



# Study on Teaching Design and Application Practice of Learning Emotion Experience Based on Analysis of Students' Facial Expressions

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## ABSTRACT

Learning is an activity process in which cognitive and emotional factors interact. In recent years, with the rapid development of Internet technology, big data, cloud computing, AI (Artificial Intelligence) and other new technologies, seeking intelligent education that plays the role of learning emotional factors has become a new trend of classroom teaching development. Based on the three major emotional elements (positive emotion, negative emotion and neutral emotion) and their dynamic transformation mechanism in the classroom learning process, combined with facial expression analysis technology, this paper constructs the teaching activity process design for learners' learning emotional experience, which can be divided into six stages: problem definition, task analysis, information processing, problem solving, evaluation feedback and summary and consolidation, Each stage will make learners have different learning emotional experience. The teaching application practice shows that the teaching activity process design can produce positive learning emotion and effectively promote the occurrence of deep learning.

**Keywords:** Facial expression; Learning emotions; Emotional experience

## 1. INTRODUCTION

Psychological research results show that in people's life activities, emotion is the responsible experience of people's attitude towards objective things, and this experience is often related to people's social needs and will be affected by the external environment. In the process of classroom teaching, students' facial expressions and gestures are a natural expression of their learning state, which can reflect the current learning state of learners. Students' learning emotion expression can profoundly affect the meaning construction of knowledge, affect students' mutual interaction and self-acceptance, and ultimately have a significant impact on students' personality growth and mental development. Therefore, in all classroom teaching activities, teachers hope to observe the emotional changes of each student in real time to master the current learning status of students, so as to adjust the teaching schedule and activate the teaching atmosphere, so as to mobilize students' enthusiasm and participation in learning. However, at the present stage, teachers only acquire students' learning emotion data through classroom

observation, after-class questionnaire, in-class testing, interview and other methods. There are two main disadvantages in these methods: first, the lag is too strong. The traditional evaluation method of students' learning emotion can only be fed back to the teacher after class, which affects the improvement of the class quality to a great extent, and the feedback may not correspond with the teaching of the following courses. Second, the evaluation method is too subjective. The current assessment lacks scientific and immediate assessment of students' behavior, emotion and engagement in the learning process. Therefore, teachers tend to focus on their own analysis of teaching deficiencies and ignore the emotional changes of students in the actual classroom teaching process. Especially when the learning mood is depressed, students often cannot get the positive guidance of the teacher in time, and will gradually lose the enthusiasm and initiative of learning. In serious cases, they will even have a boring aversion to the course, which will eventually affect the learning effect and efficiency of the whole course. In short, due to the widespread existence of emotion in learning activities, the development of a high level of effective educational intervention depends

on people's understanding of the synergy and interaction among emotion, cognition and motivation. Both promoters and suppressors of learning who can well grasp the influence of emotion will make significant progress in improving the effectiveness of educational planning. Use all kinds of intelligent technology to the classroom teaching process or environment real-time dynamic monitoring and analysis of students' emotion, will be more accurate and more comprehensive understanding of the state of students' learning, teachers can more timely communication with students, let students to learn and a joy in classroom study middle school, fully mobilize students' learning enthusiasm and subjective initiative, To achieve comprehensive cultivation of students' innovation and core literacy.

### 1.1. Learn the elements of emotion in the classroom learning

Paul Ekman, an American psychologist, has found through research that the facial expressions, physiological and behavioral responses of six basic emotions (happiness, anger, surprise, fear, disgust and sadness) are consistent across cultures. Therefore, existing researches on learning emotion recognition are based on these six basic emotions, and some of them also add other emotion categories on this basis, such as adding neutral emotion contempt. In 1976, Paul Ekman and Wallace Friesen developed the Facial Action Code System (FACS) to classify every conceivable human

Facial expression. It describes each facial expression by using multiple AUs (Action Units), each of which corresponds to a specific muscle group of the face. FACS is currently the most popular classification standard for the systematic analysis of facial expression recognition. At present, in the study of education or learning, there are many emotional factors of learning, such as motivation, anxiety and self-confidence. However, in the process of actual teaching activities, learners' emotions are often characterized by obvious changes, complexity and diversity. Learners' emotions often include joy, appreciation, happiness, pride, fear, tension, sadness, guilt, disgust, anger and so on. In classroom teaching activities, the representative classification standard is the learning emotion model proposed by Barry Kort et al. They divide learning emotion into four pairs, each pair of emotion is opposite to each other, and the degree is from weak to strong. Negative emotions are negative emotions, and positive emotions are positive emotions. In the teaching process, students have negative emotions, teachers should take measures to change to positive emotions as soon as possible to ensure the smooth learning. On the whole, the learning emotion elements of students in the process of classroom teaching can be divided into three categories: positive emotion (positive emotion +1.0), negative emotion (negative emotion - 1.0) and neutral emotion (0), and all kinds of emotion appear alternately in the whole learning process.

