

Autumn 2019 ISSUE No.11

BNU Standard Serial Number: BNU-044

Be in awe of education, for it shapes the soul of human, Be cautious to technologies, for its adoption has to be effective, Be entangled with 'wisdom', for uncertainty tends to be increasing,

Be serious to academics, for academic research needs evidence.

-Dean Ronghuai Huang, delivered at the closing ceremony of the Second US-China Smart Education Conference on March 20, 2017





Smart Learning Institute WeChat QR Code

Email: smartlearning@bnu.edu.cn **Phone:** 8610-58807219 Website: sli.bnu.edu.cn Address: 12F, Block A, Jingshi Technology Building, No. 12 Xueyuan South Road, Haidian District, Beijing, China Postcode: 100082

Email: chengzhenzhen@101.com **Phone:** 86591-88066792 Website: sli.bnu.edu.cn Address: 581 Building, 58 Hot Spring Road, Fuzhou City Postcode: 350013



2019全球教育机器人发展白皮书

北京师范大学智慧学习研究院 **互联网教育智能技术及应用国家工程实验室**

2019-08-23 于2019世界机器人大会机器人教育与创客论坛首发

北京师范大学智慧学习研究院

Smart Learning Institute of Beijing Normal University

The Smart Learning Institute (SLI) of Beijing Normal University is a comprehensive experimental platform involving scientific research, technology development and instructional teaching, which is jointly established by Beijing Normal University and a global educational technology company, Elernity (a subsidiary of NetDragon). SLI focuses on finding learning patterns powered by ICT, creating smart learning environment and platforms for lifelong learning, as well as supporting diversified, personalized and differential learning needs for digital learners.

- Focusing on the methods of design, optimization and evaluation for learning environment as well as developing the key technologies for learning environment engineering aims at providing a widelyspread solution for promoting smart learning.
- Constructing the theory of smart learning and exploring the approaches of integrating ICT with Education aims at offering an international exchange and cooperation platform to smart learning research.
- Studying on the characteristics and patterns of schooling, family education, community education, enterprise learning and public learning aims at providing support for constructing a learningoriented society and smart city.
- Expanding the experimental areas and schools for smart learning as well as exploring the characteristics of ICT-based instruction and the models of future schools aims at promoting educational transformation and innovation

Open Series in Springer

- Lecture Note in Educational Technology Series Editors: Huang, R., Kinshuk, Jemni, M., Chen, N.-S., & Spector, J.M.
- Smart Computing and Intelligence Series Editors: Huang, R., Kinshuk, & Dede, C.
- New Frontiers of Educational Research Series Editors: Zhongying Shi, Ronghuai Huang, Zuoyu Zhou.







Tel: +86-010-5880-7264 Email: smartlearning@bnu.edu.cn URL: http://sli bnu edu cn/en/ Address: 12F, Block A, Jingshi Technology Building, No. 12 Xueyuan South Road, 100082



Co-Dean Deiian LIU

Chairman of the Board, Executive Director of NETDRAGON, The Special Allowance Expert in State Council, Co-Dean of Smart Learning Institute of Beijing Normal University, Chair Professor at the College of Education of Harvard University.



Co-Dean Ronghuai HUANG

Co-Dean of Smart Learning Institute of Beijing Normal University, Director of UNESCO International Research and Training Centre for Rural Education, Director of National Engineering Laboratory for Cyberlearning and Intelligent Technology,

Springer's Journals

- Smart Learning Environment (The Official Journal of IASLE) Editors: Huang, R., Kinshuk, & Soloway, E.
- Journal of Computing in Education (The Official Journal of GCSCE) Editors: Huang, R., Hwang, G.-J., Kong, S.-C., & Chen, W.



Design and Learning Laboratory

Study on the features and patterns of design computational and innovative thinking for youth; Develop courses and books about design methodology, computational thinking and ICT; Build cooperative platform with world-renowned universities, enterprises and institutes for design and innovation.





Release Conference of White Paper: Smar ents in China 2015 Learning Environ (2015.09.20)

Index Report of Smart 2016 Report of the Cyberlearning Product Development Index in China

Open Educational Resources (OER) Laboratory

rning Er

Chinese Cities

Study on the solution of OFR under its impact to the developing countries; Construct the OER community for The Belt & Road countries; Publish reports on the trends of ICT in education.



