Design for Teaching Surroundings Based on Human-Computer Interaction Techniques

Wei Feng(✉)

Shandong College of Tourism and Hospitality, 3556, East Jingshi Road, Jinan, Shandong, China
13964076217@163.com

Abstract. Wisdom is far away, whereas Human-Computer Interaction (HCI) is very close. The thesis derives from the big vision of a vocational teacher. Education is a great system, and interaction appears here and there all the time, like Human-Human Interaction and Human-Computer Interaction. With the help of techniques like H5 Interactive media courseware, Multi-device cross-screen interaction, 3D sensing human brain recognition technology, Interactive AI teacher and VR immersion teaching VR, students do not need to enter set classrooms. A simulated teaching place will do the job. Teachers will gather all the teaching resources and it helps to break their limitation. It is possible for us to build up harmonious and efficient teaching surroundings by using advanced techniques based on Human-Computer Interaction Technique. One teacher can do little by him/herself, while he/she can expand the way, and share with others so that everyone has a chance to stand on the shoulders of giants and do the job better. HCI Technique is just like the giant who offers his shoulder.

Keywords: Human-computer interaction · Design for teaching surroundings · Intelligent education

1 Introduction

At the time artificial intelligence (AI) started to be popular, many teachers began to be anxious for the possibility that AI will take their place. How to break through the current situation of dull lectures and old teaching methods? How to bring new vigor to education? As a matter of fact, it is not only crisis of teachers, but also of education. Traditional teaching mode and staying pat is getting farther from the need of social development and students' progress. With more active ideas, wider outlook, modern teachers are serving more qualified students with better digital literacy. Artificial intelligence does not necessarily replace the teachers' job, but teachers who are skilled in artificial intelligence can replace those who are not.

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2 The Necessity of Teaching Environment Design Based on Human-Computer Interaction Technology

Everyone has experienced a good lecture that makes time flies and a bad lecture that kills time. It is a teacher's responsibility to make his/her lecture interesting, no matter how difficult it is. To make education effective and efficient, teachers must face their barrier and make good use all the resources. Only in this way can they get teaching achievements and make their students more concentrated and potential.

Albert Bandura, the famous American contemporary psychologist, has mentioned in his Reciprocal Determinism that behavior, human factors, and environmental factors actually act as determinants of interconnection and interaction.

2.1 Effective Teaching Principles of Teachers

Effective teaching refers to the establishment of a learning collaboration team under the guidance of teachers, allowing students to learn, to explore and to study independently, so as to improve learning effectiveness in a fixed period of time, to complete the established learning objectives of the curriculum, and to promote the overall development of students and the professional growth of teachers. Effective teaching is not only a process of achieving teaching, but also a process of high-qualified and high-efficient learning. It is the sustainable development of both teachers and students. The goal of effective teaching is to develop students' creative thinking. A large number of studies have shown that independent and exploratory learning is effective for developing students' creative thinking. In the process of effective teaching, teachers guide students to change from passive learning to diligent thinking, and gradually learn to cooperate and explore independently. It is necessary to use scientific methods to study the development of teaching. The only indicator to measure effective teaching is the progress of students.

According to Gary D. Borich, a professor at the University of Texas School of Education, of the seven elements of effective teaching, learning atmosphere and classroom activity are related to the teaching environment. Effective classroom teaching, which is one of the most important components of effective teaching, has limited effective teaching in time and space by full preparation, effective organization and scientific training to improve the practical utility, which mainly depends on a good teaching environment. Human-computer interaction technology is currently the best aid for building up a good teaching environment.

2.2 The Impact of Teaching Environment on Students

According to a survey conducted by MyCOS, the overall attendance rate of college students is less than 90%. Even in class, students who watch mobile phones, chat, sleep, and read books also account for a considerable proportion. Inadequate attention in class and initiative in learning have become a problem that must be solved in classroom teaching today. The investigation also shows that more than a half of the students use mobile phones in the classroom, and the proportion of students who

