Sociocultural Theory and Its Implications in College English Teaching and Learning in the Age of Artificial Intelligence

Weiwei Zhou
School of Foreign Languages, Nanchang Institute of Technology, No. 289, Tianxiang Avenue, Nanchang, China
Email:280925505@qq.com

Abstract. Artificial Intelligence (AI) technology, emerging as one of the three cutting-edge technologies in the 21st century, has greatly changed previous situations of different fields all over the world including education. The advancements in AI have brought college English into a brand new stage as AI serves as an important enabler in the reformation and development of college English teaching and learning. In this paper, the author firstly introduces the basic concepts of AI and Sociocultural Theory, which cast indispensable effects on foreign language acquisition. Then how AI influences educational resources, teachers and students of college English and collaborative activities are discussed. In spite of the benefits AI has brought, challenges and potential drawbacks are also presented. Therefore, it should be noticed that AI technology is properly applied in the field of college English teaching and learning.

1. Introduction
A new round of scientific and technological revolution and industrial transformation has been taking place in the 21st century. The formation of big data, the renovation of theoretical algorithm, the improvement of computing power and the evolution of network facilities drive the development of Artificial Intelligence (AI) into a new era, making the development of technology and industry as "intelligent" as possible. In December 2017, Ministry of Industry and Information Technology of the People’s Republic of China printed and distributed “The 3-Year Action Plan of Promoting the Industrial Development of New Generation AI”, aiming at pushing forward the further combination between AI and the real economy. The development and breakthrough in the AI field has significantly prompted the efficiency in all walks of life all over the world. AI’s rise is closely related to education—its development depends on talents, then the cultivation of talents depends on education, and the development of education act back on the progress of AI technology. Admittedly, AI plays an important role in the reform and development of education while education, in turn, acts as a sustainable driver in developing AI.

2. An Overview of Artificial Intelligence in Education and Sociocultural Theory
We all leave information footprints in the age of big data, “allowing human and societal behavior to be objectively quantified and, therefore, easily tracked, modeled and, to a certain extent, predict” (UNESCO, 2019). And the phenomenon surrounding information footprints are referred as “datafication” (Mayer-Schönberger & Cukier, 2014), which has brought a great number of new opportunities, possibilities as well as challenges to education.
2.1. Artificial Intelligence (AI)
Born in 1956 at the Dartmouth Conference, AI has made huge progress in the past 60 years and become an interdisciplinary and frontier science. It is regarded as one of the three cutting-edge technologies (the other two are genetic engineering and nano-science) in the 21st century, consisting of two parts—artificial and intelligence. Artificial means being made or manipulated by human beings while intelligence is far more difficult to be defined since it involves the concepts of consciousness, self, mind, etc. AI has been defined as the discipline about knowledge—the way to present, acquire and use knowledge. It has also been classified as the science to study the intelligent work done by computers that used to be done by human beings. Basically speaking, AI is the basic theory, method and technology to study the laws of human intelligent activities, to construct an intelligent artificial system, and to study how to make computers complete the work that was completed by human intelligence in the past, that is to study how to apply the software and hardware of computer to simulate some intelligent behaviors of human beings. Research in AI has mainly focused on the following constituent parts of intelligent: learning, reasoning, problem-solving, planning, perception and using language.

2.2. AI in College Education
The innovative application of AI in the field of education has made great contributions to the innovation of talent-training mode, the reformation of teaching methods and the improvement of educational governance. The realization of education modernization is based on an intelligent, networked, personalized, lifelong and globalized education system in which the inclusiveness and equity of education can be reached. The UNESCO has reported that “the systematic integration of AI in education has the potential to address some of the biggest challenges in education today, innovate teaching and learning practices, and ultimately accelerate the progress towards Sustainable Development Goal 4” (2019). Companies like iFLYTECH in China, Carnegie Learning and Fuel Education in the US, etc. have all applied AI to education from kindergarten through twelfth grade and more AI technologies have been applied to higher education in recent years. One study found that 34 hours on an AI education app are equivalent to a full university semester of language education. Possibilities for the reformation and renovation of education are driven by the further combination of AI and education.

