

The Effect of SPOC Hybrid Model on Deep Learning Effectiveness: A Systematic Literature Review

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The hybrid model of SPOC (Small Private Online Course) may have an impact on the effectiveness of deep learning. Nevertheless, few studies have validated the relationship between SPOC and deep learning effectiveness. This systematic review focuses on exploring the impact of the blended model of SPOC on deep learning effectiveness. The article delves into the three major SPOC categories in deep learning and the effects of deep learning in SPOC mode. In addition, the article explores various factors that influence the effectiveness of SPOC on deep learning. To accomplish this, an exhaustive review of the relevant literature was conducted to reveal potential connections and interactions between the SPOC blended model and deep learning effectiveness. This study provides educators and researchers with insights on how to more effectively combine SPOC and deep learning to optimize teaching and learning experiences.

Keyword: education, deep learning, SPOC model, MOOC teaching, effectiveness, impact

INTRODUCTION

Deep learning originated in psychology (Perrotta & Selwyn, 2020). Marton et al. first introduced the concept of deep learning in 1976 in the article Qualitative Differences in Learning: I-Outcome and Process. In the late 1970s, the concept of deep learning was formally established and introduced into the field of education (Gasparett et al. the field of education (Gasparett et al., 2018). With the rise of artificial intelligence, deep learning became an essential model for machine learning (Aggarwal et al., 2022). As a result, the field of education is paying more and more attention to the study of deep learning (Khan & Yairi, 2018).

In 2005, the Association for Educational Communications Technology (AEC&T) redefined “educational technology.” “Educational technology is the study of facilitating learning performance by creating, using, and managing appropriate technology and learning resources.” The “learning” in this definition is deep learning, where “students relate existing ideas to prior knowledge and reflect on their original understanding.” Shallow learning is “memorizing facts, processing material as unrelated pieces of

information, and the execution of routine procedures without thought or strategy” (Chin & Brown, 2000). Because deep learning has dramatically improved scholars’ efficiency and learning initiative (Li, 2021), deep learning has become an essential banner for educational reforms currently being implemented in various countries (Levine & Kawashima-Ginsberg, 2015).

In today’s educational information technology, an effective way to promote deep learning is the support of online technologies and platforms (Dede, 2014). Innovative technology-based teaching and learning models can be used as pedagogical strategies and pathways to achieve deep learning (Dede, 2014). SPOC is a deep integration of information technology and the classroom as a teaching and learning model that provides a strong impetus for current deep learning practices (Zhang, 2021).

In 2013, Fox first introduced the SPOC (Small Private Online Course), which operates on the model of students learning through videos or materials in class and discussing and communicating with the instructor and classmates in class (Fox, 2013). Fox in From MOOCs to SPOC, Fox uses Cal Poly as a pilot: students must be committed to time and intensity, participate in online discussions, and complete required assignments and exams. Those who pass will receive a certificate of course completion. Unsuccessful applicants can participate in the course by auditing but cannot interact with the teaching team or receive a certificate.

Compared to traditional MOOC. SPOC has characteristics such as small scale and barriers to entry and is a combination of online and classroom instruction (Kaplan, 2017). Moreover, since SPOC is a course format, researchers focus on using SPOC flexibly to practice educational concepts or to theoretically populate the SPOC framework, making SPOC closely integrated with deep learning (Filius et al., 2018). However, fewer studies have focused on exploring the deep learning effects of SPOC, which makes the relationship between SPOC and deep learning lack of theoretical summary and argument, and lack of theoretical foundation and theoretical perspective, which will undoubtedly hinder the full play of SPOC educational nature and limit the practical direction of SPOC in the field of deep learning. Therefore, this paper focuses on exploring the specific use of SPOC in deep learning, the effect of deep learning under the SPOC model, and the factors influencing the effect of SPOC on deep learning to provide a theoretical basis for practitioners who practice the concept of deep learning with the help of the SPOC model.

SPOC mostly comes in the form of courses that combine online and classroom education, freeing the classroom from the traditional function of imparting basic knowledge and elevating the classroom to conduct advanced cognitive processes (Zhenget al., 2018). However, due to the lack of evidence that SPOC affects the effectiveness of deep learning, practitioners are prone to ignore that SPOC may be applied to facilitate deep learning when practicing the SPOC model in deep learning. Most researchers have briefly treated SPOC as a curricular tool for deep learning. Therefore, this study is dedicated to combing the literature related to the impact of SPOC model on deep learning, exploring the application of SPOC in deep learning, the effect of deep learning in SPOC model, and the factors that influence the effect of SPOC on deep learning, to clarify the application of SPOC in deep learning, the effect of SPOC on the effect of deep learning, the mechanism that produces the effect, and the mechanism that leverages the feasibility of deep learning with SPOC.

RESEARCH METHODOLOGY

Search Strategy

The electronic databases used in this paper are mainly Scopus and Web of Science. The indexing terms were set to “SPOC” and “deep learning,” and searches were conducted for five years of literature from McKenzie et al.’s PRISMA 2020 Statement: Updated Reporting System Review Guidelines. These searches were completed on February 3, 2023.

