From hype to reality: the changing landscape of MOOC research

Wiwit Ratnasari and Tzu-Chuan Chou
Department of Information Management, National Taiwan University of Science and Technology, Taipei, Taiwan, and Chen-Hao Huang
Department of Business Administration, National Cheng Kung University, Tainan, Taiwan

Abstract
Purpose – This paper examines the evolution of massive open online courses (MOOCs) literature over the past 15 years and identifies its significant developments.

Design/methodology/approach – Utilizing main path analysis (MPA) on a dataset of 1,613 articles from the Web of Science (WoS) databases, the authors construct the main pathway in MOOC literature through a citation analysis. Pajek software is used to visualize the 34 influential articles identified in the field.


Research limitations/implications – First, data limitations from the WoS core collection might not cover all research, but using reputable sources enhances data validity. Second, despite careful algorithm selection to enhance accuracy, there remains a limitation inherent in the nature of citations. Such biased citations may result in findings that do not fully align with scholars’ perspectives.

Practical implications – The authors’ findings contribute to the understanding of MOOCs literature development, enabling educators and researchers to grasp key trends and focus areas in the field. It can inform the design and implementation of MOOCs for more effective educational outcomes.

Originality/value – This study presents novel methodologies and important findings for advancing research and practice in MOOCs.

Keywords Main path analysis, Massive open online course, Citation network, Knowledge diffusion, Key-route main path analysis

1. Introduction
Given the increasing demand for flexible and accessible forms of education delivery, the emergence of massive open online courses (MOOCs) marks a significant turning point in education. Due to its highly dynamic and ever-evolving landscape, education must continually adapt to technological advancement, learner needs and societal changes (Rahm, 2023; Sharples, 2000; Wolfe and Andrews, 2014). Indeed, MOOCs have become a revolutionary approach to delivering education, transforming distance learning and igniting a wave of interest in online education (De Freitas et al., 2015; Liu et al., 2021). However, since their emergence over a decade ago, there has been a noteworthy shift in the research paradigm surrounding online education, reflecting the dynamic and evolving nature of the field.

MOOCs have sparked vigorous scholarly discourse regarding their potential to revolutionize education through the connectivist paradigm (Bell, 2011; De Freitas et al., 2015; Kop, 2011). However, persistent challenges in implementing MOOCs, such as low completion rates, are shifting researchers’ focus toward the development and testing of instructional strategies as well as improving various aspects of the learning experience, including engagement (Cheng, 2022; Guajardo Leal et al., 2019; Liu et al., 2022), learners’
LHT

perception (Li and Canelas, 2019), completion rates (Hone and El Said, 2016), learning outcomes (Xu et al., 2021), adoption and intention (Cheng, 2023; Gupta, 2021; Moore and Blackmon, 2022) and pedagogical approaches (Balki et al., 2020; Salvaterra et al., 2023). Moreover, the COVID-19 pandemic disrupted the education landscape globally, resulting in debates examining MOOC efficacy in the context of the pandemic (Alabdulaziz, 2021; Impey and Formanek, 2021; Khan et al., 2021; Okoye et al., 2021).

Recognizing paradigm shifts within a scientific field plays a crucial role in scientific progress; however, it is hard to know when a paradigm shift occurs due to dominant paradigms that restrict the construction and dissemination of scientific knowledge (Kuhn, 1962). These dominant paradigms often shape how researchers approach problems and can create resistance against novel ideas that challenge the established framework. Nonetheless, efforts to understand the current advancements and research trends continue unabated.

For instance, Jordan (2014) delves into the initial MOOCs enrollment and completion trends. Similarly, Cheng et al. (2022) conducted a study that identified and summarized the research focal points, discussing new directions and emerging trends in MOOC research within the context of Mainland China. In addition, Moreno-Marcos et al. (2019) conducted a systematic literature review to provide an overview of the state of the art in prediction related to MOOCs. Moreover, Zhu et al. (2018b) reviewed 146 empirical studies exploring various research paradigms and topics in MOOCs. Another significant effort to comprehend the evolution of MOOC research was undertaken by Ebben and Murphy (2014), who categorized the chronological phases of MOOCs into two distinct periods: the first phase, known as the Connectivist cMOOC, emphasized engagement and creativity, while the second phase, referred to as the xMOOC, focused on learning analytics, assessment and critical discourse.

It is worth noting that bibliometric network analysis has gained attention in recent years due to the increasing availability of large-scale datasets and sophisticated analytical tools (De Natale et al., 2023). Veletsianos and Shepherdson (2015) apply descriptive and inferential statistics to bibliometric data to explore interdisciplinarity in MOOC research. Boonroungrut et al. (2022) utilized distance-based network mapping in bibliometric network analysis to evaluate research trends. This approach effectively identifies hotspots, key trends and opportunities for advancing the research field, motivating further investigation (Agac et al., 2023; Alam et al., 2023). Moreover, bibliometric network analysis offers two core benefits: reduced subjectivity and bias and the potential to yield conclusions that can be applied across diverse fields, even to nonacademic stakeholders, due to its reliance on quantitative data (Cui et al., 2023).

Although such studies can yield valuable insights into the evolution of knowledge in a research domain, they may not clearly and concisely represent the main research pathways of research development. Main path analysis (MPA), introduced by Hummon and Doreian (1989), is considered superior in exploring knowledge evolution because it allows for the identification of the most pertinent and influential articles in a particular research field over time (Liu and Lu, 2012). Having gained popularity for its capability to provide insights into how a field has developed, what ideas have influenced its progression and which topics have been of most interest, this method has become increasingly utilized in scholarly research (Jiang and Liu, 2023; Palopak et al., 2023; Yu and Sheng, 2021).

Despite many advancements in MOOC research, a comprehensive analysis of its evolution remains unexplored. This study aims to answer the following research questions to gain a comprehensive view of the MOOCs literature.

**RQ1.** What pivotal research studies have shaped and influenced the evolution of the MOOCs literature?

**RQ2.** How have past research studies shaped the current understanding and advancement of the MOOCs literature?
To answer these research questions, this study adopts key-route MPA and multiple-global MPA to trace the 15-year trajectory of MOOCs development and uncover the most prevalent topics of discussion among its researchers. Researchers have effectively used MPA to explore technological development trajectories, as it offers valuable insights into the relationship between digital technology and learning (Hwang et al., 2021; Lu and Liu, 2016; Ratnasari et al., 2023; Yu et al., 2022a). This study traces the evolution of the MOOC literature by identifying its major turning points and significant milestones.

