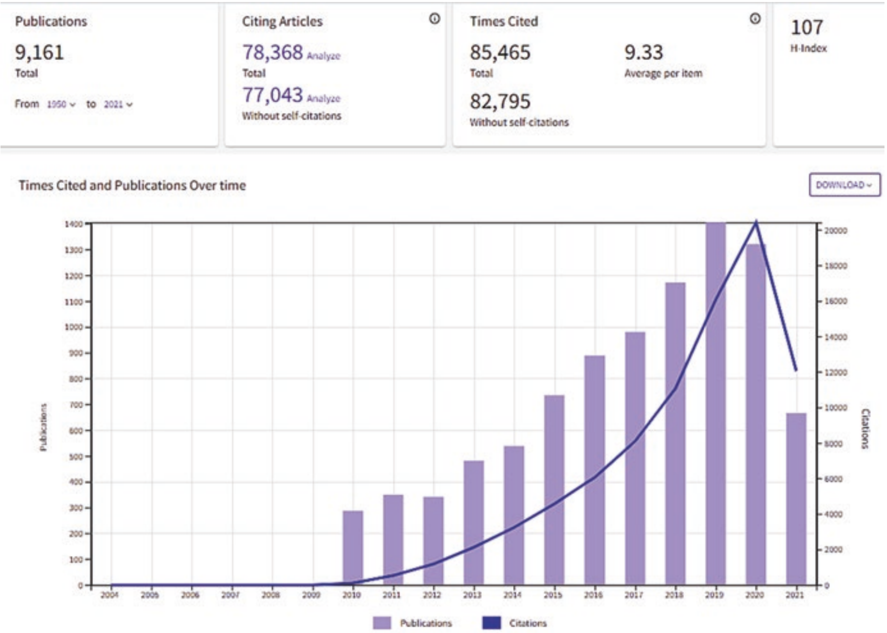

Fig. 1 Report on citation of publications from the data set W3. Source: Own research

Table 2 Distribution of authors Research Areas

	Computer science	Engineering	Education educational research	Social sciences	Mathematics
W1 (582)	66 (11.3%),	185 (21.5%)	138 (23.7%)		
S1 (633)	352 (39.8%)	238 (37.6%)		148 (23.4%)	
W3 (9161)	4494 (49%)	3406 (37.1%)	1843(20.1%)		1754 (19.1%)
S3 (8643)	4220 (48.8%)	2935 (34.0%)		1937 (24.4%)	1195 (13.8%)

Source: Own research

Education Educational Research (Web of Science Core Collection) and Social Sciences (Scopus), compared to other Research Areas. Concerning Research Areas, in addition to the category of educational sciences, we identified the most relevant Areas—those that cover more than 20% of the total number of publications (Table 2). As we can see, the main subject areas are Computer Science, Engineering, and Education Educational Research (Social Sciences), which indicates a comprehensive study of the application and support of microlearning. Moreover, the category of educational sciences is the least represented, which can be considered as a promising area of research. It should also be noted that considering microlearning as an interdisciplinary phenomenon and searching by topic (sets W3, S3), the number of publications in the field of mathematics is approaching 20% of the threshold. This may indicate the high manufacturability of a particular subject area and the actualization of the strengthening of the mathematical apparatus to ensure it.

An analysis of research on the countries of their publication (Table 3) has allowed for the revealing of a number of the countries to which it is necessary to pay primary attention to the qualitative research of experience of the realization of microlearning. Summarizing the contributions of authors (Table 3) who had ten or more publications over a period, the leaders are China and the United States—on average, scientists from each of these countries are the authors of about 20% of all publications in each of our outstanding sets. Other countries account for less than 10% each. Each set contains publications whose authors are from England, and researchers from India and Germany are also actively researching the topic of microlearning. However, with the narrowing of the field of research to educational (social) sciences, there are studies of scientists from the Czech Republic, Spain and Australia (data sets W2, W4). The analysis of the S4 data set is the basis for a more thorough study of the scientific achievements of researchers from Germany as authors of 464 publications (22.4%)—this level of participation is the highest among all countries. On the other hand, it is worth conducting repeated research, as the landscape of scientific publications is very dynamic and it is likely that some of the data we obtained for this study are not systemic.

