The Redefinition of Teachers’ Roles in the Age of AI:
An Analysis of the Chinese Discourse
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0. Introduction
AlphaGo triumphing human champion in 2016 has attracted a dramatic attention from around the world and across industries to Artificial Intelligence. Education is one of the areas that are deeply involved in this trend. Emerging and rapidly evolving AI technologies are believed to hold transformative powers in reshaping education. Since 2017, there has been a dramatic increase of Chinese literatures concerning AI and education.

During May 16-18 2019, the International Conference on Artificial Intelligence and Education “Planning Education in the AI Era: Lead the Leap” is held in Beijing, representatives from UN agencies, state governments, academic institutions, civil society and the private sector met and discussed a wide range of issues concerning the systematic integration of AI and education. The overall aim is to leverage AI to accelerate the delivery of open and flexible education systems that enable equitable, relevant and quality lifelong learning opportunities for all. The conference is encompassing in topics covered, including envisaging the future of education in the AI era, guiding the development of AI in education policies, anticipation and development of skills needed for life and work in the AI era, promoting the equitable, inclusive, and transparent use of AI in education.

There are two perspectives, namely, AI for Education and Education for AI, in current research and practice. The former focus on how AI can empower teaching and learning, as well as management of the education system, while the latter focus on what educational institutions can do to better prepare students and current workforce for an AI-powered future. In this paper we analyze the collected material from the perspective of AI for Education, and our focus is on the envisioning of future teaching and learning, especially teachers’ role change in the dawning age of AI. The 2019 Beijing Consensus on Artificial Intelligence and Education has its 13th term as follow: Dynamically review and define teachers’ roles and required competencies in the context of teacher policies, strengthen teacher training institutions, and develop appropriate capacity-building programmes to prepare teachers to work effectively in AI-rich education settings. (UNESCO, 2019)

To grasp the nature of the current discourse, its underlying assumptions and implications for future research, we collected articles around this topic within the year 2017-2019 from CNKI Database (China
National Knowledge Infrastructure) with the key word “Artificial intelligence + teacher”, and further included important scholars’ related work which may appear earlier than 2017. And we presented the most typical views of the current discourse in three closely related themes, after which a three-fold critic on the assumptions of current discourses is made. Finally the implications for future research are discussed.

1. Common Themes of the current discourse

1.1 A vision of massive personalized learning in the age of AI

The logical starting point of redefining teachers’ roles in an AI-rich future lies in the envisioning of education, teaching and learning in that future. There seems to be a concordance in vision among governmental agencies, private sectors, the academics and the practicing teachers. Personalization is the key term and AI technologies are seen as providing opportunities for massive personalized learning. And the technological approaches for personalization are mainly data-driven learning analytics and AI teachers (intelligent tutoring systems). AI-powered online learning and AI-transformed classroom teaching will give individual student customized content, flexible pace and real-time feedback according to their distinctive needs and learning profiles.

The envisioning of future education is most clearly and elaborately depicted by the educational technologists. They argued that the development of information technology featured by AI hold the potential of overcoming the classic educational dilemmas between scale and personalization, between excellence and equity, and provide quality education for all. (Yu, Wang, 2016)

Compared with the industrialized, pipelining, rigid, uniform system which looks like a plantation, aiming for test-score and uniformity, emphasizing on effort and obedience, the education system in the future would be an ecosystem which fosters flexible, open and lifelong personalized learning, aiming for quality and distinction, emphasizing on happiness and esteem. (Yu, 2017a)

Future education services will be optional, flexible and adaptable to individual learner's personality, interests, abilities, characteristics and also parents’ goals and values. And these services will be provided by various agencies, including schools, online and offline companies, professional social institutions, etc. A future school may be a self-organized smart learning environment. (Yu, Wang, 2016)

The path to the transformation of educational system is depicted in eight aspects: (Yu, Wang, 2016)

<table>
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<tr>
<th>Change of Environment</th>
<th>The whole campus becomes digitalized, thus the virtual fully merge into the real and information would flow seamlessly, and the educational environment would become smart and adaptive to optimize teaching and learning and promote the holistic development of students and teachers.</th>
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<td>Change of Curriculum</td>
<td>MOOC would be part of normal curriculum and provide more choices to students; educational content would be more relevant to</td>
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real life; class-based teaching would give way to more diverse and customized teaching; organization of curriculum would be modularized, dynamic and flexible; smart recommendation of curriculum would be adaptive to students’ distinctive needs based on big data analysis; development of curriculum would be dependent on more specialized division of labor of the teaching profession within a larger social network.

