Educational Administration: Theory and Practice
2024, 30(4), 10036 - 10054
ISSN: 2148-2403
https://kuey.net/

Research Article

The Effectiveness of Interactive Mind Mapping Technique on Performance and Motivation of College English Students in China

Luo Xinge[1]*, Siti Mastura Baharudin[2]

[1]*Luoxinge@student.usm.my, School of Educational Studies, University Sains Malaysia, Malaysia, luoxinge@student.usm.my
[2]sitimastura@usm.my, School of Educational Studies, University Sains Malaysia, Malaysia

Citation: Luo Xinge, (2024), The Effectiveness of Interactive Mind Mapping Technique on Performance and Motivation of College English Students in China, *Educational Administration: Theory And Practice, 30(4)* 10036 - 10054*, Doi: 10.53555/kuey.v30i4.6172*

ARTICLE INFO

ABSTRACT

This paper examines the influence of interactive mind mapping on student performance and learning motivation in the context of English courses in Chinese universities. It analyses the roles of interactive mind mapping on student's motivation and performance. The literature studies interactive mind mapping based on two theories: Human Constructivist theory (HCT) and experiential learning theory (ELT). The objectives of this study were as follows: (1) to design an interactive model of constructivism for the teaching and learning of interactive mind mapping in the English course of Chinese college students; (2) to investigate the significant influence of interactive mind mapping on Chinese college students' performance; (3) to investigate the significant influence of interactive mind mapping on Chinese college students' learning motivation; and (4) to investigate the relationship between performance and motivation in using interactive mind mapping. Analyses of the causal relationships are tested using a sample of 120 freshmen English majors from Sichuan University in China. The empirical findings indicate that interactive mind mapping positively and significantly affects students' motivation and performance.

Keywords: Interactive Mind Mapping, English, Motivation, Performance

Introduction

In the current global landscape, bilingual proficiency can equip university students with many advantages, from enhanced employment opportunities to advanced communication skills (Roy et al., 2019). Most businesses today conduct business internationally, making the capacity to effectively converse with customers, collaborators, and coworkers from varied cultural milieus a vital asset. Moreover, pursuing English learning can enable college students to comprehend and value different cultures, which is vital in fostering relationships and establishing connections with individuals from various backgrounds (Kim, 2020). Learning English can enhance cognitive abilities, including memory retention, problem-solving, and the skill to manage multiple tasks simultaneously (Zhang, 2022). Consequently, for college students, English learning forms a critical facet of their education, offering them invaluable skills and experiences that can positively impact their personal and professional lives.

In China, language learning, specifically English, is now fundamental in higher education syllabi (Bai & Wang, 2023). Conventional teaching approaches in Chinese colleges typically depend on rote learning and frequent repetition, practices that can prove dull and ineffective. They have faced criticism for their emphasis on these methods (Hou, 2021; Wang, 2020). Some institutions have incorporated technologies like interactive mind mapping to enrich English learning (Fu et al., 2019), employing digital resources and mobile applications to provide learners with more immersive and captivating English learning experiences (Huck & Zhang, 2021).

Interactive mind mapping is an innovative teaching approach that has recently become popular (Widiasti & Isnawati, 2023; Breslin et al., 2021; Liu et al., 2019). It involves the utilization of diagrams and imagery to organize and link ideas, a process that can enhance academic outcomes and performance. Interactive mind mapping is an influential technique aiding students in visually structuring their thoughts, ideas, and concepts (Naghmeh-Abbaspour & Rastgoo, 2020; Al Shdaifat et al., 2019; Fu et al., 2019; Rezapour-Nasrabad, 2019). When applied to English learning, mind mapping can assist learners in comprehending the relationships among words and concepts, recognizing patterns, and bolstering their memory retention (Mohaidat, 2018;

Wang & Dostál, 2018). In English learning, interactive mind-mapping tools can be used to create vocabulary maps, grammar charts, and conversation outlines (Fu et al., 2019).

In the learning environment of college English education, how to design and support truly interactive mind mapping and improve student performance and learning motivation remain the significant challenges facing contemporary college English education (Katsarou & Chatzipanagiotou, 2021). In teaching activities, the use of new technologies, such as interactive mind mapping-assisted teaching, is a critical factor in ensuring the quality of teaching and is the most critical part of teaching (Huck & Zhang, 2021; Machado & Carvalho, 2020; Engelbrecht et al., 2020). The research on how interactive mind mapping affects students' performance and motivation has gradually become an essential issue that teachers, students, and even the community care about and need to solve urgently (Tavares et al., 2021). It was confirmed that teachers would have an authorship tool to create mind maps containing elements, relationships, and interactive content related to each map element (Tavares et al., 2021).

By analyzing the influence of mind mapping technology on developing and learning English as a second language, (Naghmeh-Abbaspour & Rastgoo, 2020) found that applying mind mapping in writing teaching can improve learners' writing organization ability. As a crucial element in English course studies (Mohaidat, 2018; Wang & Dostál, 2018), interactive mind mapping proves beneficial in gauging student performance and motivation during English instruction (Naibaho, 2022; Keter et al., 2021; Keter et al., 2021; Sabarun et al., 2021). Interactive mind mapping offers students a beneficial structure for grasping and understanding English (Alsuraihi, 2022a).

Mind maps serve as cognitive devices that allow learners to graphically arrange information non-linearly, promoting profound learning and enhancing memory recall (Rezapour-Nasrabad, 2019). Interactive mind mapping, as a technique, has seen applications across diverse domains, including education, where it has been effectively used as an instructional tool across various subjects (Guo, 2021; Keter et al., 2021; Rezapour-Nasrabad, 2019). Mind mapping is an exceptionally efficient learning tool for boosting students' performance (Naibaho, 2022; Keter et al., 2021; Al-Zyoud et al., 2018).

As Sweller (2020) proposed, the Cognitive Load theory states that students have a limited capacity for working memory, and cognitive overload can occur when too much information is presented at once. Employing mind mapping as a study tool enables students to arrange and simplify intricate information, thereby reducing cognitive burden and enhancing learning outcomes. Interactive mind mapping can boost students' performance by fostering their critical thinking abilities (Keter et al., 2021; Rezapour-Nasrabad, 2019). This is substantiated by the constructivist theory (Naibaho, 2022), which asserts that knowledge is built through active interaction with the teaching material.

An increasing body of research is endorsing interactive mind mapping as an efficacious learning tool for enhancing students' academic performance (Naibaho, 2022; Keter et al., 2021; Sabarun et al., 2021). Researchers and educators alike have recognized the effectiveness of mind mapping as a learning strategy for increasing students' motivation to study (Sabarun et al., 2021). Mind mapping can help students improve their comprehension of complex concepts, spark their creativity, and motivate them to learn (Pardede, 2020; Dewi, 2019). Furthermore, prior study confirms that mind mapping can be an engaging and stimulating practice for students, boosting their motivation to learn (Astriani et al., 2020). Other studies have shown that using mind maps as a learning aid improves students' motivation to study, engagement, and memory of material (Sabarun et al., 2021; Zheng et al., 2020).

Many people working in educational institutions are concerned about the poor performance of Chinese students in English classes (Zou et al., 2021; Fang & Liu, 2020). Chinese students' results on necessary English language competence tests were below average. Chinese college students rely heavily on memorization and grammatical rules in English learning, especially English learning, rather than focusing on communicative competence and using English in context (Sun & Zhang, 2021). lack the motivation to learn.

The findings of this study provide students with appropriate tools and opportunities to apply interactive mind mapping to achieve their goals effectively. This study aims to cultivate students' English ability to improve their English listening, speaking, reading continuously, and writing ability and application ability in learning to improve their English level.

Literature Review and Hypotheses Development

2.1 Introduction

The education system was first introduced to China in 1905 during the late Qing Dynasty, when the Beijing Advanced Institute was established under the advocacy of Kang Youwei (Ming et al., 2019), a Chinese reformist. This institute is considered to be the origin of modern universities in China. Traditional teaching emphasizes the instillation of knowledge points and mechanical exam training (Wang et al., 2020), lacking sufficient interaction and student participation, and fragmented teaching makes it difficult to integrate and apply the knowledge they have learned, especially in college English teaching.

2.2 History English Course Education in China

The Chinese government has always actively promoted English majors in Chinese universities. The development of foreign language courses serves the political purposes stipulated by the government in meeting

the needs of national socio-economic exchange and cultural exchange under such socio-political conditions. The Chinese government also established English courses in correspondence with countries with which it had established diplomatic relations. During the same period, Chinese universities opened relevant English courses to strengthen China's ties with the Third World or developing countries in Asia and Africa. In China, the long-standing exam-oriented teaching model, rather than cultivating English learners with communicative competence, has produced generations of "deaf and mute" graduates (Fu & Clarke, 2019).

2.2.1 English Topics in Chinese College English Courses

College English courses are crucial in enhancing students' English abilities and thinking skills, directly impacting an individual's activities (Din, 2020). China's curriculum continues to witness various reforms in the education sector and new policies are aimed at addressing issues of students learning English (Fan, 2023). Students also complained that the English syllabus needs to be more exam-oriented and proficiently applied to life (Y.-C. Chang & Tsai, 2022). Researchers are trying to see how new teaching tools of English subject themes make it easier for students to understand English subjects through teachers' interactive mind maps to overcome the difficulties of the syllabus in English courses (Alsuraihi, 2022a). English teachers should receive explicit training on modern teaching tools of English themes (interactive mind maps), which makes it easier to improve student's learning performance and motivation (Odaryuk, 2021).

2.2.2 The Importance of English Language Courses among ESL

English language courses promote students' cross-cultural understanding and cognitive development. Students who are learning English as a second language have been found to have various cognitive benefits (Escobar Fandiño et al., 2019). It can improve problem-solving, creative thinking, memory, and multitasking skills. English is widely spoken and is the de facto international language used as the primary mode of communication in global affairs, business, and academia (Fan, 2023). Learning English in China can allow students to understand different cultures, values, beliefs, and lifestyles worldwide (Yu, 2021).