This study contributes to the field of MOOC research in several ways. First, we identify the most significant works based on the citation network of MOOC research. This approach allows us to identify the key contributors and their impact on the development of this field. Second, we identify the main research pathways that have emerged in the development of MOOCs literature. Through key-route MPA and multiple-global MPA, we map out the trajectories and trends that have guided the evolution of this field, allowing us to discern the key areas of focus and the significant contributions made within each area and to gain a complete understanding of the advancements and evolution in the field of MOOC research over time. Lastly, we examine the historical context and evolution of MOOCs literature. MPA maps the research trajectory chronologically, and by examining the historical development of the MOOC research field, this analysis provides valuable insight into the factors that have influenced and shaped the trajectory of its literature. This is crucial for comprehending the field’s current state and predicting future directions.

2. Research methodology

2.1 Data collection

Selecting documents and analyzing their content form the basis for our analysis. Therefore, a query strategy is an integral part of our approach. We aim to obtain complete datasets covering the entire MOOC research field and include as many relevant articles as possible. We employ a five-step data collection process to ensure that the data included in our study are genuinely representative of the MOOC literature (see Figure 1).

First, we study recent review articles to comprehensively understand the MOOC field and compile a list of relevant keywords (Moore and Blackmon, 2022; Zhang et al., 2022; Zhu et al., 2022). Second, we develop a query using the relevant keywords compiled. Third, the scientific publications in the MOOCs literature were retrieved from the Web of Science (WoS) core collection, which covers the Science Citation Index Expanded (SCIE), Social Sciences Citation Index (SSCI), Arts & Humanities Citation Index (AHCI), Book Citation Index (BKCI-S), Book Citation Index – Social Sciences & Humanities (BKCI-SSH) and Emerging Sources Citation Index (ESCI). A Connectivism and Connective Knowledge course by George Siemens and
Stephen Downes in 2008 was one of the earliest instances of MOOC research (Fini, 2009). As such, we have limited the timeframe for our data collection from January 1, 2008, when the first MOOC was run, to the year this study starts, December 31, 2022. Fourth, we analyze the citation network statistics and refine the query to achieve a high precision rate, ensuring our datasets are of high quality. The precision value is the number of articles divided by the network size. A higher precision value indicates that the data within the dataset are mutually cited by one another. The main reason is that in MPA, networks are constructed based on citation data, which deems articles that are not cited and those that do not cite others as irrelevant in the field (see Table 1). Therefore, a good dataset exhibits high precision, as it signifies a strong level of correlation between the articles present in the dataset.

These preliminary steps result in a query with a high precision rate of 86%. The queries are listed as follows:

\[ TS = (\text{massive open online courses OR MOOCs OR massively open online course}) \]

\[ \text{AND TS = (education OR teaching OR platform OR higher education OR distance learning OR online education)} \]

The last step is making sure highly cited articles in the MOOC field are included in our dataset by reviewing reference sections of the selected review papers. Furthermore, we incorporate all highly cited MOOC papers from the WoS database into our dataset.

### 2.2 Main path analysis

Hummon and Doreian (1989) set forth an intriguing concept that changed how researchers approached deoxyribonucleic acid (DNA) theory development. This concept, MPA, uses publication citations to understand how knowledge diffuses over time. Their method focuses on a network’s structural connectivity, which is then quantified based on sequences of links and nodes. Considering that citation links represent the knowledge transmission from one work to another, each citation link is assigned a significant indicator to represent the number of times it has been traversed. Once the significant indicator is determined, a “priority first search” algorithm is used to construct the path. How the link’s traversal is calculated will determine the main path constructed. As such, the constructed path may slightly differ depending on how one applies the computation path (Hummon and Doreian, 1989).

The earliest traversal count algorithms proposed by Hummon and Doreian (1989) are similar to Freeman’s (1979) centrality measure. However, while Freeman’s measure targets the centrality of nodes, Hummon and Dereian’s algorithms focus on the connectivity of links in a network. These algorithms are node pair projection count (NPPC), search path link count (SPLC) and search path node pair (SPNP). Since then, several attempts to enhance the algorithm have been made by many scholars. The significant indices of Hummon and Dereian saw advancement in handling extensive and complex social networks effectively.

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of papers</td>
<td>1873 article</td>
</tr>
<tr>
<td>Network Size</td>
<td>1,613 nodes</td>
</tr>
<tr>
<td>Precision = Network size/Number of papers</td>
<td>1,613/1873 = 0.86</td>
</tr>
<tr>
<td>Total number of citation links</td>
<td>8,369</td>
</tr>
<tr>
<td>Average cited counts per node</td>
<td>5.188469</td>
</tr>
<tr>
<td>Network density</td>
<td>0.000219</td>
</tr>
<tr>
<td>Total number of paths (counted from sources)</td>
<td>2094694.000000</td>
</tr>
</tbody>
</table>

Table 1. Citation network statistics

Source(s): Authors, 2023

Hummon and Doreian’s (1989) search procedure is to find the single most significant path for the whole network. Liu and Lu (2012) argue that this approach cannot guarantee that this single path is the most significant. To overcome this limitation, Liu and Lu (2012) propose an integrated approach combining several methods into one analysis and offering new types of main paths: global, backward, multiple and key-route. These methods provide a highly effective means of retracing the evolution of entire scientific fields. Compared to Hummon and Doreian’s approach, the key-route method gives greater control over the level of detail in the main paths by constructing the path based on a given key-route number. As a result, the key-route method ensures the inclusion of the most significant top links with the highest traversal counts (Liu and Lu, 2012).

It is essential to acknowledge the differences that exist among the algorithms used to weight the links. How the source and the sink are determined may vary depending on the counting methodology employed. This differentiation underscores the importance of carefully considering the nuances and intricacies of each counting method to ensure accurate and comprehensive analysis.

There has been an ongoing debate regarding selecting a suitable algorithm for determining traversal count because the underlying assumptions of these algorithms can significantly affect the way search paths are counted (Kuan, 2023). In SPNP, links in the middle of search paths receive higher counts as they are part of more node pairs, whereas in SPLC, they receive lower counts as they are only counted once per search path (De Nooy et al., 2018; Hummon and Doreian, 1989). Consequently, Batagelj (2003) recommends the SPC method for determining traversal count due to its favorable property of having the sum of inflow and outflow traversal counts be equal, which has been noted by other studies (Huang et al., 2017; Lathabai et al., 2018; Liu et al., 2020; Liu and Lu, 2012).