The Third US-China Smart Education Conference (2018.03)





Initial Conference in Experimental Area of Smart Education 101 Education PPT Solution in Fuquan, Guizhou Province

Educational Robotics Center

Study on the scenarios of robotics in education and the trend of artificial intelligence; Develop the courses for robotic education and STEAM education for K-12 schools. Design educational robotic for various learning fields, such as school, family, etc.



White Paper: The Global Development





The 48H Competitive Game of Education Design (2019.01)

Discuss with Prof. Larry Leifer at d.School of Stanford University (2017.04.11)

Smart City and Learning Environment Laboratory



CAN!

Study on the typical learning fields in smart cities and learning societies; Create database of smart learning environment; Publish serial reports on learning environment as well as service industry and products of cyberlearning.







Series of Horizon At a Glance: Education Report in China Development in the Belt & Road Countries

Smart Learning and OER International High-end Forum (2017.05.25)

ICT-based Instruction Center

Explore the methodology of integrating ICT into education with large-scale experiments; Study on the solutions of smart classroom and smart campus: Provide the services for transferring education through the bridge of the theory and practice





The Next Big Thing: Global Development Status and Trends in Educational Robotics



Prototype of Educational Robotics



Autumn 2019 ISSUE NO.11

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Associate Editors

Tingwen Chang Hongyan Kuai

Editorial Board Members

Yongzhong Wang Yanli Jiao Zhiying Nian Zhong Ren Jingjing Jin Chunyan Wu Qian Cheng



Any feedback or suggestions, please: Email: smartlearning@bnu.edu.cn Phone: (8610)58807219 Address: 12F, Block A, Jingshi Technology Building, No. 12 Xueyuan South Road, Haidian District, Beijing, China

Postcode: 100082 Website: http://sli.bnu.edu.cn/

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🜔 Wei Zhou



2019 Educational Robotics White Paper: The Global Development was Released in Beijing

Introduction

In recent years, with the strategy of robotics and Artificial Intelligence developing in various countries, increasing practical explorations have been made to apply Artificial Intelligence technology and robotics to education. ICT in Education 2.0 Action Plan emphasizes that the "Action for Smart Education Innovation and Development" should attach importance to the research and application of key technologies such as intelligent teaching assistants, educational robotics, intelligent learning partners, and ICT-based language and text. As representatives of robotics used in education, educational robotics will become an important part of the smart learning environment.

2019 Educational Robotics White Paper: The Global Development is based on the research results of 2016 Educational Robotics White Paper: The Global Development published by SLIBNU. With the collection, aggregation, analysis and comparison of numerous materials, it provides academic, educational and industrial fields with a comprehensive report on academic research results, industry status and trends, and applications of educational robotics.

On August 23rd, Smart Learning Institute of Beijing Normal University and the National Engineering Laboratory of Cyberlearning Intelligent Technology and Application jointly released 2019 Educational Robotics White Paper: The Global Development at the 2019 World Robotics Conference.



2019 Educational Robotics White Paper: The Global Development Conference on-Site

Haijun Zeng, Deputy Dean of SLIBNU, introduced the research framework and main ideas of the white paper on behalf of the project team. Based on the results of the research in 2016 Educational Robotics White Paper: The Global Development, this white paper provides academic, educational and industrial fields with a comprehensive report on academic research results, industry status and trends, and applications of educational robotics with the collection, aggregation, analysis and comparison of numerous materials. In addition, it explores the innovative application of educational robotics and the way to design and develop functions that can meet the needs of various educational service objects, identifying possible trends for the development of educational robotics, offering reference to teachers, educational policy makers and those who want to enter the industry of educational robotics.

The white paper analyzes the research hotspots of educational robotics in the past five years, sums up the 17 roles and 12 application scenarios of educational robotics, proposes a product analysis framework from 4 dimensions and 5 levels, comes up with the needs of 9 groups from 7 perspectives, summarizes 3 key technologies and mainstream design ideas, and sorts out a 7-layer framework of industrial chain. It is estimated that the market model of educational robotics will reach 84.1 billion dollars by 2023.



Application scenarios for 12 kinds of educational robots

04 |Features

Panoramic Rendering of Educational Robotics

By analyzing the current status of manufacturers in the educational robot industry and aiming at the future development trend of the industry, this White Paper sets forth a seven-layer industrial chain framework for educational robots by referring to the maturely developed tablet computer industrial chain, as shown in Figure 5-1.