regularly use mobile phones in class is higher than 30%. It makes it very difficult for teachers to carry out effective teaching. But when teachers play videos and practice object teaching, the situation will be significantly changed and more students began to focus on the class. The traditional teaching model is obviously difficult to adapt to the needs of the development of the times. In fact, it is not an easy task to rely solely on the student's own willpower to persist in learning. Various factors of the external environment often directly affect the efficiency of student learning. Constructivism Theory Emphasizes the Influence of Learning Environment on Learners' Knowledge Construction. The role of teachers has changed from the traditional transfer of knowledge to the guidance of students' learning. Teachers create situations and interactions between teachers-students and students-students. Developing useful teaching situations is the most important aspect in teaching design. Traditional teachers occupy the dominant position and control the teaching environment. In modern class, students play the major role of creating more active and free learning environment. At the same time, students can make use of various information resources in the environment (such as multimedia courseware, rich materials, literature from multiple sources of information, etc.) and auxiliary tools to achieve their learning goals. In this process, teachers' help and guidance, together with the collaboration and mutual support between students work and complement each other. Teachers should provide students with as comprehensive and rich information resources as possible (including various types of teaching courseware, teaching media and teaching materials), which are mainly used to support students' self-learning and team cooperation exploration.

2.3 A Good Teaching Environment Is a Powerful Guarantee for Effective Teaching

The teaching environment is usually divided into the physical environment of teaching and the psychological environment of teaching. The development of the times makes us pay more attention to the information environment of teaching. Contemporary students grow up in the digital age, and the environment in which they are exposed in is the digital environment. They are more likely to receive digital information than traditional teaching information. Education informatization refers to the use of advanced information technology to improve the quality and efficiency of education in the process of education, and to form a new educational model that meets the requirements of information society. Compared with traditional teaching, the digital teaching environment has richer teaching content, more active teaching process and better learning method. The informatization teaching mode is a self-exploration and interactive teaching mode, students play as the main body and teachers as the assistant. The classroom is the most direct interaction between teachers and students with thoughtful design and better experience, and it helps to grasp the heart of the students and achieve the best teaching result.

3 Human-Computer Interaction Technology and Education

Human-computer interaction technology has wide applications in somatosensory, artificial intelligence, simulation environment and so on. The purpose is to "make the machine know you better" and a better user experience. Traditional teachers-oriented classroom has obvious limitations like fixed teaching methods and teaching content that are not flexible enough to adapt to the changes of the times, the result is students lack practical and exploratory learning situations, which is not conducive to the creative thinking of students. Human-computer interaction technology can make up for these defects well.

At present, smart cities, smart homes, and unmanned vehicles have become the hotspots in the field of human-computer interaction, while it is rarely seen in integrated application to the education industry. As an important factor to the development of a country, education should share and participate in the wave of technology by making the students completely realize the power of high technology. Although not everyone has the ability to develop technology, you can use current digital technology to use AI as a powerful tool for learning and work growth. In fact, education is a better field of human-computer interaction learning and application than other industries. From Pearson to DuoLingo, we can see they are trying to use adaptive learning to design personalized learning services for students. Many companies in the education industry have begun to use this technology. These companies have helped us redefine "learning" and spread more advanced ideas whether for human beings or machines.

The essence of human-computer interaction technology is to improve the quality of life and serve the people, the core feature is user-centric that is committed to improving the "user experience"; the essence of education is people-oriented, the purpose is to obtain ability to promote personal development; modern education is based on students, teachers' job is to guide students to learn independently, and to cultivate individualized talents needed in the society. The idea of human-computer interaction technology is completely consistent with the concept of "cultivation" of education. To do something well, it is necessary to use good tools and techniques. Rational application of human-computer interaction technology in the field of education can improve the quality of education for effective teaching, extending unlimited teaching possibilities in a limited educational environment and making education more advanced, more efficient, and rejuvenating. Human-computer interaction technology and intelligent education are very suitable combinations.

China AI industry research report (2018) indicates that artificial intelligence has been integrated in education of teaching, learning and evaluation. It covers multiple artificial intelligence technologies such as self-adaption, voice recognition, computer vision, natural language processing, translating machine, learning machine, etc. and multi-function like class scheduling, scoring, evaluation and so on. Artificial intelligence is creating a smarter and more efficient and personalized learning environment that serves lifelong learning.

