



Deep Learning in the Context of Big Data: The Theoretical Basis of Undergraduate Education Reform

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Abstract. With the rapid development of new information technology such as big data, cloud computing, artificial intelligence and so on, the process from industrial society to information society has been accelerated. With the uncertainty of knowledge, the value demands of undergraduate education have changed substantially. How to promote deep learning and cultivate students' deep learning is an important direction of current educational reform and development. Deep learning is an understanding learning with the characteristics of critical understanding, promotion of knowledge construction, and emphasis on transfer and application. It is an inevitable choice for the current undergraduate education reform to accurately understand the theoretical basis of deep learning, deeply excavate the value implication of deep learning, and devote ourselves to promoting the concrete practice of deep learning.

Keywords: Deep learning · Theoretical basis · Value implication · Practice orientation

1 Introduction

With the application and development of computer science and artificial intelligence, the transformation from industrial society to information society has been accelerated, and the whole society has entered the "Internet era ". The Internet has brought people more abundant and convenient information resources, which can fully mobilize the enthusiasm, initiative and even creativity of learners, which has a strong impact on undergraduate education and has caused the overall change of teaching and learning methods in the field of education and teaching. Under the background of core accomplishment, the value appeal of undergraduate education has undergone profound changes, emphasizing the subjective role of middle school students in the process of education, paying attention to the generative nature of educational content, advocating the cultivation of students' creative thinking and paying attention to the individuality of educational value. Deep learning is the expectation, choice and orientation of teaching methods in the era of core literacy. [1] As a symbol of the change of new educational concept and learning style, deep learning has become the common concern of undergraduate education reform and development.

2 The Orientation of Undergraduate Education Reform and Development: The Theoretical Basis of Deep Learning

The research of deep learning mainly focuses on three aspects: learning style theory, learning process theory and learning result theory, which also represent different stages of deep learning development.

A way of learning to say. As early as the 1950s, Bloom thought that “learning is divided into deep and deep levels”, and divided the teaching objectives into six levels: knowledge, understanding, application, analysis, synthesis and evaluation. This view contains the idea of deep learning. [2] The essential difference in learning: results and processes, Ference Marton(marton) and Roger Saljo(salcho), in 1976, first proposed deep learning, which is based on Bloom’s principle of hierarchical division of cognitive dimensions. The concept of deep learning and shallow learning is clearly put forward for simple memory and non-critical knowledge. Deep learning here is generally understood as deep learning in the field of education. Some scholars believe that deep learning is a kind of advanced or proactive learning method of cognitive processing of knowledge, and the corresponding shallow learning is a low-level cognitive processing method (Biggs,1999) Professor Li thickening of Shanghai normal University first mentioned the theory and research results of deep learning abroad, and analyzed the essence of deep learning. “Deep learning is based on understanding learning, learners can critically learn new ideas and facts, and integrate them into the original cognitive structure, and can connect with many ideas, And can transfer the existing knowledge to the new situation, make the decision and solve the problem learning” [3].

The second learning process says. Some scholars believe that the core idea of deep learning is that learners should be good at grasping the internal relationship of knowledge in the process of learning (Osama bin Laden 1988); The National Research Council of the United States defines deep learning as the process by which individuals apply learning knowledge from one situation to another, that is, transfer. [4] Some scholars point out that deep learning is to enable students to really understand the learning content and store knowledge in memory for a long time, so that students can use what they have learned to solve new problems in different situations. [5] Some scholars also believe that deep learning needs to link real-world, meaningful, problem-oriented learning tasks, and teachers need to design such a learning environment to support the occurrence of deep learning [6].

Three learning results say. William and Flora, USA. Hewlett defines deep learning as: deep learning is the ability of students to be competent for work and civic life in the 21st century. These abilities enable students to master and understand subject knowledge flexibly and apply it to solve problems in class and future work. It mainly includes the basic ability of mastering core subject knowledge, critical thinking and complex problem solving, team writing, effective communication, learning to learn, learning perseverance [7].

3 Taking Student Development as the Center: The Value Implication of Deep Learning

(1) Characterization of deep learning.

Deep learning and shallow learning permeate each other. Deep learning is a transition from simple and mechanical learning to meaningful and inquiry innovative learning based on shallow learning. In order to better distinguish deep learning from shallow learning and understand the characteristics of deep learning more clearly, it is necessary to compare them.