Understanding the importance of supporting the open access initiative for the development of science, we analyzed the selected data sets by the level of access to publications (Table 4).

In general, there is a tendency for researchers to support the open access initiative. For example, 55% of the publications in the W1 dataset and 62% of the S1 are publicly available, with 42% fully supporting open access (135 of the 320 open access publications in the W1 dataset) and 44% in the S1 dataset, where the open access initiative is supported by the authors of 395 publications, and full openness

Table 3 Distribution of authors by countries

	China	USA	England	Germany	India
W1 (582)	167 (28.694%)	111 (19.072%)	33 (5.670%)	33 (5.670%)	31 (5.326%)
S1 (633)	166 (26.2%)	116 (18.3%)	44 (UK)–7%	39 (6.2%)	36 (5.7%)
W2 (138)	33 (23.9%)	17 (12.3%)	8 (5.8%)	CZ 7 (5.1%)	
S2 (148)	18 (12.2%)	19 (12.8%)	15 (10.1%)	9 (6.1%)	6 (4.1%)
W3 (9161)	2034 (23.3%)	2208 (24,1%)	698 (7,6%)	531(5.8%)	548 (6%)
S3 (8643)	1824 (21.1%)	1970 (22.8%)	694 (8%)	434 (5%)	651 (7.5%)
W4 (1843)	336 (18.2%)	372 (20.2%)	137 (7.4%)	Australia 117 (6.3%)	Spain 106 (5.8%)
S4 (1937)	171 (8.8%)	426 (22.0%)	211 (10.9%)	434 (22.4%)	Australia 116 (6.0%)

Source: Own research

Table 4 The number of related publications over Open Access

	All Open Access	Gold	Hybrid Gold	Bronze	Green
W1 (582)	135	73	16	27	69
S1 (633)	174	68	9	42	102
W2 (138)	20	11	3	6	4
S2 (148)	29	13	1	8	17
W3 (9161)	2632	1287	371	517	1535
S3 (8643)	2633	1037	213	537	1696
W4 (1843)	418	183	72	99	253
S4 (1937)	526	210	58	81	334

Source: Own research

by 174 (Table 3). However, these data do not give a complete picture, because, for example, in the process of analyzing the metadata of the W3 set by Web of Science, the system issued the following message: "6529 record (s) (71.270%) do not contain data in the field being analyzed".

Thus, analyzing publications from different scientometric databases (Tables 3–4) we can conclude the relevance and effectiveness (assessed by quantitative bibliometric indicators) of research on a particular topic, which does not depend on a specific scientometric base or policy of the publisher: also, there are the same general trends in the analysis of different sets of groups W and S. Although there are some "non-critical" differences, their detection in the process of this study may be random.

3.2 Findings on Thematic Publications Employing VOSviewer

With the help of VOSviewer, the thematic orientation of publications was studied, which allowed for the building of terminological maps based on terms found in the titles, keywords and annotations of articles from the data sets of groups W and S. For each group separately using VOSviewer tools:

- a keyword analysis was performed, based on the results of which it is possible to assess the intensity of use of one term with others;
- a special thesaurus has been compiled to combine similar terms and eliminate mistakes in the spelling of keywords;
- build a scientific map by keywords (Fig. 2), which highlighted clusters (denoted by different colours), combining key concepts (the size of the circle reflects the frequency in the use of a particular term, its "total link strength") by thematic proximity; within the clusters, the closeness of the connections between the corresponding terms (the closer, the closest) and the different variants of combinations of terms both within the clusters and between them (the width of the lines reflects the so-called "link strength" between pairs of terms).