4 Design for Teaching Environment Based on Human-Computer Interaction Technology

The purpose of teaching environment design is to enable the students/end-users to obtain a better learning experience and stimulate learning initiative in teaching process, the purpose of which is to improve learning efficiency and fulfill the established learning objectives. Facing a new generation of learners and "network aborigines" who are surrounded by information technology and are more active in thinking and possess a broader vision, ways like comprehensive usage of a variety of human-computer interaction technologies, the development of a new teaching model based on human-computer interaction technology in the Internet era and design a teaching environment more in line with the characteristics of contemporary students can better solve the problems of education and teaching under the impact of artificial intelligence.

4.1 Principles of Designing Teaching Environment Based on Human-Computer Interaction Technology

The design of interactive teaching environment should be simple, well-arranged, clear-oriented, and easy to implement. Here are some principles to follow.

Combination of Physical Environment and Psychological Environment. The teaching environment is usually divided into the physical environment of teaching and the psychological environment of teaching. Physical environment is the external cause of students' learning motivation, while psychological environment is the internal cause of students' learning motivation. They complement each other and work together. If physical environment is regarded as the interface of human-computer interaction and interaction between people in the teaching process, teachers and students will be regarded as users. The user-friendly interface is good, and the viscosity is high, which directly affects the effects of teaching process. Well-designed physical environment will virtually relieve the external pressure of teachers, the result is more energy can be used to pay attention to the student's reaction and guidance/correction and greater help will be obtained in creating a harmonious teaching psychological environment.

Combination of Theoretical Teaching and Situational Teaching. Multi-subjects knowledge systems are divided into two parts: theoretical knowledge and practical operation, the proportions they account for in the system are different. Therefore, both should be considered when designing the teaching environment, that is to say, designers should not only pay attention to the study of theoretical knowledge, but also the situational design of practical teaching. Extinct immersive experience technologies, such as VR and AR, are ideal match to environmental design in practical teaching.

Combination of Traditional Teaching with Modern Teaching. Traditional teaching is systematic and rigorous, teachers act as the main body; modern teaching pays more attention to information-based teaching, which is more flexible and takes students as the main body. Both have their own advantages and cannot simply negate or support either side. In the design of the teaching environment, the proportion should be

rationally distributed according to the characteristics and stages of the curriculum and make the best of both worlds.

4.2 Design Conception of Teaching Environment for Human-Computer Interaction Technology

For a long time, or even until today, teachers and students communicate through traditional blackboards, PPT and verbal language. Some universities in China, the United States, South Korea and Japan made some surveys recently and found there is basically no intelligent teaching that is applied systematically. Some schools implement mobile terminal applications such as attendance check and classroom evaluation, all of which need independent app or web platform account login methods. The functions are relatively simple and not related to each other, the truth is, multiple functions did not form a systematic application. The new technology cannot be systematically and timely applied in and promote to teaching in schools. Main reasons are: the technology is not mature enough, the support is not ideal, and the cost is high; conservative teachers are afraid to face new technologies and great changes in teaching, multiple functions are not properly designed and integrated, all these reasons lead to difficulties in wide application.

At present, 5G network technology, with wider coverage and faster transmission speed than the current 4G network, has matured and gradually taken into commercial use. Larger connection applications such as VR/AR, smart city and smart home become possible. The human-computer interaction technology is developing increasingly, the cost is reduced in a large scale, the technology and the use environment are improved, and the relevant application interfaces developed are friendly and easy to use. All of these lead to a result that wider and easier human-computer interaction technology will be put into use soon. A well-designed, well-planned, and integrated AI technology can be set into the teaching system and create a scientific teaching environment. The communication between teachers and students will be changed from traditional verbal languages, blackboards and PPT to human-computer interaction technology. The artificial intelligence will be transited with human-computer interaction as the core aspect and wisdom teaching will be realized (Fig. 1).