Study Screening

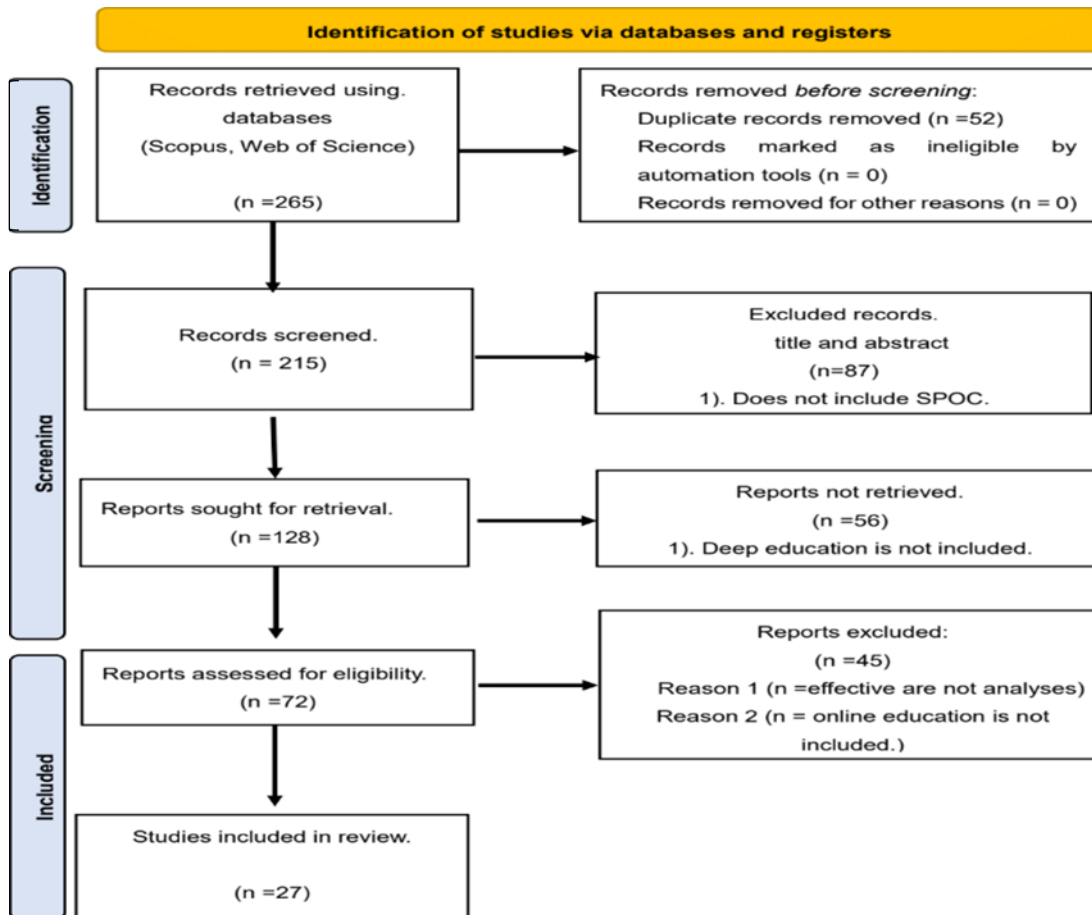
First, these articles are original research and do not involve the secondary review of potential study categories. All studies had to include original data to synthesize the reviewed information accurately. Second, all articles were required to include SPOC with deep learning. Articles only addressed SPOC with

deep learning algorithms. SPOC or deep learning that appeared in other scenarios, such as the relationship between SPOC and MOOC or the conceptual evolution of deep learning, were excluded because they were not relevant to the topic of this article. The first screening required all articles from within the five years 2018-2023, including SPOC, and deep learning. The articles were screened under these restrictions and further screened for two additional metrics. In the second screening, articles were excluded if they did not have significant impact relationship factors, even if they mentioned SPOC and deep learning. They were within the appropriate scenario, as the study focused on impact factor analysis. Finally, full-text screening included a complete reading of the articles to determine the relevance of their findings. All records with insufficient information or data that did not provide relevant or citable information were excluded.

TABLE 1
THE SEARCH STRINGS

Database	Search string
Scopus	(TITLE-ABS-KEY (online AND learning)) AND (SPOC) AND (Deep Learning) (LIMIT-TO (PUBYEAR , 2023) OR LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017)) AND (LIMIT-TO (PUBSTAGE , “final”)) AND (LIMIT-TO (DOCTYPE , “ar”)) AND (LIMIT-TO (SUBJAREA , “SOCI”)) AND (LIMIT-TO (LANGUAGE , “English”))
Web of Science	Results for ((TS= (SPOC) AND Deep Learning)) AND TS=(Online) and Article or Review Article (Document Types) and English (Languages)