Comparative projects	Deep learning	Shallow learning
Presentation	Look critically at new ideas and knowledge and think deeply	Simple reproduction, mechanical memory, superficial understanding
Level of thinking	Higher-order thinking	Low-level thinking
Learning status	To analyze, identify and evaluate new knowledge and new problems using original knowledge and experience	Simple learning, lack of reflection
Learning content	The content itself and the learning process (cognitive strategies and metacognitive strategies)	Content of pure subject knowledge
Knowledge systems	Promote the integration of multidisciplinary knowledge and the connection between old and new knowledge to deepen the understanding of complex concepts and deep knowledge	Focusing only on knowledge itself and thinking of knowledge as an isolated, disconnected unit for memory and acceptance can not well promote understanding and long-term retention of knowledge and information
Learning objectives	Use your knowledge to analyze and solve problems creatively	Staying at the cognitive level of “understanding and knowing” can not promote the development of learners’ higher knowledge and ability
Learning outcomes	High level, high quality	Low level, low quality

Through the comparison between deep learning and shallow learning and the analysis of the concept connotation of deep learning, we can conclude that the characteristics of deep learning are mainly manifested in the following aspects:

1. Deep learning pays attention to critical understanding. Deep learning is that learners, based on their own interests and learning needs, emphasize that learners accept new knowledge and information critically, and require learners to maintain a questioning and critical attitude towards all kinds of new things. Look at new things critically and think

deeply to promote the development of learners' innovative spirit and critical thinking. In contrast, shallow learning is for learners to accept new ideas and knowledge through mechanical memory, simple replication learning, driven by external tasks.

2. Deep learning promotes the construction and reflection of knowledge. Facing the information age of uncertain knowledge, the students trained in school education should not only have knowledge, but also learn to think and reflect, reorganize and integrate new knowledge and old knowledge, realize the adaptation and assimilation of knowledge, construct a new knowledge framework, and analyze, identify and evaluate the newly constructed knowledge to promote the development of high-level abilities such as critical thinking and cooperative innovation. Learners should not only transfer and apply their own knowledge in new situations, but also master how to better transform knowledge to solve practical problems. Deep learning emphasizes the process of cultivating learners' critical and innovative thinking, guiding learners to learn effectively and putting their knowledge into application.

3. Deep learning is devoted to the transfer and application of knowledge. Deep learning requires learners to "learn from one another" and "learn to use", and transfer the new knowledge to new situations to solve complex problems in reality. If knowledge transfer can not be applied to real-life problem-solving, then such knowledge is only the product of originalism and dogmatism, which is not conducive to learners using principle knowledge to analyze problems and creatively solve all kinds of "complications". Therefore, the transfer and application of knowledge is the starting point and focus of deep learning research and the main melody of undergraduate curriculum reform.

4. Deep learning develops higher-order thinking, which is mainly embodied in problem-solving, critical and creative thinking, and belongs to the category of deep learning. Deep learning focuses on the understanding and application of knowledge on the basis of shallow learning. At the cognitive level of "application, analysis, evaluation and creation", it cultivates students' problem-solving, critical and creative higher-order thinking activities. College students' innovation and entrepreneurship training program is an important practical way to cultivate students' independent thinking, practical ability and stimulate students' interest in innovation and entrepreneurship. It is an important means of the current undergraduate education reform to construct the education mechanism of "promoting education by competition, promoting reform by competition, and promoting innovation and entrepreneurship by competition" and to improve students' innovation and entrepreneurship ability. Innovation and entrepreneurship are meaningful activities carried out by using higher-order thinking, and the application and development of higher-order thinking are the key to the realization of deep learning, as well as the core characteristics of deep learning.

(2) Deep learning is the value demand of undergraduate education reform.