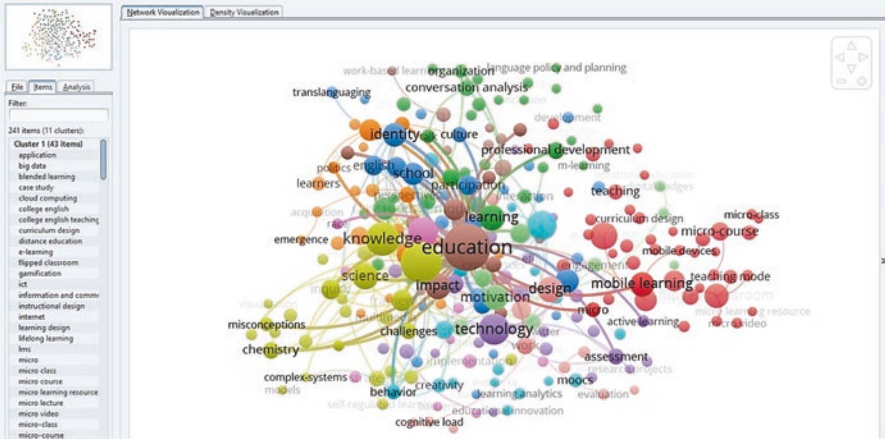

Fig. 2 Visualization of “total link strength” and “link strength” on the example of constructing a map of concepts according to the set W4 (minimum number of occurrences of keyword: 5). Source: Own research

To determine the main directions of research according to publications placed in different scientometric databases (groups of data sets W and S), we analyzed maps based on data from pairs of sets (W1, S1), (W2, S2), (W3, S3) and (W4, S4). In particular, in the field of educational sciences (W2, W4 and S2, S4), an analysis of thesauri shows that the main keywords include e-learning, education, learning systems & technology, information system, learning platforms, deep learning, machine learning, etc. However, the number, composition and capacity of clusters depend on various factors. The following are examples of VOSviewer-built maps and their interpretation. It should be noted that the interpretation of clusters is based on the grouping of keywords, but this distribution is quite conditional because both clusters and terms are interrelated. Moreover, the structure of clusters depends on the selected minimum number of occurrences of keywords for one data set (see Figs. 2 and 3) and the number of keywords on which the map is based for the different sets. For example, to build maps on data sets W4 and S4 according to the same algorithm, thesauri with 4639 and 1057 keywords, respectively, were generated. Accordingly, the frequency of use of certain terms in different publications is different, so, analyzing the terms with the minimum number of occurrences of keyword: 15, we obtained terminological maps with visualization, of which 40 meet the threshold of the 4639 keywords (Fig. 3) and 73 meet the threshold of the 10,057 keywords (Fig. 4), respectively.

An analysis of visualization of the maps built on one query, but from different scientometric databases (Figs. 3 and 4) is the basis for the assumption that the directions of microlearning research in the field of educational sciences, in general, do not depend on the scientometric base, where their results are presented, because the key terms in both samples are identical. A slightly larger number of keywords in set S4 with about the same number of articles in sets W4 and S4 may depend on the

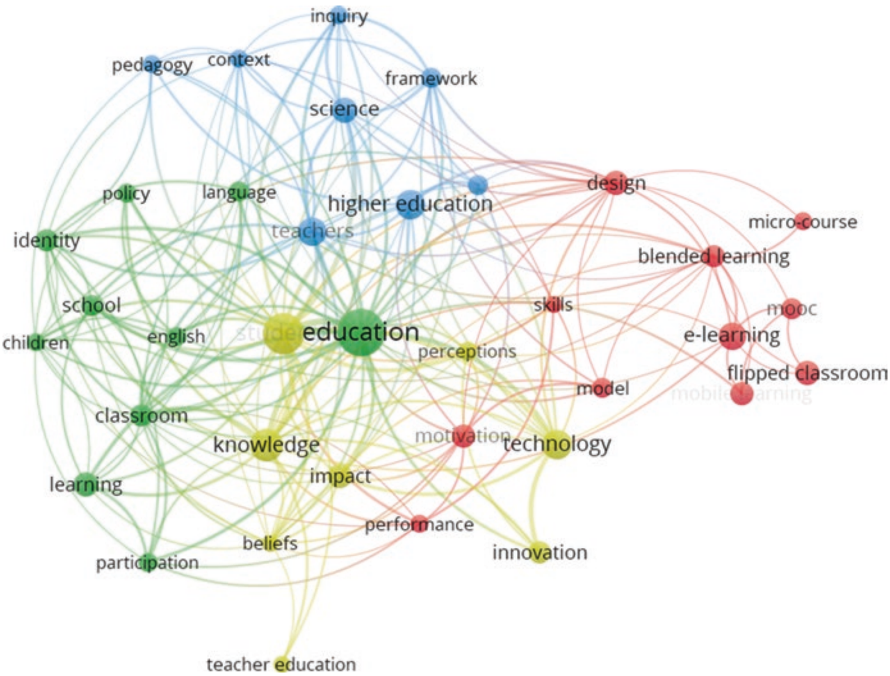

Fig. 3 Visualization of “total link strength” and “link strength” based on the example of constructing a map of concepts according to the set W4 (minimum number of occurrences of keyword: 15)