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manufacturers	GPU	FPGA	FPGA		ASIC	
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Independent design/develop			STRATT			
Content suppliers	Exclusive educational robot content		Universal digital educational content			
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Figure 5-1 The industrial chain framework of educational robots

The Core Views of the Development of Educational Robotics

Statistics show that the United States and Europe (Britain, France, Italy) are the main areas of academic research on educational robotics. The research focuses on the five aspects of the ontology, teaching role and influence, teaching practice, design and applicable scenarios of educational robotics. The value of robotics in STEAM, language education, treatment of physical and mental disorders, and the cultivation of students' abilities have received more attention from academic circles.

The diversity of users determines the need for educational robotics to be wide and varied. From the 2 perspective of the application, the demand for family is obviously more than that for school; from the perspective of function and utility, the demand for language education and robotic education is relatively large in percentage; from the perspective of the applicable object, the robotics which are oriented to the students are more than those which are oriented to other groups. The design of educational robotics should be based on the analysis of demands, with intelligence as 3 the focus. The products should meet the user's subjective needs and optimize the natural humancomputer interaction, while the users' needs should be judged rationally. The technologies in human-computer interaction, robotics vision, and circumstance perception are the main issues in the development of educational robotics. The combination of local intelligence and cloud intelligent design in educational robotics will provide new ideas for improving perception and interaction. In addition, educational robotics should be more applicable in education, improving their competence in educational services. The terminal market for educational robotics is expanding rapidly, and the industry of educational 5 robotics will usher in a period of rapid development. The system of R&D and promotion of special products has gradually formed with a rising market of system integrators. Subdivision is expected to become the main trend of educational robotics market.

6

The educational robotics market will form a service-oriented ecosystem circle. Similar to the development of smart phones, the operating system of educational robotics and open SDK or API services will attract software developers to establish a complete service system from hardware integration to software development to various teaching services.

Focus on the System, Policy and Ethics of Artificial Intelligence Education | The 2019 Summit on Artificial **Intelligence and Big Data in Education**

The 2019 Summit on Artificial Intelligence and Big Data in Education, co-hosted by Beijing normal university and iFLYTEK, was held at the China National Convention Center in Beijing from August 1st to 2nd, 2019. During the summit, the sub-forum four - "The System, Policy and Ethics of Artificial Intelligence Education" achieved great success, which was jointly hosted by Smart Learning Institute of Beijing Normal University (SLIBNU) and National Engineering Lab for Cyberlearning Intelligent Technology (NEL4CIT) at the China National Convention Center on the morning of August 2nd.



Group Photo of Parts of the Guests



The Keynote Speech Given by Principle Qi Dong



The Keynote Speech Given by Prof. Ronghuai Huang

This forum focused on the system, policy and ethics of Artificial Intelligence education as well as the existing practical problems and development suggestions concerning these topics. The forum was divided into two parts: keynote report on Artificial Intelligence education and special discussion on the system, policy and ethics of Artificial Intelligence education. The guests attending this forum included Zhimin Li, former Director of Science and Technology Development Center of the Ministry of Education and Deputy Chairman of the Chinese Society of Educational Development Strategy, Zhang Xiong, professor of the School of Computer Science and Engineering of Beihang University, Zhenqiang Wang, Director of Information Technology Department of the Basic Education and Teaching Research Center of Beijing Academy of Educational Sciences, Lei Fan, professor of Capital Normal University, Guangde Xiao, associate professor of Hebei University, Chengjie Mao, Senior teacher of Beijing Jingshan School, as well as enterprises representatives Zhuo Wang, Vice President of iFLYTEK education group, and Li Xiong, CEO of NetDragon Websoft Inc. Besides, Ronghuai Huang, Dean of SLIBNU and Director of NEL4CIT attended the forum at the invitation of the organization committee.

This successful forum has clarified the ethical issues that cannot be ignored in Artificial Intelligence education, made clear the countermeasures, and emphasized the ethics, data security and other issues. It has also further promoted the in-depth integration, application and innovation of Artificial Intelligence and education and teaching by looking forward to the future application scenarios of Artificial Intelligence education.



Group Photo of Guests of the Forum "The System, Policy and Ethics of Artificial Intelligence Education"



The Forum The System, Policy and Ethics of Artificial Intelligence Education







Vice Chairman of Chinese Society of Educational Development Strategy

Development of Information Technology and Transformation of Educational Formation

Zhenqiang Wang

Director of Information Technology Department of the Basic Education and Teaching Research Center of Beijing Academy of Educational Sciences

The Current Situation, Problems and Thoughts of the Artificial Intelligence Education in Primary and Secondary Schools

Guangde Xiao Associate professor of Hebei University

Requirements on Artificial Intelligence in the Curriculum Standards for Information Technology



Li Xiong CEO of NetDragon Websoft Inc.