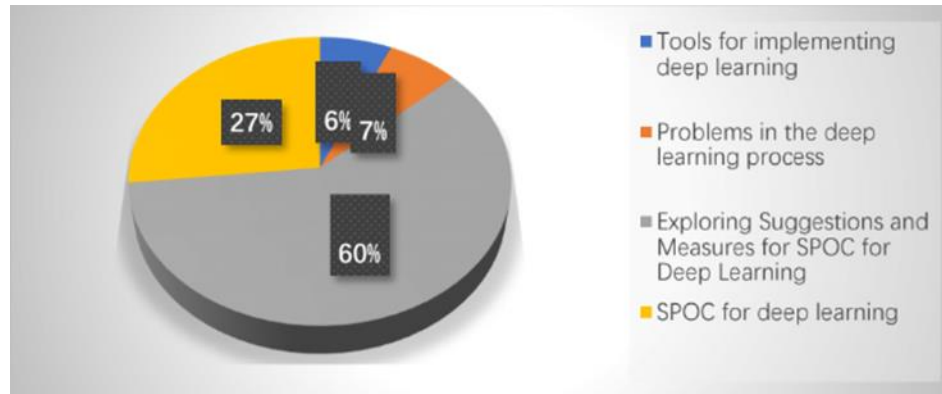
**FIGURE 1
PRISMA FLOW DIAGRAM**



Item of Data Source

Among the 27 papers screened since 2018-2023, 2 articles considered SPOC as a curricular tool that can enable deep learning, exploring the difficulties and crises encountered by SPOC in deep learning practice, but without giving specific recommendations (Filius et al., 2018; Dong & Zeng, 2020); 18 papers focused on exploring 18 articles focus on exploring suggestions and measures for SPOC to facilitate deep learning (Filius et al., 2018; Filius et al., 2018; An & Qu, 2021; Yang et al., 2019; Filius, 2019; Chen & Chen, 2019; Li et al., 2023; Liu, 2020; Filius & Uijl, 2021; Gan et al. al., 2022), such as the development of SPOC courses (An & Qu, 2021), or enhancing learning through peer feedback (Filius et al., 2018); eight papers focused on examining the role and effectiveness of SPOC for deep learning (Bin & Ahmad, 2022; Kang & He, 2018; Zhang et al., 2019; Ning et al., 2021; Chen et al., 2021; Ma, 2021; Shang, 2022). Moreover, most studies conducted on SPOC and deep learning are empirical. Among them, interview method (Filius et al., 2018; Filius et al., 2018; Ma, 2021; Hadad et al., 2021); questionnaire analysis (Filius et al., 2018; Gan & Zhang, 2020); (Filius et al., 2018; Bin & Ahmad, 2022; Zhang et al., 2019; Li et al., 2023; Ning et al., 2021), experimental method (Yang et al., 2020), and case method (Zhang, 2021; Kang & He, 2018; Dong & Zeng, 2020) as the primary research methods.

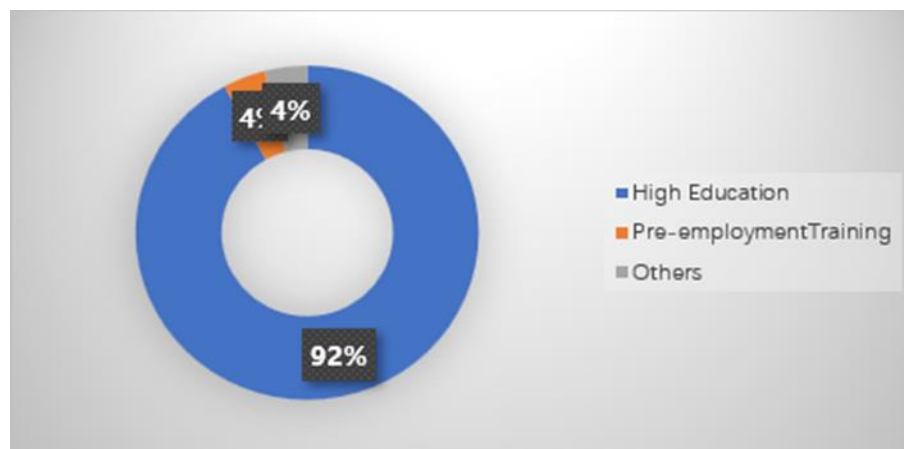
FIGURE 2
ITEM OF PUBLISHED ARTICLES



As shown in the figure, research on SPOC and deep learning has focused on aspects such as exploring measures of the effectiveness of SPOC in facilitating deep learning (Filius et al., 2018; Yang et al., 2020; Zhang, 2021; Gan & Zhang, 2020), with a preference for practice-based research (Dong et al., 2019; Filius, 2019). However, it is essential to note that such studies mainly focus on specific modality initiatives (Gan et al., 2019) and neglect to argue that SPOC can facilitate deep learning (Agrebi, 2019). In other words, such studies have taken SPOC can enable deep learning as a research premise (Filius et al., 2018) or treated deep learning as a guiding theory for the SPOC model (Yang et al., 2020) without systematically arguing the relationship.