Continued efforts are being made to enhance the algorithm for traversal weight in citation networks to better map technological trajectories and knowledge diffusion paths. For example, Yu and Sheng (2021) adjust previously mentioned traversal weights by considering citing papers’ citation influence, while Liu and Kuan (2016) suggest decaying the search path by length since long paths may have higher information loss (Jiang and Liu, 2023). However, Liu et al. (2020) contend that the most suitable method for calculating search paths in scientific and technological development is SPLC because it considers intermediate nodes not only as intermediaries but also as knowledge sources, thus more closely resembling how knowledge diffuses (Huang et al., 2022; Kuan, 2020; Liu et al., 2019).

In this study, we shall apply the SPLC algorithm to determine the significance of a citation link, as it aligns with our research objective. The key-route MPA will be employed to capture the evolution of knowledge, as it offers an effective mechanism to control the level of detail in our analysis. This approach is excellent for understanding the divergence-convergence-divergence process within citation networks (Liu et al., 2019; Liu and Lu, 2012). Furthermore, we conducted a multiple-global MPA to shed light on the most popular discussions among MOOC researchers. With these cutting-edge techniques, our study presents a comprehensive understanding of knowledge diffusion in the MOOC literature.

3. Findings and analysis
This section gives an overview of the main characteristics of scientific growth in MOOCs. This field has witnessed a significant number of publications, offering 1,613 works published from 2008 to 2022. Figure 2 provides an overview of the distribution of publications and
citations in the MOOCs literature. In 2009, a single publication on MOOCs was recorded in the WoS databases. This pioneering article, authored by Fini (2009) and titled “The Technological Dimension of a Massive Open Online Course: The Case of the CCK08 Course Tools,” stands out as the earliest contribution to the field.

Publications on MOOCs initially had limited coverage but then witnessed substantial growth from 2013 onward, with a four-fold increase in the subsequent year (Figure 2). This surge in research interest can be attributed to Stanford’s initiative in 2011, when the school offered free online classes (Vardi, 2012). In contrast with early MOOCs by Siemens and Downes, elite USA institutions follow a behaviorist-based approach (Daniel, 2012; Ebben and Murphy, 2014).

Despite the lack of a clear business model for this newly emerging type of education, numerous top USA universities have adopted MOOCs (Vardi, 2012). This phenomenon raised the question of why MOOCs received so much attention. Vardi (2012) argues that USA higher education suffered a significant setback due to the aftermath of the global financial crisis, leading to the belief that the enthusiasm for MOOCs is motivated by the possibility of cost reduction rather than recognizing the inherent educational value of technology. Consequently, MOOCs have become a highly discussed topic in higher education, as evidenced by Figure 2, confirming that this phenomenon has generated significant hype among educational technology researchers. Similarly, Cheng et al. (2022) discovered a correlation wherein China’s prominent trends in educational research mirror global advancements. This indicates a growing emphasis on MOOC research within Mainland China, aligning with the broader international trajectory. However, a notable contrast emerges when comparing the primary areas of focus. Mainland China’s research tends to focus more on curriculum design and pedagogy, while the predominant themes revolve around motivation and issues related to dropout rates on a global scale (Cheng et al., 2022; Zhu et al., 2018a).

Furthermore, Loglet analysis will be employed to analyze the growth trend of publications related to MOOCs. This statistical tool has been developed to examine time series data and to decompose the growth process into S-shaped logistic components, enabling researchers to perform trend analysis (Kim, 2012; Meyer et al., 1999). The process involves using the publication data as input and breaking them down into Loglet, sub-cycles of the time series, each with a distinct growth rate. The analysis reveals the growth trend over time by fitting

![Figure 2. Distribution of publications and citations in the MOOCs literature](source(s): Authors (2023))
each Loglet with a logistic curve (Kim, 2012). We present the results of our MPA based on the data collected.

The growth trend of research on MOOCs appears in Figure 3, illustrating a steady increase in attention and interest observed over time. The analysis suggests that if this trend persists, the research topic will continue to expand until 2030. Our findings are consistent with previous research by Chen et al. (2021) on topic-based bibliometric analysis of smart learning and highlight the continuous increase in research interest in MOOCs. These results emphasize the growing recognition of MOOCs as a valuable tool in education and validate the need for further investigation and development in this research area.

3.1 Development trajectory of the massive open online course domain
In this study, we perform key-route MPA to identify the most influential path within the domain of the MOOCs literature. The key-route method consists of two steps: determining the traversal count of each citation link and then searching for the main path by connecting citation links based on the highest traversal counts. For this analysis, we employ key route 10, which means we use the top 10 citation links with the highest traversal links obtained through the SPLC algorithm as seed links to construct the network.

The key-route approach allows us to control the level of detail in our visualization. While it is possible to determine more seed links, doing so would increase the complexity of the network and make it more challenging to observe the shifting phenomena of the research trajectory in the field. Given that we have 1,613 articles and 8,369 citation links, the citation network of the MOOCs literature is undeniably complex.

Our examination reveals that the main path of key route 10 encompasses numerous significant links, while paths with lower traversal links are disregarded. Consequently, we assert that key-route 10 effectively captures critical junctures within the field of MOOC research and provides a clear and concise representation of the main research pathways in its development. Table 2 below presents the ten highest traversal links used as seed links.

Figure 4 illustrates the main path of MOOC research, highlighting the 34 most influential articles published between 2008 and 2022. We utilize Pajek software to visualize the main path network. The graph comprises four main features: node colors, labels, arrows and line thickness. The colors assigned to the nodes signify the roles and positions of the respective articles. Each node represents an article and is color-coded accordingly. Green nodes denote sources, red nodes represent intermediates and blue nodes indicate sinks. Each node is labeled with a code comprising the first author’s last name, followed by the initials of any subsequent authors and ends with the year of publication.

Source(s): Authors (2023)
The node label LiyanagunawardenaAW2013 may be one example. This label represents an article by Tharindu Rekha Liyanagunawardena as the first author, followed by the last initials of the second and third authors, Andrew Alexandar Adams and Shirley Ann Williams. The label also indicates that the article was published in 2013. The arrows between the nodes depict the direction of knowledge flow, while the thickness of the arrow lines reflects the traversal counts. In this manner, thicker lines represent links with higher traversal counts, indicating increased significance (Liu and Lu, 2012).

