Deep Learning in EFL Education in China: Definition and Dimensions

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Abstract
Deep learning in EFL education in China is defined as a learning approach driven by English learning motivation, through deep learning strategies and active engagement, aiming to acquire not only an in-depth understanding of knowledge in the English language and comprehensive language application skills but also the development of higher-order thinking, including knowledge transfer, critical thinking, creative thinking, problem-solving ability. To clarify the definition of deep learning in EFL education, the origins, schools of thought, and dimensions of deep learning in EFL education were elaborated, as well as the components of deep learning outcomes. A model consisting of four dimensions and six learning outcomes was presented. The four dimensions involve learning motivation, learning strategies, learning engagement, and learning outcomes. The learning outcomes involve an in-depth understanding of knowledge in the English language, comprehensive language application skills, knowledge transfer, critical thinking, creative thinking, and problem-solving ability.
Keywords: Deep Learning, Motivation, Strategies, Engagement, Outcomes

Introduction
Deep learning in education has become increasingly heated over the last decades. According to Biggs (1987a), deep learning refers to students' learning approach that implies an intention to seek to understand the issues and interact critically with the contents of particular teaching materials, relate ideas to previous knowledge and experience, examine the logic of the arguments and relate the evidence presented to the conclusions. The surface approach, on the other hand, implies that students learn simply to memorize facts of the content of teaching materials without distinguishing any underlying meanings, accept passively the ideas and information given, and are easily influenced by assessment requirements (Biggs, 1987; Entwistle & Ramsden, 2015). Since Marton and Saljo elaborated

on the concepts and differences between deep-level processing and surface-level processing (Marton & Saljo, 1976)], research on deep learning has been penetrating all over the world.

Deep learning is given increasing attention in China's EFL education because the focus on higher-order thinking, such as analyzing, evaluating, and creating, is generally missing in traditional English classrooms (Tao, 2015; Wang, 2017; Wei, 2019). What is seen in English classrooms is that both the instructors and students divide the English learning text into isolated knowledge pieces, such as vocabulary, grammar, and syntax, which are easy to cope with in the tests and quizzes. The passively rote learning fragments plus repetitious grammatical drills in English classrooms resulted in surface learning, low efficiency, and absence of critical thinking (Wang, 2017).

The efforts to improve students' deep learning cannot be separated from the call for competitiveness in the 21st century. The three main frameworks of 21st-century skills involve 1) learning and innovation skills, 2) life and career skills, and 3) information, media, and technology skills (Scott, 2017). Deep learning is the requirement of 21st-century skills (Bell, 2010). There is voluminous literature presenting the definition of deep learning but little was done to specify deep learning in EFL education. Starting from the origination and schools of thought of deep learning, the study conceptually delineated the definition, dimensions, and outcomes of deep learning in EFL education.

Origins of Deep Learning

The concept of deep learning originated from the field of artificial intelligence, as algorithmic thinking that simulates the process of individual thinking(Chen & Zou, 2020). In the field of learning science, deep learning was first proposed by American scholars Ference Marton and Roger Saljo (1976). After studying the performance of reading comprehension done by Swedish college students, they found that the respondents adopted two different strategies in the process of reading. One strategy is to understand the concepts in the text, the relationship between concepts, the context, as well as the connotation of the text. Another strategy is to recognize and memorize the facts in the text in order to simply respond to the reading-based tests. They call the first learning strategy deep-level processing and the second surface-level processing.

Throughout the 1980s, following Marton and Saljo, additional research was conducted by Entwistle, Biggs, and Collis, to mention a few (Eury, 2020). Besides surface learning and deep learning, the third learning approach was developed: strategic learning (Bain, 2004; Bain & Zimmerman, 2009; J. Biggs, 1987; Ramsden, 1979). A strategic learner understands and follows the rules of academic games. He concentrates on getting good sores with the least amount of work. The strategic learner, for example, comes to the classroom raising his hand to ask a question that sounds informed and reasonable, providing the teacher with exactly what is expected as an answer but without constructing knowledge in himself or in the learning community. The strategic learner is actually a surface learner and this is exactly why some scholars chose to categorize this type of learning into surface learning (Hermida, 2014).