In addition, research has focused on addressing the difficulties and challenges encountered by SPOC in implementing deep learning (Filius et al., 2018). Researchers have keenly noted that there is no fixed upward trend between SPOC and deep learning (Dong & Zeng, 2020), but rather it is influenced by multiple factors (Dong et al., 2019). Therefore, such studies analyze factors such as learning activities, teaching strategies, and teacher-student interactions (Filius et al., 2018) to suggest challenges and considerations for SPOC in achieving deep learning (Dong & Zeng, 2020). Besides, some researchers focus on exploring the role and effectiveness of SPOC for deep understanding. Such studies are primarily based on specific course practices (Kang & He, 2018), and regression analysis (Bin & Ahmad, 2022), case studies (Kang & He, 2018), and empirical studies (Ma, 2021) are used to compare learners' performance or status before and after using the SPOC model, as a way to clarify the effect of SPOC on the effectiveness of deep learning.

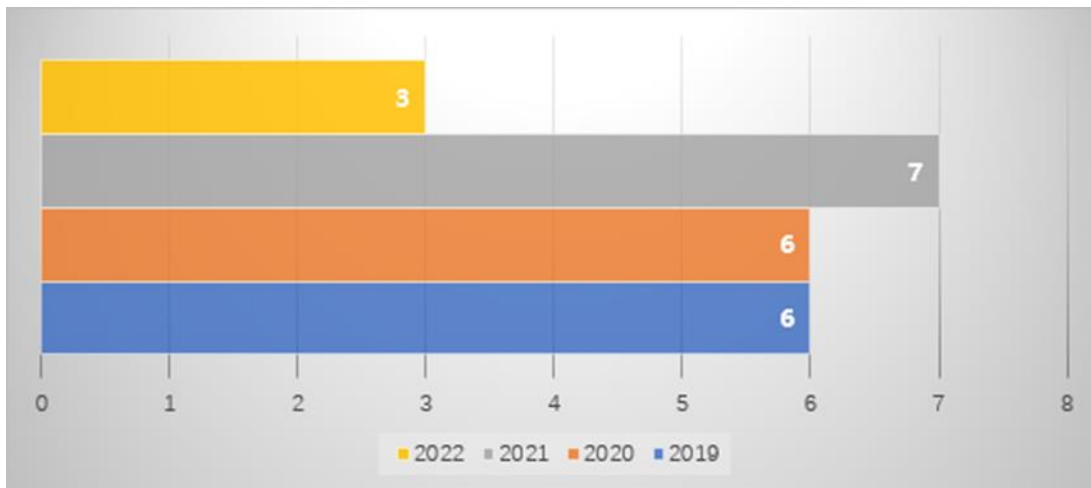
FIGURE 3
EDUCATION LEVEL



Population

In SPOC and deep learning studies, the age and gender of the study participants are not strictly limited but show specific range characteristics. Of the 27 papers, 23 were positioned in higher education (Filius et al., 2018; Filius et al., 2018; Filius et al., 2018; An & Qu, 2021; Yang et al., 2020; Bin & Ahmad, 2022; Zhang, 2021; Kang & He, 2018; Gan & Zhang, 2020; Dong & Zeng, 2020; Xianyu & Hu, 2020; Zhang et al., 2019; Chen & Chen, 2019; Li et al., 2023; Liu, 2020; Filius & Uijl, 2021; Chen et al., 2021; Gan et al., 2019; Xiao, 2020; Yue & Jiqiong, 2020; lAgrebi, 2019; Fang et al., 2022), and 21 studies from China (An & Qu, 2021; Yang et al., 2020; Zhang, 2021; Kang & He, 2018; Gan & Uijl, 2021; Gan et al., He, 2018; Gan & Zhang, 2020; Dong & Zeng, 2020; Xianyu & Hu, 2020; Dong et al., 2020; Chen et al., 2021; Ma, 2021; Gan et al., 2019; Xiao, 2020; Yue & Jiqiong, 2020; Agrebi, 2019; Fang et al., 2022; Shang, 2022). Only some studies have focused on students in other academic segments (Ning et al., 2021) or pre-service training (Ma, 2021). SPOC and deep learning have been applied in higher education in recent years, an important direction to cultivate students' comprehensive quality in higher education. Moreover, China has paid more attention to SPOC and deep learning research recently. It should be noted that the range of characteristics of such studies in terms of population is related to the use of educational technology at different levels of education, as well as the pedagogical objectives and teaching methods developed by other groups.

FIGURE 4
TIME DISTRIBUTION



Time Distribution

The year interval of literature covered in this paper is 2018-2023, and since 2023 is not over, the literature needs to be completed and have research value. Therefore, this section will analyze the relevant literature from 2018-2022 to explore the research themes focused on different years from the time dimension to sort out the pulse of SPOC and deep learning research. Among them, four papers were covered in 2018. The topics covered are challenges faced by SPOC in implementing deep learning (Filius et al., 2018), facilitating deep learning by adapting factors in SPOC (Filius et al., 2018; Filius et al., 2018), SPOC model for deep learning (Kang & He, 2018).

Six articles in 2019 on the topics of factors that SPOC influences deep learning (Dong et al., 2019; Filius, 2019; Chen & Chen, 2019; Gan et al., 2019; Agrebi, 2019); SPOC on deep learning by (Zhang et al., 2019).