Lecture Preparation, Rhythm Control of Class, and Student-Oriented Teaching Activities. Teachers create class models, input student information and make related tools like PPTs, teaching videos, tests, questionnaires and other related teaching resources based on mobile terminals, and upload an interactive teaching platform database for students to review in advance, all these are supposed to be finished on Html5, the interactive media platform. With teachers' invitation, students are allowed to enter the corresponding online classroom. Hence a basic human-computer interactive teaching environment is built. Students log in to the classroom through the mobile terminal or PC and use face recognition technology to pass teachers' license certification to achieve attendance and effectively avoid absenteeism. At the same time, the attendance data is automatically put in the background database to complete the attendance module data collection, and relevant reports can be generated for teachers to refer to. In the process of teaching, multi-screen interactive technology is used to

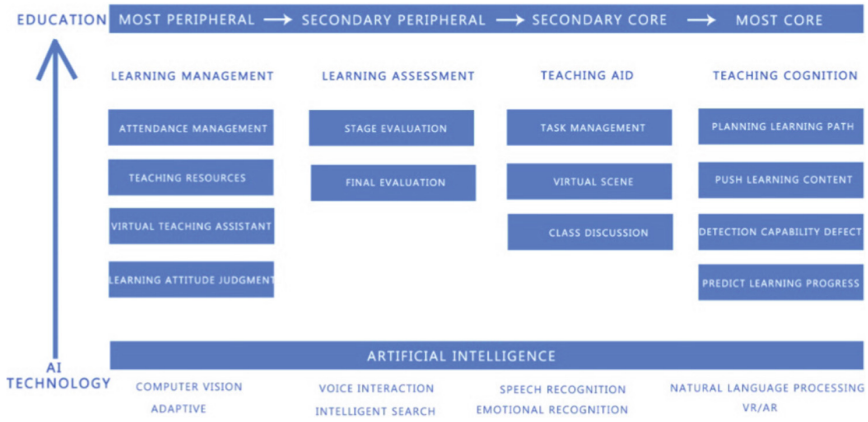

Fig. 1. Education and AI applications (Source: iResearch)

realize the three-screen display of mobile terminals, PCs and teaching large screens. The interactive teaching platform uses the forms of discussion, voting, and classroom testing to guide the teaching process and activate the classroom atmosphere. The results of the mission are publicly displayed on the spot to promote students' thinking. Virtual teaching assistants will answer questions and communicate with students after class. The virtual teaching assistants are online all the time and can communicate in a chat mode, or chat with the help of voice recognition. They can also learn and self-educated through interacting with the students and even perfect their own knowledge base, even more, they collect and analyze the highly frequent feedback of the students, and help the teachers to perfect the teaching system and realize the in-depth teaching (Fig. 2).

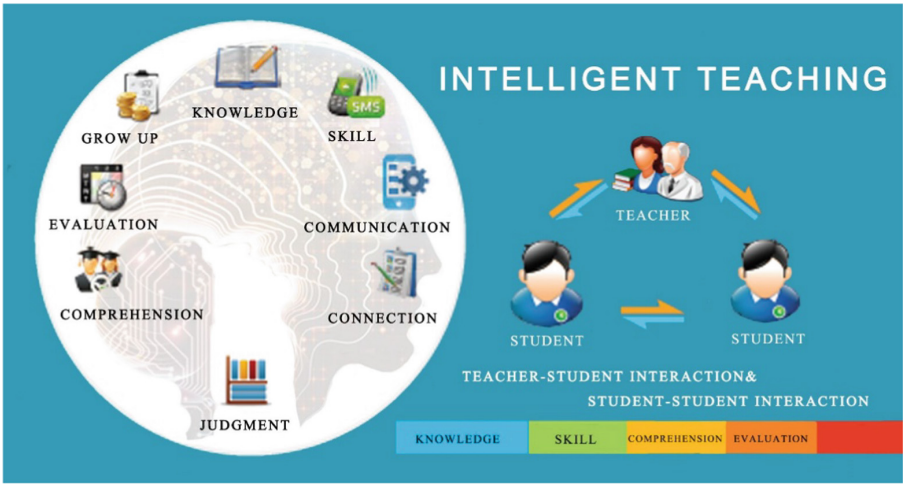

Fig. 2. Intelligent teaching (Source: Author)

The essence of the teaching process is also a serving process. In the application of human-computer interaction technology, the teaching activities are specialized. If the teaching environment is regarded as a large human-computer interaction interface, the user will not be an independent individual. "People" includes both teachers and students. With friendly interface, good user experience, and smooth and effective teaching activities, the user's stickiness will be greatly improved and good teaching results can be achieved. Human-computer interaction should ultimately serve for human-to-human interaction. While using human-computer interaction, the interaction between people (the interaction between students and teachers, the interaction between students and students) must also be considered to ensure smooth progress of human-computer interaction. The largest advantage of the teaching environment based on human-computer interaction technology is interactive experience, and the effect of the experience directly depends on the level of teachers, which needs more qualified teachers.