Currently, Chinese students need help with learning English, such as the inability to integrate the memory of many English words and the lack of logic in grammar learning, leading to weak motivation for learning English and poor performance. Cores-Bilbao et al. (2019) indicate that English courses enable individuals to communicate effectively in a foreign language. People can gradually enhance their English abilities and communicate more fluently and confidently via methodical learning, practice, and the growth of cultural awareness (Sreena & Ilankumaran, 2018).

According to Masterson (2020), English is a means of communication and a reflection of culture. Learning English can help people develop their intercultural competencies and increase their understanding of cultural diversity. English improves cognitive processes like memory, problem-solving, and critical thinking (Escobar Fandiño et al., 2019). It can increase cognitive flexibility, inventiveness, and analytical capacity. Learning English encourages the development of critical thinking and problem-solving skills (Scisciola et al., 2021).

English programs promote effective communication (Mardiah, 2020), foster cultural understanding, advance cognitive development, personal growth, travel opportunities, and global citizenship (Papanthymou & Darra, 2019). Therefore, it is necessary to seek improved cognitive tools, such as interactive mind maps, to teach students to cultivate a positive learning attitude to research and nurture English teaching conducive to improving their learning performance and motivation (Li et al., 2021).

2.3 Development of the Interactive Mind Mapping

Tony Buzan proposed mind maps in the 1970s and published his first book in 1974. Abubakar et al. (2021) defined mind maps (MM) as a tool that can enhance human cognitive thinking abilities through an influential graphic method, which provides a general possibility to reveal brain functions (radiant thinking). The principle behind MM is to use both hemispheres of the brain to maintain memory and improve efficiency (Abubakar et al., 2021). However, many researchers criticized his work for lacking enough evidence to support it (Zheng et al., 2019). MM is a strategy that shapes learners' learning through a system or other graphic images combined with verbal and visual elements (Beel, 2017). These methods are consistent with current constructivist teaching strategies, emphasizing active student participation, using prior knowledge to create or build new ideas, and then connecting them with old knowledge in memory (Guo, 2021).

Goodnough and Woods (2002) revealed that Tony Buzan developed MM to promote notetaking, enhance creativity, build thinking skills, and form concepts. MM represents information, concepts, ideas, knowledge, and relationships in the brain through graphics, images, and symbols (Abubakar et al., 2021b). MM is the most convenient way to input information into the brain and extract it from the brain; it is an active, creative way of note-taking that can quickly "sketch" one's point of view (Tulloch, 2020). Empirical research by Abubakar et al. (2021b) shows that MM associates absorb and visualize academic thought materials and propose possible responses using lines, colors, images, font sizes, numbers, symbols, or keywords, thus demonstrating systemic solid thinking skills.

Mind mapping is among the best tools for students to achieve meaningful learning through other cognitive tools (Luangkrajang, 2022). Using a Mind map as a cognitive tool for teachers and educators to execute the learning and teaching process to achieve learning objectives can gradually bring innovation to the curriculum in China (Zheng et al., 2019a). The use of mind maps will supplement the deficiencies in teaching and learning

tools, which often lead to poor academic performance of students, making them passive listeners rather than active participants in the classroom (Nyagblormase et al., 2021).

2.3.1 Definitions and Characteristics of Interactive Mind Mapping

Interactive mind mapping as a teaching strategy has significantly improved students' academic scores and information storage or retention (Trakunphutthirak & Lee, 2022).
Buzan (2006) identified four characteristics of Interactive mind mapping:

a. The central theme should be a central image with words or phrases.
b. The central theme should radiate to branches.
c. The sub-themes radiating from the theme should contain essential words or images positioned on the line.
d. The branches should be interconnected, forming a complete system.

Interactive mind mapping functions as a repository of information, enabling the storage of novel ideas and replacing the best ideas as needed (Ożadowicz, 2020). One characteristic of Interactive mind mapping is that it helps students summarize their information, enhancing their knowledge retention and recall levels and making information retrieval opportunities very straightforward (Harris & Bacon, 2019). Interactive mind mapping provides various observable thinking skills that have been found to contribute to excellent learning outcomes (Hafeez, 2021).
Interactive mind mapping is a cognitive strategy for learning that stimulates thinking to aid in the assimilation of opinions and knowledge, and it is also a tool for conceptualizing ideas (Guo, 2021). Interactive mind mapping enhances students' creativity and allows higher thinking ability levels, enabling them to understand any given information (Narayanan, 2018).

2.3.2 Method of Using Interactive Mind Mapping

Buzan's Mind Mapping is a powerful graphical strategy and a well-known intelligent tool designed for teaching (Buzan & Buzan, 1996). It transforms or condenses lengthy information into a systematic, colourful, memorable illustration accompnaying the brain's normal functioning (Abd Karim & Abu, 2018). Interactive mind mapping is built based on brain thinking; its structure mainly starts from the centre and radiates outward with lines, colours, and pictures, giving moderate, brain-friendly thoughts (Tatipang et al., 2022).
Students should first place an image in the paper's centre that represents the Mind Map's central theme (Malallah & Weese, 2020) and then freely build the mind map clockwise or counterclockwise (Buzan & Buzan, 1996), followed by creating significant branches from the central theme and build essential vocabulary representing various sub-themes based on the content of the Mind Map (Corazzo, 2019). Each central theme and sub-theme should be composed of images to help students quickly memorize information. It can be interconnected, thus grouping various parts of the Mind Map (Hyderabad & Soam, 2022).

2.3.3 Classroom Application of Interactive Mind Mapping

Educators must shift from teacher-centered teaching strategies to student-centered learning, which can generate meaningful learning, enhancing students' intellect, creativity, and systems thinking (Hanif et al., 2019). In a dynamic educational system, cognitive tools simplify students' understanding of concepts (Narayanan, 2018). Interactive mind mapping allows students to develop new knowledge based on existing information, thus achieving meaningful learning (Buzan & Buzan, 1996). Ożadowicz (2020) found that students who used interactive mind-mapping strategies in experiments scored higher than those who did not use interactive mind-mapping. The study confirmed that students learn from interactive mind mapping, not just constructing maps but also being creative (Luangkrajang, 2022).
Constructing the interactive mind mapping in groups rather than individually during the students' brainstorming simplifies and significantly decomposes the theme. Grouping allows students to share ideas, listen to each other's opinions, and fully affirmatively support them (Baker & Cavinato, 2020). It is possible to use interactive mind mapping in teaching and learning to enhance students' attitudes and thinking abilities (Andrews & Richmond, 2019). However, the issue with applying interactive mind mapping in the classroom is selecting the best concepts and writing them on the map rather than discussing the entire idea (Soeiro et al., 2018). Interactive mind mapping has been proven to be a lifelong learning tool both inside and outside school (Abubakar et al., 2021a).

2.4 Performance of English among ESL Students

Academic performance refers to the extent to which students demonstrate the knowledge, skills, and abilities they have acquired through the educational process. It encompasses various aspects of a student's academic development, including their ability to understand and apply concepts, their level of participation in learning activities, their progress in acquiring new knowledge and skills, and their overall achievements in academic assessments or evaluations (Oducado & Estoque, 2021). Traditional cognitive tools, students' performance in English courses has declined, attributed to ineffective teaching tools, leading to rote memorization, imitation of unfamiliar concepts, and repetition of facts. Guo et al. (2018) observed that if one reflects on the output of students' learning and academic achievement, especially in English, schools do not seem to perform as well as shown in national exams.

Besides, traditional English teaching methods in China have often been based on rote memorization and grammar translation, focusing more on written English than spoken (Yi, 2021). This has led to some students being able to read and write in English proficiently but needing help speaking and listening. Research by Guo et al. (2018) suggests that the refinement and adjustment of thought and knowledge influence the changes in individual English performance and that students' learning and thinking styles impact academic achievement. Wang et al. (2022) also confirmed that when schools use cognitive tools that affect students' English learning outcomes, students' academic performance can be improved more successfully. Kliziene et al. (2021) found that mind maps are more effective than other cognitive tools in improving student learning.

Chakraborty and Biswas (2020) believe that concept mapping is an excellent strategy to improve learning performance and identify new problem-solving tools because it is related to the growth of an organized knowledge base. In addition, mind maps also help students promote knowledge construction and recall concepts related to metacognition in learning (Luo et al., 2022) because it improves students' thinking skills, enabling them to solve problems that may increase knowledge (Cancer et al., 2023). the cognitive tools used are essential (Cao et al., 2022), and students' attitudes, thinking abilities, and creativity may be additional advantages for their achievements.

2.5 Motivation in Using Interactive Mind Map among ESL

As an underlying factor behind learning, motivation enables individuals to act and is considered a sub-dimension of self-regulation strategies (Aubret et al., 2023). Motivation refers to the individual's active pursuit to achieve anticipated results and is also a determinant factor in the value judgment of whether a student can succeed (Escobar Fandiño et al., 2019). Motivation is highly correlated with student success and is essential in promoting learning (Eggers et al., 2021). There are two types of motivation, which are intrinsic and extrinsic. Intrinsic motivation keeps an individual's thinking active and determines the level of desire and curiosity generated within the individual, while extrinsic motivation influences intrinsic motivation (Deci). Two concepts together or separately affect learning (Razali et al., 2020)—decisive factors in student motivation (Zalts et al., 2021).

Students' responses to learning practices and strategies and student-centered curriculum design also add to the decisive factors of motivation (Aubret et al., 2023). Therefore, enthusiasm and interest in the course positively impact student motivation and participation (Bigazzi et al., 2022). Interactive mind maps can provide a personalized learning experience. Students can selectively delve into specific topics or expand related concepts based on their learning progress and interests (Hatfield et al., 2017). The personalized learning process can increase students' autonomy and learning motivation. Interactive mind maps can promote collaborative student learning (Tatipang et al., 2022). Students can learn from and inspire each other, enhancing their sense of participation and learning motivation (Machado & Mello-Carpes, 2018).

In this concept, it is believed that the proper use of gamification strategies in the tool of interactive mind maps can serve as a problem solver for motivation and achievement (Odaryuk, 2021). As a reasonable learning strategy, interactive mind maps can effectively stimulate students' interest and increase their learning motivation by integrating students' knowledge, establishing a logical framework, and providing opportunities for personalized and collaborative learning (Chang et al., 2018). Interactive mind maps help ESL learners visualize how different ideas or concepts are connected, which can assist them in organizing their thoughts in English more effectively. This can provide a sense of accomplishment that motivates further learning (Eli, 2021).