Six articles in 2020, covering topics such as the application of SPOC in different courses and the effect of deep learning (Yang et al., 2020; Xianyu & Hu, 2020; Xiao, 2020; Yue & Jiqiong, 2020), SPOC in

practice to promote deep challenges of deep learning in practice (Dong & Zeng, 2020), factors of SPOC to facilitate deep learning (Liu, 2020).

Seven articles in 2021 on the topics of applying deep learning models to SPOC classrooms (An & Qu 2021; Zhang, 2021), strategies of SPOC to facilitate deep learning (Gan & Zhang, 2020; Ning et al., 2021; Filius & Uijl, 2021; Chen et al., 2021; Ma, 2021); and three articles in 2022, covering topics such as the application of SPOC models in different courses and the effects of deep learning (Bin & Ahmad, 2022; Fang et al., 2022), SPOC to promote deep learning (Shang, 2022).

It can be found that the number of related literature in 2018 is small, and the research theme is mainly focused on exploring the relationship and influencing factors between SPOC and deep learning. 2019 has more literature, and the research theme is focused on analyzing the factors that SPOC influences on deep understanding and proposes to combine SPOC with other models. 2020 has a steady development, and the research theme is focused on applying SPOC in practice and involves studying influencing factors. The number of research papers increased in 2021, and the research topics were the application of deep learning theory to SPOC classrooms and the strategies of SPOC to promote deep learning. 2022 saw a drop in research, and the research areas focused on applying SPOC in practice and its impact on deep understanding. It can be seen that the research on the effect of SPOC on deep learning is a gradual process, from the exploration of theory to the analysis of practice. Still, the research is always practice-oriented, and the study of the impact factors of SPOC on deep learning is carried out throughout.

SPOC MODEL IN DEEP LEARNING

Application Status

SPOC is a form of curriculum (Filius et al., 2018), and deep learning is both a state of learning (Filius et al., 2018) as well as an educational theory (Liu, 2020). Therefore, the relationship between SPOC and deep learning needs to be defined by the researcher according to the research context. If the researcher treats deep learning as an ideal state of learning, then SPOC is a feasible way to facilitate deep learning (Filius et al., 2018); if the researcher treats deep learning as an educational theory, then SPOC is a classroom model that operates under the guidance of deep learning (An & Qu, 2021). In other words, the researcher's definition of deep learning directly reflects the researcher's research intention and determines the role and position of the SPOC model in the study.

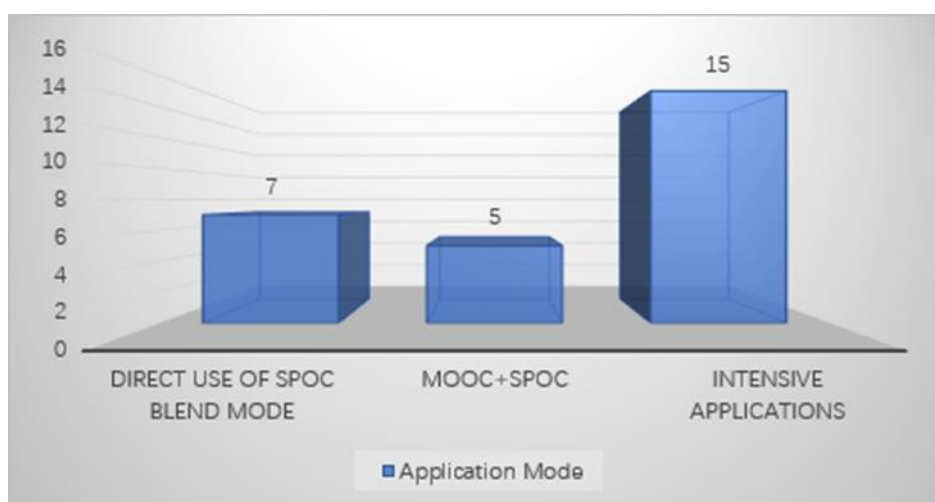
Of the 27 relevant papers, 16 papers treat deep learning as a learning state, focusing on exploring how this desired learning state can be achieved or enhanced through SPOC (Filius et al., 2018; Filius et al., 2018; Filius et al., 2018; Yang et al., 2020; Kang & He, 2018; Dong & Zeng, 2020; Xianyu & Hu, 2020; Zhang et al., 2019; Filius, 2019; Chen & Chen, 2019; Li et al., 2023; Filius & Uijl, 2021; Chen et al., 2021; Yue & Jiqiong, 2020; Shang, 2022). 11 papers deal with deep learning as an educational theory to explore the application of SPOC guided by deep learning theory and the final results that this application can achieve (An & Qu, 2021; Bin & Ahmad, 2022; Zhang, 2021; Gan & Zhang, 2020; Dong et al., 2019; Ning et al., 2021; Liu, 2020; Gan et al., 2019; Xiao, 2020; Agrebi, 2019; Fang et al., 2022). In the relationship between SPOC and deep learning, SPOC has instrumental properties: both the achievement of deep learning states and the implementation of deep learning theories point to the proper use of SPOC (Zhang, 2021; Xianyu & Hu, 2020; Agrebi, 2019). This finding corroborates the ability of SPOC to influence the effectiveness of deep learning. It is important to note that SPOC practice guided by deep learning theory is independent of the goal of deep learning because the ideal state to which deep learning models in education ultimately point is deep learning itself. Therefore, such research is within the scope of this paper.