Explore AI+ Education and Seek the New Direction of Individualized Education









Zhang Xiong Professor of the School of Computer and Engineering of Beihang University

Nonnegligible Ethical Education in Artificial Intelligence Education

Lei Fan Professor of Capital Normal University

Ethical Problems in Artificial Intelligence Education: Challenges and Solutions

Chengjie Mao Senior teacher of Beijing Jingshan School

How Artificial Intelligence Empowers Classroom Teaching - Practice and Reflection on Driverless Courses

Zhuo Wang Vice President of IFLYTEK education group

The Practical Influence of AI Technology in Education

Focusing on Future Education in China: Innovation, Design, and Technology—2019 BNU Summer Training Program for The Belt & Road Countries Achieved Great Success

In order to serve the national development strategy of The Belt & Road Initiative and the overall scheme of Beijing Municipality to construct "Four Centers", as well as to promote the cultivation of national high-end talents for The Belt & Road Initiative and the construction of relevant disciplines, Beijing Municipal Education Commission and Beijing Municipal Finance Bureau set up "National Talent Training Base for The Belt & Road Initiative in Beijing". Among the participating universities, Beijing Municipal Education Commission is responsible to select and fund persons who are qualified as national high-level talents for The Belt & Road Initiative and send them to Beijing for learning, training and cultural exchange. Based on the 2018 BNU Winter Training Program for The Belt & Road Countries, SLIBNU successfully held the 2019 BNU Summer Training Program for The Belt & Road Countries during July 15th to 21st. The theme of this program was "Future Education in China: Innovation, Design, and Technology."



Kai Xiao, Vice Director of Office of International Exchange Cooperation, Beijing Normal University

Students also visited a number of humanities, scientific and educational institutions, so as to closely understand and feel the application of information technology in education in China from multi perspectives. At the closing ceremony, Dean Huang delivered a summing-up speech for the training.



Group Photo of Members of 2019 BNU Summer Training Program for The Belt & Road Countries

This program is mainly geared for educational managers and researchers of The Belt & Road countries. With the core training course of BNU advantageous, characteristic curriculum – Design Methodology in the Era of "Internet+" and the diverse learning and exchange methods like field research, experience sharing and so on, the program is expected to drive the development of innovation education of China and other countries of The Belt & Road Initiative in the international exchange and cooperation. 24 participants from 13 The Belt & Road countries, including Albania, Bulgaria, Hungary, Estonia, Macedonia, Poland, Russia, Mongolia, Cambodia, Pakistan, Philippines, Myanmar, Bangladesh took part in the training courses and experienced inter-school activities. The participators include Director of the Information and Social Development Department of the Hungarian Ministry of Innovation and Technology, Adviser to the Deputy Prime Minister of Macedonia, project manager of Estonian HITSA, educational adviser on Sofia "Todor-Minkov" Innovative Primary School in Bulgaria, adjunct instructor of Tirana University in Albania, teaching supervisors and teachers of local primary and secondary schools in other countries, PhDs in education and linguistics, etc.



Visit the Beijing Royal School on-Site



Visit the National Library on-Site

Kai Xiao, Vice Director of Office of International Exchange Cooperation, Beijing Normal University, and Prof. Yonghe Zheng, Chief Strategy Officer of NEL4CIT, respectively gave opening speech and welcoming speech, which officially marked the beginning of 2019 BNU Summer Training Program for The Belt & Road Countries.



Prof. Yonghe Zheng, Chief Strategy Officer of NEL4CIT



Visit the Headquarters of Tang International Education Group on-Site



Summing-up Speech Given by Dean Huang

International Course of Knowledge Science Started

With themes such as Cognitive Science, Psychology Science and Computer Science, this course is applicable to students who study computer science, psychology, educational technology, information science and other related majors. Additionally, Professor Ronghuai Huang served as the main lecturer. After the course was offered this semester, Bin Xu, associate professor of Tsinghua university, Kaushal Kumar Bhagat, assistant professor of Indian Institute of Technology, and Xiang' en Hu, professor of University of Memphis and Dean of School of Psychology of Central China Normal University were successively invited to give lectures in this course.