Interactive mind maps in ESL learning can significantly improve learner engagement, comprehension, and material retention, all contributing to a greater motivation to learn. Interactive mind maps can help learners visually organize information, showing relationships between concepts and ideas (Eli, 2021). Mind maps can facilitate better memory retention by allowing learners to create connections between different topics (Alqasham, 2022). Mind maps' visual nature can help recall information more effectively than traditional linear notes—collaborative tools (Tatipang et al., 2022). Learners can work together to create mind maps, promoting peer learning and cooperation.

2.6 Theories used in this study.

This research focuses on two crucial and relevant theories and models in current academic investigations, namely the Human Constructivist theory (HCT) and experiential learning theory (ELT) (Kolb & Kolb, 2017). The purpose of utilizing these theories and models is to demonstrate the suitability of the theory upon which this study is built (Ferland & Kaszap, 2019).

2.6.1 Human Constructivism Theory (HCT)

Constructivism is an educational and cognitive theory that emphasizing individuals constructing their knowledge and understanding through active participation and personal experience (Sumarna & Gunawan, 2022). Constructivism posits that learning is a subjective process, where each constructs their knowledge structure through personal experience and reflection during learning (Wahab et al., 2021). Learners actively explore new ideas and concepts through observation, experimentation, questioning, discussion, and reflection and incorporate them into their existing cognitive framework (Vygotsky, 1980). Mohamad Abdel-Haq et al. (2019) points out that constructivism emphasizes the proactivity and cooperativity of learners.

Constructivist teaching methods emphasize contextual and inquiry-based learning, advocating for learners to practice and explore in real situations and to verify and consolidate their understanding through practical operations and experiments (Rillo et al., 2020). Teachers in constructivist teaching play the role of guides and facilitators, providing learners with appropriate resources and support and encouraging them to engage in self-directed learning and discovery (Wahab et al., 2021).

Rillo et al. (2020) pointed out that constructivist theory reveals the importance of attitudinal and intellectual factors to the educational environment. This will be very difficult for those who only accept orders from others and do not actively participate in education (Angel & Nettle, 2019). People construct and acquire knowledge by establishing and mapping the mutual connections between basic skills and current skills (Ismail et al., 2022). Learning is an active process, and individuals gradually construct their knowledge system through interaction with the environment and accumulation of experience during learning (Thoe et al., 2022).

The Human Constructivist Theory (HCT) is a learning theory based on cognitive constructivism that emphasizes the process of individuals actively constructing knowledge (Rillo et al., 2020). This theory emphasizes the importance of active participation and individual differences in learners and believes that learning is a process of individual knowledge construction rather than simply accepting and memorizing information (Sumarna & Gunawan, 2022). For constructivists, knowledge is constructed, not discovered; meaningful learning only occurs when education provides skills that require students to attach knowledge to three learning domains, namely cognitive, affective, and psychomotor domains (Alsuraihi, 2022b). Giusti et al. (2021b) point out that mind mapping is an active learning strategy that can help students build or construct new ideas from previous knowledge.

Cao (2023) mentioned that education is the process of controlling intellectual, emotional, imaginative, judgmental, and action forces; it is a discussion between teachers and students to form the student's psychological structure. Constructivist knowledge is about teaching, learning, and constructing new ideas (Freire et al., 2021). Constructivism opposes the view that knowledge is passively received; on the contrary, it believes that learning is an active, contextual process of constructing knowledge, not a process of acquiring knowledge. Kulikovskikh et al. (2020) reiterate that each learner must construct their own knowledge structure or cognitive structure through their efforts; the construction or construction of knowledge is entirely the responsibility or commitment of the learner.

2.6.2 Experiential learning theory (ELT)

Experiential Learning Theory (ELT) is a self-motivated understanding of knowledge built on a learning cycle determined by an individual's involvement in learning experiences (Kolb & Kolb, 2005). Kolb defined experiential learning as creating knowledge through transforming experience (Kolb, 1984). Experiential learning emphasizes the central role of experience in the learning process. This process is not linear but continuous, where learners continually revise and perfect their understanding through new experiences and reflections (Kolb & Kolb, 2017). Moreover, he emphasizes the importance of transformation- transforming experience into knowledge.

In the self-motivated process, learners must actively participate and invest in learning from experience (Hallberg et al., 2018). The Experiential Learning Theory has profound implications for educational practice, promoting deeper levels of learning and helping learners build skills and knowledge relevant to the real world (Shah & Kumar, 2019). Manalayil et al. (2020) defined experiential learning as learning in which the learner is directly in touch with the realities being studied. The Experiential Learning (EL) built by David Kolb on the foundation of Lewis et al. (2010) theory of experience is based on the fact that learning is built upon prior knowledge, including one's attitudes, thinking skills, and creativity generated through interaction with the environment (Kolb & Kolb, 2005).

According to Kolb & Kolb (2005), experiential learning is based on the interaction between the individual and their learning environment; it is a form of learning from life experiences, often contrasted with the classroom learning environment (Kolb & Kolb, 2017). Habib et al. (2021) regard experiential learning as a powerful educational method that promotes students' cognition, skills, and personal development by combining learning with practical experience and participation.

John Dewey's work profoundly impacted educational theory and practice in the 20th century, especially in progressive education and experiential learning (Kolb & Kolb, 2017). Dewey believed that the role of teachers in education is to select appropriate stimuli to produce the desired outcomes and impulses, and they are responsible for choosing the correct stimuli to stimulate students' interest in learning and to induce them to produce the expected learning outcomes and impulses. In Kolb's (2017) research on the experiential learning cycle based on John Dewey, he found that learners change their existing concepts to accept new knowledge when they experience the transformation of new knowledge or ideas and assimilate the stimuli into their existing knowledge.

Passarelli & Kolb (2023) believe that Experiential Learning Theory (ELT) provides a model for educational participation, a holistic approach to human adaptation by transforming experience into knowledge. English teaching is a holistic theory of learning, widely regarded as a valuable framework for learning educational innovation, including instructional design, curriculum development, and lifelong education (Kolb & Kolb, 2017). Learning is not just about improving personal cognitive abilities and obtaining academic certificates, but a way to design and organize relevant experiences into "knowledge" for students to consume.

2.7 Development of Theoretical Framework

No single theory can comparatively examine the impact of interactive concept mind maps on students' academic performance and motivation (Bruhl & Bruhl, 2020). Interactive mind maps significantly impact Chinese university students' performance and academic motivation in English courses, providing a basis for understanding their influence on the variables above (Habib et al., 2021). This study focused on the impact of interactive mind maps on the academic performance and motivation of Chinese university students in English courses. This theoretical framework is formed based on two learning theories: Human Constructivism Theory and Experiential Learning Theory (refer to Figure 2).

The connections between Human Constructivism Theory and Experiential Learning Theory are interrelated. Rogers (1969) pointed out that the connection between Experiential Learning Theory (ELT) and Human Constructivism Theory (HCT) is unimaginable. The figure is connected as an interconnected system (Tsamardinos et al., 2022). Each element is constructively combined to support and provide a high level of meaningful learning. The triangular model is mainly designed to ensure the connectivity and reliability of the entire system (refer to Figure 1).

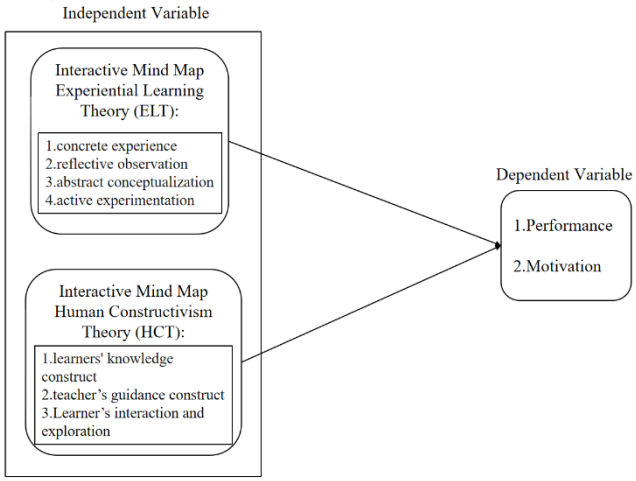

Figure 1. The triangular model

2.8 Hypothesis and research model built for this study.

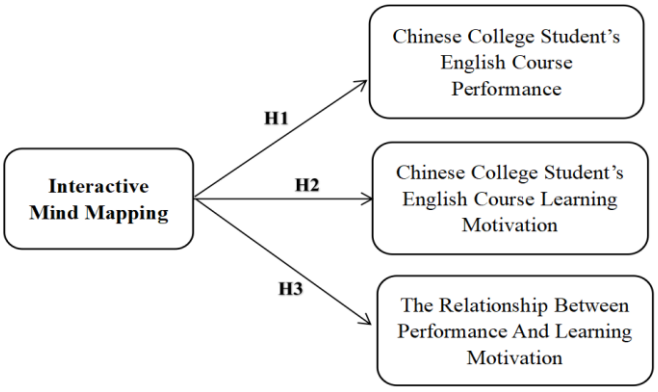

Figure 2. Hypothesis

The null and alternative hypotheses for question1-3 are as follows (refer to Figure 2) :

Ho1: There is no significant difference in Chinese college students' language course performance among using interactive mind mapping.

Ho2: There is no significant difference in Chinese college students' language course learning motivation among using interactive mind mapping.

Ho3: There is no significant relationship between students' performance and motivation in using interactive mind mapping.

3. Methodology

This study adopted a quasi-experimental design, which employed the pre-test and post-test control group design (Tanhan et al., 2020) to collect data on the effects of interactive mind mapping on performance and motivation in the English course of college students in China. Rogers and Révész (2020) and Tanhan et al. (2020) recommended using a control group in quasi-experimental research. The reason for choosing this type of design is to compare the results of the experimental and control groups to determine if the treatment has a specific effect or if the observed results are consistent with what would happen naturally in the absence of intervention (Tanhan et al., 2020).