1. Undergraduate education promotes critical and creative thinking.

The Outline of the National Plan for Medium - and Long-term Education Reform and Development (2010–2020) emphasizes "what kind of people to train", which is consistent with the concept of deep learning, that is, we train talents not only to master knowledge, but also to use the knowledge to solve complex problems through thinking, with the spirit of criticism and innovation. With the rapid development of cloud computing, artificial intelligence and other information science, various fields have also

caused profound changes. The direction of applied undergraduate education reform is mainly reflected in: requiring students to have a reasonable knowledge structure, master the general methods of scientific work, be able to correctly judge and solve practical problems, have the ability and habit of lifelong learning, and be able to adapt and be competent in changeable professional fields. The teaching of undergraduate education knowledge should not only develop to the depth of discipline, but also pay attention to the horizontal relationship between disciplines. At the same time, undergraduate education should pay attention to cultivating students' scientific thinking ability, creative ability, innovative spirit and entrepreneurial spirit[8] And the biggest difficulty that undergraduate education faces is how to cultivate students' innovative ability and interdisciplinary high-order thinking ability to deal with complex problems. The social life is complex and changeable, the new generation of students are facing a more complex environment, which must fully realize the importance of students' inquiry and innovative learning. The important significance of cultivating students' ability to adapt to the environment of future change and development and innovation and creativity.

2. Undergraduate education returns to whole-person education, emphasizing interdisciplinary interaction and integration of knowledge.

At present, the establishment of undergraduate education specialty in colleges and universities in our country is classified according to the subject category, and the division of specialty affects the connection of knowledge between disciplines. Strengthening professional ownership and knowledge specialization hinders the integration of knowledge across disciplines. The interdisciplinary cross-specialties keep up with the great social trend of the era of technology integration and knowledge integration, and train talents who meet the needs of social development with rich cultural knowledge and strong innovative thinking. Return to the whole person education is the value pursuit of the undergraduate education reform. The value goal of the whole person education is mainly reflected in: promoting the all-round development of human beings, is the harmony and unity of human body and mind, emotion, intelligence, spiritual potential, creativity and so on.

3. Undergraduate education pays attention to the subjectivity of educational process and promotes learners' meaningful learning.

The Ministry of Education, in response to a reporter's question on "Opinions on Deepening the Reform of Undergraduate Education and Teaching and Improving the Quality of Personnel Training in an All-round Way", pointed out: "Adhere to student centres, combine strict management with careful care, increase the proportion of total credits and courses, increase the proportion of students' time to study independently, explore the establishment of student management models such as college system, guide students to read more, think deeply, ask questions and practice diligently, and stimulate students' learning potential and interest" [9] This shows that the reform of undergraduate education attaches importance to the internal experience of the main body of education, so the undergraduate education based on deep learning should pay attention to the subjectivity of the educational process, take students as the center, dig into the contents of

teaching materials, coordinate and balance the proportion of knowledge and uncertain knowledge, make the content flexible, encourage learners to actively learn, connect isolated knowledge elements, guide students to integrate knowledge storage in memory in a situational way, and promote learners to carry out meaningful knowledge construction and personality development.

4. Pay attention to the generative content of education and emphasize the transfer and application of knowledge.

Wu Libao, a scholar, put forward:” The content of undergraduate education is generative, which regards education as the process of active participation of educational subjects, and is a manifestation of students’ creativity. Through the joint creation and active construction of teachers and students, we can understand the significance and value of educational content, generate new learning experience and expand educational content “ [10]. It can be seen that only the knowledge obtained through careful consideration, in-depth inquiry and knowledge application has the use value and is the essence of learning. Deep learning requires learners pay more attention to the initiative in a complex technical information environment to study and think critically, through deep understand complex concepts, depth of processing information, depth of knowledge inner link, take the initiative to construct the personalized knowledge system, the depth of the high-order thinking ability and skills and effective migration to solve complex problems in real life.

Deep learning promotes active, critical and innovative meaningful learning and requires learners to pay more attention to active learning and critical thinking in a complex technological information environment. The idea of deep learning provides a strong explanation and active and effective guidance for the reform of undergraduate education.

4 Pointing to the Reform of Undergraduate Education: Practice Direction of Deep Learning

At the National Conference on Undergraduate Education in Colleges and Universities in 2018, we put forward “taking this as the basis “, pushing forward” four returns “, emphasizing that “talent training is the basis and undergraduate education is the root “. The holding of undergraduate education conference is the focus on the quality of undergraduate education and the “booster” of the paradigm reform of undergraduate education “. The new idea and new strategy of undergraduate education determine the direction of undergraduate education development. Deep learning, as a new learning paradigm, promotes the development of undergraduate education reform in teaching strategies.

- (1) The transformation of the educational concept into a “student-centered” and the construction of a learning-centered university.