Bin Xu

Doctoral supervisor of Department of Computer Science & Technology of Tsinghua University, once Deputy Dean of Global Innovation Exchange of Tsinghua University, Director of CCF TCAPP and Deputy Secretary General of SIGKG of Chinese Information Processing Society in China.

Construction



Xiang' en Hu

He is professor of Department of Electrical and Computer Engineering, Department of Psychology, and Department of Computer Science of University of Memphis, professor and Dean of School of Psychology of Central China Normal University, and senior researcher of Key Laboratory of Adolescent Cyberpsychology and Behavior of Ministry of Education. He has long engaged in mathematical psychology, research design and statistics, and cognitive psychology. In addition, he was once funded by U.S. National Science Foundation (NSF), U.S. Institute of Education Sciences (IES), Advanced Distributed Learning (ADL) of U.S. Department of Defense (DoD), Army Research Laboratory (ARL), U.S. Office of Naval Research (ONR), University of Memphis and Central China Normal University.

Tutoring System

Kaushal Kumar Bhagat

He is associate professor of Indian institute of technology (IIT). In September 2016, he obtained his doctoral degree in science education from Taiwan Normal University. He has worked as a postdoctoral staff for two years in the research team of professor Ronghuai Huang in the institute of SLIBNU. He also published many journal articles and chapters in books, and was awarded NTNU International Outstanding Achievement Award and 2017 IEEE TCLT Young Investigator Award. His research areas cover Online Learning, Augmented Reality (AR), Virtual Reality (VR), Math Education, etc.

Learning



The Distant Course Given by International Experts



Report on How to Make Computers Knowledgeable - Knowledge Graph

Lecture on Edition, Layout, and Data Analysis of Session-Based Intelligent

Report on To Enhance Emerging Technologies for the Next Generation in Science

Design and Learning Course of 2019-2020 Semester Started

With the intensification of the scientific and technological revolution and industrial transformation, developing innovative economy, grasping the trend of global development, finding the breakthrough and the main direction have become the key issues of education in the future. It is an important mission of education to train a large number of high-end talents with innovative ability and cooperative spirit. SLIBNU launched "Design and Learning", a brand course with innovative design, which combines the design experience of several enterprises such as NetDragon Websoft Inc. By teaching design thinking principle and provide practical experience, this course can help students improve the ability of cooperative learning, innovation, design, project management, as well as the ability to apply the design thinking to solve concrete problems, thus to cultivate innovative talents and promote the development of the future education.

The course has been offered twice in BNU from 2017 to 2018. This semester, professor Ronghuai Huang, Dr. Dejian Liu, Dr. Zhiying Nian, Dr. Dingwen Zhang will jointly teach lessons. Moreover, other experts in the field of design will be regularly invited to the lecture site to bring wonderful lectures to the students.



Curriculum Theoretical Model of Design Methodology

The course adopts the project-based method and consists of 32 hours of online live lectures and 16+ hours of offline instruction (synchronous live broadcasting) in Shanghai, Fuzhou, Xi' an, Hangzhou, Chongqing, Wuhan, Xuzhou, Lanzhou and Shenzhen. The tutor team provided all-round online guidance, and the teaching assistant team provided 360° auxiliary teaching. At last, the prototypes of educational products were designed and produced, and excellent works were exhibited and evaluated.



Relevant Theories of "Design Methodology" by Dr. Zhiying Nian



"Design of Teaching and Learning Space" by Dr. Dingwen Zhang

Cooperation& Communication



Dean Huang Attended 2019 IEEE ICALT in Brazil and Delivered a Speech (December 7, 2019)



Dean Huang Attended 2019 SEAMEO CDM in Bangkok and Delivered a Speech (August 8, 2019)



Visit and Reception of International Network of Educational Institutes Summer School (July 8, 2019)



Visit of Leaders Ningxia Telecom (July 10, 2019)



Visit of Shenzhen Foreign Languages School (July 16, 2019)



Visit of National Accounting Institute (July 31, 2019)



Visit of Training Group of Principles (August 22, 2019)



Visit of Foreign Professor Richard (September 6, 2019)

Project Status

2019 Global Competition on Design for Future Education (GCD4FE)

The competition is jointly sponsored by the Organizing Committee of Beijing Design Week and Beijing Normal University, and undertaken by SLIBNU. The competition aims to drive college students from The Belt & Road countries to think together about the future of educational formations and the construction of a community with a shared future for mankind. A series of activities are designed in the competition, including the forum with the theme of innovative design of education, the competition of educational design for The Belt & Road countries, academic salons, etc. At present, the recruitment of the competition started comprehensively, and the project team also visited Serbia and Tunisia for the discussion of work on competition.