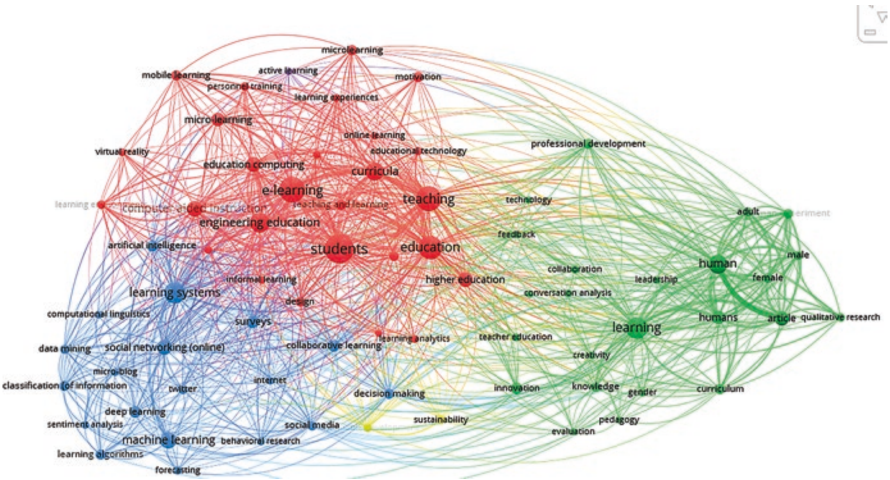

Fig. 4 Visualization of “total link strength” and “link strength” based on the example of constructing a map of concepts according to the set S4 (minimum number of occurrences of keyword: 15)

publisher's terms regarding the number of keywords in each article, the selection of thematic keywords, and so on. The analysis of the formed clusters is the basis for determining the main directions of research on a certain topic because we analyzed only keywords with a high frequency of use.

Despite the difference in the results of mapping data groups W4 and S4 (Figs. 3 and 4), we can identify (with some generalization) three main areas of research in the subject area of microlearning as an educational technology, which can be designated as:

– "Human and knowledge" (yellow cluster in Fig. 3 and green—Fig. 4);
– "Education and learning technology" (red, green, dark blue—Fig. 3, red—Fig. 4);
– "Learning system" (blue—Fig. 4).

It should be noted that the greater focus of publications from the Web of Science Core Collection (Fig. 3) on the study of methodological and psychological-pedagogical research (highlighted by separate clusters of teaching and research in higher education (blue cluster) and secondary (green cluster)) and learning research systems in publications indexed in Scopus (Fig. 4).

To determine the directions of interdisciplinary research in the subject area of microlearning, we compared thematic maps based on a single data set (as an example, consider the data set S3), with filtering according to the identified leading Research Areas (Table 1).

Based on the analysis of relevant visualizations (Figs. 4, 5, 6), we can confirm the assumption that the educational component is the least researched, as evidenced by both the smallest number of selected articles and the number of keywords: we obtained terminological maps with visualization, of which 73 meet the threshold of the 10,057 keywords (Fig. 4), 234 meet the threshold of the 15,382 keywords (Fig. 5) and 241 meet the threshold of the 16,345 keywords (Fig. 6) respectively.

Researchers in the field of Computer Science and Engineering, as related to the technical sciences and engineering, pay attention to ensuring the implementation of microlearning—in Table 5 and Fig. 6, the main clusters are identified, which can be conventionally designated:

– "Artificial Intelligence", which is a combination of red and green clusters (Figs. 5, 6) and partially blue (Fig. 6) and contains the concept of Machine learning, Deep learning (as a set). Machine-learning methods), Learning algorithms, in particular, based on neural networks;
– "Learning system" (Lilac cluster—Fig. 5 and partially red—Fig. 6);
– "Data processing" (yellow cluster—Fig. 5 and partially blue—Fig. 6);
– "Human" (blue cluster—Fig. 5 and Lilac—Fig. 6).

