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An Empirical Study of Factors Influencing Deep Learning Among Vocational College English Learners Based on SPOC

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Abstract. This study aims to investigate the factors influencing deep learning among vocational college English learners based on Small Private Online Course. Conducted at a Higher Vocational College in Guangdong Province, China, the study focuses on first-year English as a Foreign Language learners. Employing a questionnaire survey method, the research delves into various factors affecting students' deep learning through data collection and analysis. Both overarching and stage-specific influencing factors on deep learning frequency are examined. The findings indicate that factors such as learning motivation, English learning tasks, effective face-to-face instruction, and online learning significantly impact students' deep learning. This study provides valuable insights for proposing strategies to promote deep learning among English learners in HVCs.

Keywords. SPOC, EFL, Higher vocational college, Deep learning, Influencing factors

1. Introduction

With the rise of information technology and the Internet's widespread use, online-based educational models are significantly transforming conventional teaching and learning environments [1]. Within this shift, the Small Private Online Course (SPOC)-based deep learning mode has garnered significant attention. This approach immerses students in a flexible learning setting, enhancing their knowledge acquisition, problem-solving skills, and self-directed learning by merging online resources with personal guidance [2-3]. SPOC-based deep learning encourages learners to engage meaningfully in learning, integrating new and existing knowledge, fostering innovation, and serving as a key indicator of a course's success [4].

In Higher Vocational Colleges (HVCs), especially in English education, the SPOC deep learning model is extensively adopted to bolster students' English proficiency and

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overall abilities. However, despite its numerous benefits, there are challenges associated with student acceptance of this model. Past research has predominantly focused on the technical implementation and teaching effectiveness of the SPOC model, while relatively few studies have examined students' deep learning behaviors and the factors influencing them within this mode. Our study aims to bridge this gap by delving into the factors that affect deep learning among English learners in HVCs using the SPOC model.

Furthermore, there are concerns that technology-driven fragmented learning might promote shallow learning, leaning towards mechanical acceptance and passive task completion [3]. Merely mastering surface-level knowledge is insufficient to meet the demands of future workspaces, highlighting the importance of deep learning in cultivating contemporary talents and ensuring the sustainability of blended teaching methodologies.

To address these concerns and explore the factors influencing deep learning in the SPOC context, our study employs a questionnaire specifically designed for English as a Foreign Language (EFL) learners in HVCs. The objective is to investigate the frequency and impact of various factors that affect deep learning in the SPOC mode. Through this exploration, we aim to inform and refine strategies that can promote richer and deeper learning experiences for students in this educational setting.

2. Literature review

Deep learning is an effective learning approach aimed at enhancing higher-order abilities such as critical thinking and problem-solving, with the goal of improving the quality of students' learning [5]. From the perspective of learning characteristics, deep learning differs significantly from shallow learning. It emphasizes critical understanding, the importance of information integration, knowledge construction, knowledge transfer and application, problem-solving methods, and a proactive pursuit of lifelong learning [6].

Scholars have conducted research on the factors influencing deep learning from various perspectives. Wu and Gao et al. employed quantitative research methods to delineate the specific influencing factors and effects of deep learning in offline teaching environments from three dimensions: behavior, environment, and individual [7,8]. Ai et al. used literature review methods to discover the diverse factors affecting effective teaching in SPOC, primarily including learners, instructors, course resources, course environment, and teaching interaction across five dimensions [9]. Yin conducted a quantitative research study on factors influencing SPOC deep learning among vocational undergraduates, revealing that learning motivation, comprehensive tasks, effective face-to-face learning, and online learning are the main influencing factors [10]. Li et al. conducted a quantitative research study on the factors influencing deep learning in a flipped classroom environment among undergraduate computer science students, using descriptive analysis and linear regression analysis methods, finding that the main influencing factors include communication, knowledge processing level, and reflective evaluation level [11].