Schools of Thought of Deep Learning

Deep learning, also known as deeper learning (Alliance for Excellent Education, 2011; Darling-Hammond & Oakes, 2021; M. Huberman et al., 2014; Jensen & Nickelsen, 2008), is reported to help with the sustainability of education and the solution to higher education's performance dilemma. While in China, deep learning and deeper learning were translated into the same words *shenduxuexi*, the study tends to use deep learning for the sake of

consistency. Deep learning has aroused widespread concern in education. The understanding of the concept can be categorized into three theories: the learning approach theory, the learning process theory, and the learning outcome theory (Bu et al., 2016; Dong, 2021).

First, in the learning approach theory, deep learning is regarded as an approach to learning opposite to focusing on fragmented and detailed knowledge content. Biggs (1979) believes that deep learning includes high-level or active cognitive processing, while surface learning adopts low-level cognitive processing, such as rote learning or mechanical memory. In 2005, Chinese scholars He and Li (2005) took the lead in introducing Western deep learning research into China. In their research deep learning is a learning approach based on understanding and the learners integrate what they have learned into their prior cognitive structure, applying it to many other ideas, synthesizing all the existing knowledge, and transferring it to the present situations. This is in alignment with Bloom's taxonomy of educational objectives (Bloom et al., 1956): knowledge, comprehension, application, analysis, synthesis, and evaluation. The taxonomy ranges from lower-order objectives that require less cognitive processing to higher-order objectives that demand deep learning and more cognitive processing (Adams, 2015; Hung, 2015). Several years later, Anderson and Krathwohl (2001) revised Bloom's taxonomy replacing the six categories of nouns with verbs to label the same categories, as is shown in Figure 1. The categories of "remember" and "understand" constitute lower-order thinking while the categories of "apply", "analyze", "evaluate", and "create" constitute higher-order thinking(Wei, 2019; Zhang et al., 2017).
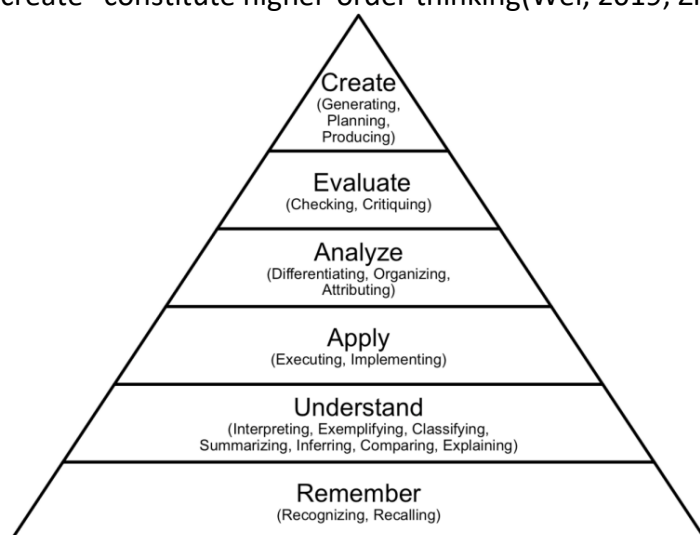

Figure 1. An illustration of the revised Bloom's Taxonomy adapted from Anderson and Krathwohl (2001)

Just as Bloom et al. (1956) stated, the taxonomy was designed hierarchically: to accomplish higher-order thinking, one must first develop lower-order thinking. It means that although there are essential differences between the deep approach and the surface approach, the two are not completely separated. Generally, knowledge memory and comprehension involved in surface learning are also the necessary basis for deep learning.

Second, following the learning approach theory, more scholars turn to the research of the learning process theory. T. F. N. Laird et al. (2005) proposed that deep learning is to understand materials through various strategies, such as extensive reading, connecting various resources, discussing views with others, synthesizing fragmented information into larger structures, and applying knowledge in practical situations. Fullan and Langworthy