| Change of Instruction          | The paradigm of teaching would change from a teaching-centered knowledge transmission model to a learning-centered cognitive construction model. Online instruction will become common. Teachers would focus on designing activities rather than arranging contents. Mixed instructions where diverse modes of teaching would support students to transit between activities seamlessly according to their needs of learning. |
| Change of Learning            | Formal, informal and non-formal learning would integrate into all aspects of life and learning is not confined to school anymore; innovative learning modes would spring up and learning could happen anytime anywhere; learning analytics would follow the learning path of every student and give individualized just-in-time feedback; within an online-to-offline integrated campus, bring-your-own-device would be inevitable; digital literacy and 21st century skills would be the focus of learning outcome. |
| Change of Assessment          | Assessment would be based on data other than personal experience; formative assessment embedded into the learning process with individualized and real-time feedback would be more common; measurement and evaluation would be multi-dimensional and covers the range of knowledge, skills, values and attitudes instead of focusing solely on test scores; more assessments would become automatized; more stakeholders would participate in the assessment process. |
| Change of Management          | The business of education is fully digitalized, visualized and automated. All management data is digitized, and it flows freely along business processes. Dynamic monitoring and analysis will be able to diagnose and discover abnormal conditions of educational |
operations at any time, and give warnings when necessary. Through data mining, it provides timely comprehensive and accurate data support for decision makers, transforming decision-making from empirical to data-driven.

| Change of Teacher Development | Teachers’ digital competency and Technology-integrated-Pedagogical-Content-Knowledge would be essential. Participative and collaborative learning in a more digitalized and diverse community focusing on real cases of teaching and learning would become the main approach of teacher development. |
| Change of School Organization | More educational services would be provided by agencies outside schools and they would complement each other. Schools will organize learning based on students’ abilities and needs rather than age cohort. Organizational structure and management system of the school will become more open, flexible, flat and networked. Data and information will become the most important asset of a school, and the ability to use data will become the core competitiveness of the school. |

Under this envisioning of future educational system, it’s argued that future teaching and learning would definitely not be the single dominant form of classroom teaching and learning, instead, it will take the form of such a trinity: online learning by students, problem-oriented project-based learning in the practical field, combined with teacher's supervision, management and companion. (Yu, 2018a)

The key of this transformation to a massive personalized learning system, is believed to lie in the generating and using of educational big data. It is argued, data (information) gradually replaced land, labor, and capital as the core productive factor of the big data era. In the field of education, information technology featured by the Internet, cloud computing, big data, artificial intelligence, etc., will promote the comprehensive digitization of the business of education where full-sample, whole-process data will be generated and used. Educational big data focuses on the performance of each student and records the various data generated during the learning process. Through the accumulation of a large amount of process data, each learner's knowledge and ability structure, personality and dispositions, thinking style, learning path and subject-specific literacy development can be accurately analyzed; “precise supply” of education according to the actual needs of students can be realized; timely feedback to each individual can be achieved, providing best service in a cost-efficient way, without large-scale human resource input. It is said, in the era of big data, data will become the most important asset of the school, and the school will become the cornerstone of the educational big data ecosystem. (Yu, 2017b)
These envision articulated by educational technologists are not original or insulated from the popular discourses in the educational field. Instead, they borrowed lots of concepts from the field of educational research and practice, such as “personalized learning”, “student-centered teaching”, “project-based learning”, “learning activity designing” etc., what they did was to interpret these wide-spread ideas in light of possible technological assistances. So there seems not much difference between groups about “massive personalized learning” and educational technologists’ views are echoed by the non-technological educational researchers and practicing teachers.