Through the lens of the MPA, three significant phases in the trajectory of MOOC research become evident (refer to Figure 4). The initial phase emphasizes the emergence of

---

**Table 2.** Highest traversal links  
Source(s): Authors, 2023

<table>
<thead>
<tr>
<th>Counts</th>
<th>Traversal counts (SPLC)</th>
<th>Routes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>733462</td>
<td>DewaardAGHKKR2011 → LiyanagunawardenaAW2013</td>
</tr>
<tr>
<td>2</td>
<td>471933</td>
<td>VeletsianosCS2015 → HoodLM2015</td>
</tr>
<tr>
<td>3</td>
<td>467846</td>
<td>Bell2011 → DewaardAGHKKR2011</td>
</tr>
<tr>
<td>4</td>
<td>466602</td>
<td>HoodLM2015 → LittlejohnHMM2016</td>
</tr>
<tr>
<td>5</td>
<td>366731</td>
<td>Bell2011 → LiyanagunawardenaAW2013</td>
</tr>
<tr>
<td>6</td>
<td>366731</td>
<td>Fini2009 → LiyanagunawardenaAW2013</td>
</tr>
<tr>
<td>7</td>
<td>341796</td>
<td>EbbeM2014 → VeletsianosCS2015</td>
</tr>
<tr>
<td>8</td>
<td>294515</td>
<td>LiyanagunawardenaAW2013 → HewC2014</td>
</tr>
<tr>
<td>9</td>
<td>252070</td>
<td>LiyanagunawardenaAW2013 → EbbeM2014</td>
</tr>
<tr>
<td>10</td>
<td>246654</td>
<td>ShapiroRLCC2017 → WattedB2018</td>
</tr>
</tbody>
</table>

---

**Figure 4.** Main path of MOOC research  
Source(s): Authors (2023)
connectivism as a learning theory, accompanied by a lively debate regarding the concept of MOOCs. In the second phase, the research shifts towards facilitating education reform through learner-focused investigations. Finally, the third phase directs attention towards overcoming barriers to MOOC adoption, exploring learner perceptions and intentions and investigating strategies to enhance course completions.

3.1.1 Phase 1: Connectivism’s emergence as a learning theory. The initial phase of the MOOC landscape places significant emphasis on the emergence of connectivism as a learning theory and a heated debate surrounding the concept of MOOCs. Considered one of the first MOOCs, the Connectivism and Connective Knowledge (CCK08) course offered by the University of Manitoba was built on the connectivism learning theory (Liyanagunawardena et al., 2013). Fini (2009) investigates CCK08 learners’ attitudes towards multi-tool environments adopted in the course. The core premise of the multi-tool environment was to empower learners by allowing them to choose tools they perceived as their own. On this premise, the CCK08 instructor assumed the role of an information broker, curating relevant resources from various technological tools to foster connectivity and learning networks among participants. Given the varied learner needs, purposes and self-organization skills, Fini’s (2009) research addressed the design and conditions of multi-tool environments to support education and optimize learning effectiveness, emphasizing the importance of providing clear tool descriptions and granting learners the freedom to select their preferred tools for the course’s success.

However, Bell (2011) refutes that connectivism alone is insufficient to effectively support or facilitate the learning process in an inter-networked world. Bell (2011) rejects connectivism as a theory and argues that it is best understood as a phenomenon rather than a full-fledged learning theory (Ebben and Murphy, 2014). However, it does influence the practice of instructors and learners due to its occurrence in MOOCs. Furthermore, five scenarios have been presented, advocating an active and justifiable choice of theories supporting technologically enhanced education change (Bell, 2011). Later in the same year, deWaard et al. (2011) investigated how mLearning and MOOCs can help analyze the complexity, emergence and chaos at work in education. It is through the use of MOOCs, developed by connectivist researchers and enthusiasts, in combination with mLearning that deWaard et al. (2011) argue that this will enable the construction of a redesigned educational landscape that better fits the new knowledge age.

The complex interaction of connectivism within the MOOCs landscape brings a transformative era of learning networks and multi-tool environments. Despite the criticisms highlighting its limitations, integrating connectivist principles continues to reshape instructional paradigms. This shift played a crucial role in shaping the trajectory toward an educational horizon tailored to meet the dynamic demands of the new knowledge age.

3.1.2 Phase 2: Facilitating education reform. After Stanford’s initiative and recognition of MOOCs as forming the “Year of MOOC” by The New York Times, these online courses gained significant popularity (Pappano, 2012). However, there were notable differences from the initial phase, as MOOCs developed by prestigious USA institutions followed a cognitive behaviorist’s pedagogical approach (Daniel, 2012; Ebben and Murphy, 2014). While MOOCs brought hope for education reform and garnered enthusiasm from educators and learners, challenges such as low completion rates and implementation difficulties faced by instructors hindered their full potential. As a result, in the second phase, researchers focused on facilitating education reform in the digital age, striving to overcome obstacles and unlock MOOCs’ full potential. Researchers try to tackle two main issues to facilitate the transformation in this phase. First, they seek to comprehend learners by identifying factors influencing their self-learning abilities and maintaining motivation. Second, they focus on how instructors design and personalize MOOCs to facilitate students’ self-learning abilities.
While traditional investigations into learning in MOOCs have primarily focused on analyses of platform statistics and logs, this approach often fails to understand how learners behave comprehensively (Veletsianos et al., 2015). Consequently, researchers such as Veletsianos et al. (2015), Hood et al. (2015) and Watted and Barak (2018) have explored various contextual factors that may influence learners’ behavior within MOOCs. Veletsianos et al. (2015) seek to determine what motivates learners to engage in particular activities by investigating aspects such as their social interaction outside of MOOCs, note-taking habits and the broader context surrounding their consumption of course content. In the MOOC environment, individuals are required to self-regulate their learning, a topic examined by Hood et al. (2015), investigating whether learners’ role and context impact their self-regulation abilities. Meanwhile, Watted and Barak (2018) focus on learners who complete MOOC courses, aiming to understand the motivations that distinguish them from those who do not.

Along with understanding learners’ behavior, context and motivation, how the instructor designs and delivers these courses has a role that is no less important for the success of MOOCs (Kop, 2011; Margaryan et al., 2015; Zhu et al., 2018a). In order to gain a deeper understanding of MOOC design experiences from instructors’ perspectives, Bonk et al. (2018) explored the activities, tools and resources experienced MOOC instructors use to enhance their MOOC personalization. Their study reveals a diverse range of personalization methods, necessitating additional measures such as in-depth interviews, focus groups and course observations to accurately capture all forms of MOOC personalization (Bonk et al., 2018).

Furthermore, Zhu et al. (2018a) examined instructors’ considerations and challenges in MOOC design. The study reveals that instructors face challenges when framing learning objectives, deciding suitable assessment methods, fostering learner engagement and monitoring learner progress. Ensuring learners’ understanding of learning objectives and selecting appropriate assessment methods aligned with intended goals demand a keen understanding of learners (Zhu et al., 2018a). However, due to the massive number of learners for a MOOC and their diverse backgrounds, prior knowledge and different student learning motivations, determining learning objectives and assessment methods is not easy (Zhu et al., 2018a).