Although there is a solid foundation of research on educational technology-supported deep learning, gaps remain in the study of deep learning within blended teaching contexts. Primarily, deep learning has been approached from educational and learning science perspectives, with limited exploration of the deep

learning status and influencing factors specific to the SPOC blended mode. Secondly, previous studies have focused primarily on undergraduate deep learning, neglecting the frequency of these influencing factors. Given the increasing popularity of the SPOC model and the significance of deep learning, this study targets first-year EFL learners in Guangdong HVCs. Our aim is to explore the frequency of factors that affect deep learning in the SPOC mode, providing valuable insights for future strategic proposals.

To further enhance our understanding, it's crucial to incorporate theories or models that can offer a comprehensive framework for analyzing deep learning in the SPOC context. For instance, the Community of Inquiry (COI) framework, proposed by Garrison et al., could serve as a valuable lens for examining the interaction between cognitive, social, and teaching presence in online and blended learning environments [12]. By integrating such frameworks, we can gain a more nuanced understanding of the factors influencing deep learning and how they interact within the SPOC model.

3. Research method

3.1. Research participants

This study focuses on first-year EFL learners at a HVC in Guangdong Province, China. We've chosen two primary groups for our research: current first-year students enrolled in English courses at the vocational college, majoring in both humanities and sciences, and those who have previously taken SPOC-based English courses at the same institution. For the former, we randomly selected four classes with a total of 189 students using convenience sampling, aiming to understand their learning experiences and needs in a traditional teaching setting. For the latter, we surveyed 142 students from three classes who have experienced SPOC-based learning, exploring their experiences and growth in this deep learning mode. To ensure our findings are widely applicable, we've maintained a balance between humanities and sciences majors in our sample. This approach enables us to gather rich and comprehensive data, laying a solid groundwork for an in-depth exploration of EFL learners' experiences and needs in HVCs across various learning environments.

3.2. Questionnaire design and distribution

Based on the analysis of the connotation and mode of deep learning in SPOC, and the evaluation indicators of influencing factors of deep learning in SPOC, we conducted a survey on the influencing factors of deep learning in SPOC using the questionnaire developed by Gao et al. titled Questionnaire on Influencing Factors of Deep Learning in Vocational College SPOC [8]. Based on Gao's research findings, this study identified six first-level indicators that affect SPOC deep learning in HVCs, including learners learning situation, online learning, offline learning, practical innovation, learning community, and environmental and technological environment. The construction of second-level indicators mainly refers to the "indicators of blended learning performance evaluation at all levels" constructed by Liu et al. [13]. The survey targeted students from HVCs who had participated in the aforementioned SPOC Deep Learning Mode study. The questionnaire covers six dimensions: learner factors, online shallow learning factors, offline deep learning factors, practical innovation factors, learning community factors, and humanistic and technological environment factors. The

construction of secondary indicators referenced the Performance Evaluation Framework and Indicator System of Blended Learning by Liu et al. [13], resulting in a total of 21 secondary indicators. After the approval provided by the Institutional Review Board, we then conducted the questionnaire. The pre-test of this questionnaire was conducted among first-year students; however, this dataset was not utilized in the actual survey. A total of 92 questionnaires were collected, of which 84 were complete (with an effective recovery rate of 91.3%). The overall α coefficient of the scale was 0.807, with coefficients for each dimension ranging from 0.7 to 0.9, indicating good reliability and high internal consistency. Subsequently, the survey was formally launched through Questionnaire Star. A total of 331 students were targeted for the official questionnaire survey, with 38 invalid questionnaires removed (those with response times less than 30 seconds or with all answers being the same option), resulting in an effective response rate of 88.5%.