1.2 Dissection of the education process and what AI will take over

The dissection of education process in AI-rich educational settings and the reallocation of teachers’ roles to AI and Human Teachers are discussed widely in the literature. Different groups seem to have an agreement of this dissection based on the current forms of school education. The educational technologists hold the most optimistic view of AI teachers’ potential. Generally, the teaching tasks are divided into low skills/repetitive/knowledge transmission/cognitive parts and high skills/creative/character formation/social-emotional parts. While AI will take over the former, human teachers can focus more on the latter. Human-machine hybrid teaching will benefit students and promote learning outcomes.

As Yu (2019) stated and most literature echoed, “Teachers’ work is divided into two categories: creative work represented by instructional design and emotional communication, and mechanical repetitive work represented by examining homework and giving feedback.” Tasks commonly mentioned as repetitive, tedious and low skill includes lecturing on fixed content knowledge, giving assignments and exams, managing student information, searching resources for lesson preparation, regular feedback to parents, attendance checking, essay assessment, etc..

But considering the potential of AI based on data collection and analysis of the whole process of education, the roles for AI teacher is much more ambitious. Yu (2018a) outlined 12 roles AI teachers have assumed and will assume in the future: (1) assistant for automatic and individualized assignments and assessments; (2) analyst for automatic learning diagnosis and real-time feedback; (3) coach for problem-solving ability assessment; (4) counselor for evaluation and improvement of students' psychological well-being; (5) physical health monitoring and improvement; (6) head teacher responsible for generating students’ comprehensive assessment reports; (7) consultant for personalized intelligent teaching; (8) smart tutor for students' individualized questions interacted in natural language; (9) career development consultant for students; (10) interactive companion for teachers in precise teaching research; (11) automatic personalized learning content generator and aggregator; (12) data-driven educational decision-making assistant for educational governance.

Given the roles that AI is expected to play, we can see that massive personalized learning supported by AI has two pillars: (1) creating, sharing and organizing online contents, including learning resources and assessment tools; (2) process data collection and learning analytics which covers not only subject-specific
learning data but also data on students’ physical, psychological and other conditions. As the first pillar evolves, “knowledge transmission” will be taken over by AI; and as the second pillar evolves, “precise education” for everyone will ultimately be realized.

1.3 Human teachers’ role change in an AI-powered future

It is predicted that in the future the teaching profession will differentiate in two directions. One is the all-round teacher who masters subject knowledge, teaching knowledge, technical knowledge, knowledge about cognitive and neural science and developmental psychology for children, and knowledge about societies. All-round teachers should have the leadership to promote individual and group development in a social-ecosystem. The second is the specialized teacher. The teaching profession will have an increasingly finer division of labor. There will be teachers who specialize in domain-specific practice counseling, in project design, in psychological counseling, in classroom teaching, and in teaching design, etc. In the future, a course may be undertaken by a number of teachers. Teachers should be good at providing education services within large-scale social coordination. (Yu, 2017a)

Most of the discussions are about the first kind of future teacher who interact with students directly in educational settings. Since AI has the potential to do so much in future education, teachers need to work well with AI, it is said that in the future teachers will not be replaced but teachers who cannot work with AI will be replaced. (Yu, 2018a) Thus, teachers need to develop competency in digital literacy, data analytic skills and intelligent use of data and reports provided by AI. In the meantime, teachers should focus more on what they would do better than AI, which is believed to be the social-emotional aspect of learning. Discourse like “cultivating the whole person”, “teaching for happiness”, “teachers’ emotional intelligence” are very popular in the literature. Teachers should improve their social-emotional intelligence, sensitiveness to students’ needs, creativity in teaching, etc. They should play better the roles of online content curator, learning activity designer and organizer, facilitator, etc. instead of mere transmitter of knowledge.

A well-known scholar in Educational Theory (Li, 2017) discusses three kinds of intelligence teachers need in the age of AI which are Love Intelligence, Data Intelligence and Information Intelligence. Love Intelligence, mainly focusing on the social-emotional aspect of teaching, means “teachers should accurately understand students' needs and distinct personality, thus provide nuanced personalized care, protection and respect in a timely manner, so that students can still feel the warmth of humanity and the power of love in a cold world of programming, coding, and algorithms, and thus learn to pass each other warmth and love”. Data Intelligence is “characterized by sensitivity and enthusiasm for data. It includes the ability to collect, integrate, analyze, utilize and generate data, as well as the ability to create new data and transform data into teaching objectives, methods and steps.” Information Intelligence means facing huge amount of information, teachers should be able to "retrieve, analyze, judge, refine, integrate, utilize, and generate all kinds of information" "in order to be the master other than slave of information".