2.3. Sociocultural Theory
Sociocultural Theory, advocated by Russian psychologist Lev Vygotsky, makes a big contribution to the second language learning. From the perspective of socioculturalism, learning is seen as first social, then individual. “Consciousness and conceptual development are seen firstly as inter-mental phenomena, shared between individuals; later, individuals develop their own consciousness, which becomes an intra-mental phenomenon” and language is regarded as the “prime symbolic tool for the development of consciousness” (Mitchell and Myles, 2004). Scholars following Vygotskian views consider learning as social when Lantolf put forward that “the source of development resides in the environment rather than in the individual” (Lantolf, 2006). That is to say, any knowledge always appears first at social level and then through interpersonal activities and appropriation becomes intrapersonal knowledge that is understood and used by oneself. Wells thinks that learning is mediated through learners’ developing use and control of mental tools while language is the central tool for learning (Wells, 1999). In the 1980s, James Lantolf began to apply Vygotsky’s theories to second language learning aspects. There are many aspects being covered in socioculturalism among which the Zone of Proximal Development, scaffolding and interaction between “novices” and “experts” or peers’ communication are attached the greatest importance. For so many years, sociocultural theories, including the above three, have been widely applied to the second language learning. Since language is the central tool that mediates all the mental activities, language is intimately related to social, cultural and psychological aspects of human beings.

Sociocultural theorists deem that children’s early language learning is developed through the processes of meaning-making in interactional activity with other participants, such as the parents, caregivers, peers, etc. of a shared culture. Through this activity, the language becomes a tool for
meaning making (Mitchell and Myles, 2004). Similarly, the second language learner can develop this tool through collaborative activity with other speakers of the target language. Vygotskian second language learning researchers regard the second language learning as a process that the second language learners appropriate it to their own tools for self-regulation and thinking, just as the children do when learning first language (Ortega, 2009).

3. AI in College English Teaching and Learning from the Perspective of Sociocultural Theory

Most of the studies into the Sociocultural Theory’s role in second language learning have been conducted in classrooms rather than in informal settings. But with the advancements in AI technology these recent years, the ways teachers teach, students learn and they interact with each other have been dramatically changed. It is significant to look into the effects AI has made on language teaching and learning.

3.1. Effects of AI on Educational Resources

The application of AI in college English teaching and learning equip teachers and students with a great number of global online resources. Materials like news, research reports, e-books, and videos can be shared globally without the limitation of time and location. Online education platforms like Coursera, and icourse offer online courses in different fields and subjects, providing various options for teachers and students and making extracurricular activities possible at any time and any place. The way online resources work, to some extent, eliminates the inequality in education.

The Ministry of Education of the People’s Republic of China advocated the project to establish and perfect a national public service system for educational resources, including a national platform by connecting 32 provincial systems and opening the sharing of digital educational resources. A national public service system of digital educational resources featuring interconnection, multi-level distribution, nationwide coverage, co-governance and sharing, and collaborative service is under the process of being built. Measures include establishing the national digital public service system alliance of educational resources, releasing a series of technical and functional standards and specifications, exploring a new mechanism of resource sharing, improving the supply capacity of digital educational resources, and supporting schools, teachers and students to carry out information-based teaching and learning application.

3.2. Effects of AI on College English Teachers

It is important to realize the specific teaching and learning situations Chinese college English teachers and students are in. Many teachers have not yet found an effective and efficient way to teach because of the large size of their classes and they are unable to decide the suitable level of the tasks for the students and how much scaffolding should be given, so it is impossible to decide a task that fits for every student, resulting in the possibility that some leaners do not get their learning potential developed while others find the tasks not within their ZPD. To learn within the ZPD means that the teacher is supposed to control the task in a reasonable range, suitable for the students’ developmental potential and it should be designed according to the existing knowledge of the students. Therefore, teachers must get to know more about their students and think about what tasks will be carried out aiming at getting more effectiveness. This is the basic foundation for teaching. While there are too many students in one class, it makes it difficult for the teacher to scaffold everyone.

In this circumstances, AI can help to test the needs gaps in teaching and learning and decide the specific ZPD of students by testing and collecting the data of their performance, so as to equip teachers with knowledge of their students’ current ability and directions to get them improved in the following teaching process. AI provides a dual-teacher model so that it streamlines admin tasks and improves efficiency by freeing teachers from routine and administrative tasks such as distributing assignments and answering the same question repeatedly so that they have more time and energy to focus on tasks like student guidance and one-to-one communication that machines cannot do. Teachers have started to work together with AI assistants for the best outcomes for the students. They therefore have more time in controlling the extent and amount of scaffolding—the teacher offers more precise assistance with the skills that are out of the students’ reach, leaving the task to be completed by the
students independently as much as possible. The role of teachers, in the age of AI, is to give specific feedback to students and to prompt them until they can master the task themselves.