Table 1 The format for the research design

Teaching Approaches	Group	Design		
Interactive Mind Mapping	Experimental Group (P&M)	O_1	X_1	O_2
	Control Group (P&M)	O_1		O_2

Where:
O1 = Pre-Test
X1 = Treatment
O2 = Post-Test
P = Performance
M = Motivation

The primary goal of this design is to demonstrate that the treatment X is the cause of the difference between the initial score and the last score in the experimental groups (Kothari, 2004). In this study, one group of English students was exposed to treatment, that is, interactive mind mapping, while another group's students did not receive the treatment. The experimental group (P&M) is exposed to interactive mind mapping, while the Control group (P&M) is not under treatment. Then, they are tested before and after the interventions (Pre-test and Post-test) to evaluate the college English course students of interactive mind mapping at the end of the interventions.

The variables that constitute the independent constructs of this study are interactive mind mapping and comparing their performance and motivation for students. The experimental group used interactive mind-mapping therapy, and the control group did not use interactive mind-mapping therapy. The dependent variables of this study are performance and motivation. Specifically, the study was conducted in China, so students outside of China should be excluded. Secondly, this study is currently aimed at English majors from Sichuan University in China. This is because Sichuan Province has nearly 5 million college students, which makes the target sample more accessible.

As for the minimum sample size, Pallant (2016) mentioned 30 participants as the appropriate minimum sample size for the experiment. This study employed a purposive sampling technique to select the college for this research. This sampling procedure is suitable for quantitative research to reach a broad scope of comprehensive the population (Scholtz, 2021). Purposive sampling is used in this study to demonstrate how interactive mind mapping is used as a cognitive tool in teaching English in China. Thus, the sample in this study is all first-year college students (120 students) enrolled in English classes, which exceeded the suggested minimum sample size (40 participants) (refer to Figure 3). This study compared the effects of interactive mind mapping on Chinese college students' performance and motivation during English course learning by using four full classes at a selected university during the intervention period.

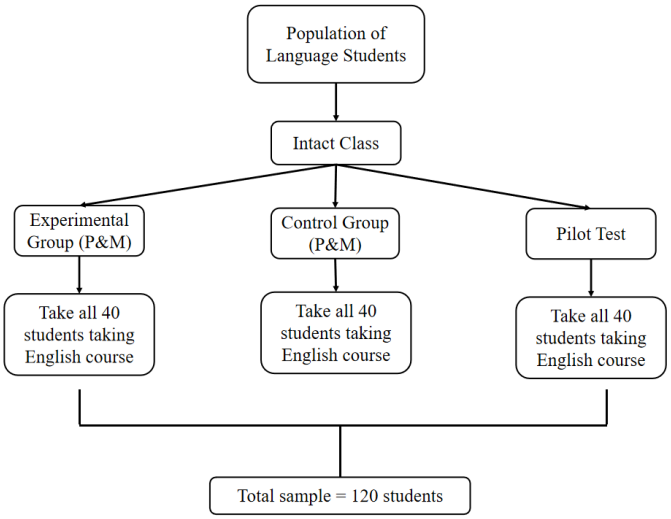

Figure 3 Sample Population

This study uses a quantitative research methodology, and a questionnaire survey is used to obtain the data. These questions included writing, listening, reading comprehension, and translation. The College English Test Band 4 (CET-4) measures students' performance in English based on a 57-item tool, 55 questions involving single choice (A-M), and two questions that require students to provide answers.

Content Area	Number of Items	Item Number
Writing	1	Part I
Listening Comprehension	25	1-25
Reading Comprehension	30	26-55
Translation	1	Part IV

Table 2 Summary of Items per Topic in the English Performance Test

Three English teachers selected samples of past test papers from the CET-4 real question series and randomly selected the December 2022 CET-4 real questions (set 1 and 2) as sample questions. Cet-4 is a comprehensive standardized test of writing, listening, reading, and translation skills. The subjects were tested in the pre-test and the post-test under timed conditions.

The Course Interest Survey (CIS) was proposed by Keller and Subhiyah (1993); it was used to assess the pre-service teachers' motivation for the course. The questionnaires used a 5-point Likert-type scale with the following ratings: SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, and SA = Strongly Agree. The questionnaire comprises 34 items divided into four sections: attention, relevance, confidence, and satisfaction. In this study, two methods were used to determine the scale's internal consistency: Cronbach alpha and Richardson coefficient (Pallant, 2020). Instrument Course Interest Survey (CIS) reliability was determined by Cronbach's Alpha test (through the use of SPSS Version 26) to determine the range of responses where there may be no right or wrong answer. Therefore, a minimum reliability value of 0.70 is acceptable (Pallant, 2020), but scores above 0.50 are acceptable in the study (Field, 2013).

Cronbach's Alpha was used as the reliability index of learning motivation, and the result was 0.893 (refer to Table 3), which was consistent with Cronbach's Alpha's general statistical measure (Hair et al., 2019). Therefore, the questionnaire management of this study is reliable.

Cronbach's Alpha	N of Items
0.893	34

Table 3 Reliability Statistics for Motivation Test

The reliability test for English Performance Test (CET-4) uses Kuder Richardson (KR_{20}) to compute the instrument. The KR_{20} is used for items that have varying difficulty. The result of KR_{20} larger than 0.7 represent a high reliability and therefore can be accepted for this study (refer to Table 4).

Kuder Richardson	N of Items
0.96	57

Table 4 Kuder-Richardson Formula 20

Results

4.1 Descriptive Statistics

4.1.1 Mean, Median, Model, and Standard Deviation of the Pre-Test

To begin the data analysis, Table 5 presents the descriptive statistics.

	Group	Performance	Motivation
N	Experimental Group	40	40
	Control Group	40	40
Mean	Experimental Group	450.13	107.45
	Control Group	452.65	108.03
Median	Experimental Group	448	107
	Control Group	452.50	108
Std Deviation	Experimental Group	28.486	6.850
	Control Group	30.241	7.259
Minimum	Experimental Group	393	94
	Control Group	391	93
Maximum	Experimental Group	513	122
	Control Group	515	123

Table 5 Mean, Median, Model, and Standard Deviation of the Pre-Test

4.1.2 Normal Distribution of Performance Test in Pre-Test

The study involved 80 participants, divided into two distinct groups: the experimental and the control groups. Initially, 40 participants were randomly allocated to the experimental group, where they received the interactive mind-mapping technique. Concurrently, the remaining 40 participants were assigned to the control group, where they underwent conventional teaching methods for English learning.

The results of the Performance Pre-test Shapiro-Wilk statistical test are presented in Table 6. A non-significant result (indicated by a Sig. value greater than 0.05) suggests that the data follows a normal distribution. In this context, the Sig. value for the experimental group, which was exposed to the interactive mind mapping learning approach, is 0.711, while the Sig. value for the control group undergoing contemporary instructional teaching is 0.238. Consequently, it can be assumed that both groups exhibit normal score distributions, and this assumption remains unviolated.

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Group	Statistic	df	Sig.	Statistic	df	Sig.
Pre-test Performance	Experimental	.103	40	.200	.981	40	.711
	Control	.109	40	.200	.965	40	.238

Table 6 Normality of Performance Pre-test in Experimental Group and Control Group

4.1.3 Normal Distribution of Motivation Test in Pre-Test

The results of the Motivation Pre-test Shapiro-Wilk statistical test are presented in Table 7. In this context, the Sig. value for the experimental group, which was exposed to the interactive mind mapping learning approach, is 0.560, while the Sig. value for the control group undergoing contemporary instructional teaching is 0.178. Consequently, it can be assumed that both groups exhibit normal score distributions, and this assumption remains unviolated.

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Group	Statistic	df	Sig.	Statistic	df	Sig.
Pre-test Motivation	Experimental	.118	40	.200	.976	40	.560
	Control	.112	40	.200	.961	40	.178

Table 7 Normality of Motivation Pre-test in Experimental Group and Control Group

4.1.3 Descriptive Statistical Analysis of the Post test

Apart from the descriptive statistical analysis for the pre-test, this study also provides descriptive statistical analysis for the post-test. The result showed the mean and standard deviation of post-test performance for the experimental group (M = 514.50, SD = 27.841) and control group (M = 459.53, SD = 29.789), motivation for the experimental group (M = 122.90, SD = 6.652) and control group (M = 109.50, SD = 7.105) (refer to table 8).

	Group	Performance	Motivation
N	Experimental Group	40	40
	Control Group	40	40
Mean	Experimental Group	514.55	122.90
	Control Group	459.53	109.68
Median	Experimental Group	511.50	122
	Control Group	458	109.50
Std Deviation	Experimental Group	27.841	6.652
	Control Group	29.789	7.105
Minimum	Experimental Group	453	108
	Control Group	403	96
Maximum	Experimental Group	577	108
	Control Group	520	124

Table 8 *Mean, Median, Model, and Standard Deviation of the Post-Test*

4.1.4 Normal Distribution of performance Test in Post-Test

The outcomes of the Shapiro-Wilk statistical test are displayed in Table 9. If the result is not statistically significant (with a Sig. value greater than .05), it suggests normality. In this instance, the Sig. value for the experimental group, which employs an interactive mind mapping, is 0.812, whereas the Sig. value for the control group, receiving conventional instructional teaching in a matriculation setting, is 0.207. Consequently, normal distributions are met in this test.

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Group	Statistic	df	Sig.	Statistic	df	Sig.
Post-test Performance	Experimental	.077	40	.200	.983	40	.812
	Control	.113	40	.200	.963	40	.207

Table 9 *Normality of Performance Post-test in Experimental Group and Control Group*

4.1.5 Normal Distribution of Motivation Test in Post-Test

The results of the Motivation Pre-test Shapiro-Wilk statistical test are presented in Table 10. In this context, the Sig. value for the experimental group, which was exposed to the interactive mind mapping learning approach, is 0.795, while the Sig. value for the control group undergoing contemporary instructional teaching is 0.184. Consequently, it can be assumed that both groups exhibit normal score distributions, and this assumption remains unviolated.