Both Zhu et al. (2018a) and Bonk et al. (2018) assert that the avenue to engage learners lies in personalization. Consequently, these studies suggest that MOOC instructors would benefit from additional training in personalization techniques while designing or refining their MOOCs (Bonk et al., 2018; Zhu et al., 2018a).

3.1.3 Phase 3: Breaking through barriers to MOOC adoption: examining learners’ perceptions and intentions. Despite being widely adopted, MOOCs have faced persistent challenges since their inception, such as low completion rates. As a result, in the third phase, MOOC researchers have shifted their interest toward investigating the underlying causes of this phenomenon. Liu et al. (2021) argue that understanding learner perceptions and intentions is crucial as they significantly impact MOOCs’ continued use. Therefore, more and more researchers are examining the factors influencing learner adoption and intention to enhance MOOC quality and performance.

Al-Adwan (2020) evaluates learners’ intention to adopt MOOCs in the pre-adoption stage, suggesting that student acceptance determines the courses’ success. The study argues that students in well-structured classroom environments struggle to effectively manage their learning, leading to their resistance toward MOOCs. As a solution, Al-Adwan (2020) recommends that MOOC developers and designers make more of an effort to provide a solution to help students who lack experience using MOOCs improve their self-learning abilities.

Meet et al. (2022) discover that perceived value is important in influencing Generation Z’s intention to adopt MOOCs. The authors claim that Gen Z students may have limited financial resources, meaning that MOOC providers must emphasize that their value is worth more to students than the cost of the course or certification.
Kala and Chaubey (2022) explore the relationships among student technology acceptance, engagement and perceived learning in the context of a tourism MOOC. This study reveals a strong relationship between student engagement and perceived learning. However, the authors also observe that the influence of technology acceptance on student engagement is not notably substantial. Additionally, the authors put forth a range of suggestions to foster student engagement and enhance perceived learning, ultimately cultivating a favorable disposition towards MOOC platforms and the institutions that administer them.

3.2 Research themes of the massive open online course

We apply the multiple-global MPA to uncover the sub-themes around MOOC research fields. Clusters represent different sub-themes of research. We then examine each article’s title, abstract and keywords on this network. Based on this approach, we find six clusters as visualized in Figure 5. The six subthemes are self-regulated learning (SRL), motivation, learner engagement, continuance intention, student performance and the COVID-19 pandemic. In the following sections, we will discuss the cluster’s main concern and major contribution. We put the label of the article below each cluster name.

3.2.1 Group 1: Self-regulated learning. As MOOCs offer low levels of support and guidance, learners need to self-regulate their learning process (Kizilcec et al., 2017; Littlejohn et al., 2016). This makes SRL an extensively discussed research topic in the field because a deep understanding of SRL is pivotal to the success of MOOC learning. Thus, MOOC researchers are keen on understanding SRL strategies in online scenarios. Kizilcec et al. (2017) identify learner characteristics predicted to have weaker SRL skills to provide effective targeted support. According to Kizilcec et al. (2017), learners who tend to seek help are less confident about their ability to succeed.

![Figure 5. Multiple-global main path of MOOC research](image-url)
Additionally, the authors point out that learning is not necessarily facilitated by seeking help. Thus, the study suggests that help seekers in MOOCs might require different scaffolding approaches depending on the context. While it is true that help-seeking might assist students, the importance of guiding them on when to utilize it is noted (Kizilcec et al., 2017). In this sense, supporting perseverance in students is crucial, rather than simply focusing on finding the right solution.

3.2.2 Group 2: Motivation. Motivation is one of the key areas of research in MOOCs. Given the limited interaction between instructors and students, successful MOOCs require students’ high level of self-motivation. Badali et al. (2022) study the impact of motivational factors on learners’ retention and completion of MOOCs. The study identifies six main motivational factors influencing MOOCs’ completion: academic, social, course, personal, professional and technological. In another study, open badges were found to be a motivational tool that increased learner engagement and motivation to complete courses (Buchem and Borrás-Gené, 2020). Other studies show that self-regulation is crucial in maintaining motivation throughout the course (Reparaz et al., 2020). By understanding the role of motivation, educators and designers can create effective online learning environments that meet the needs and interests of learners.

3.2.3 Group 3: Continuance intention. Continuance intention is a fundamental concept in the MOOC literature, as it provides insights into why some learners persist until the end of a course while others drop out. While comprehending the factors that drive MOOC adoption is critical to facilitating their initial uptake, it is crucial to note that initial technology adoption does not guarantee its continued use (Yan et al., 2021). This underscores the multifaceted nature of MOOC adoption, where factors extending beyond the initial enrollment stage come into play (Joo et al., 2018). Dai et al. (2020) have contributed to this understanding by revealing that attitude and curiosity significantly explain continuance intention in MOOCs. These findings allow practitioners to better understand how learners’ attitudes toward MOOCs affect their course retention, hence designing interventions accordingly.

3.2.4 Group 4: Students’ performance. MOOC researchers discuss a wide range of factors that can impact student performance. Research on student performance helps identify effective strategies, design considerations and features that enhance MOOCs’ effectiveness and sheds light on how to blend elements of traditional learning experiences for students (Wang et al., 2022a; Xing, 2019). Xing (2019) emphasizes the influence of course design features on student performance, while Wang et al. (2022a) advocate combining traditional and e-learning elements as a more effective approach rather than simply replacing one with the other. Both studies suggest that integrating MOOCs into blended learning can provide students with a more interactive and engaging learning experience. This approach helps to reinforce and apply the material covered in traditional lectures, thus enhancing student performance. Although MOOCs show promise in providing education to a wide and diverse range of people, several issues concerning student performance remain a crucial area of ongoing research to continually improve MOOCs’ effectiveness as an educational tool.

