Research on E-learning system based on Affective Computing

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Abstract—E-Learning is a kind of study system. In this system we can teach and learn through the Internet and other digitized media. Affective Computing is related to, arises from or deliberately influences emotions. It tries to construct a kind of computer system which can recognize, synthesize and understand the human emotions to make intelligent, smart, friendly reaction. In this paper we combine the e-Learning system with Affective computing to propose the e-Learning system model based on affective computing. This system can resolve the problem of communication deficiency between the computer and users effectively.

Keywords-e-Learning; Facial Expression; Recognition; Affective Computing Recognition; Affective Computing

I. INTRODUCTION

Different from traditional education, e-learning is defined as the use of new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services, as well as remote exchange and collaboration. With the rapid development of information technologies, e-Learning will be more popular and become one of the most important education means in the future. However, emotion deficiency caused by the lack of face to face communication with the instructor and the learner, makes the e-lesson a simple “textbook mover”[1].

The network institute of Yangzhou University has carried out an investigation on learning conditions for 500 distance education learners in 2008. The author took out two results that are related to emotion deficiency form the investigation results. Two results are shown in table1 and table 2.From tables 1 and table 2, the influence that is caused from the separation among teachers and students is obvious (obvious influence and great influence occupy 57.2%). The influence that is caused from the interaction deficiency of teaching contents is obvious too. (Obvious influence and great influence occupy 57.2%).

II. THE MODEL OF E-LEARNING SYSTEM BASED ON AFFECTIVE COMPUTING

In the learning process, the expression and language of learners are abundant. When they understand and accept the learning content, their emotion is high and displays as smile expression and cheerful spoken language. Otherwise, their emotion is low and displays as brows closing expression, discouragement and so on. These emotional behaviors are quite important feedback signals of learners. We may use these feedback signals effectively and adjust teaching

<table>
<thead>
<tr>
<th>Influence</th>
<th>Great influence</th>
<th>Obvious influence</th>
<th>A little influence</th>
<th>No influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student number</td>
<td>85</td>
<td>201</td>
<td>160</td>
<td>54</td>
</tr>
<tr>
<td>percent</td>
<td>17</td>
<td>40.2</td>
<td>32</td>
<td>10.8</td>
</tr>
</tbody>
</table>

So, how to evaluate a learner’s real time cognitive and emotional states in long distance learning environment to realize affective interaction, has attracted more and more attention of education technologists, and become one of the most important worthy projects in the long distance education.

Affective computing is an innovative research in Artificial intelligence. It can be defined as “computing that relates to, arises from, or deliberately influences emotion”[2], has attracted education technologists’ eyes. In order to establish good web learning environment like the real world, Qi Luo [3], Xi-rong Ma [4], P.A. Jaques[5] have explored the potential of affective computing in e-learning models one by one. These e-Learning system models emphasize particularly on the evaluation of the learner’s emotional states and adjustment of teaching strategies, and ignore how to evaluate learning performance and how to adjust teaching strategies according to the contents of evaluation module. To solve the problems, we proposed an e-Learning system model based on affective computing in this paper, which can detect and aware the learner’s emotional states by using facial expression and posture recognition technologies, modify teaching strategies automatically according to the learning performance and emotion transition, and provide emotion stimulus according to special cognitive states, thus solving the problem of emotion deficiency radically and providing better learning conditions.

TABLE I. THE INFLUENCE IS CAUSED FROM THE SEPARATION AMONG TEACHERS AND STUDENTS OR STUDENTS AND STUDENTS

<table>
<thead>
<tr>
<th>Influence degree</th>
<th>Great influence</th>
<th>Obvious influence</th>
<th>A little influence</th>
<th>No influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student number</td>
<td>75</td>
<td>198</td>
<td>177</td>
<td>50</td>
</tr>
<tr>
<td>percent</td>
<td>15</td>
<td>39.6</td>
<td>35.4</td>
<td>10</td>
</tr>
</tbody>
</table>
strategies to serve personalized learning. The model of E-learning system based on affective computing is Fig.1.

<table>
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<th>TABLE III. The e-Learning System Model Based on Affective Computing</th>
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| As interface between user and computer, this part is mainly responsible for the identity of the user to verify the information, collection of user feedback, showing courses dealing with information and analysis of user feedback information. User information input includes interface agents, affective computing server and user accounts database. Affective computing terminals in agent interface and affective computing server are characteristics in this e-Learning system model. In the learning process, users are monitored by affective computing terminals real-time, and the information gathered about facial expression, speech, and other messages be passed to affective computing server. After a period of learning, the types and proportion of facial expressions, speech appeared are automatic calculated. Users can fill out a questionnaire survey to take the initiative to form a study evaluation to adjust the pace of learning; The system forms a final evaluation with the support of cognitive psychology automatically to feedback.

III. REALIZATION OF KEY TECHNOLOGIES

Facial expression recognition

Human expression scientists Ekman and Friesen have defined six kinds of basic expression, such as happy, sad, surprise, fear, anger, and disgust as well as 33 kinds of different expressions[6]. Classification and recognition of basic expressions are proposed in the paper. First, facial characteristics are extracted.

Supposed the distance and change among parts in the face are measured by Euclidean distance. Six parameters of one-dimensional vector have defined as a face expression model $X=(d_1, d_2, d_3, d_4, d_5, d_6)$, where $d_1$ is the distance between two eyebrows, $d_2$ is the distance between upper eye side and nether eye side, $d_3$ is the distance between eyebrow and nether eye side, $d_4$ is the mouth high, $d_5$ is the mouth width, $d_6$ is the distance between mouth corner and upper lip. Therefore, an expression is a spot in six-dimensional space, and the expression is recognized though judging Euclidean distance in six-dimensional space.

Adjusting teaching strategies

The change of learners' emotion is more complex in the learning process. The learner contacts with a new knowledge point, two kinds of attitudes such as interested state and indifferent state may appear. With the learning process advancing, learner's emotion is changed. For instance, the learner has an idea to solve this problem. If the learner defeated repeatedly, he will suspect himself and changes into the depression state, this kind of state is disadvantageous to learning. The system should apperceive this kind of emotional change and carry on emotion intervening, which let him turn to self-confident state. When he contacts with a next new knowledge point, the emotion turn to the state of surprise and puzzle too.

Teaching strategies are adjusted according to student's emotion dynamically though production rules. We neglect other influencing factors and take the learning style as the example.

IV. CONCLUSION

In this paper, through the analysis of each module shows that the e-learning system based on affective computing can manage and track real-time learning process, evaluate learning effect, set down different learning schemes for different learners, provide feedbacks and evaluations in time, thus setting individual learning conditions, inspiring learning interest, enhancing learning consciousness and learning effect, which will result in improvement of teaching quality.

With the development of network technology, e-learning systems based on affective computing would have more wider developing potential and application value, and would be developed quickly in the near future, thus bringing good social benefits and tremendous economic benefits for long-distance education.

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REFERENCES