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Group	Statistic	df	Sig.	Statistic	df	Sig.
Post-test Motivation	Experimental	.079	40	.200	.983	40	.795
	Control	.112	40	.200	.961	40	.184

Table 10 *Normality of Motivation Post-test in Experimental Group and Control Group*

4.2 Performance towards English

The research inquiry and the associated hypothesis regarding this variable have been addressed by examining the data gathered from the Performance test instrument. In a pre-test and post-test design like this, the variable that may influence the outcome, aside from the treatment variable, is the pre-test itself (Hayes & Preacher, 2014). The covariates utilized in this study's statistical analyses are the pre-test scores. The data for the Performance test consists of the scores obtained from a 57-item assessment.

4.2.1 Independent Samples t-test for the Pre-test on Performance Towards English Learning

To compare the average scores of the experimental group and the control group in terms of students' English performance, an independent sample t-test is employed. This t-test is employed to determine if there exists a statistically significant distinction in the mean scores between the two groups. However, prior to conducting the t-test, Levene's Test for Equality of Variances is assessed (refer to Table 11).

Performance Pre-test	F	Sig.
Equal Variances Assumed	.119	.731

Table 11 *Leven's Test for Equality of Variances in Pre-test on Performance*

The p-value is 0.731 ($p > 0.05$), the two groups exhibit similar variance, and the assumption of equal variance is not violated. Conversely, if the p-value (i.e., Sig.) probability is less than or equal to 0.05, it suggests that the compared groups have different variances, potentially violating the homogeneity of variance assumption.

Group	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Experimental Group	450.13	28.486	.384	78	.702
Control Group	452.65	30.241			

Table 12 *Independent Samples t-test for the Pre-test on the Performance*

This study conducted an independent sample t-test to compare the average English performance scores between the experimental and control groups. The analysis showed that there was no significant difference in the mean scores between the experimental group ($M = 450.13$, $SD = 28.486$) and the control group ($M = 452.65$, $SD = 30.241$) as indicated by $t(78) = 0.384$, $p > 0.05$ (refer to Table 12). Consequently, the two groups are equivalent. Therefore, there is no need to perform ANCOVA for the post-test of performance, and the independent sample t-test is sufficient.

4.2.2 Independent Samples t-test for the Post-test on Performance Towards English Learning

Performance Post-test	F	Sig.
Equal Variances Assumed	.395	.531

Table 13 *Leven's Test for Equality of Variances in Post-test on Performance*

The p-value is .531 ($p > 0.05$), the two groups share similar variances (refer to Table 13). Consequently, there is no violation of the assumption of equal variance.

Group	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Experimental Group	514.55	27.841	-8.535	78	.000
Control Group	459.53	29.789			

Table 14 *Independent Samples t-test for the Post-test on the Performance*

The t-test results indicated a significant disparity in post-test attitude mean scores between the experimental group (Mean = 514.55, SD =27.841) and the control group (Mean = 459.53, SD = 29.789), with a t (78) value of -8.535 and p < .001 (refer to Table 14). Therefore, these findings demonstrate a substantial impact of the experimental group on the performance of first-year students in college majoring in English. Therefore, Hypothesis 1 (H1) is supported, alternatively H01 is rejected.

4.2.3 Independent Samples t-test for the Pre-test on Motivation Towards English Learning

Performance Pre-test	F	Sig.
Equal Variances Assumed	.111	.740

Table 15 *Leven's Test for Equality of Variances in Pre-test on Motivation*

The p-value is 0.740 (p > 0.05), the two groups exhibit similar variance, and the assumption of equal variance is not violated (refer to Table 15). Conversely, if the p-value (i.e., Sig.) probability is less than or equal to 0.05, it suggests that the compared groups have different variances, potentially violating the homogeneity of variance assumption.

Group	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Experimental Group	107.45	6.850	.364	78	.717
Control Group	108.03	7.259			

Table 16 *Independent Samples t-test for the Pre-test on the Motivation*

This study conducted an independent sample t-test to compare the average English motivation scores between the experimental and control groups. The analysis showed that there was no significant difference in the mean scores between the experimental group (M = 107.45, SD = 6.850) and the control group (M = 108.03, SD = 7.259) as indicated by t (78) = 0.364, p > 0.05 (refer to Table 16). Consequently, the two groups are equivalent. Therefore, there is no need to perform ANCOVA for the post-test of performance, and the independent sample t-test is sufficient.

4.2.4 Independent Samples t-test for the Post-test on Motivation Towards English Learning

Performance Post-test	F	Sig.
Equal Variances Assumed	.410	.524

Table 17 *Leven's Test for Equality of Variances in Post-test on Motivation*

The p-value is .531 (p > 0.05), the two groups share similar variances (refer to Table 17). Consequently, there is no violation of the assumption of equal variance.

Group	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Experimental Group	122.90	6.652	-8.594	78	.000
Control Group	109.68	7.105			

Table 18 *Independent Samples t-test for the Post-test on the Motivation*

The t-test results indicated a significant disparity in post-test attitude mean scores between the experimental group (Mean = 122.90, SD =6.652) and the control group (Mean =109.68, SD = 7.105), with a t (78) value of -8.594 and p < .001 (refer to Table 18). Therefore, these findings demonstrate a substantial impact of the experimental group on the motivation of first-year students in college majoring in English. Therefore, Hypothesis 2 (H2) is supported, alternatively H02 is rejected.

4.2.5 The correlation Between the Dependent Variables

A correlation analysis was performed to investigate the relationship, strength, and direction between the two dependent variables used in this study: performance and motivation in English learning. The results show a significant, robust, and positive correlation between the two variables, performance and motivation for the experimental group.

		Performance	Motivation
Performance	Pearson Correlation	1	.859**
	Sig. (2-tailed)		.000
	N	80	80
Motivation	Pearson Correlation	.859**	1
	Sig. (2-tailed)	.000	
	N	80	80

Table 19 Results of Person Correlation Analysis

Drawing from the Pearson correlation analysis outcomes among performance and motivation, as showcased in Table 19, the calculated correlation coefficient (r) surpasses 0.859. This finding suggests substantial and noteworthy connections between performance and motivation. Therefore, Hypothesis 3 (H3) is supported, alternatively H03 is rejected.

5. Discussion

The effects, benefits, and costs of learning the English language through interactive mind mapping among English class students in China have been well-researched and supported. As important as its direct effects, learning the English language has been shown to create many advantages, such as a better understanding of culture, fostering relationships and establishing connections with individuals from different regions, and improving the learning processes and performances.

In the 1950s, the Chinese government vigorously promoted the learning of Russian in schools at all levels due to China's reconciliation with the Soviet Union. In 1962, the Ministry of Education approved the "Report on the Development of Foreign Language Majors at Beijing Foreign Studies University," in 1964, it passed the "Seven-Year Plan for Foreign Language Education at Beijing Foreign Studies University." The report and the blueprint stipulated that China should further develop foreign language education, especially outlining that English should become the first foreign language in school education. The number of students majoring in English should increase, and the number of students majoring in French, Spanish, Arabic, Japanese, and German should also moderately increase.

The objectives of this study were as follows: (1) to design an interactive model of constructivism for the teaching and learning of interactive mind mapping in the English course of Chinese college students; (2) to investigate the significant influence of interactive mind mapping on Chinese college students' performance; (3) to investigate the significant influence of interactive mind mapping on Chinese college students' learning motivation; and (4) to investigate the relationship between performance and motivation in using interactive mind mapping. Analyses of the causal relationships were tested using a sample of 120 first-year college students in China. The empirical findings indicate that interactive mind mapping is positively and significantly related to student performance and learning motivation in Chinese college students. These findings are consistent with the earlier studies by Sabarun et al., 2021.

Conclusion

The activities or indicators associated with learning English and interactive mind mapping directly affect the student's performance and learning motivation in a Chinese college. This study aims to cultivate students' English ability to improve their English listening, speaking, reading continuously, and writing ability and application ability in learning to improve their English level. By the end of this course, students will better understand international culture, international economy, international communication, etc., to broaden their international vision. The knowledge gained from this study is helpful for students as it can serve as a guide to improve their performance and motivation in learning English in the classroom. It improves students' performance and learning motivation in English courses.

The information obtained from this study can be adapted to the needs of Chinese college students studying English. Interactive mind maps help measure student performance and motivation. It also found that the requirement of interactive mind mappings needed to be evaluated in the student's performance. This is because interactive mind mappings improve the student's understanding and cognitive learning skills and turn them into a competitive advantage to improve student's performance and increase motivation to learn. The contributions are both theoretical and practical.

The theoretical implication of this study is that it is one of the few studies of interactive mind mapping in English courses on students' performance and learning motivation of Chinese college students. By exploring multiple past research studies, this study uncovers the critical factors affecting the student's performance and motivation to learn on Chinese college students. This study opens a window for Chinese college students taking English courses to draw a practical portrait of interactive mind mapping underway in the English course classes, influencing the student's performance and learning motivation.

This study's practical and social implications can further provide students with appropriate tools and opportunities to effectively apply interactive mind mapping to achieve their goals. The importance of English courses in this study must be considered because students need to be educated in the English curriculum

system to nurture the environment. The student can seek the correct channels to share or transfer their knowledge and understanding through interactive mind mapping to others. Another practical implication of this study is that students can foster the relationship between the learning process and learning motivation through interactive mind mapping to enhance learning performance.

This study has several limitations. First, this study aims to focus only on students and not on teachers (consider the effects of interactive mind mapping on student learning performance and motivation). The evaluation was based on Multivariate analysis of Variance (MANOVA) and independent T-test analysis based on English course performance and motivation. Secondly, this study is limited to the topic of language, using university-level students, and in particular, using interactive mind mapping as a cognitive tool. Compare the effect of these teaching tools on students' learning performance and motivation. This study involves universities offering language courses in China.

Thirdly, the sample size of this study is from students of language courses in 5 different colleges. The results of this study can only represent the number of students in some universities in China, as it is only conducted in five universities. Finally, the study sample of college students in English courses in Chinese universities was conducted during the first semester of the study, and the allotted period was eight weeks. The time frame needs to be revised to provide students with all the information needed to use interactive mind mapping as a cognitive tool in the true sense of the word. A more extended period would be preferable.