It should be noted that in contrast to the terminological map, which reflects the mapping of microlearning as an educational technology, where all key terms are distributed more or less evenly with a slight "reinforcement" of the terms "e-learning", "student", "teaching" (Fig. 4), in the maps that reflect the research of the technical

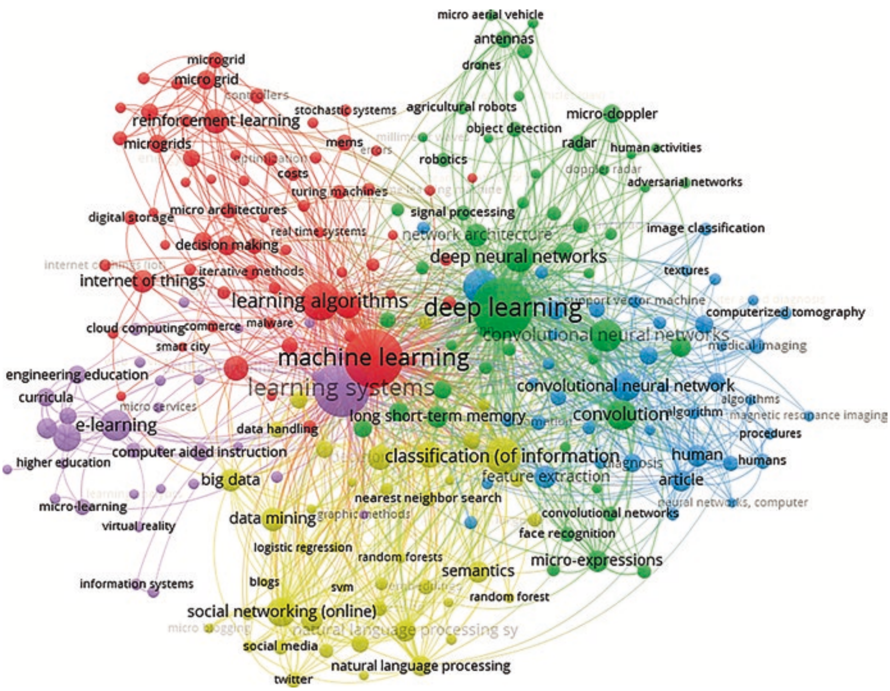

Fig. 5 Visualization of "total link strength" and "link strength" based on the example of constructing a map of concepts according to the set S3 with filtering by Computer Science Research Area (minimum number of occurrences of keyword: 15)

direction (Figs. 5, 6) in the centre of the analysis are the concepts of "machine learning", "deep learning", "learning system".

In general, the presence of clusters of the same name in terminological maps of publications from various Research Areas (Figs. 4, 5, 6), in particular, "Human" and "Learning system", as well as "complementary" categories "Education and learning technology" in the field of education, "Artificial Intelligence" & "Data processing"—in the field of technical sciences and "Network architecture" as a supplement to Engineering) can be interpreted as a comprehensive approach to research and the development of micro-learning as a promising area of modern e-education.

4 Conclusions

Micro-learning technologies have long been the subject of research mainly in the corporate sector and non-formal education. However, in the context of the COVID-19 pandemic and its possible consequences, when uncertainty remains high, the issue of changing the paradigm of education in higher education institutions is relevant. One of the areas is the creation of an improved micro-learning environment to