Human-Computer Interaction Technology to Create Realistic Teaching Scenes. Most real facilities and equipment used in practical teaching are expensive, not flexible, and hard to be updated in a timely manner. If VR and other technologies are used to construct virtual reality scenes for practical teaching, human-computer interaction can realize the interaction between people and the environment, and the situation is similar to that in real working place, which can greatly save money and integrate with reality.

Technologies like VR and AR are currently mainly used in the area of movies and television shows, games, architectures, etc., and are not widely used in teaching practice. In fact, VR and AR technology and many other teaching practice scenarios like mechanical manufacturing, environmental art, architectural design and tourism-related simulation hotels, simulated attractions, simulated aircraft cabins, etc. can be very well matched with real training situation. It is not difficult to publish to a PC or mobile terminal by Unity3D modeling, and to assist the immersive experience with the help of a wearable device. It is also possible for several people to enter a special scene at the same time. Related equipment surely needs some funds.

Pay Attention to Learning Status and Promote Active Learning. Some students are easily distracted during the learning process. Eye tracking technology and emotion recognition technology can be used to monitor students' learning status in real time, and give feedback to teachers through the interactive teaching platform to remind teachers so that reasonable guidance will be given to students.

Try to make good use of AI as a medium of teaching and make teaching context richer and more diversified. With the characteristics of massive information data based on AI, teachers can use the cloud platform to share teaching methods, thereby develop and perfect more contexts of teaching, adjust curriculum design, and achieve valuable education of both rationality and sensibility. Students are led not only to active learning knowledge in the process of advanced and technical means of education, but also broaden their horizons, develop ideas, update concepts, and benefit together with teachers from the advanced technologies and tools.

Accumulate and Build a Richer Digital Resource Library. The existing learning resources lack in-depth analysis of students and the design of learning content is dull.

There is no targeted knowledge sharing or sharing platform. Students are not interested which lead to poor learning results. To establish and enrich the library of teaching resources, we do need an abundant supply of teaching resources, and also, the resources from users/students are also needed. Students are both learners of knowledge and creators and promoters of knowledge. In the teaching process, teachers should guide them to master the knowledge and innovate, and update the learning resources in real time. In the process of teacher-student interaction and student-student interaction, Try to form a digital teaching resource library that is growing and suitable for students. There are several measures to take, like constantly improving the knowledge system, establishing a valuable relationship system between teaching objectives, teaching content and teaching environment…. The first step is to build and optimize the learning content model. Try to establish a knowledge model so that students can find the content that suits them more conveniently and accurately. The second step is to achieve adaptive learning. Utilize human-computer interaction technology to collect data through the students' daily learning process, intelligently derive their future performance, recommend the most needed learning content for them, and finally improve the learning effect efficiently and clearly. By data analysis, the system recommends appropriate learning methods and learning content for students, long-term learning information are provided, and a personalized growth model for students are established to help students achieve lifelong learning.

Improve Comprehensive Assessment and Improve Learning Initiative. Assessment is the last part of the learning process. It is not only testing the level of students, but also testing the teaching effect of teachers. Tests are usually divided into process testing, final testing of the discipline, and comprehensive proficiency testing according to the stage of study. The way of testing can be divided into objective test and subjective test. For teachers, it is a very difficult task, heavy and cumbersome. Objective testing of knowledge is the most difficult one. Testing is repetitive work that is boring and consumes a lot of teachers' energy.

At present, machine review has already been used in objective testing, such as multi-disciplinary computer test system. Teachers can use the H5 interactive media platform to collect data for process testing and final test design. Students can not only test their mastery of subject knowledge at any time, but the system can also automatically create a student's wrong question base based on the test results, and strengthen the practice of error-prone knowledge points. Teachers can also use human-computer interaction related technologies to interact with students, to test, collect and analyze results in real time, and activate classroom atmosphere. The system records each student's assessment each time. At the end of the semester, individualized test papers will be automatically generated for each student's learning situation, and assessed separately to break the unscientific situation of the same test papers.