In the era of artificial intelligence, the responsibility of teachers is commonly said “not to transmit
knowledge, but to help students grow and become coaches or counselors for students to help them discover their strengths and realize their potentials.” Teachers are required to discover, explore and cultivate the individuality of students. Teachers' work will focus on cultivating the whole person. Students' core competencies such as creativity, aesthetic ability, collaboration ability, and contextualized application of knowledge are the focus teachers should pay attention to. This requires teachers to become designers of questions, learning resources, learning tools, learning activities, and learning assessments. The companionship, organization, supervision, and inspection of teachers are very important for students' self-directed learning. (Yu, 2018b)

Thirteen forms of work for human teachers in the future are outlined (Yu, 2019): design and development of learning service; guidance for personalized learning; organization of comprehensive learning activity; guidance for students' cognitive development and social network building; diagnosis and improvement of learning difficulties; mental health management and counseling; physical health monitoring and improvement; direction of faith and value; formative assessment and improvement; guidance for career development planning; AI-Peer-assisted professional growth; human-machine hybrid educational decision-making; ethical supervision of AI education services. As for the relationship of human teacher and AI teacher, Yu proposes that “future human teachers are more like well-known experts in the hospital, with the 'diagnostic report' provided by AI, they can give the final explanation and 'treatment plan' which is personalized and precise. For later treatment, it can be done by the 'ordinary doctor' and 'medical equipment' which is the AI teacher.” (Yu, Wang, 2019)

In conclusion, current discourse of teachers’ role change in the age of AI are dominated by educational technologists, they take the popular ideas and concepts about education, e.g. “personalized learning”, “student-centered learning”, “teachers as facilitators”, “cultivating of whole person”, etc. and give them an interpretation in the context of AI-technologies. They have a comprehensive envision of future education, a systematic technological framework, and have developed prototype platforms and tools. Online educational companies have commercialized these ideas and produce apps used by students in a large scale. Others such as non-technological educational researchers and practicing teachers echoed the discourse, so they play a relatively passive role in creating and renewing discourses on “AI + Education” and teachers’ role change.

2. Underlying assumptions of the discourse and their critics
Having outlined the common themes and main ideas emerged from the literature, we now take a further step to read between the lines and examine their assumptions about teaching and learning. We’ll present a three-fold critic on the assumptions, namely, pedagogical, epistemological and ontological.

2.1 Pedagogical assumption: personalized learning as customized learning?
Pedagogically, we argue that in the current discourse personalized learning is interpreted as customized learning with the supportive technology of AI based on individual students’ data collection and analysis. In
this customization approach, the what, when, where and how to learn are considered, but the most important “why” to learn is largely overlooked. Concern or purpose is the initiating force in learning and should be paid much more attention in our conception of personalized learning which is first of all, personal. We all know that the biggest challenge for teachers dealing with disadvantage groups of students is to ignite their confidence and passion in learning. Thus the current conception of “massive personalized learning” is incomplete and needs to consider more social, historical and cultural aspects relevant to learning.

This identification of personalization to customization has its industrial discourse origins:

First, the aim of education is deeply influenced by one of the leading discourse of the Fourth Industrial Revolution which is absolute customized production in the “smart factories” model. (Schwab, 2016) Education is conceptualized as a service where students are customers and flexibility is the key feature of future educational production and consumption.

Second, the approach of education is also heavily influenced by discourse in the industry. Customer Profile, Product Recommendation, Precision Marketing are conveniently turned to ideas as student profile, learning resource recommendation, precision education. And these are based on big data collection and analysis which is exactly imported ideas and business models from the IT giants like Google and Facebook.

So, it seems though education is trying very hard to shackle off the stereotyped industrious model from the Fordism mass-production model, its envisioning of the future is still highly influenced by the discourse and models of the industrial world, albeit a new one.