3.2.5 Group 5: COVID-19 pandemic. The COVID-19 pandemic has increased interest in MOOCs as many educational institutions have had to move their courses online (Gómez Gómez and Munuera Gómez, 2021; Liu et al., 2021). MOOCs provided advantages during the pandemic, such as remote learning, which is crucial when in-person learning is neither possible nor safe, flexibility in scheduling and pacing and accessibility due to low-cost or free options (Gómez Gómez and Munuera Gómez, 2021). However, although MOOCs have proven to be an effective educational tool during the pandemic, it is critical to be aware of their limitations and ensure that they are appropriate for all populations and types of learning. MOOCs must continuously adapt to changing learner needs and societal shifts, including those caused by unforeseen circumstances that hinder traditional in-person education (Gómez Gómez and Munuera Gómez, 2021; Rahm, 2023; Sharples, 2000).
3.2.6 Group 6: Learner engagement. Learner engagement is important in designing and evaluating MOOCs (Wang et al., 2022b). However, a standardized and validated scale for measuring learner engagement is lacking within the MOOC context (Deng et al., 2020a). In order to enhance its effectiveness and impact on learners, measuring and fostering learner engagement are more crucial. Therefore, Deng et al. (2020a, b) conducted a study to address these concerns, revealing a positive association between learner engagement, course completion rates and the perceived usefulness of the course. The findings suggest that learners reporting higher levels of engagement are more likely to complete the course and find it beneficial. Moreover, numerous studies (Atapattu and Falkner, 2017; Padilla Rodriguez et al., 2020) have demonstrated the critical role of engagement in the success of MOOCs, emphasizing the importance for designers and instructors to prioritize strategies that promote engagement. As online teaching continues to evolve, research and development in engagement within MOOCs are expected to remain fundamental.

4. Discussion
In this study, we sought answers to two research questions: RQ1 and RQ2. We employ the key-route MPA and multiple-global MPA to illuminate the knowledge diffusion trajectories in MOOCs. We identified 34 influential papers that have shaped the MOOCs literature by using the key-route MPA. The comprehensive list of these impactful papers is enumerated in Appendix, addressing RQ1, which pertains to pivotal research studies shaping and influencing the evolution of the MOOCs literature.

Furthermore, we address RQ2 regarding how these studies have contributed to the current understanding and advancement of the MOOCs literature. This exploration is facilitated through an extensive analysis of the identified significant articles. Our analysis reveals a paradigm shift within MOOCs literature, delineated into three phases: the emergence of connectivism as a learning theory, facilitating education reform and breaking through barriers to MOOCs adoption. A visual representation of this categorization can be found in Figure 4 in Section 3.1.

In addition, by performing the multiple-global MPA, we discern the key focus area and the significant contributions made within each area. Our analysis reveals popular subthemes within the MOOCs literature, including SRL, motivation, learner engagement, continuance intention, student performance and the COVID-19 pandemic. This approach is crucial in comprehending the field’s current state and predicting its future.

4.1 MOOCs development and trend
MOOCs have significantly impacted education and garnered substantial attention from researchers, exhibiting exponential growth since their inception. Through the key-route approach, this study divides the evolution of MOOCs literature into three distinct phases: the emergence of connectivism as a learning theory, the facilitation of education reform and the examination of learner perceptions and intentions in breaking through barriers to MOOC adoption.

Although large-scale online courses were not entirely new when MOOCs first emerged, introducing connectivism as a learning theory has played a crucial role in drawing significant attention to these courses. Connectivism emphasizes the importance of networks, connections and the use of technology in facilitating learning in digital environments (Downes, 2008). It provides a theoretical framework that aligns well with the design and implementation of MOOCs, contributing to the increased interest in and exploration of MOOCs as a new educational approach. Incorporating connectivism into the MOOC format marks a notable departure from traditional online courses, raising numerous questions about their design,
delivery and assessment, as we found in the studies by Fini (2009) and Hew and Cheung (2014), which are among the important pivotal studies explaining the first phase. These inquiries have spurred extensive debates surrounding the definition and defining features of MOOCs and their potential benefits for learners and educators. This phenomenon is exemplified in studies conducted by Bell (2011) and deWaard et al. (2011). These debates play a crucial role in clarifying the concept of MOOCs and establishing a foundation for future research and development in this field. However, it is important to acknowledge that the initial phase of these conception debates has set the direction and established trends within a specific area of study. Our findings align with those of Ebben and Murphy (2014), who noted during the first phase of MOOC scholarship that the primary discussion topics centered around developing connectivism as a learning theory in its early phase. Our findings further support and validate the initial research phase in the MOOC field.

The debate over the concept of MOOCs is an important starting point, but it is not the only factor contributing to the development of knowledge in this area. Our understanding of MOOCs has significantly advanced beyond the debate over their initial use through continuous research and experimentation. We find in the second phase that researchers have been instrumental in driving education reform by conducting experiments and delving into learners’ behavior, context and motivation. We discuss the prominent study in Phase 2, Section 3.1, showing that Veletsianos et al. (2015), Hood et al. (2015) and Watted and Barak (2018) explain this paradigm. Additionally, the researchers have explored how instructors can design captivating courses that foster active learner engagement as we found in the studies by Kop (2011), Margaryan et al. (2015) and Zhu et al. (2018a).

These findings align with the research conducted by Cheng et al. (2022), which specifically explores the context of MOOC research in China. Cheng et al. (2022) observe a prevalent focus on learners within this context. This emphasis on understanding learners’ individual needs and their potential for self-directed learning is deemed crucial for the successful implementation of MOOCs. It is, therefore, not surprising that learners have been a prominent subject of investigation. The collective effort of these studies contributes significantly to positioning MOOCs as a powerful tool for educational reform.

Moreover, MOOCs have long grappled with low course completion rates, despite their popularity and potential. This has been a problem since their early days and remains a significant challenge a decade later (Chen et al., 2018; Cheng, 2023). Consequently, as evident from our findings, researchers in this phase have been studying and breaking down barriers that hinder learner adoption and completion of MOOCs. Learners are being explored in this research to determine their perception and intention to enroll in a MOOC and complete it. Studies by Al-Adwan (2020), Meet et al. (2022) and Kala and Chaubey (2022) were among the pivotal studies of this shifting phenomenon. The increasing emphasis on this topic in the third phase is intriguing. Despite the longstanding issue of persistently low completion rates in MOOCs, it has only been during the third phase that focus in MOOCs began to shift toward addressing acceptance issues and examining learner perception and intention. Liyanagunawardena et al. (2013) note during their research that the limited availability of data on MOOC completion rates has affected the understanding of experiences among noncompleting MOOC participants. Consequently, this poses a significant challenge for researchers seeking comprehensive insights in this area (Zhang et al., 2022). Therefore, it is plausible to suggest that the limited availability of readily accessible information on MOOC completion rates may play a role in the relatively scarce discussion of this topic in the early phases.