(2014) pointed out that deep learning focuses on the effective use of knowledge, and its transfer into real-life situations, as well as a learning process full of challenges, which stimulates students' internal motivation, attraction, and joy. The Chinese researcher Cui (2017) explains that deep learning is a learning process in which students experience guidance, challenges, high commitment, and high-level cognitive skills with the lecturer's professional assistance. This is consistent with another Chinese researcher Guo (2016) who believes that deep learning is a process in which students study challenging themes, actively participate, achieve development, and experience the joy of success under the lecturers' guidance. The emphasis on the lecturer's role in students' deep learning process mirrors the influence of Confucius heritage culture in China and shows a great difference from Western deep learning which encourages student autonomy to the greatest degree (Ford, 1992; Iyengar & DeVoe, 2003; Markus et al., 1996). Nevertheless, with research on deep learning heated in China, more researchers advocate the importance of student autonomy in deep learning (Wei, 2019; Zheng & Liu, 2018).

Third, researchers who adhere to the learning outcome theory regard deep learning as one of the learning outcomes, which involves skills, knowledge, and cognitive competencies required for future life. Deep learning, in learning outcome theory, is usually written in deeper learning (Mette Huberman et al., 2014; M. Huberman et al., 2014; Jensen & Nickelsen, 2008). It is not only a necessary way to achieve the outcome of comparatively deeper learning but also the outcome itself as well as desirable competencies. For example, the American National Research Council (2012) put forward the competency of students' deeper learning from three domains: the cognitive domain, the intrapersonal domain, and the interpersonal domain. The Alliance for Excellence in Education (2011) considered deeper learning as a competency to combine standard tests and communication, collaboration, and autonomous learning under the lecturers' innovative guidance of rich learning materials. Michael Fullan (2017) defined the six global competencies, known as the 6Cs, for deep learning: character, citizenship, collaboration, communication, creativity, and critical thinking. Similarly, in China, a lot of researchers expressed deep learning competency as higher-level competencies, including problem solving, critical thinking, creative thinking, and metacognition (Wei, 2019; Zhang & Wu, 2012; Zheng & Liu, 2018).

To sum up, from the perspective of learning approach theory, as an approach to learning different from repeatedly memorizing unconnected and fragmented knowledge, deep learning emphasizes the internal connections of knowledge and cognitive schema, which is similar to meaningful learning proposed by Ausubel et al. (1968). From the perspective of learning process theory, deep learning is considered to be a challenging learning process that emphasizes the use and transfer of knowledge to solve problems in real-life situations. From the perspective of learning outcome theory, learning deeply highlights the importance of learners facing the future world with a variety of competencies needed in the 21st century. To achieve deep learning outcomes, a deep learning approach emphasizing active and meaningful constructing of knowledge is needed, and a deep learning process is thus encountered. In this sense, among the three schools of thought, the learning outcome theory is more holistic because it encompasses the learning approach theory and learning process theory.

The current study favors the stance of learning outcome theory due to the fact that in language learning students do not learn a language for the language itself, but rather to develop their higher-order thinking skills and apply them in situations beyond the language classroom(Richards & Rodgers, 2014; Sun, 2019; Zhang, 2019). The next section elaborated

on the four dimensions of deep learning in EFL education based on the learning outcome theory.

Definition of Deep Learning in EFL Education in China

When the theoretical development of deep learning in education is examined closely, it is easy to notice that deep learning comprises multi-faceted behavior and goals that resonate with the requirement of 21st-century learning and can be applied to any discipline including EFL education. Integrating the second language acquisition theory and deep learning theory, the study defined deep learning in EFL education as a learning approach driven by English learning motivation, through deep learning strategies and active engagement, aiming to acquire not only an in-depth understanding of knowledge in the English language and comprehensive language application skills but also the development of higher-order thinking, including knowledge transfer, critical thinking, creative thinking, problem-solving ability.

This definition proposed four dimensions of deep learning in EFL education: learning motivation, learning strategies, learning engagement, and learning outcomes. The following offered a detailed discussion of the four dimensions.

Dimensions of Deep Learning in EFL Education

First, motivation has been closely related to the access to deep learning (J. Biggs, 1987; Biggs, 2022; Entwistle, 2013; Fullan & Langworthy, 2014; Tochon, 2010). Deep learning begins with positive emotions such as intrinsic learning motivation, strong learning interest, and a correct learning attitude (Zhang & Wu, 2012). In the field of EFL education, motivation is also one of the most important determinants of students' learning achievements (Cheng & Dörnyei, 2007; Dörnyei, 1994). Instructional strategies were given in voluminous literature among which the ten commandments suggested by Dörnyei and Csizér (1998) were the best-known. The foreign/second language teachers were suggested to adopt the ten motivational strategies, for example, setting good examples with their own behavior, promoting students' self-confidence in language, making the learning tasks stimulating, and helping students establish particular learning goals.