Application Modes

The application modes of SPOC in deep learning are divided into three types: direct application, combined application, and enhanced application. Among them, the direct application refers to the direct use of the SPOC hybrid model in teaching practice with the adaptation of the unSPOC model (Filius et al., 2018), and seven of the 27 research papers adopted the direct application model (Filius et al., 2018; Kang & He, 2018; Dong & Zeng, 2020; Dong et al., 2019; Ma, 2021; Shang, 2022). Combined application refers

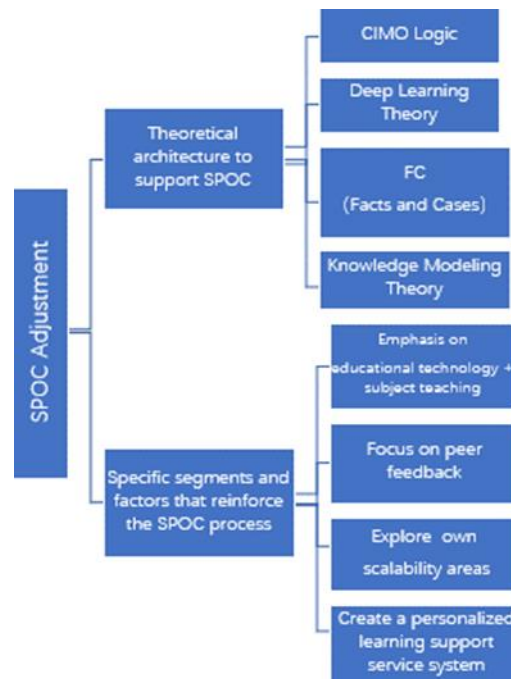
to combining SPOC with other course formats in teaching practice, such as adopting the “MOOC+SPOC” model to promote students’ in-depth learning (9). Zhang, 2020; Xiao, 2020; Yue & Jiqiong, 2020). Reinforcement application, on the other hand, refers to the appropriate adaptation of the SPOC to reinforce factors that promote deeper learning (Bin & Ahmad, 2022), such as developing recommendations for the implementation of the SPOC based on CIMO logic (Filius et al., 2018); or the design of a factor of the SPOC (Zhang, 2021), such as enhancing peer feedback (Filius et al., 2018), as a way to enhance the effectiveness of SPOC for deep learning. Fifteen papers chose the model of reinforcement application (Filius et al., 2018; Filius et al., 2018; Bin & Ahmad, 2022; Zhang, 2021; Xianyu & Hu, 2020; Filius, 2019; Chen & Chen, 2019; Li et al., 2023; Ning et al., 2021; Liu, 2020; Filius & Uijl, 2021; Chen et al., 2021; Gan et al., 2019; Agrebi, 2019; Fang et al., 2022). In using SPOC to achieve or enhance deep learning goals, researchers have focused on designing and adapting SPOC to meet the requirements of deep learning.

FIGURE 5
APPLICATION MODE



Among the adaptations made to SPOC are the use of theoretical architectures to design the mechanisms of SPOC (Filius et al., 2018), such as CIMO logic (Filius et al., 2018), deep learning theory (Bin & Ahmad, 2022; Zhang, 2021; Xianyu & Hu, 2020; Liu, 2020; Fang et al., 2022), FC (Facts and Cases) knowledge modeling theory (Liu, 2020); strengthening specific aspects or specific factors in SPOC, such as focusing on peer feedback (Filius et al., 2018; Filius, 2019), emphasizing educational technology subject teaching (Chen & Chen, 2019), creating personalized learning support service systems (Li et al., 2023; Agrebi, 2019), and exploring their scalable area (Scalable area) (Filius & Uijl, 2021; Chen et al., 2021).

FIGURE 6
DESIGNING OF SPOC USING THEORETICAL ARCHITECTURE



Effectiveness of Deep Learning in the SPOC Model

In the relevant literature, the effectiveness of deep learning in SPOC has been measured in the following types of ways: interview studies (Filius et al., 2018, Filius et al., 2018; Ma, 2021), questionnaires (Filius et al., 2018), graded classification assessments (An & Qu, 2021), experimental controls (Yang et al., 2020; Zhang et al., 2019), regression analysis (Bin & Ahmad, 2022), principal component analysis (Li et al., 2023), case study analysis (Zhang, 2021; Gan & Zhang, 2020; Dong & Zeng, 2020; Xianyu & Hu, 2020. Dong et al., 2019; Filius, 2019; Chen & Chen, 2019; Liu, 2020; Filius & Uijl, 2021; Chen et al., 2021; Xiao, 2020; Fang et al., 2022).