4.2 Theoretical and practical implications

This research contributes significantly to the theoretical landscape of the MOOCs field. Through our rigorous analysis, we have uncovered three distinct phases in the development
of MOOC research: the emergence of connectivism as a learning theory, the facilitation of education reform and the examination of learner perceptions and intentions in breaking through barriers to MOOCs adoption. These findings not only validate the seminal work of Ebben and Murphy (2014), who observed that during the initial phase of MOOC research, the primary focus revolved around developing connectivism as a learning theory, but also extend our understanding of this early phase. Based on these findings, MOOC researchers may need to reconsider and adapt to these shifting phenomena to accommodate the nuanced development of MOOCs. Specifically, this could involve revisiting how connectivism is integrated into contemporary learning theories and exploring how technological innovation continues to shape the MOOC landscape. Such revisions are essential for maintaining the relevance and accuracy of our theoretical foundations in the dynamic field of MOOCs.

Furthermore, the implications of our study extend beyond theoretical boundaries. This study prompts us to consider how these evolving phases in MOOC research might impact the practical design and implementation of MOOCs and their potential to drive educational reform, as we have witnessed that technological implementation in education may transform traditional MOOC research into new practices. As evidenced by the research of Ratnasari et al. (2023), the emergence of new phenomena like massive multiplayer online role-playing games (MMORPGs) and advancements in technology are ushering in new educational practices, such as digital game-based learning, making learning more engaging and innovative.

4.3 Limitations
This study has several limitations that should be acknowledged. First, data selection is limited to the available sources in the WoS core collection, which may limit its comprehensiveness. Nevertheless, it is important to note that the SCIE, SSCI, AHCI and ESCI databases in the WoS core collection are widely recognized as reputable sources for scholarly articles (Nguyen et al., 2022).

The absence of some articles in the datasets due to their unavailability in the WoS databases is unfortunate. However, it is important to acknowledge that no single database can comprehensively cover all published research. Therefore, excluding other articles does not invalidate the study's findings but suggests that future research should consider incorporating additional databases or sources to comprehensively understand the topic.

The inclusion of SCIE, SSCI, AHCI and ESCI databases in the WoS core collection in the study provides a solid foundation for analyzing MOOCs because they often contain high-quality research papers that contribute significantly to the understanding of educational trends and innovations (Pranckutė, 2021). In other words, focusing on well-regarded sources enhances the validity of the data used in the study.

Second, scholarly citations can at times be subject to biases (Urlings et al., 2021). As a consequence, these biases within citations can inadvertently lead to a lack of comprehensive representation of the referenced body of knowledge. Our meticulous selection of the most appropriate algorithm for navigating the weight within the citation network ensures precise mapping of MOOCs' trajectories and knowledge diffusion paths (Kuan, 2020; Liu et al., 2019). Despite these efforts to enhance accuracy, there remains a limitation inherent in the nature of citations. Such biased citations may result in findings that do not fully align with scholars' perspectives.

5. Conclusions and future work
This article presents a comprehensive analysis of the evolution of the MOOC research field by examining the citation network of publications from 2009 to 2022. The chronological analysis of the MOOC literature provides valuable insights into its evolution, which could be useful for
researchers, educators and policymakers seeking to enhance the effectiveness of MOOCs. Furthermore, it reveals intriguing thematic trends across disciplines and the influential works that shape scholarly discourse on MOOCs. To investigate MOOCs' knowledge dissemination, we employ the key-route MPA, followed by the utilization of the multiple-global MPA, to reveal the most prominent discussions among MOOC researchers. Through in-depth exploration, our study sheds light on the changing nature of MOOC research evolution and contributes to the field by comprehensively analyzing its developmental trajectory.

To extend the findings herein, our recommendations for future studies cover four aspects. First, we aim to expand the scope of data selection by incorporating the Scopus database. The Scopus and WoS databases are widely recognized for their comprehensive coverage and extensive usage within the academic community, particularly for citation analysis and indexing scholarly literature (Pranckutė, 2021). In contrast, Google Scholar offers broader coverage beyond traditional scholarly publications, encompassing scholarly articles, theses, pre-prints, books, institutional repositories, personal websites and nonpeer-reviewed sources. Nonetheless, it is important to acknowledge that Google Scholar has a limitation in its inability to support large-scale data collection (Batagelj et al., 2017). Consequently, integrating it into this study would not be practical. Hence, any future work may consider utilizing a combination of multiple databases, such as the WoS and Scopus, to enhance comprehensiveness and diverse sets of citations and to reduce the impact of any specific bias.

Second, to complement citation analysis, future studies can incorporate a qualitative approach, such as interviews or focus groups with scholars in the field. This may provide insights into their perceptions, opinions and trends that MPA might not fully capture. Furthermore, comparing the MPA result to expert evaluations or academic rankings might help validate the findings and provide a more robust understanding of research trajectories in the MOOC research field.

Third, future research could explore alternative network analysis techniques or develop innovative methodologies to capture research trajectories’ intricate and evolving nature more accurately. This could include incorporating co-citation analysis, co-word analysis or other measurement techniques in bibliometrics.

Lastly, future research endeavors should embrace a transdisciplinary approach that transcends the confines of the prevailing paradigm. Instead, MOOC researchers should ardently embrace a transdisciplinary approach that navigates the ever-evolving landscape of technology and adapts to learners’ shifting needs and perceptions in our dynamic society. Such exploration will undoubtedly enhance the adoption and effectiveness of this educational approach. As we have previously emphasized, our findings underscore the transformative potential of technology and the imperative to reevaluate conventional frameworks. By exploring and integrating these multifaceted aspects, researchers can better position MOOCs to effectively respond to these shifts, providing a holistic and adaptable educational solution.