This customization and data-centrism discourse is a reduced scenario of teaching and learning which simplified what Sato (2004) called a three-dimensional process of becoming, namely, retexturing relations with the world (cognitive/cultural practice), with others (social/political practice) and with oneself (ethical/existential practice). The essence of learning lies in relationship, instead of choice. If we take this relational understanding of teaching and learning, the focus for massive personalized learning might be inappropriately skewed. Individual flexibility should be the infrastructure, background. What needs to be in the figurative place is students/teachers as persons in a transactional relationship with the social-physical-digital learning environment. The quality of relationship formation is the essence of learning. And the relationship is both with what you learn and whom you learn with. Education is primarily about the transactional unity growing together, not about the individuals as customers choosing what he/she wants.

2.2 Epistemological assumption: knowledge as cognitive things apart from emotion?

Epistemologically, there is an obvious separation of cognitive and affective dimensions of knowing and learning, and different dimensions are even taken as separate things which could be cultivated by different agents. Human teachers are supposed to be loving, caring and supporting and focus on social-emotional aspects of students’ learning, where AI teachers are much more efficient in teaching and consolidating specific knowledge through online educational resources and automatic assessments.

We argue that the current understanding of the word knowledge and its relationship with social
interaction and emotion is problematic. Of course, this concept is not a clear defined concept to begin with. As Dewey and Bentley said, knowledge is rated as “No.1 on a list of ‘vague words’ ”(Dewey, lw.16.47). This is also the case in modern Chinese language which is heavily influenced by western languages, especially English. In current discourse, knowledge is understood as static, cold-storage things which could be acquired through seeing, hearing, remembering and exercising. So the “transmission of knowledge” can be done by online learning thus taken over by AI. Human teachers should dispose the traditional role of “knowledge transmitter”. But, instead of taking knowledge as simply information and can be transmitted just through one saying and the other listening, we do have an alternative understanding of knowledge. In Dewey’s pragmatic theory of knowledge, knowledge is defined as follows:

...knowledge in its strict sense of something possessed consists of our intellectual resources—of all the habits that render our action intelligent. Only that which has been organized into our disposition so as to enable us to adapt the environment to our needs and to adapt our aims and desires to the situation in which we live is really knowledge. Knowledge is not just something which we are now conscious of, but consists of the dispositions we consciously use in understanding what now happens. Knowledge as an act is bringing some of our dispositions to consciousness with a view to straightening out a perplexity, by conceiving the connection between ourselves and the world in which we live.

For Dewey, knowledge is not to be separated with the whole situation we act upon, with aims, desires and emotions, with our dispositions and habits, with competencies or power to do. So knowledge is not just some cold storage of information in an external media, be it a textbook or a digital terminal. Knowledge in its proper sense is alive and embodied in person.

In Dewey’s theory there is also the continuity of knowledge with an activity which purposely modifies the environment. So knowledge is what the situation with purpose, aim, thus with social-emotional motivation calls for and constitutes. Cognition and emotion are both constitutive moment of person-environment unity which is activity or experience in Dewey’s term, and they’re not to be separated. “Concern or interest” which denotes more of the social-emotional-volitional aspects of activity is central to Dewey’s participative interpretation of education. And any concern or interest is always about something, thus is always about some content. So we really can’t separate knowledge from affection or any activity which inherently is social for human beings.

2.3 Ontological assumption: humans as behavioral-data-generator for AI?

In most of the literatures, personalized learning or precision education is based on big data. Students are reduced to a behavioral-date-generator, with every aspects of their learning process digitalized, and data generated in this process constantly collected and analyzed in a multi-modal fashion (e.g., with video data for emotional computation). It is believed that as long as we collected enough data about someone we will know enough about him/her and we can predict what he or she needs in the future. The future is determined by the past and the quantifiable-measurable past. What we think are problematic here includes:
First, it reduces life to information or dataset. A person is almost fully describable in data. The “brain in a vat” metaphor would take the essence of human as data stored in the neurolinks of his brain. What would be a more appropriate metaphor for human being? What is the understanding of the essence of human that serves better for education? We take human being as a continuous and constantly changing process which intersects with other processes and becomes immanent in each other (including other things and other persons). A person is alive. Data are but traces of her life. Learning is the constant changing and becoming process of people. Only a small fragment of the results of this process manifests as collectable data. While taking advantage of big data to better understand students, we must not undermine the power of human communication. An instant of eye contact may tell so much about a student for a human teacher who shares the complicated and evolving context with the student which is not at all understandable for current and even future AI. And seeing student from the lens of data, we must also remind ourselves that we’re dealing with real people, that we’re experiencing life and growing together for a shared future.