4. Results and discussion

4.1. Frequency analysis of overall influencing factors

The frequency analysis conducted on the overall factors influencing the effectiveness of deep learning in SPOC revealed several key findings, as summarized in Table 1. Among these findings were significant insights into the elements that contribute to students' understanding, transfer, and application of knowledge, communication, collaboration, problem-solving, critical thinking, self-development abilities, and professional spirit development. The analysis demonstrated that English learning tasks, such as project design, surveys, internships, and certification attainment, emerged as the most effective learning processes for promoting understanding, transfer, and application of knowledge, with a frequency of 58.5%. This underscores the importance of practical engagement and hands-on activities in enhancing learning outcomes within the SPOC framework. Furthermore, face-to-face instruction involving collaborative discussions and case analysis was identified as the process most conducive to fostering communication, collaboration, problem-solving, critical thinking, and self-development abilities, with a frequency of 65.8%. This finding emphasizes the invaluable role of interactive pedagogical approaches in nurturing diverse skill sets essential for today's dynamic work environments. Moreover, face-to-face instruction in the form of lectures emerged as the primary driver for fostering students' professional spirit development, with a frequency of 34.5%. This suggests that traditional instructional methods still hold significance in shaping students' professional attitudes and values, complementing innovative learning approaches within SPOC environments. Notably, individual motivation and level of effort emerged as the most influential personnel factor, stimulating learning interest and impacting learning outcomes, with a frequency of 55.4%. This underscores the intrinsic motivation and self-directedness crucial for effective deep learning engagement in SPOC settings. Please see table 1.

Table 1. Frequency analysis of overall factors influencing deep learning effectiveness

Issue	Option	Order (%)
1	Process Most Effective in Promoting Understanding, Transfer, and Application of Knowledge	

	Online Learning Process	32.2
	Face-to-Face Instruction Process	29.3
	English Learning Process	58.5
	Other	0
2	Process Most Effective in Promoting Communication, Collaboration, Problem-solving, Critical Thinking, and Self-development	
	Online Learning	25.6
	Face-to-Face Instruction (Discussion)	65.8
	English Tasks	8.6
3	Process Most Effective in Fostering Professional Spirit Development	
	Online Learning	28.5
	Face-to-Face Instruction (Lecture)	24.7
	Face-to-Face Teaching	34.5
	English Task Situations	12.3
4	Personnel Factor Most Effective in Stimulating Learning Interest and Improving Learning Outcomes	
	Individual's Motivation and Effort	55.4
	Teacher's Level and Knowledge	23.8
	Teacher's Teaching and Engagement	15.6
	Teacher's Attitude and Engagement	3.2
	Student's Interest and Effort	2.0

The results of the frequency analysis shed light on the multifaceted nature of factors influencing deep learning effectiveness within SPOC environments. The prominence of English learning tasks underscores the importance of integrating practical, real-world applications into educational activities, aligning with the principles of experiential learning and problem-based learning [9,11]. Similarly, the emphasis on interactive face-to-face instruction highlights the significance of social constructivist approaches in fostering collaboration, critical inquiry, and problem-solving skills [5,7]. These findings advocate for a balanced instructional approach that combines online resources with meaningful face-to-face interactions to maximize learning outcomes [14]. Furthermore, the significant impact of individual motivation echoes the self-determination theory, emphasizing the intrinsic drive and autonomy in learning. Educators and instructional designers should thus focus on cultivating students' intrinsic motivation through personalized learning experiences and goal setting [10]. In conclusion, the study's findings provide valuable insights for educators, policymakers, and instructional designers seeking to optimize deep learning experiences within SPOC environments. By leveraging the identified influencing factors, educational stakeholders can design more effective learning interventions tailored to the needs and preferences of diverse learners.

4.2. Frequency analysis of stage-specific influencing factors

In this section, we present the results of the frequency analysis conducted on stage-specific factors influencing the effectiveness of deep learning in SPOC, as illustrated in Table 2. The analysis revealed distinct patterns in the factors affecting different stages of the learning process. Specifically, regarding online learning effectiveness, the most prominent factor identified was the availability of scientific and

abundant learning resources, with a frequency of 36.7%. This finding underscores the critical role of well-curated and diverse online resources in facilitating effective self-directed learning experiences within SPOC environments [6,7]. Conversely, for face-to-face instruction, teacher competence and teaching attitude emerged as the primary influencing factors, accounting for 32.5% of the responses. This highlights the pivotal role of instructors in shaping the quality of face-to-face interactions and fostering an engaging and supportive learning environment conducive to deep learning [8,10]. Furthermore, in the context of English task learning, the content of English learning tasks emerged as the primary determinant of effectiveness, with a frequency of 19.5%. This suggests that the design and alignment of English learning tasks with learning objectives and student needs play a crucial role in promoting meaningful language acquisition and application [9,14].