References


Changing landscape of MOOC research


(The Appendix follows overleaf)
## Most influential studies in MOOC literature

<table>
<thead>
<tr>
<th>No</th>
<th>Label</th>
<th>Reference</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fini2009</td>
<td>Fini (2009)</td>
<td>The technological dimension of a massive open online course: The case of the cck08 course tools</td>
</tr>
<tr>
<td>2</td>
<td>Bell2011</td>
<td>Bell (2011)</td>
<td>Connectivism: Its place in theory-informed research and innovation in technology-enabled learning</td>
</tr>
<tr>
<td>3</td>
<td>deWaard et al.2011</td>
<td>deWaard et al. (2011)</td>
<td>Using mLearning and MOOCs to understand chaos, emergence, and complexity in education</td>
</tr>
<tr>
<td>5</td>
<td>Hew and Cheung2014</td>
<td>Hew and Cheung (2014)</td>
<td>Students’ and instructors’ use of massive open online courses (MOOCs): Motivations and challenges</td>
</tr>
<tr>
<td>6</td>
<td>Ebben and Murphy2014</td>
<td>Ebben and Murphy (2014)</td>
<td>Unpacking MOOC scholarly discourse: A review of nascent MOOC scholarship</td>
</tr>
<tr>
<td>7</td>
<td>Veletsianos et al.2015</td>
<td>Veletsianos et al. (2015)</td>
<td>Digging deeper into learners’ experiences in MOOCs: Participation in social networks outside of MOOCs, notetaking and contexts surrounding content consumption</td>
</tr>
<tr>
<td>8</td>
<td>Hood et al.2015</td>
<td>Hood et al. (2015)</td>
<td>Context counts: How learners’ contexts influence learning in a MOOC</td>
</tr>
<tr>
<td>12</td>
<td>Shapiro et al.2017</td>
<td>Shapiro et al. (2017)</td>
<td>Understanding the massive open online course (MOOC) student experience: An examination of attitudes, motivations, and barriers</td>
</tr>
<tr>
<td>13</td>
<td>Stich and Reeves2017</td>
<td>Stich and Reeves (2017)</td>
<td>Massive open online courses and underserved students in the United States</td>
</tr>
<tr>
<td>15</td>
<td>Watted and Barak2018</td>
<td>Watted and Barak (2018)</td>
<td>Motivating factors of MOOC completers: Comparing between university-affiliated students and general participants</td>
</tr>
<tr>
<td>16</td>
<td>Zhu et al.2018a</td>
<td>Zhu et al. (2018a)</td>
<td>Instructor experiences designing MOOCs in higher education: Pedagogical, resource, and logistical considerations and challenges</td>
</tr>
<tr>
<td>17</td>
<td>Bonk et al.2018</td>
<td>Bonk et al. (2018)</td>
<td>Pushing toward a more personalized MOOC: Exploring instructor selected activities, resources, and technologies for MOOC design and implementation</td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>No</th>
<th>Label</th>
<th>Reference</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>ZhuBD2020</td>
<td>Zhu et al. (2020)</td>
<td>Self-directed learning in MOOCs: exploring the relationships among motivation, self-monitoring, and self-management</td>
</tr>
<tr>
<td>20</td>
<td>Al-adwan2020</td>
<td>Al-Adwan (2020)</td>
<td>Investigating the drivers and barriers to MOOCs adoption: The perspective of TAM</td>
</tr>
<tr>
<td>21</td>
<td>DengBG2020a</td>
<td>Deng et al. (2020a)</td>
<td>Learner engagement in MOOCs: Scale development and validation</td>
</tr>
<tr>
<td>22</td>
<td>DengBG2020b</td>
<td>Deng et al. (2020b)</td>
<td>Linking learner factors, teaching context, and engagement patterns with MOOC learning outcomes</td>
</tr>
<tr>
<td>23</td>
<td>DengB2021</td>
<td>Deng and Benckendorff (2021)</td>
<td>What are the key themes associated with the positive learning experience in MOOCs? An empirical investigation of learners’ ratings and reviews</td>
</tr>
<tr>
<td>25</td>
<td>MeetKA2022</td>
<td>Meet et al. (2022)</td>
<td>Exploring factors affecting the adoption of MOOC in Generation Z using extended UTAUT2 model</td>
</tr>
<tr>
<td>26</td>
<td>YuXS2022</td>
<td>Yu et al. (2022b)</td>
<td>A meta-analysis of eight factors influencing MOOC-based learning outcomes across the world</td>
</tr>
<tr>
<td>27</td>
<td>KalaC2022</td>
<td>Kala and Chaubey (2022)</td>
<td>Examination of relationships among technology acceptance, student engagement, and perceived learning on tourism-related MOOCs</td>
</tr>
<tr>
<td>28</td>
<td>NiederNSB2022</td>
<td>Nieder et al. (2022)</td>
<td>Massive open online courses for health worker education in low- and middle-income countries: A scoping review</td>
</tr>
<tr>
<td>29</td>
<td>Al-adwanYAAA2022</td>
<td>Al-Adwan et al. (2022)</td>
<td>Novel extension of the UTAUT model to understand continued usage intention of learning management systems: the role of learning tradition</td>
</tr>
<tr>
<td>30</td>
<td>BettiolPM2022</td>
<td>Bettiol et al. (2022)</td>
<td>A perspective of massive open online courses (MOOCs) and public health</td>
</tr>
<tr>
<td>31</td>
<td>RahimiC2022</td>
<td>Rahimi and Cheraghi (2022)</td>
<td>Unifying EFL learners' online self-regulation and online motivational self-system in MOOCs: A structural equation modeling approach</td>
</tr>
<tr>
<td>32</td>
<td>SchettinoC2022</td>
<td>Schettino and Capone (2022)</td>
<td>Learning design strategies in MOOCs for physicians’ training: A scoping review</td>
</tr>
<tr>
<td>33</td>
<td>CaitanoGDBMC.CRV2022</td>
<td>Caitano et al. (2022)</td>
<td>Massive health education through technological mediation: Analyses and impacts on the syphilis epidemic in Brazil</td>
</tr>
<tr>
<td>34</td>
<td>ZaremohzzabiehRMIAA2022</td>
<td>Zaremohzzabieh et al. (2022)</td>
<td>Influencing factors in MOOCs adoption in higher education: A meta-analytic path analysis</td>
</tr>
</tbody>
</table>

Source(s): Authors, 2023

Table A1.
About the authors
Wiwit Ratnasari, is a Ph.D. candidate in the Department of Information Management at the National Taiwan University of Science and Technology. Her research interests include emerging technologies, digital transformation, e-learning, higher education, technology adoption, social media and networking, preservation and conservation, among others. Wiwit’s research has been published in prestigious international peer-reviewed journals such as Educational Technology & Society; Information and Software Technology; Preservation, Digital Technology & Culture and Studies in Conservation.

Tzu-Chuan Chou, Ph.D. is Professor of the Department of Information Management at National Taiwan University of Science and Technology. His research interests include issues surrounding organizational behavior, IT management and knowledge management. His work has appeared in such journals as Decision Support Systems, Information and Management, OMEGA, International Journal Information Management, Journal of Information Science, International Journal of Technology Management, Information Technology & People, IEEE Transactions on Engineering Management, European Journal of Information Systems and International Journal of Physical Distribution & Logistics Management. Tzu-Chuan Chou is the corresponding author and can be contacted at: tchou@mail.ntust.edu.tw

Chen-Hao Huang is Assistant Professor in the Department of Business Administration at National Cheng Kung University (NCKU). His research work sits at the intersection of digital technology and organization, analyzing the changing nature of digital technology and its use in new organizations.