References

1. Abd Karim, R., & Abu, A. G. (2018). Using mobile-assisted mind mapping technique (mammat) to improve writing skills of esl students. Journal of Social Science and Humanities, 1(2), 1–6.
2. Abubakar, S. R., Hidayat, A., Gadafi, M., & Sahriana, N. (2021a). Using mind mapping learning methods for children's language skills. Jurnal Pendidikan Usia Dini, 15(1), 141–161.
3. Abubakar, S. R., Hidayat, A., Gadafi, M., & Sahriana, N. (2021b). Using mind mapping learning methods for children's language skills. Jurnal Pendidikan Usia Dini, 15(1), 141–161.
4. Al Shdaifat, S., Al-Haq, F. A. A., & Al-Jamal, D. (2019). The impact of an E-mind mapping strategy on improving basic stage students' english vocabulary. *Jordan Journal of Modern Languages and Literatures*, *11*(3), 385–402.
5. Al- Zyoud, A. A., Al Jamal, D., & Baniabdelrahman, A. (2018). Mind mapping and students' writing performance. *SSRN Electronic Journal*, *May 2018*. https://doi.org/10.2139/ssrn.3094556
6. Alqasham, F. H. (2022). Effectiveness of mind-mapping as a digital brainstorming technique in enhancing attitudes of Saudi EFL learners to writing skills.
7. Alsuraihi, A. A. (2022a). The effect of implementing mind maps for online learning and assessment on students during COVID-19 pandemic: A cross sectional study. BMC Medical Education, 22(1), 1–16.
8. Alsuraihi, A. A. (2022b). The effect of implementing mind maps for online learning and assessment on students during COVID-19 pandemic: A cross sectional study. BMC Medical Education, 22(1), 169. https://doi.org/10.1186/s12909-022-03211-2
9. Andrews, C.D.J., & Richmond, G. (2019). Professional development for equity: What constitutes powerful professional learning? Journal of Teacher Education, 70(5), 408–409. https://doi.org/10.1177/0022487119875098
10. Angel, C., & Nettle, C. J. (2019). A theoretical strategy for enhancing learning through metacognitive practices on a constructivist methodology. CRoNe2018: 4th Congress on Robotics and Neuroscience. https://doi.org/10.21428/9cad5e0b
11. Astriani, D., Susilo, H., Suwono, H., Lukiati, B., & Purnomo, A. R. (2020). Mind mapping in learning models: A tool to improve student metacognitive skills. *International Journal of Emerging Technologies in Learning*, *15*(6), 4–17. https://doi.org/10.3991/IJET.V15I06.12657
12. Aubret, A., Matignon, L., & Hassas, S. (2023). An information-theoretic perspective on intrinsic motivation in reinforcement learning: A survey. Entropy, 25(2), Article 2. https://doi.org/10.3390/e25020327
13. Bai, B., & Wang, J. (2023). The role of growth mindset, self-efficacy and intrinsic value in self-regulated learning and English language learning achievements. *Language Teaching Research*, *27*(1), 207–228. https://doi.org/10.1177/1362168820933190
14. Baker, L. A., & Cavinato, A. G. (Eds.). (2020). Teaching analytical chemistry in the time of COVID-19. Analytical Chemistry, 92(15), 10185–10186. https://doi.org/10.1021/acs.analchem.0c02981
15. Beel, J. (2017). Towards effective research-paper recommender systems and user modeling based on mind maps. ArXiv Preprint ArXiv:1703.09109.
16. Bigazzi, R., Landi, F., Cascianelli, S., Baraldi, L., Cornia, M., & Cucchiara, R. (2022). Focus on impact: Indoor exploration with intrinsic motivation. IEEE Robotics and Automation Letters, 7(2), 2985–2992. https://doi.org/10.1109/LRA.2022.3145971
17. Breslin, K., Mohsen, S., & Kumar, P. (2021). Neurodiversity in the teaching of the mental state examination: a pilot study of interactive mind-mapping seminars for the new ScotGem (Scottish graduate-entry medicine) students during the COVID-19 pandemic. *BJPsych Open*, *7*(S1), S10–S11. https://doi.org/10.1192/bjo.2021.87

18. Bruhl, J. C., & Bruhl, W. G. (2020, June 22). Engineering creativity: Ideas from the visual arts for engineering programs. 2020 ASEE Virtual Annual Conference Content Access. https://peer.asee.org/engineering-creativity-ideas-from-the-visual-arts-for-engineering-programs
19. Buzan, T., & Buzan, B. (1996). How to use radiant thinking to maximize your brain's untapped potential. Dutton: New York, NY, USA.
20. C. R. Kothari. (2004). Research-Methodology-CR-Kothari (Second ed).
21. Cancer, A., Iannello, P., Salvi, C., & Antonietti, A. (2023). Executive functioning and divergent thinking predict creative problem-solving in young adults and elderlies. Psychological Research, 87(2), 388–396.
22. Cao, Y., Subramonyam, H., & Adar, E. (2022). VideoSticker: A tool for active viewing and visual note-taking from videos. 27th International Conference on Intelligent User Interfaces, 672–690.
23. Chakraborty, S., & Biswas, M. C. (2020). 3D printing technology of polymer-fiber composites in textile and fashion industry: A potential roadmap of concept to consumer. Composite Structures, 248, 112562.
24. Chang, J.-H., Chiu, P.-S., & Huang, Y.-M. (2018). A sharing mind map-oriented approach to enhance collaborative mobile learning with digital archiving systems. The International Review of Research in Open and Distributed Learning, 19(1). https://doi.org/10.19173/irrodl.v19i1.3168
25. Chang, Y.-C., & Tsai, Y.-T. (2022). The effect of university students' emotional intelligence, learning motivation and self-efficacy on their academic achievement—Online English courses. Frontiers in Psychology, 13, 818929.
26. Chen, Y.-C., Yang, F.-Y., Chang, C.-C., & Chang, C.-C. (2020). Conceptualizing Spatial abilities and their relation to science learning form a cognitive perspective.. Journal of Baltic Science Education, 19(1), Continuous. https://doi.org/10.33225/jbse/20.19.50
27. Corazzo, J. (2019). Materialising the Studio. A systematic review of the role of the material space of the studio in Art, Design and Architecture Education. The Design Journal, 22(sup1), 1249–1265. https://doi.org/10.1080/14606925.2019.1594953
28. Cores-Bilbao, E., Fernández-Corbacho, A., Machancoses, F. H., & Fonseca-Mora, M. C. (2019). A music-mediated language learning experience: Students' awareness of their socio-emotional skills. Frontiers in Psychology, 10, 2238.
29. Dewi, A. K. (2019). Improving students learning outcomes through mind map in human reproductive system topic in natural science learning. *International Journal for Educational and Vocational Studies*, *1*(7). https://doi.org/10.29103/ijevs.v1i7.1675
30. Din, M. (2020). Evaluating university students' critical thinking ability as reflected in their critical reading skill: A study at bachelor level in Pakistan. Thinking Skills and Creativity, 35, 100627.
31. Eggers, J. H., Oostdam, R., & Voogt, J. (2021). Self-regulation strategies in blended learning environments in higher education: A systematic review. Australasian Journal of Educational Technology, 37(6), Article 6. https://doi.org/10.14742/ajet.6453
32. Eli, T. (2021). Students` perspectives on the use of innovative and interactive teaching methods at the University of Nouakchott Al Aasriya, Mauritania: English Department as a Case Study. International Journal of Technology, Innovation and Management (IJTIM), 1(2), Article 2. https://doi.org/10.54489/ijtim.v1i2.21
33. Engelbrecht, J., Llinares, S., & Borba, M. C. (2020). Transformation of the mathematics classroom with the internet. *ZDM - Mathematics Education*, *52*(5), 825–841. https://doi.org/10.1007/s11858-020-01176-4
34. Escobar Fandiño, F. G., Muñoz, L. D., & Silva Velandia, A. J. (2019). Motivation and E-Learning English as a foreign language: A qualitative study. Heliyon, 5(9), e02394. https://doi.org/10.1016/j.heliyon.2019.e02394
35. Fan, H. (2023). Winter is coming? University teachers' and students' views on the value of learning English in China. Review of Education, 11(2), e3410.
36. Fang, F., & Liu, Y. (2020). 'Using all English is not always meaningful': Stakeholders' perspectives on the use of and attitudes towards translanguaging at a Chinese university. *Lingua*, *247*, 102959. https://doi.org/10.1016/j.lingua.2020.102959
37. Ferland, Y., & Kaszap, M. (2019). Geoliteracy, cartology, and a mobile serious game. Abstracts of the ICA, 1, 1–2.
38. Field, A. (2013). *Second Edition of the Discovering Statistics Using SPSS 5th Edition*.
39. Freire, S. de M. L., Silva, R. A., Melo, G. A. A., Aguiar, L. L., Caetano, J. Á., & Santiago, J. C. dos S. (2021). Meaning and dimensionality of state of comfort in patients with chronic haemodialysis kidney disease. Texto & Contexto - Enfermagem, 30, e20200037. https://doi.org/10.1590/1980-265X-TCE-2020-0037
40. Fu, G., & Clarke, A. (2019). Teachers' moral agency under neo-liberal influences: What is educationally desirable in China's curriculum reform? Educational Review, 71(1), 51–66.
41. Fu, Q. K., Lin, C. J., Hwang, G. J., & Zhang, L. (2019). Impacts of a mind mapping-based contextual gaming approach on EFL students' writing performance, learning perceptions and generative uses in an English course. Computers and Education, 137, 59–77. https://doi.org/10.1016/j.compedu.2019.04.005
42. Giusti, L., Mammarella, S., Salza, A., Del Vecchio, S., Ussorio, D., Casacchia, M., & Roncone, R. (2021a). Predictors of academic performance during the covid-19 outbreak: Impact of distance education on mental