It is difficult to achieve automatic review by technology in subjective testing because of the creative and personalized content. However, speech recognition and semantic analysis technology make machine scoring possible. For uncomplicated semantic statements, the machine can automatically identify and judge, and even assist the teacher to propose revisions, which will greatly reduce the burden on teachers and improve the teaching efficiency of teachers.

Knowledge learning has a life cycle from analyzing the key points and difficulties of the course to establishing a personalized learning model for each student, and, to the testing and final testing process in the study, and then, the consolidating the knowledge completion course, in which the teacher is in a guiding position. Teachers can make full use of students' dependence on smart mobile terminals to design learning activities such as upgrading and customs clearance, just like playing games. There are personal efforts and teamwork in the learning activities, the whole process has success and disappointment, rewards and punishment. Learning assessment covers the entire learning process.

4.3 Do What You Can and Build a Throughout Personalized Model

With advanced technologies such as cloud computing, big data and human-computer interaction, the system will create a growth file for each student, from the time of admission to the student's entire learning process. Try to establish a student's growth big data based on student's learning experience, each test score and each activity record in the school. Through systematic scientific analysis, students' interactive growth models are formed and every data about the student is clear, like the advantages and disadvantages of students' knowledge, ability, personality, and subject preferences, etc. The purpose is to provide the students with guiding advice to help students develop their advantages, avoid disadvantages, and further improve teaching and learning. The individualization, precision and effectiveness of learning make students realize that future can be expected, and it will stimulate students' internal motivation, constantly improve themselves to grow up into a valuable person (Fig. 3).

Fig. 3. Build personalized model (Source: Author)

In the construction of an interactive teaching environment should be done according to the situation of the school. Technology is getting more and more mature and the cost is falling. The way of adding economic pressure on students is not advisable.

5 Conclusion

In the era of smooth network access and human-computer interaction technology, it is not difficult to over the education crisis. As a development designer and guide for teaching activities, teachers are acting irreplaceable social attributes. As long as the scientific teaching methods and modern educational techniques are used reasonably and effectively, the teaching environment is designed reasonably, and the teaching process is scientifically guided, students can truly become the main body of learning and master the initiative of learning and benefit from it.

Mei Yiqi, former president of Tsinghua University once mentioned: A university is famous and successful not because of high buildings, it is because of great masters. Now we can say a good university is based on both high buildings and great masters, this is because high building represents the hardware and techniques we need to provide HCI, smart classroom and smart campus, the result is students can learn in a smarter way.

In the end, Human-computer Interaction would grow and turn into no interaction. The best user experience is no experience.

References

1. Ye, C.: Interactive study of future classrooms. China Inf. Techn. Educ. **11**, 80–84 (2012)
2. Sweet little life: what is the core of effective teaching? [EB/OL]. https://baijiahao.baidu.com/s?id=15777821163197146. Accessed 06 Sept 2017
3. Wang, Y.: How to improve the efficiency of classroom teaching. Educ. Art **01**, 42 (2014)
4. Yang, X.: The connotation of classroom teaching environment from the perspective of ecological philosophy. Teach. Manag. **03**, 6–9 (2012)
5. Wang, Z.: Theoretical Study on Constructivism Teaching Model and College Students' Innovative Ability. Xi'an Technological University, Xi'an (2006)
6. CCW: 2018 China artificial intelligence industry research report [EB/OL]. http://www.ccw.com.cn/tank/2018-06-19/2266.html. Accessed 19 June 2018
7. Sohu: 2018 education industry blue book [EB/OL]. http://www.sohu.com/a/277953114_660587. Accessed 26 Nov 2018
8. Deng, T., Fu, W.: Design of project teaching network collaborative platform based on "witkey model". Educ. Teach. Forum **03**, 97–98 (2014)
9. Li, H.: Research on Interactive Platform Construction of Teacher's Wisdom Learning. Southwest University, Chongqing (2016)