Second, strategies are developed to address the issues resulting from students' motives and this combination of motive and strategy is defined as an approach to learning (Biggs, 1991). Table 1 displays the combination of motives and strategies in deep and surface learning.

Table 1.
Motive and strategy in approaches to learning and studying adapted from J. B. Biggs (1987)

Approach	Motive	Strategy
Deep	Deep Motive is intrinsic; learn for own interest and competence in a particular area of study.	Deep Strategy is meaningful; reading extensively; finding correlations with previous relevant knowledge.
Surface	Surface Motive is extrinsic; to meet requirements with the least effort; a balance between working too hard and failing.	Surface Strategy is rote learning; reproducing fragments; failing to see the connection of prior knowledge

Motivation in a deep approach to learning is intrinsic. Students learn for their own interests. They adopt a deep strategy of meaningful discovery by reading extensively and trying to find correlations between existing knowledge and prior knowledge. On the other hand, motivation in a surface approach to learning is extrinsic. Students engage in learning in order to meet the minimal requirements with the least effort. They always try to find a balance between working too hard and failing. They adopt a surface strategy of rote learning by reproducing the fragments in learning materials and failing to see the connection between existing and prior knowledge.

Third, engagement and motivation are inextricably intertwined in that engagement depends on the student's concentration on completing the job and maintaining a strong sense of personal efficacy and engagement is a suitable measure of motivation (Schunk, 1989). Self-regulated learning, in which students plan and manage their own learning and have a high degree of personal control and autonomy, is the highest and the most desirable type of engagement (Corno & Mandinach, 1983). Three engagements were identified in Fredricks et al. (2004): emotional engagement, cognitive engagement, and behavioral engagement. Emotional engagement mainly interacts with learning motivation, cognitive engagement mainly with learning strategies, and behavioral engagement mainly with the engagement in pre-, in-, and after-class (Jiang, 2022). Learning engagement, learning motivation, and learning strategies were reported to be the factors influencing the outcomes of deep learning (Qian et al., 2018; Wang et al., 2020; Wu, 2017).

Fourth, learning outcomes are viewed as essential as the other three dimensions in deep learning, each of which influences learning outcomes. Clarification of learning outcomes helps students to know what they are expected to learn and also helps teachers in many ways, like planning their teaching and choosing the appropriate assessment methods (Harden, 2002). Since Dearing (1997) put forward the point of learning outcomes, people have been realizing the importance of defining the intended learning outcomes. However, the concern of the outcomes should not be the topics taught but the achievement made (Biggs, 2022). Researchers voiced their opinions on different categories of learning outcomes. Some considered the issue of learning context. For example, Biggs elaborated on learning outcomes in three levels, the university level, program level, and course level. Some just highlighted learning outcomes from higher-order thinking abilities. The three domains categorized by National Research Council (2012) is one of the examples. The cognitive domain includes deep content knowledge, critical thinking, and complex problem solving; The interpersonal domain includes collaboration and communication; the intrapersonal domain includes learning-to-learn competencies and academic mindsets. Another well-known example can be seen in Fullan (2017) defined the six global competencies in learning outcomes, known as 6Cs, for deep learning: character, citizenship, collaboration, communication, creativity, and critical thinking. However, elaboration on learning outcomes in the College English curriculum in terms of both lower- and higher-order abilities is scarce. The study synthesized learning outcomes for deep language learners in the following six components in the next subsection.

Components of Learning Outcomes in EFL Education

Integrated with second language acquisition theories, a considerable amount of literature underscored the importance of English-related academic outcomes and higher-order thinking outcomes. As Table 2 displays, English-related academic outcomes include an in-depth understanding of knowledge in the English language and comprehensive language application skills. The higher-order thinking outcomes consist of knowledge transfer, critical

thinking, creative thinking, and problem-solving ability. In this sense, there are six components of deep language learning outcomes.