Survey Project on Information-based Classroom Behavior

The project team held a seminar "Intelligent Analysis Technology of Classroom Behavior", on which the online survey questionnaire of "Survey of Classroom Behavior in Intelligent Learning Environment" was compiled and got argumentation from experts. Later, three questionnaires respectively for "school administrators, teachers and students" were successively predicted in Beijing Xinghuo Primary School, Beijing No. 11 Middle School, Primary School Affiliated to Peking University and so on. Through interviews with teachers and students and extensive consultation, the questionnaires have been revised and improved, which are expected to be implemented online in October.



"Intelligent Analysis Technology of Classroom Behavior" Seminar



By Yongzhong Wang

Special Planning Project of Smart Education in Xiong'an New Area

The project team contacted with the Public Service Bureau of Xiong'an New Area Administrative Committee and the responsible officers of ICT in education in Xiongxian County, Rongcheng County and Anxin County, conducted a survey on current ICT in education basis and the demand for smart education in the three counties and also carried out studies on literature, policies and data simultaneously. For now, the team has entered into the stage of actually writing the plan. At the same time, it has actively connected social resources to provide support for the construction of smart education in Xiong'an New Area.



Delegation of the Education Bureau of Wuhou District, Chengdu

By Yanli Jiao

Design of Artificial Intelligence Teaching Activity and Research and Development Project of Supporting Resources

This project was designed to explore and develop teaching activities, supporting software and hardware for middle and high school students and teachers to carry out Artificial Intelligence teaching, to help teachers teach with Artificial Intelligence smoothly, and to help students learn and understand relevant knowledge of Artificial Intelligence. At the beginning of the new semester, the project team of Educational Robotics Centre of the research institute held a trial lecture in the No.2 Affiliated High School of Beijing Normal University, which received a warm response.

By Zhong Ren

Pilot Area/School Project

The project group of Five-year Plan on Smart Education of Wuhou District, Chengdu Province, has conducted the baseline research on the overall development of ICT in education in Wuhou District. The online survey started in mid-September and lasted for one month. The samples covered four groups: principals, ICT managers, teachers and students of various schools at all levels. During the 10-day survey, 14 schools were involved, accounting for 18% of all kinds of schools in Wuhou District, which comprised model schools of modern education technology in Chengdu, digital schools in Chengdu, future schools in Wuhou District, schools with weak ICT construction and ordinary primary and secondary schools. At the same time, it carried out research on relevant departments of Institute of Education in Wuhou District.

Design Methodology Published

By publishing the relevant results produced by corresponding resources in the course of "design and learning", this book enables the course and the related results of it to be applied and promoted in more colleges and universities, so as to make more students benefit from it. Moreover, it can also further enhance the influence of "design methodology" in colleges and universities in the field of design. At present, the first chapter and the second one of the manuscript have been finished. The multilingual translation of Dean Dejian Liu's small lectures will be completed soon.

Construction of "Demonstration Zone of Smart Education"

Currently, the project team has completed the work schedule of "Demonstration Zone of Smart Education" (2019-2020), the performance evaluation index of "Demonstration Zone of Smart Education" (draft), and the project materials such as the electronic work bulletin of the construction of "Demonstration Zone of Smart Education". The team has also built a website and create a public WeChat account for construction of "Demonstration Zone of Smart Education".



Artificial Intelligence Teaching Activity on-Site



By Yongzhong Wang

By Zhiying Nian

By Jingjing Jin

Books and Articles Recommended

Huang Ronghuai, etc.: Three Basic Computing Issues for **Intelligent Education**

Abstract

Intelligent technology with Artificial Intelligence as the core is promoting the transformation of the whole society. Human society will usher in the intelligent era characterized by human-computer collaboration, cross-border integration and shared innovation. The education is expected to be changed systematically into "intelligent education". The article first demonstrates the profound impact of intelligent technology on education, including: 1) ICT-based society "reversely force" reforms to be taken place in classroom teaching, 2) the dilemma that classroom reforms needs a new integration of intelligent technology and education; 3) Intelligent technology supported by Artificial Intelligence is expected to be applied to solve problems raised in the reform; 4) Intelligent education is gradually recognized as the basic feature of future education. Following a comprehensive analysis of the main contradictions which need to be solved in current education and key features of intelligent education, the article proposes three basic computing issues for intelligent education, namely cognitive computing, behavioral computing and environmental computing, and further analyzes the origin and open questions of three issues. Cognitive computing focuses on the improvement of learning performance; behavioral computing focuses on the reconstruction of teaching process; environmental computing focuses on the optimization of learning environment. At the end of the article, a model of "computational pedagogy" containing the three issues is proposed. It is expected that people will conduct extensive and in-depth research on the basic computing issues of intelligent education, help with the coexistence of Artificial Intelligence and education, take educational reforms successfully and orderly, and promote the sustainable development of human society.