health, social cognition and memory abilities in an Italian university student sample. BMC Psychology, 9, 1–17.
43. Giusti, L., Mammarella, S., Salza, A., Del Vecchio, S., Ussorio, D., Casacchia, M., & Roncone, R. (2021b). Predictors of academic performance during the covid-19 outbreak: Impact of distance education on mental health, social cognition and memory abilities in an Italian university student sample. BMC Psychology, 9, 1–17.
44. Goodnough, K., & Woods, R. (2002). Student and teacher perceptions of mind mapping: A Middle School Case Study.
45. Guo, H., Tong, F., Wang, Z., Min, Y., & Tang, S. (2018). English- vs. chinese-medium instruction in chinese higher education: A quasi-experimental comparison. Sustainability, 10(11), Article 11. https://doi.org/10.3390/su10114230
46. Guo, Q. (2021). Research on the application of mind map in multimedia network teaching environment. *Journal of Physics: Conference Series*, *1827*(1), 990–995. https://doi.org/10.1088/1742-6596/1827/1/012162
47. Habib, M. K., Nagata, F., & Watanabe, K. (2021). Mechatronics: Experiential learning and the stimulation of thinking skills. Education Sciences, 11(2), Article 2. https://doi.org/10.3390/educsci11020046
48. Hafeez, M. (2021). Systematic review on modern learning approaches, critical thinking skills and students learning outcomes. *Indonesian Journal Of Educational Research and Review*, *4*(1), Article 1.
49. Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203
50. Hallberg, I., Ranerup, A., Bengtsson, U., & Kjellgren, K. (2018). Experiences, expectations and challenges of an interactive mobile phone-based system to support self-management of hypertension: Patients’ and professionals’ perspectives. Patient Preference and Adherence, 12, 467–476. https://doi.org/10.2147/PPA.S157658
51. Hanif, S., Wijaya, A. F. C., & Winarno, N. (2019). Enhancing students' creativity through STEM project-based learning. Journal of Science Learning, 2(2), Article 2. https://doi.org/10.17509/jsl.v2i2.13271
52. Harris, N., & Bacon, C. E. W. (2019). Developing cognitive skills through active learning: A systematic review of health care professions. Athletic Training Education Journal, 14(2), 135–148. https://doi.org/10.4085/1402135
53. Hatfield, M. C., Cahill, C. F., & Monahan, J. (2017, June 24). UAS curriculum for students using an active learning approach. 2017 ASEE Annual Conference & Exposition. https://peer.asee.org/uas-curriculum-for-students-using-an-active-learning-approach
54. Hayes, A. F., & Preacher, K. J. (2014). Statistical mediation analysis with a multicategorical independent variable. British Journal of Mathematical and Statistical Psychology, 67(3), 451–470. https://doi.org/10.1111/bmsp.12028
55. Hou, Z. (2021). Research on adopting artificial intelligence technology to improve effectiveness of vocational college english learning. *Journal of Physics: Conference Series*, *1744*(4). https://doi.org/10.1088/1742-6596/1744/4/042122
56. Huck, C., & Zhang, J. (2021). Effects of the COVID-19 pandemic on K-12 education: A systematic literature review. *New Waves-Educational Research and Development Journal*, *24*(1), 53–84.
57. Hyderabad, I.N. & Soam, S. K. (2022). Mind mapping as a learning and teaching tool in agricultural higher education in India. *Indian Research Journal of Extension Education*, *22*(3), 176–181.
58. Ismail, W. B., Azizan, K. F. B. K., Rahman, A. B. A., Jamali, H. N. B., & Nordin, H. M. (2022). Reflection on the Ausubel's theory application (ATA) in basic grammar mapping (BGM) for teaching arabic text reading skills. International Journal of Academic Research in Business and Social Sciences, 12(1), 1407–1416.
59. Katsarou, E., & Chatzipanagiotou, P. (2021). A critical review of selected literature on learner-centered interactions in online learning. *Electronic Journal of E-Learning*, *19*(5), 349–362. https://doi.org/10.34190/ejel.19.5.2469
60. Keller, J. M. , & Subhiyah, R. (1993). *Course interest survey*.
61. Keter, P. K., Simiyu, J., & Mubichakani, J. (2021a). Effect of mind mapping teaching strategy on mathematics achievement among secondary school students in Nandi County. *Kenya. Journal of Research Innovation and Implications in Education*, *5*(4), 164–172.
62. Keter, P. K., Simiyu, J., & Mubichakani, J. (2021b). Effect of mind mapping teaching strategy on mathematics achievement among secondary school students in Nandi County. *Kenya. Journal of Research Innovation and Implications in Education*, *5*(4), 164–172.
63. Kim, D. (2020). Learning language, learning culture: Teaching language to the whole student. *ECNU Review of Education*, *3*(3), 519–541. https://doi.org/10.1177/2096531120936693
64. Kliziene, I., Taujanskiene, G., Augustiniene, A., Simonaitiene, B., & Cibulskas, G. (2021). The impact of the virtual learning platform EDUKA on the academic performance of primary school children. Sustainability, 13(4), Article 4. https://doi.org/10.3390/su13042268
65. Kolb, A. Y., & Kolb, D. A. (2005). Learning styles and learning spaces: Enhancing experiential learning in higher education. Academy of Management Learning & Education, 4(2), 193–212. https://doi.org/10.5465/AMLE.2005.17268566

66. Kolb, A. Y., & Kolb, D. A. (2017). Experiential learning theory as a guide for experiential educators in higher education. Experiential Learning and Teaching in Higher Education, 1(1), Article 1. https://doi.org/10.46787/elthe.v1i1.3362
67. Kolb, D. (1984). Experiential learning: Experience as the source of learning and development. In Journal of Business Ethics (Vol. 1).
68. Kulikovskikh, I., Lipic, T., & Šmuc, T. (2020). From knowledge transmission to knowledge construction: A step towards human-like active learning. Entropy, 22(8), Article 8. https://doi.org/10.3390/e22080906
69. Lewis, K., Hulme, K., Kasprzak, E., Moore-Russo, D., Singla, P., & English, K. (2010). *Teaching Automobile, Flight And System Dynamics Using Innovative Motion Simulation Experiments*. 15.1168.1-15.1168.15.
70. Li, X., Chen, L., & Wu, D. (2021). Turning attacks into protection: Social media privacy protection using adversarial attacks. Proceedings of the 2021 SIAM International Conference on Data Mining (SDM), 208–216.
71. Liu, R., Chen, B., Chen, M., Wu, Y., Qiu, Z., & He, X. (2019). Mappa mundi: An interactive artistic mind map generator with artificial imagination. *IJCAI International Joint Conference on Artificial Intelligence*, *2019-August*, 6545–6547. https://doi.org/10.24963/ijcai.2019/951
72. Luangkrajang, M. S. (2022). Use of mind-mapping in language learning: A cognitive approach. Theory and Practice in Language Studies, 12(8), 1616–1621.
73. Luo, L., Zeng, X., Wu, Y., An, F., Huang, J., Yang, H., Jiang, Q., Ou, Q., Du, J., & Song, N. (2022). Influencing factors of students aged 10–20 non-participating in home physical exercise during the COVID-19 isolation policy period: A cross-sectional study from china. Frontiers in Public Health, 10. https://www.frontiersin.org/articles/10.3389/fpubh.2022.787857
74. Machado, C. T., & Carvalho, A. A. (2020). Concept mapping: Benefits and challenges in higher education. *Journal of Continuing Higher Education*, *68*(1), 38–53. https://doi.org/10.1080/07377363.2020.1712579
75. Machado, R. S., & Mello-Carpes, P. B. (2018). The use of an open-ended, student-led activity to aid in the learning and understanding of action potential. Advances in Physiology Education, 42(2), 324–328. https://doi.org/10.1152/advan.00101.2017
76. Malallah, S., & Weese, J. L. (2020). The effects of mind maps on computational thinking. 2020 ASEE Virtual Annual Conference Content Access.
77. Manalayil, J., Muston, A., Ball, A., & Chevalier, D. (2020). 1HR ON-CALL — Using simulated ON-CALL to underpin experiential learning in final year medical students. Journal of European CME, 9(1), 1832749. https://doi.org/10.1080/21614083.2020.1832749
78. Mardiah, H. (2020). The use of e-learning to teach English in the time of the Covid-19 pandemic. English Teaching and Linguistics Journal (ETLiJ), 1(2), 45–55.
79. Masterson, M. (2020). An exploration of the potential role of digital technologies for promoting learning in foreign language classrooms: Lessons for a pandemic. International Journal of Emerging Technologies in Learning (IJET), 15(14), Article 14. https://doi.org/10.3991/ijet.v15i14.13297
80. Ming, J. L., Huang, H. M., Hung, S. P., Chang, C. I., Hsu, Y. S., Tzeng, Y. M., Huang, H. Y., & Hsu, T. F. (2019). Using simulation training to promote nurses' effective handling ofworkplace violence: A quasi-experimental study. *International Journal of Environmental Research and Public Health*, *16*(19). https://doi.org/10.3390/ijerph16193648
81. Mohaidat, M. M. T. (2018). The impact of electronic mind maps on students' reading comprehension. *English Language Teaching*, *11*(4), 32. https://doi.org/10.5539/elt.v11n4p32
82. Mohamad Abdel-Haq, E., Mohamad Al-Hadi, T., & Ghanem Mohammad, S. (2019). A transformative learning- based strategy for developing critical reflection and reflective writing skills of secondary school efl students. ج يوليو 119)30, بنها. مجلة كلية التربية 2), 1–39. https://doi.org/10.21608/jfeb.2019.61316
83. Naghmeh-Abbaspour, B., & Rastgoo, V. (2020). Analysis for finding the effect of mind mapping technique on the iranian english as foreign language learning' writing skills. *Texto Livre*, *13*(2), 102–116. https://doi.org/10.35699/1983-3652.2020.24559
84. Naibaho, L. (2022). The integration of mind mapping strategy on students' essay writing at universities kristen Indonesia. *JPPI (Jurnal Penelitian Pendidikan Indonesia)*, *8*(2), 320. https://doi.org/10.29210/020221678
85. Narayanan, S. (2018). A study on the relationship between creativity and innovation in teaching and learning methods towards students academic performance at private higher education institution, Malaysia. International Journal of Academic Research in Business and Social Sciences, 7(14), 1–10.
86. NYAGBLORMASE, G., GYAMPOH, A., Hinson, J., AIDOO, B., & Yeboah, E. (2021). Effect of mind mapping as a learning tool on online learning of chemistry. Studies in Learning and Teaching, 2(2), 47–58.
87. Odaryuk, I. (2021). Using Mind Maps to motivate the digital generation of students to learn foreign languages. E3S Web of Conferences, 273, 12146.
88. Oducado, R. M., & Estoque, H. (2021). Online learning in nursing education during the COVID-19 pandemic: Stress, satisfaction, and academic performance. Journal of Nursing Practice, 4(2), 143–153.