Table 2.
Learning outcomes in EFL education

English-related academic outcomes	(1) An in-depth understanding of knowledge in the English language (2) Comprehensive language application skills
Higher-order thinking outcomes	(3) Knowledge transfer (4) Critical thinking (5) Creative thinking (6) Problem solving

The first fundamental learning outcome most usually found in EFL education literature concerns the understanding of the English language(MOE, 2020; Pei & Liu, 2013; Sun, 2019). The mastery of core academic content in the College English curriculum definitely means understanding the knowledge of English language which incorporates phonetics, vocabulary, grammar, discourse, etc., and knowing about the culture of English-speaking countries, and cross-cultural communication theories(Dai, 2001; Zhang & Zhao, 2017). According to Hewlett (2013), students are encouraged to apply core knowledge to new tasks and situations in other disciplines and real-life situations, which means English learners are supposed to express their ideas in English not only in the English classroom but also when studying their specific major and in their daily life. Besides, knowledge of the English language offers support for comprehensive language application skills.

The second component of learning outcomes, therefore, is the comprehensive language application skills, or language skills, which refer to skills in listening, speaking, reading, writing, and translating. Language skills should come before critical thinking and be the first thing that any language teacher considers to improve in students, which means the cultivation of higher-order thinking couldn't be achieved in the English classroom if language skills are ignored(Sun, 2019). Language skills have been one of the core English competencies that students are supposed to develop since high school(Ministry of Education, 2018). For College English, MOE (2020)specified the English application skills, cross-cultural communication, learning autonomy, and critical thinking as teaching aims of College English. It's easy to see that English application skills are the first aim among these several aims. English language application skills are developed on the basis of solid knowledge of the English language. The two discipline-specific learning outcomes are prerequisites for developing higher-order thinking outcomes. Just as Hattie and Donoghue (2016) suggested, without an adequate understanding of content knowledge, one can't advance directly to higher-level thinking, such as creative thinking and problem solving.

The third learning outcome expected in deep English learning, or the first higher-order thinking outcome, is knowledge transfer ability, the ability to make connections between the prior knowledge and what is acquired now, to know how to solve problems in new situations, to apply the knowledge acquired in the book to the real-life situations (Thomas F. Nelson Laird et al., 2005; T. F. N. Laird et al., 2005; Lu & Guo, 2013). As Lu and Guo (2013) insisted, transferred knowledge is one of the features of meaningful learning while learning in-depth

results in transferred knowledge. Likewise, Fullan and Langworthy (2014) pointed out that learning in-depth emphasizes the practical application of knowledge, the integration of knowledge into real-world contexts, and a demanding educational process that ignites students' intrinsic motivation, curiosity, and interest.

Regarding knowledge transfer in language learning, there mainly exist two kinds of transfer, one being within a language, or intralingual transfer, for instance, the transfer of the simple present tense to the present progressive tense, the other being among languages, or interlingual transfer, for instance, the transfer of Chinese learning to English learning (Song & Yu, 2001). In deep learning research, there exists a third knowledge transfer: Creating connections to the real world, for example, students visiting local companies that had taken measures to become model companies in sustainability after studying the meaning of sustainability(Mette Huberman et al., 2014). To achieve the outcome of the three kinds of knowledge transfer, lecturers need to provide students with real-life opportunities and situations to participate in language communication activities, either directly or indirectly, explicitly or implicitly. Besides peer interactions can be a significant resource for effective transfer, too, as Campione et al. (1995) have found that transfer can be facilitated in peer conversations and cooperative learning by, for example, explaining what one has learned to other students (Song & Yu, 2001).

The last three deep-learning outcomes are critical thinking, creative thinking, and problem-solving abilities. Considerable researchers articulated the significance of the three outcomes in deep learning. For instance, Zou (2012) stated that deep language learning means connection and integration, cooperation and development, and transfer and application. Wei (2019) voiced the same idea that learning English in-depth is understanding problems, thinking critically, transferring knowledge, exploring connections between knowledge, making decisions, and finally solving problems. As one of the deep-learning methods, project-based English learning is a good way to foster students' creative thinking, since students are encouraged to improvise, solve problems as they arise, find different ways to complete tasks, collaborate, take risks, develop effective communication skills, make ultimate products which are not predetermined, and evaluate themselves and their peers (Iakovos, 2011).