3.3. Effects of AI on College English Students

As is mentioned above, the relatively large size of the class makes personalized learning difficult for college English students. As is shown by the current situations college English students are in, the appropriation of the knowledge of the students tends to become a mechanical recitation process which results from the need to gain required scores, leading to the unnatural regulation of the knowledge when much of it isn’t appropriated into the learners’ own consciousness.

But AI allows a level of differentiated and personalized learning for students when each individual student is able to map their plans, locate their strengths and weaknesses and develop their own strategic skills if their learning processes are documented by AI individually. When qualitative change occurs in students’ understanding of the new knowledge, AI would identify it and provide the students with possible patterned strategic skills so that they can solve the similar problems independently in future by using this strategy since they have appropriated the necessary concepts and can self-regulate their performance. Meanwhile, AI technology enables students, especially college students with autonomous learning ability. Students in this era are transforming from passive recipients of knowledge to explorers and cooperators and are able to build up their own learning database recording their personal information like specialties, interests, needs, academic performance, etc. with the help of AI. Exact educational resources are afterwards matched and recommended, real interactive scenarios and contexts are constructed, and personalized learning schemes are customized, and more intelligent learning modes are accessible to students. In this way, autonomous learning, internalization, self-evaluation and self-correction can be realized.

3.4. Effects of AI on Collaborative Learning

The third aspect being influenced is collaborative learning. According to Sociocultural Theory, less proficient participants in an activity can appropriate their newly gained knowledge or skills to their own understanding through collaborative interaction while the reality is that little interactional or collaborative work exists in a traditional Chinese college English classroom, let alone the scaffolded talk. In a class, different actions may be taken by students to achieve the same goal. For instance, students make efforts to improve their English by reading English newspapers to improve reading comprehension, using a bilingual dictionary to expand the knowledge of vocabulary, listening to BBC news to practice listening ability, etc. It is the same with the situation of group work—the students may take various actions to achieve their objectives. That’s the reason why proper instruction and guidance are important to students before the task is in process as every step taken by them is directed by the goal. Another factor that must be taken into consideration is the operational level of the task. Context and conditions for learning keep changing and how the task will be handled depends largely on the context of the activity. Preparations should be made for the students when they are meeting these changes. Scaffolding within the ZPD is not only about collaborative work in joint activity, it also contains the regulation of mental conditions of the learners and the actions they take.

Considering the importance of collaborative work, AI plays an indispensable role in advancing collaboration especially when learners are not physically in the same place. It allows students to take part in online asynchronous discussion groups being monitored by AI-based systems, with information being recorded, analyzed, reorganized and stored so as to direct teachers to guide their students’ engagement and scaffold their learning properly and allow students successfully regulate their learning. Also, AI is able to divide the students into better-balanced groups. For example, students with the same level understanding of a subject or students with different levels of academic performance can be assigned to the same group. The most eye-catching role AI plays in collaborative work is that AI agents can act as participants, working peers or even objects for students to teach. After large numbers of corpora being built up, it is possible for students to interact with AI systems in their target languages. AI serves as an enabler in facilitating the occurrence of collaborative work.
3.5. Challenges of Using AI in College English Teaching and Learning

The first challenge is to coordinate the work of different sectors such as education administration department, schools, teachers and students themselves while integrating AI into college English teaching and learning since technologies are far more complicated than what we have imagined. Both technological and humanistic factors need to be taken into consideration during the process. The second challenge is to ensure the equity and completeness of the data collected. It is important to make the quality of data the top of the list. The collection, systematization and analysis of the data should be attached great importance. The third challenge is related to ethical problems of AI. When teachers’ and students’ personal information and private data are collected, it should be remembered to keep regulations on the privacy and security of them.

4. Conclusion

After analyzing and applying Sociocultural Theory to practical teaching and learning, it can be clearly concluded that apart from the inner-mental aspect of learners, outside performance and conditions of teaching and learning should also be attached great importance as well. AI technology enables related systems, machines, etc. to think and act humanly and rationally. As the main context for college English teaching and learning is in college classrooms, teachers should take up practical measures and think deeply about how they can scaffold their students. By collecting characteristic data and setting up database for each student, more online educational resources, more advanced teaching and learning solutions and more various collaborative activities have come into being. AI, acting as a teaching assistant, a participant and a mediator, prompts the processes of collaborative work and internalization of gained information, reshaping the future of education significantly.

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