Intelligent Education; Cognitive Computing; Behavioral Computing; Keywords Environmental Computing; Computational Pedagogy; Artificial Intelligence

Authors

Ronghuai Huang, Wei Zhou, Jing Du, Feipeng Sun, Huanhuan Wang, Haijun Zeng, Dejian Liu

Overview

1. A New Round of Scientific and Technological Revolution and Intelligent Education

In a congratulatory letter to the International Conference on Artificial Intelligence and Education, Xi Jinping points out that Artificial Intelligence is an important driving force for leading a new round of scientific revolution and industrial transformation. Artificial Intelligence is notably changing the methods of production, life and learning, and promoting human society to usher in the intelligent era characterized by human-computer collaboration, cross-border integration and shared innovation (Xinhuanet, 2019). Emerging technologies represented by Artificial Intelligence will inevitably trigger a new round of educational reform and promote the transformation and evolution of human education to the "intelligent education" stage.



Figure 1 The System Model of Intelligent Teaching from the Perspective of Experts in Different Fields

2. The Service and Computing of Intelligent Education

Teaching services refer to a kind of paid or unpaid behavior that benefits "educational object" through teaching and other activities, including educational public services and educational service industries. The supply, evaluation and teaching environment of future education need intelligent technology to provide services and support.

3. Cognitive Computing on the Improvement of Learning Performance

Learning performance includes learning efficiency and learning effectiveness. From computer-assisted teaching to intelligent teaching system, experts has improved learning performance by exploring ways to integrate technology and education.

4. Behavioral Computing on the Reconstruction of Teaching Process

The combination of computational behavioral science and education provides a theoretical and methodological basis for the analysis of learning activities, and forms a computing framework for teaching behavior based on learning activities. The automatic analysis of learning activity makes it possible to reconstruct and optimize the teaching process.

5. Environmental Computing on the Optimization of Learning Environment

Through studying environmental computing on learning environment, we can establish the models of learning context, design and optimize learning environments, and form adaptive learning support and services considering learning contexts, which is significant in this field.

Conclusion

Researchers in various fields should promote the integration of disciplines such as education, information science, psychology, and cognitive science, and study three basic computing issues in education, namely, cognitive computing on the improvement of learning performance, behavioral computing on the reconstruction of teaching process, environmental computing on the optimization of learning environment, which are significant factors in computational pedagogy.



Figure 2 The Computing Framework for Teaching Behavior Based on Learning Activities



Figure 3 The Model of "Computational Pedagogy'

Wisdom & Learning

Exclusive Interview



Wei Zhou

Doctor of Education Technology, **Beijing Normal University**

I joined SLIBNU in 2017 as a Ph.D. student instructed by Ronghuai Huang in Educational Technology. I major in Artificial Intelligence and Education and Smart Learning Environment. I support the construction and development of the ICT-based system of various research projects of SLIBNU. I published 3 academic papers, and applied for 8 software copyrights. The first project I participated in was the Report on The Development of Venue Smart Learning, which studied the status and trend of Smart Learning in Chinese venues. During this research, I was mainly responsible for the research and development of the platform of Venue Smart Learning Environment, providing the collection, processing, analysis and visualization of data for research. At the same time, I applied for my first software copyright "The Platform of Venue Smart Learning Environment". While working for the project, I learned that SLIBNU often used the Delphi method to conduct research based on the WIFI platform which enjoyed the advantage of collaborative editing. However, there was special marking language, unstructured knowledge generated by the experts. The answers given by experts need to be manually labeled, and the reading condition cannot be judged. I developed the research platform on Delphi method in order to solve those problems, reduce the cognitive load of the experts while using the platform, improve the efficiency of the experts' collaborative construction, and reduce the workload on maintenance of basic data and later data processing. Later, I developed many ICT-based systems, such as TangShibieyuan, the identified sharing platform of learning resource, the standard management platform of education resource, the data platform of education development in Hebei Xiong'an New District, the selection platform of future education technology laboratory equipment and the adaptive test platform of Chinese as a second language.

with us?