It can't be emphasized enough that English-related academic outcomes, including a deep understanding of knowledge in the English language and comprehensive English application skills, lay a foundation for the development of higher-order thinking outcomes which refer to knowledge transfer, critical thinking, creative thinking, and problem solving. Knowledge and skills of the English language should be developed while higher-order thinking abilities are focused. Researchers like Sun (2019), Wen and Sun (2015); Zhang (2019) found that without the focus on knowledge and skills of the English language, higher-order thinking in English classrooms is fancy but ineffective; similarly, without cultivation of higher-order thinking, English learning can't go deeper.

Conclusion

The study synthesized the origins and schools of thought of deep learning and put forward the definition and dimensions of deep learning in EFL education in China. Deep learning in EFL education is a learning approach driven by English learning motivation, through deep learning strategies and active engagement, aiming to acquire not only an in-depth understanding of knowledge in the English language and comprehensive language application skills but also the development of higher-order thinking, including knowledge transfer, critical

thinking, creative thinking, problem-solving ability. As Figure 1 shows, there exist four dimensions in deep EFL learning: learning motivation, learning strategies, learning engagement, and learning outcomes. In learning outcomes, there are six outcomes: an in-depth understanding of knowledge in the English language and comprehensive language application skills. The higher-order thinking outcomes consist of knowledge transfer, critical thinking, creative thinking, and problem-solving ability. In this sense, there are six components of deep language learning outcomes.
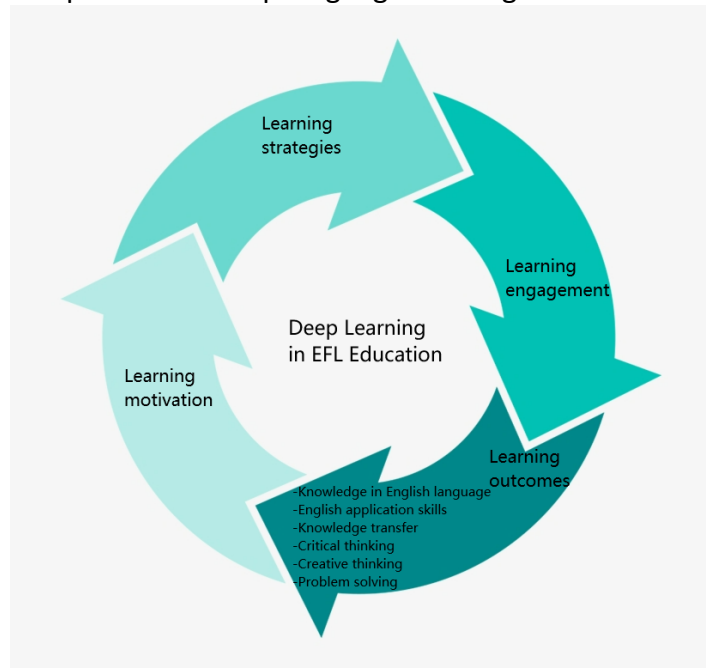

Figure 2. Deep learning in EFL education

Generally, the study elaborated on the definition and dimensions of deep learning in EFL education in China, thereby providing new insights into the theoretical development of deep learning in language education. It not only demonstrated the possibility of integrating the concept of deep learning and second language acquisition theories but also removed the ambiguity of deep learning in EFL education in China. Since the concept of deep learning in EFL education in China became explicit, it is suggested that, in order to facilitate students' deep learning, EFL teachers from K12 to higher education in China should try to awaken students' deep learning motivation, provide deep learning strategies, enhance deep learning engagement, and assess deep learning outcomes. When assessments are made, two tips are worthwhile to notice. First, not only English-related academic outcomes but also higher-order thinking outcomes in language learning are supposed to be assessed. Second, assessment methods should be diverse ranging from traditional tests, portfolios, and students' reflective journals to performance assessment. Future research can study EFL teachers' teaching competencies for deep learning, factors influencing each of the four dimensions, or the relationship between deep learning outcomes and students' exam scores, etc.

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