89. Ożadowicz, A. (2020). Modified blended learning in engineering higher education during the COVID-19 lockdown—Building automation courses case study. Education Sciences, 10(10), 292.
90. Pallant, J. (2016). *SPSS Survival Manual A Step By Step Guide to Data Analysis Using SPSS Program (6th ed.)* (6th ed.). Hill Education.
91. Pallant, J. (2020). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS*. Routledge.
92. Papanthymou, A., & Darra, M. (2019). The contribution of learner self-assessment for improvement of learning and teaching process: A review. Journal of Education and Learning, 8(1), 48–64.
93. Pardede, P. (2020). Integrating the 4Cs into EFL integrated skills learning. *JET (Journal of English Teaching)*, *6*(1), 71–85. https://doi.org/10.33541/jet.v6i1.190
94. Passarelli, A. M., & Kolb, D. A. (2023). Experiential learning theory. Student learning abroad: What our students are learning, what they're not, and what we can do about it.
95. Razali, N., Nasir, N. A., Ismail, M. E., Sari, N. M., & Salleh, K. M. (2020). Gamification elements in quizizz applications: Evaluating the impact on intrinsic and extrinsic student's motivation. IOP Conference Series: Materials Science and Engineering, 917(1), 012024. https://doi.org/10.1088/1757-899X/917/1/012024
96. Rezapour-Nasrabad, R. (2019). Mind map learning technique: An educational interactive approach. *International Journal of Pharmaceutical Research*, *11*(1), 1593–1597.
97. Rillo, A. G., Martínez-Carrillo, B. E., Castillo-Cardiel, J. A., & Rementería-Salinas, J. M. (2020). Constructivism: An interpretation from medical education. IOSR J Res Method Educ, 10, 1–12.
98. Rogers, C. R., & Freiberg, H. J. (1969). Freedom to learn. Columbus, OH: Charles Merrill. (n.d.).
99. Rogers, J., & Révész, A. (2020). Experimental and quasi-experimental designs.
100. Roy, A., Newman, A., Ellenberger, T., & Pyman, A. (2019). Outcomes of international student mobility programs: a systematic review and agenda for future research. *Studies in Higher Education*, *44*(9), 1630–1644. https://doi.org/10.1080/03075079.2018.1458222
101. Sabarun, S., Muslimah, A. H. S., Muhanif, S., & Elhawwa, T. (2021). The effect of flow mind map on writing accuracy and learning motivation at islamic higher education. *Language Circle: Journal of Language and Literature*, *16*(1), 146–161. https://doi.org/10.15294/lc.v16i1.30551
102. Scholtz, S. E. (2021). Sacrifice is a step beyond convenience: a review of convenience sampling in psychological research in africa. *SA Journal of Industrial Psychology*, *47*. https://doi.org/10.4102/sajip.v47i0.1837
103. Scisciola, L., Fontanella, R. A., Surina, Cataldo, V., Paolisso, G., & Barbieri, M. (2021). Sarcopenia and cognitive function: Role of myokines in muscle brain cross-talk. Life, 11(2), 173.
104. Shah, P.H.D., & Kumar, R. (2019). Effective constructivist teaching learning in the classroom. Shah, RK (2019). Effective Constructivist Teaching Learning in the Classroom. Shanlax International Journal of Education, 7(4), 1–13.
105. Soeiro, A., Uras, F., & Royo, C. (2018). Skills gap – solution may be with digital skills accelerator project. EDULEARN18 Proceedings, 4789–4793. https://doi.org/10.21125/edulearn.2018.1188
106. Sreena, S., & Ilankumaran, M. (2018). Developing productive skills through receptive skills–a cognitive approach. International Journal of Engineering & Technology, 7(4.36), 669–673.
107. Sumarna, C., & Gunawan, H. (2022). Foundations of constructivism philosophy in classroom learning. International Journal of Science and Society, 4(3), Article 3. https://doi.org/10.54783/ijsoc.v4i3.499
108. Sun, Q., & Zhang, L. J. (2021). A sociocultural perspective on English-as-a-Foreign-Language (EFL) teachers' cognitions about form-focused instruction. In *Frontiers in Psychology* (Vol. 12). https://doi.org/10.3389/fpsyg.2021.593172
109. Sweller, J. (2020). Cognitive load theory and educational technology. *Educational Technology Research and Development*, *68*(1), 1–16. https://doi.org/10.1007/s11423-019-09701-3
110. Tanhan, A., Karaman, M. A., & Nalbant, A. (2020). The effect of counselling on anxiety level from the perspective of ecological systems theory: A quasi-experimental pre-test - post-test control group study. *International Journal of Psychology and Educational Studies*, *7*(3), 58–69. https://doi.org/10.17220/ijpes.2020.03.006
111. Tatipang, D. P., Oroh, E. Z., & Liando, N. V. F. (2022). The application of mind mapping technique to increase students' reading comprehension at the seventh grade of SMP.
112. Tavares, L. A., Meira, M. C., & Amaral, S. F. Do. (2021). Interactive mind map: A model for pedagogical resource. *Open Education Studies*, *3*(1), 120–131. https://doi.org/10.1515/edu-2020-0145
113. Thoe, N. K., Jamaludin, J., Pang, Y. J., Choong, C., Lay, Y. F., Ong, E. T., Durairaj, K., Talib, C. A., & Chin, C. K. (2022). Developing conceptual and procedural knowledge/skills of lifelong learners from basic to advance learning: Exemplars, challenges and future direction. Dinamika Jurnal Ilmiah Pendidikan Dasar, 14(1), Article 1. https://doi.org/10.30595/dinamika.v14i1.13164
114. Trakunphutthirak, R., & Lee, V. C. (2022). Application of educational data mining approach for student academic performance prediction using progressive temporal data. Journal of Educational Computing Research, 60(3), 742–776.
115. Tsamardinos, I., Charonyktakis, P., Papoutsoglou, G., Borboudakis, G., Lakiotaki, K., Zenklusen, J. C., Juhl, H., Chatzaki, E., & Lagani, V. (2022). Just Add Data: Automated predictive modeling for knowledge

discovery and feature selection. Npj Precision Oncology, 6(1), Article 1. https://doi.org/10.1038/s41698-022-00274-8
116. Tulloch, B. J. (2020). Canadian" Anne-Girl [s]": Literary Descendents of Montgomery's Redheaded Heroine.
117. Vygotsky, L. S. (1980). Mind in society: Development of higher psychological processes (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.). Harvard University Press.
118. Wahab, N. A., Osman, A., Ibrahim, N., & Ilyas, S. S. M. (2021). Integrating constructivist learning environments (CLEs) in designing a multimedia learning application for cyber-bullying intervention. Journal of Computing Research and Innovation, 6(3), Article 3. https://doi.org/10.24191/jcrinn.v6i3.251
119. Wang, L., Liu, Y., Wang, Q., Wang, J., & Yang, Z. (2020). PLC course teaching method based on OBE teaching concept. Advances in Educational Technology and Psychology, 4(1), 101–109.
120. Wang, X., & Dostál, J. (2018). Using a mind map to learn English vocabulary. *ACM International Conference Proceeding Series*, *November*, 150–153. https://doi.org/10.1145/3291078.3291121
121. Wang, Y. (2020). A survey of the use of english vocabulary mnemonic strategies by non-english majors. *Theory and Practice in Language Studies*, *10*(12), 1656–1661. https://doi.org/10.17507/tpls.1012.21
122. Wang, Y., Xia, M., Guo, W., Xu, F., & Zhao, Y. (2022). Academic performance under COVID-19: The role of online learning readiness and emotional competence. Current Psychology. https://doi.org/10.1007/s12144-022-02699-7
123. Widiasti, F., & Isnawati. (2023). Development of flashcard and interactive mind mapping media in the website on plant tissue material to improve student's comprehension. BioEdu. *BioEdu: Berkala Ilmiah Pendidikan Biologi*, *12*(1).
124. Yi, D. (2021). Grammar translation and its use in present-day China: Challenges and issues. Journal of Arts and Humanities, 10(05).
125. Yu, X. (2021). Foreign language learning anxiety in China: Theories and applications in English language teaching: by Deyuan He, Singapore, Springer Nature, 2018, xx+ 221 pp., 74, 96€(eBook), ISBN 978-981-10-7662-6 (Vol. 24). Taylor & Francis.
126. Zalts, R., Green, N., Tackett, S., & Lubin, R. (2021). The association between medical students' motivation with learning environment, perceived academic rank, and burnout. Int J Med Educ, 12, 25–30. https://doi.org/10.5116/ijme.5ff9.bf5c
127. Zhang, C. (2022). The advantages and disadvantages of learning a second language early. *Proceedings of the 2021 International Conference on Social Development and Media Communication (SDMC 2021)*, *631*(Sdmc 2021), 32–37. https://doi.org/10.2991/assehr.k.220105.008
128. Zheng, X., Johnson, T. E., & Zhou, C. (2020). A pilot study examining the impact of collaborative mind mapping strategy in a flipped classroom: learning achievement, self-efficacy, motivation, and students' acceptance. *Educational Technology Research and Development*, *68*(6), 3527–3545. https://doi.org/10.1007/s11423-020-09868-0
129. Zheng, X., Li, C., & Xiong, X. (2019a). The significance of mind mapping in english teaching in independent colleges. 2019 3rd International Conference on Education, Management Science and Economics (ICEMSE 2019), 127–130.
130. Zheng, X., Li, C., & Xiong, X. (2019b). The significance of mind mapping in english teaching in independent colleges. 2019 3rd International Conference on Education, Management Science and Economics (ICEMSE 2019), 127–130.
131. Zou, C., Li, P., & Jin, L. (2021). Online college English education in Wuhan against the COVID-19 pandemic: Student and teacher readiness, challenges and implications. *PLoS ONE*, *16*(10 October), 1–24. https://doi.org/10.1371/journal.pone.0258137