Since you joined in SLIBNU, you have participated in the construction and development of many ICT-based systems in the institute. Can you share with us the main results and your research experience?

In such a short period of time, it is marvellous to establish so many ICT-based systems and service platforms. Is there any experience that you wish to share

I practiced my typing seriously when I began to learn computer. With strong interest in computer, I can type very fast. The earliest computer I learned to use is the one named 586 that produced in the mid-1990s. The most impressive experience was the TT typing game on the DOS system, which required the input of words within limited time when the words fell from the top to the bottom of the screen. In those days, there were very few games that could be played, so I started to practice the TT. After that, I can type more than 200 letter per second. It is worth mentioning that although the popularity of computers in 21st century is more than that in the past era, the basic computer skills mastered by students today are far from those in the past century.

In the middle school, I didn't forget to learn computer despite of heavy schoolwork, and the computer had always been an auxiliary tool in my study and life. Although I was also addicted to various graphical computer games, thanks to the lack of Chinese version of the game at the time, I learned a lot of English words while reading the plots of the games. In the process, I also learned the software such as electronic dictionary and how to type in words by Wubizixing input method. In student activities, I also learned to use Office to make posters. Nowadays due to computer games are greatly improved in graphics and playability, increasing students are addicted to playing games rather than acquire knowledge from games. "Learning in games" and "game-based learning" are attracting more and more attention from researchers. Various mobile games that young people can get access to become fast moving consumer goods, no longer promoting learning in a single aspect.

In my undergraduate study, I had established a solid foundation in mathematics and cultivated mathematical thinking during four years of mathematic study, and I met with my partners in programming learning. When I majored in the mathematics and applied mathematics of the School of Mathematical Sciences of Beijing Normal University, I learned that the "achievement" Wisdom & Learning

the learning curve of programming is extending, which is really a double-edged sword.

In the senior year, I chose to work and got postgraduate recommendation. Learning from my work, I built a software model using abstract thinking and developed a common software building framework, a component-based cloud development platform. I started from the research of the collection system of enrollment catalogue, and gradually built the enrollment management system including the enrollment catalogue, registration system, examination organization, re-examination and admission, completing the construction of my first large-scale management ICT-based system. In the continuous iteration and optimization, it is found that the system is more and more difficult to be maintained, so I thought about building a general model of software development. After trial and error, I finally made a build-based cloud development platform of management information system, allowing developers to assemble components in the cloud through the browser and quickly build and deploy functions in an iterative manner. The programming concept of "assembly rather than coding, integration rather than implementation" is finished.

In my subsequent study and work, I constantly optimize this software model and try to write perfect software documentation. So that colleagues and friends who are interested in Web development can also use more organized methods of software reuse provided by the development platform to configure, assemble, and develop components online, greatly raising the development speed and enhancing the quality of Web applications. The platform has supported the development of over 20 applications of SLIBNU and laboratories. In addition to the above-mentioned 8 systematic platforms which have been applied for software copyrights, there are also other platforms such as the information collection of smart classrooms, the source tool



of using computers in primary and secondary schools only confined in "playing computers". Some classmates participated in the international ACM competition in the middle school. Gradually realizing the gap between myself and the excellent students, I encouraged myself to think more and learn more. In the process of learning, I especially selected computer-related courses, such as data structure, numerical analysis, operational research and multiple programming, fostering a mathematical and computational thinking. Particularly in my work for student association, I met my friends to programme together, study the development method of websites on our own, and develop my first Web application to solve the practical problem. The application was intended to help with finding study rooms, which aroused the media's interest, and then I got to learn to control the computer. Currently computer cloud services are emerging one after another. Without basic knowledge, one can also develop websites, APP, and small programs in a certain field, but collection of Artificial Intelligence, academic resource crawler, unified identity authentication, and contact sharing.



In your next research and work, what is your focus?



We are pioneers in education of the intelligent age. I would like to focus on the following three points:

The first is to rapidly cultivate an ICT-based team. We will further support the research projects of SLIBNU and laboratory on the favourable basis;

The second is to study the computing issues of intelligent education. We will ensure the rational coexistence of AI and education, and promote orderly reform in education;

The third is to construct of a education technology laboratory with AI for future teachers. By learning the principles of AI, using AI in self-improvement, applying AI in teaching, and introducing AI-assisted teaching experience, we can strengthen the ICT-based abilities and teaching competence of normal university students.