Second, it overlooked the stochastic nature of life, the genuine novelty and unpredictable aspect of it. The relationship between the past, present and future is not linear, but within a “specious present” as William James named it, where the future and the past are all in the present. We’re always living in a particular situation, with our memory and narration of the past, and anticipation to the future. And what will happen always have an element of surprise, even in a short conversation. We can never precisely predict what the other person would say next. The current discourse seems deterministic in nature.

In conclusion, with the rapidly changing landscape of technologies and successive waves of concepts such as “internet +”, “big data +”, “AI +” permeating educational discourse, we’re more urgently obliged to reflect on our ontological and epistemological assumptions about human being and the process of teaching and learning in a digitalized world. By working out a more holistic and coherent ground for theory and practice, we would be in a better position to develop technologies that empower teachers and students in an AI-rich educational environment.

3. Implications for Future Research and Practice
The outlining of current discourse and the analysis of its underlying assumptions has some implications for future research and practice.

First, for theoretical research, we need more in-depth discussion of the common vision “Massive Personalized Learning” in the age of AI. This is not as easy as it seems, because our understanding of this vision is not built on solid and steady ground. Since Artificial Intelligence is still developing and showing its potential and consequences and Human Intelligence is still an enigma being tackled from various disciplines, this soft, fluid and rapidly changing ground naturally bring difficulties to the discussion. But to continuously clarify the public discourse, scholars from computer science and technology, educational technology, (educational) philosophy, (educational) psychology, neuroscience, etc. should come together and
complement each other’s perspective to give the public a bigger and fuller picture of the scenario.

Second, we need more empirical research on this issue. For most articles, when talking about what AI can do and teachers’ role change, there is no specification of the stages of education, subjects of learning, social-economic status of students, or any characteristic of teachers mentioned. Empirical research on how AI is used in primary and secondary educational settings and the evaluation of their impacts on educators and learners are rare. We need much more responsible empirical research to see how these ideas actually work out in practice and provide feedback to our envisioning and reshaping of future education.

Third, currently there seems to be a tendency to automate things of the old educational system. Except for online learning resources, until now online assignments are still the main role AI plays in education. To avoid hard-wiring the past, it would be important to consider and design AI technologies with a clearer vision of the kind of education we want in the future. SDG4 and massive personalized learning as macro-level vision needs to be worked out in detail with various challenges considered. We need innovative and diversified educational practice to try out these ideas in real settings. And teachers are the most important stakeholders in harnessing the potential of digital technologies to transform education. So they should play a much active role in the designing, researching, practicing and communicating of how AI technologies should be integrated into teaching and learning.

In brief, the redefinition of teachers’ roles in the age of AI requires a deep and holistic understanding of teaching and learning in an AI-rich future. We need a better theorization to describe this process, more empirical research to tell us what works and a more progressive and transformative attitude toward educational practice assisted by technology. This is an ongoing discussion which may never have an end but we do hope the public discourse would get more and more clear, meaningful and relevant to the transformation of education and society.

References
UNESCO, 2019, “Beijing Consensus on Artificial Intelligence and Education, Outcome Document...
Abstract: With AI technology rapidly developing and having the potential of altering all aspects of society, literatures on “AI + Education” has dramatically increased in China. There is a concordance of envisioning future education as “Massive Personalized Learning” powered by AI. With this vision, the teaching and learning process is dissected into repetitive and creative parts, and thus allocated to AI teachers and human teachers respectively. Human teachers will focus more on social-emotional aspects of learning and cultivate the whole person by working with and taking advantage of AI technologies. This paper presents these most typical notions in current discourse and then reflects upon the underlying assumptions, including the pedagogical assumption of personalized learning as customized learning, the epistemological assumption of knowledge as cognitive things apart from emotion, and the ontological assumption which tends to take students as behavioral-data-generator for AI. The final part explores implications for future research and practice in order to redefine teachers’ roles in the age of AI where a better theorization of teaching and learning process, more empirical research of the actual consequences of new solutions powered by AI and a more progressive and transformative attitude toward educational practice is advocated.