Most of the measurements of the effects of deep learning are of three types: case studies and interview surveys. Among them, the studies that chose to use case studies as the measurement method mainly were the development of SPOC courses, such as the teaching model of SPOC from the perspective of deep learning (Zhang, 2021), the use of SPOC in teaching American literature courses (Xianyu & Hu, 2020), and the practice of college English SPOC courses (Liu, 2020), from a holistic perspective, The impact of SPOC courses on the effect of in-depth learning was analyzed and demonstrated. The studies that chose to use interview surveys as the measurement method placed more emphasis on learners' subjective perceptions (Ma, 2021) and mainly examined the difficulties encountered and the measures taken by SPOC in deep learning (Filius et al., 2018; Filius et al., 2018). As can be seen, traditional case studies continue dominating research on the SPOC model and deep learning effects. When examining the effect of deep learning, researchers pay more attention to the learners' learning effects. However, it should be noted that the dimensional division of deep learning still needs to be clarified, so the dimensional criteria used in other literature are different. Comparing and integrating each piece of literature in the cross-sectional dimension is challenging.

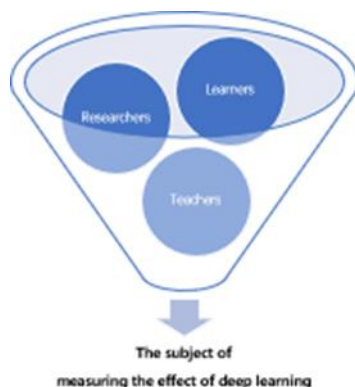
The Subject of Measuring the Effect of Deep Learning

The main subjects involved in measuring the effectiveness of deep learning in the SPOC model are learners (Filius et al., 2018; An & Qu, 2021; Yang et al., 2020; Bin & Ahmad, 2022; Dong et al., 2019; Zhang et al., 2019; Filius, 2019; Li et al., 2023; Ning et al., 2021; Ma, 2021; Agrebi, 2019), teachers (Filius

et al., 2018; Filius et al., 2018; Dong & Zeng, 2020), and researchers (Zhang, 2021; Kang & He. 2018; Gan & Zhang, 2020; Xianyu & Hu, 2020; Liu, 2020; Filius & Uijl, 2021; Chen et al., 2021; Gan et al., 2019 Xiao, 2020; Yue & Jiqiong, 2020; Fang et al., 2022. Shang, 2022).

A large amount of literature involves the researcher himself because this kind of literature is mostly case studies, where the researcher is the case developer, implementer, and participant and is always present in the study (Shang, 2022). Moreover, this kind of literature is primarily practical research, which is a theoretical summary of the researcher's practical experience (Fang et al., 2022), so the researcher must be an essential subject to measure the effect of deep learning. In addition, the division between learner, teacher, and researcher subjects does not represent a division. All three can coexist in a single study (Filius, 2019), and the measurement of learner learning is always an essential basis for evaluating the effectiveness of deep learning, and the observations, analyses, and evaluations conducted by teachers and researchers always fall on the learners (Dong & Zeng, 2020).

FIGURE 7
THE SUBJECT OF MEASURING THE EFFECT OF DEEP LEARNING



Results of Measuring the Effect of Deep Learning

Because of the plasticity and flexibility of the SPOC hybrid model, teachers can make more precise edits to the primary curriculum structure according to their needs (Filius et al., 2018), such as creating SPOC-STAD cooperative learning (Yang et al., 2020), increasing the weight of peer feedback in SPOC (Filius, 2019), and creating new teaching and evaluation models (Chen & Chen, 2019).

Thus, the SPOC in practice has been designed, which makes the deep learning in the SPOC hybrid model more effective. However, it is essential to note that these findings are derived from the SPOC in practice designed by the researcher and are more like validation. The results are closely related to the researcher's design. Not all elements in SPOC are beneficial for deep learning. For example, SPOC instructors have argued that SPOC has challenges in facilitating deep learning and requires discretion and control over factors such as learning activities, students' needs, and teaching strategies (Filius et al., 2018). Moreover, the measurement of the effectiveness of deep learning in SPOC in 27 papers was done from a holistic perspective; in other words, the researchers measured the overall performance of learners under the guidance of the SPOC blended model and rarely retrieved the possible drawbacks of the SPOC from its different dimensions, which measures the effectiveness of deep learning limited.

As a whole, 27 papers show that the SPOC blended model can have an impact on deep learning effectiveness (Bin & Ahmad, 2022), that SPOC provides a suitable course format for driving deep learning for learners (Filius et al., 2018), enables the power of learner peer feedback (Filius et al., 2018), allows teachers to hold a high degree of freedom in their practice (Chen et al., 2021), enabling personalized learning system customization (Agrebi, 2019). Moreover, the SPOC teaching approach has a broader range of content than traditional teaching models (Yue & Jiqiong, 2020), promotes more vital student interest in learning (Agrebi, 2019), and provides better teacher-student interaction (Xiao, 2020). In addition, the SPOC teaching model improves students' independent learning ability (Liu, 2020), addresses the shortcomings of

traditional classroom teaching (Kang & He, 2018), and promotes the deep application of information technology in classroom teaching (Zhang, 2021). However, the specific measurement of the impact of SPOC on the effect of deep learning needs to be determined according to the practice of SPOC (Filius et al., 2018) and cannot be generalized.