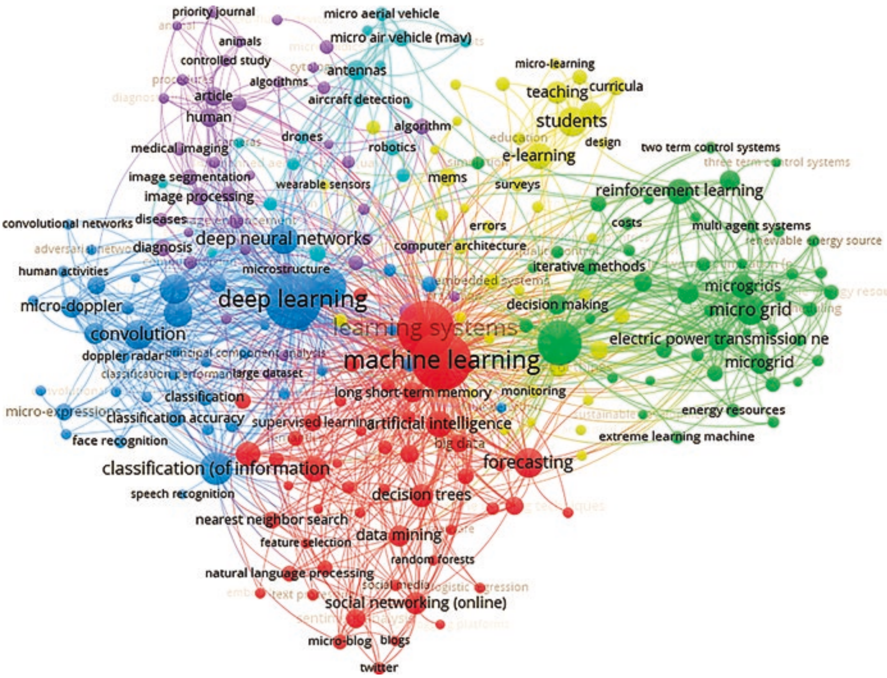

Fig. 6 Visualization of "total link strength" and "link strength" based on the example of constructing a map of concepts according to the set S3 with filtering by Engineering Research Area (minimum number of occurrences of keyword: 15)

Table 5 Symbols of clusters according to the defined Research Areas

Cluster colour	Research area	
	Computer science (Fig. 5)	Engineering (Fig. 6)
Red	Machine learning & learning algorithms	Machine learning & learning systems
Green	Deep learning	Learning algorithms & resources
Lilac	Learning system	Human & Research
Yellow	Classification of information & data processing	
Dark blue	Human & Convolutional neural network	Deep learning & classification of information
Blue		Network architecture

Source: Own Research

ensure the efficiency and effectiveness of teaching and learning, which is preceded by a scientific justification and analysis of the state of development of a particular subject area.

The study was conducted using the method of extensive search in electronic databases. The analysis covered scientific publications for the years 2010–2021, as presented in the abstract and citation databases Scopus and Web of Science Core Collection.

The results of the analysis of the formed samples by types of inquiries, years of publication, countries of origin of the authors, branches of research, as well as the openness of access are presented in the above tables and diagrams. Applied refinements (period, databases, key queries, search categories, etc.) limit its scope and facilitate processing, but somewhat narrow the analyzed area. In general, there is a tendency for researchers to support the open access initiative and, consequently, to expand the scientific and educational community to the results of research on a wide range of issues related to micro-learning.

As a result of bibliometric analysis and mapping, the growth of scientific interest in the problem of the effective implementation of microlearning in three main areas: Computer Science, Engineering and Education Research (Social Sciences), which indicates the consideration of microlearning as an interdisciplinary phenomenon.

For a qualitative study of the experience of microlearning, it is advisable to pay attention to the research of scientists from the United States and China, because they are the authors of approximately 20% of all publications in each of the defined sets of bibliometric data. At the same time, research on the application of micro-learning as an educational technology, i.e. with the narrowing of the field of research to educational (social) sciences, is more actively conducted in universities within the Czech Republic, Spain and Australia.

Based on an analysis of the visualizations of the terminological maps, the main directions of interdisciplinary research of microlearning are revealed, namely: "Human and knowledge", "Education and learning technology", "Learning system", "Data processing", "Artificial Intelligence". At the same time, the educational component is the least researched, i.e. technologies for the development and creation of channels for the delivery of micro-learning content attract more attention from Computer Science and Engineering researchers. Therefore, it is necessary to motivate teachers and experts in the field of Education Educational Research (Social Sciences) to conduct additional research and seek solutions to create a reliable model of implementation of micro-learning in educational institutions that will meet the expectations of teachers and students. We can distinguish the most important educational impact of the FITPED project—namely, new methodologies and modernized didactical approaches for IT topics as investigated by the project, were proposed and evaluated. Improved evaluation methods based on automation was used across the whole educational model (Drlik et al., 2019). Some important project results are presented in other chapters of the current book. The project has not only an IT area of implementation, but could develop in the several interdisciplinary fields.

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