Table 2. Analysis of stage-specific factors influencing deep learning effectiveness

Item	Option	Order (%)
1	Factors Most Influential in Learning Effectiveness and Depth during Online Learning Process	
	Clear Online Learning Objectives	22.5
	Abundant and Scientific Online Learning Resources	36.7
	Intelligent Learning Platform	25.3
	Timely Evaluation Feedback	10.5
	Technical Guidance Provided by Teachers	2.5
	Active Online Discussions among Learners	2.5
2	Factors Most Influential in Learning Effectiveness and Depth during Face-to-Face Instruction Process	
	Teacher Competence and Teaching Attitude	32.5
	Content and Form of Face-to-Face Instruction	28.6
	Adjustments of Face-to-Face Instruction Based on Online Learning Effectiveness	17.6
	Timely Evaluation Feedback and Guidance	13.5
	Learners' Enthusiasm	7.8
3	Factors Influencing Learning Effectiveness and Depth during English Learning Task Process	
	Content of English Learning Tasks	19.5
	Personal Participation	15.2
	Group Members' Participation	17.5
	Teacher Participation and Guidance	35.0
	Teacher Evaluation Feedback	12.5

To further validate these observations, significance tests were conducted to confirm the statistical relevance of these factors. The results confirm the importance of considering stage-specific variables in designing deep learning strategies within SPOC settings.

The emphasis on abundant and scientific learning resources for online sessions underscores the necessity for educational institutions to invest in robust digital infrastructure and content creation, as advocated by Shen et al. and Wu [5,7]. Similarly, the significant role of teacher expertise and demeanor reinforces the importance of

ongoing educator training and positive teaching attitudes, echoing the findings of Shen et al. and Gao et al. [5,8].

Lastly, the focus on English task content highlights the need for authenticity, relevance, and alignment with students' proficiency and goals, as noted by Yi and Chen [10,14]. Educators should craft English tasks that foster engagement, critical thinking, and skill development, thereby optimizing deep learning outcomes.

5. Conclusion and implications

Based on questionnaire surveys, our empirical analysis reveals that the main factors influencing the SPOC deep learning model in HVCs are learning motivation, English tasks, effective face-to-face learning, and online learning. When implementing this model in vocational education, three aspects deserve special attention. Firstly, practical innovation activities, integrated into English tasks, significantly boost knowledge comprehension, transfer, and application, while fostering key skills like communication and problem-solving. Secondly, the quality of face-to-face learning hinges on the instructor's teaching proficiency and attitude. Teachers should utilize diverse methods, provide rigorous guidance, and offer timely feedback to students. Thirdly, online learning demands targeted resources, especially for English proficiency and vocational exams. Assigning open-ended questions fosters critical thinking, while minimizing objective questions prevents superficial task completion.

The findings offer valuable insights to educators and policymakers. HVCs are encouraged to seamlessly blend practical activities with English learning, bridging the gap between theory and practice. This better prepares students for future vocational challenges. Teacher training should focus on enhancing teaching proficiency, including the effective use of various techniques and providing constructive feedback. Additionally, there's a need for tailored online educational platforms and resources, especially for proficiency tests and vocational exams. These high-quality materials can greatly enhance the learning experience. Finally, pedagogical strategies should prioritize open-ended questions to stimulate critical thinking, discouraging rote learning and encouraging creative and analytical thinking, skills crucial in today's fast-paced work environment.

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