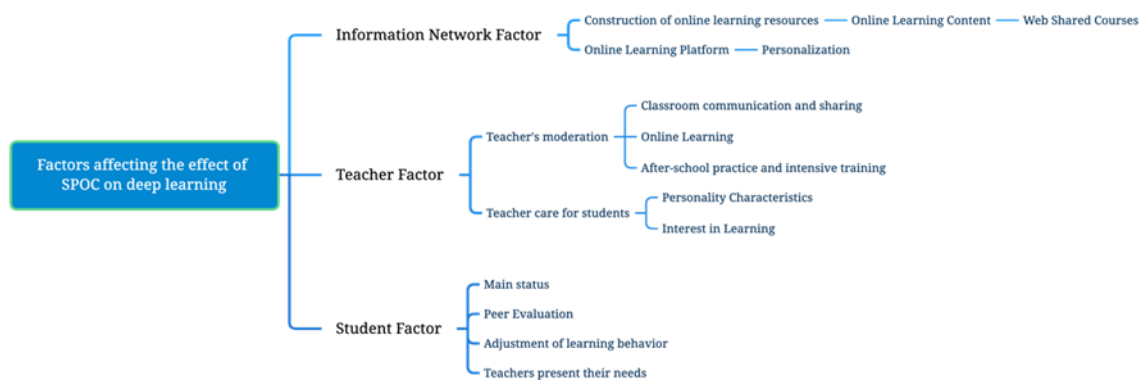
Factor Affecting the Effect of SPOC on Deep Learning

The factors that influence the effect of SPOC on deep learning are mainly the information network factor, the teacher factor, and the student factor. The influence of the information network level on deep learning mainly comes from the construction of online learning resources (An & Qu, 2021), i.e., online learning content (Xianyu & Hu, 2020) and online learning platforms (Zhang, 2021). Currently, the construction of online learning content is mostly online shared courses (Shang, 2022), while the construction of online learning platforms has a trend of personalization (Agrebi, 2019).

The influence of teacher factors on deep learning comes from teachers shaping the specific implementation model of SPOC (Dong et al., 2019). the use of SPOC involves online learning (Kang & He, 2018), classroom communication and sharing (Bin & Ahmad, 2022), and post-class practice and reinforcement (Yang et al., 2020), which all need to be moderated by teachers. In addition, teachers need to screen online resources (Filius & Uijl, 2021) to provide students with quality learning content and platforms (Agrebi, 2019). In this process, teachers must also consider students' needs (Filius et al., 2018), personality traits (Filius et al., 2018), and learning interests to create appropriate SPOC courses that facilitate students' deep learning.

The influence of student factors on deep learning comes from the fact that students are the subjects of learning, and the SPOC's unleashing of classroom potential highlights the students' subjectivity even more (An & Qu, 2021). Therefore, students need to be engaged in the SPOC to explore deeply, understand their learning process and peer assessment (Filius et al., 2018), and make timely adjustments to their learning behaviors based on feedback (Filius et al., 2018). In addition, students and teachers should maintain adequate communication and promptly present their needs to teachers (Filius et al., 2018), making SPOC more perfect in teacher-student interaction to promote their deep learning.

FIGURE 8
FACTOR AFFECTING THE EFFECT OF SPOC ON DEEP LEARNING



Presented with xmind

CONCLUSION

SPOC teaching mode is currently one of the more popular teaching methods, which can make up for the shortcomings of traditional MOOC and combine the advantages of MOOC teaching organically while paying attention to the ability level of different learners, ensuring the efficiency of a small number of

learners, etc. However, it is difficult to grasp the learning situation of online students. The SPOC-based blended teaching mode is divided into online and offline. Most online teaching relies on students' independent learning, and offline teaching relies on teachers' answering and solving students' questions.

In the SPOC-based blended learning model, independent online learning takes up about half of the teaching time. Since the teacher is not directly involved in online teaching, students must do it independently. The teacher can only analyze whether they are really and earnestly involved in learning through completing assigned tasks and occasional tests on students. However, due to the advanced Internet technology, students can easily search for answers on the Internet. Therefore, the actual situation of students' independent learning during online teaching needs to be further grasped. For example, whether the tasks assigned by teachers are completed by students themselves or by students using online resources to search for answers cannot be accurately obtained and can only be verified from students' homework and test scores, which is undoubtedly a significant shortcoming.

Moreover, the importance of online teaching has been highlighted under the influence of lifelong education, which also brings a good opportunity for the development of SPOC-based blended teaching mode. With the rapid development of information technology, more novel and effective teaching methods will be derived in the future. Still, the teaching mode is not unchanging, and its research is a process of continuous exploration and practical improvement.

LIMITATIONS

Because the literature review is limited to specific databases, the review does not include information on surveys and other studies of other primary and secondary databases. This narrows the scope of information that can be analyzed in the study to the largest and most valuable databases but may overlook potentially helpful data. The breadth of research and the number of databases will be increased in future studies. For future research, related studies lacked a psychological level of resource setting for interventions so that future research may encompass psychological resources into intervention strategies for dyslexia. In addition, as the indoctrination function of online education is being explored, the forms and scope of online education will continue to increase, and how to effectively respond to the changes in online teaching and provide practical help for people with dyslexia is also an issue that needs to be explored in future research.

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