The teacher’s “teaching” and the student’s “learning” are a kind of integrated relationship, and the learners’ real deep learning is carried out under the premise of the teacher’s deep guidance. For a long time, under the influence of examination-oriented education,

the traditional teaching method of “spoon-feeding” is used in classroom teaching in colleges and universities. This kind of “quick-impact” classroom only pays attention to the memory of knowledge fragments, which leads to “dull thought” and dispels the cultivation of knowledge education and classroom teaching. At present, the reform of undergraduate teaching mostly appears the rough allocation of teaching time and the simple flipping of teaching procedure, and even regards knowledge as a symbol for surface learning. According to Egan, “There are three basic criteria for ‘learning depth’, that is, the full breadth, depth and relevance of knowledge learning “. [11] The quality of undergraduate education depends on whether educational resources can effectively promote the development of learners and adapt to the needs of social development. As the main body of teaching activities, learners’ learning quality is an important index of undergraduate education quality. While deep learning embodies the representation of initiative, situational, interactive, critical, innovative, and so on. Learners’ deep learning ability is the embodiment of high quality learning.

- (2) The transformation of educational content to “integrated education” to deepen whole-person education.

The fundamental purpose of undergraduate education is to cultivate students into people with social responsibility. From another point of view, undergraduate education is a kind of intrinsic value pursuit that transcends the value of tools. It is a kind of cultural activity that faces the main body of life, cares for the inner experience, attaches importance to the dynamic generation, and promotes the common development of teachers and students. Undergraduate education is the key period of the formation of the three views of young students. High quality undergraduate education plays an important role in building a powerful country of human resources. Therefore, the reform of undergraduate education should return to the goal of all-person education. The whole-person education emphasizes the all-round development of human beings, which not only requires learners to learn knowledge, but also to accept correct values, so as to inspire learners to learn from one another and learn to use it in order to meet the needs of social development. In the face of uncertain knowledge, pointing to deep learning is an important choice for undergraduate education reform. On the one hand, the undergraduate education of “pointing to deep learning” should develop to the depth of the subject, but also pay attention to the horizontal relationship between the subjects. On the other hand, learners should master the core knowledge of the subject, understand the process of learning, grasp the essence of the subject, form positive internal learning motivation, advanced social emotion, positive attitude, correct values, and become independent, critical, creative and cooperative learners. The integration of interdisciplinary knowledge of undergraduate education is mainly the integration of curriculum content, which is reflected in the curriculum. Only by breaking the barriers between majors and disciplines and forming an interdisciplinary learning model can students extensively dabble in different subject areas, broaden their basic knowledge, form a variety of thinking models, and promote the all-round development of students.

- (3) The transition of students' learning to "innovative learning" promotes meaningful learning by learners.

With the deepening and development of learning subject and artificial intelligence, the research on teaching and learning has changed from the relationship between teaching and learning to the study of paying attention to the learning process. Professor Guo Yuanxiang pointed out: at present, the direction of international teaching reform is to transcend the surface learning of symbolic knowledge, pay attention to deep learning, and pursue the personal significance of public knowledge. It can be seen that undergraduate education needs to transcend the simple transfer of knowledge, face the needs of talents for social development, integrate social responsibility, and cultivate learners' critical thinking and innovative ability. The concept of deep learning is highly compatible with the innovative learning of undergraduate education. The reform of undergraduate education pays more attention to the life itself, stimulates learners' thinking and improves learners' innovative ability in concrete practice. The process of learners' innovative learning is not their individual independent knowledge construction, but the process of equal dialogue and meaning construction between teachers and students, which effectively promotes learners to produce meaningful learning. Deep learning is not a result but a process" [12]"In this process, from the perspective, it can coordinate, integrate, and apply much knowledge" [13] Learning through dialogue, innovative learning, reflective thinking, promote meaningful learning is the breakthrough point of undergraduate education reform.

Deep learning is a kind of dialogue, understanding and reflective learning, which emphasizes reflective learning and critical thinking, pursues the extension of the intrinsic value of knowledge, and it has become an indisputable fact for learners to carry out deep learning. The cultivation of deep learning ability plays an important role in the reform and development of college students and even the whole higher education. In the future research and practice, under the premise of grasping the concept connotation, characteristics and objectives of deep learning, combining the national conditions and cultural characteristics of our country, we should carry out the undergraduate education reform pointing to deep learning, and explore the path of deep learning which is more effective and more suitable for the national conditions.

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