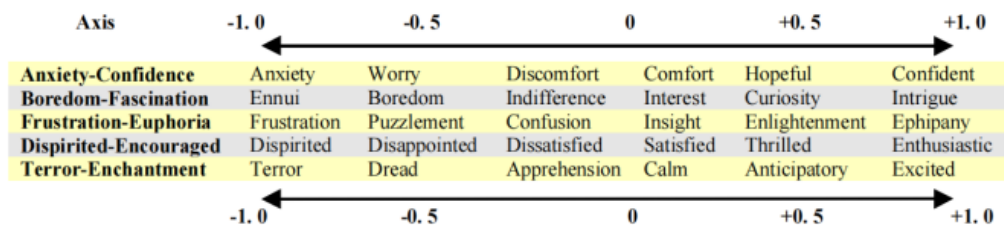


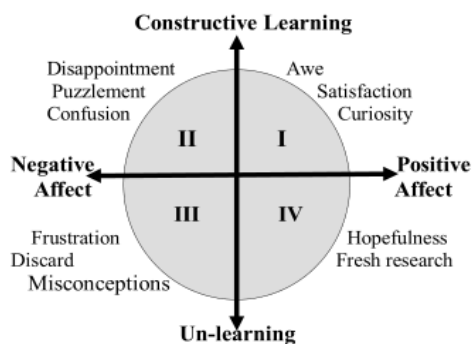
Figure 1 The emotion sets of learning process

### 1.2. Learn the Emotional Process in the classroom learning

When trying to reshape the state of teaching and learning, people always tend to seek help from experts or teachers who are good at identifying students' emotional states first, and take appropriate actions to affect learning according to their observations. It's believed that accurate identification of students' cognitive emotional state is a key indicator to determine their learning style and effect, and dynamic adjustment of learning emotion can help learners understand the efficiency and fun of the learning process. Therefore, it is necessary to reconsider the reliability of reasonable explanations for students' learning emotional states based on the observation of facial expressions, body language, speech content and tone, especially the overall

process of students' learning emotional changes in the teaching process. Ideally, at the start of the classroom teaching activities, students will first start from quadrant I or II: in quadrant I, when learners to build up capability of ideas, concepts, and learning expectations and expectations are high, they may be curious about a new project or problem and fascinated, and appear confident or interested in positive emotional state. In Quadrant ii, learners' speed of knowledge construction is reduced, and negative emotions such as confusion or worry appear, or emotional decline, which may be reduced by boredom or disappointment and motivation. In both quadrants, if the student's focus is on constructing, testing, and exploring the development of knowledge, the student is in the upper half of the positive and neutral learning emotional space. With the further development of classroom learning activities, emotions will decline with the passage of time, and the

movement transformation of learning emotional experience begins to occur in this space. For example, when students run a learning activity and fail as a result, they find that some parts of their ideas don't work (and new knowledge construction is needed), and they move down to quadrant iii, the lower quadrant with negative emotions. In quadrant iii, because the negative emotional impact of learning will continue until the students decide to discard their original wrong concepts and ideas; In Quadrant iv, since the infeasible and ineffective concepts have been cleared, students adopt a positive attitude to restore hope and confidence, and at the same time start a new cycle again, finally facilitating students to establish a correct and complete mental model related to learning. In other words, when students consolidate their knowledge with the awareness of progress and motivation to continue exploring, learners are highly likely to enter Quadrant iv. Especially when the student gets a new research idea or hope during the problem solving process, she will keep moving forward and return to the upper half of the positive emotional space (most likely quadrant i). Therefore, the typical learning experience in the process of classroom teaching activities involves a series of emotions. Students can stay in the four quadrant space at will during the learning process, and they are in the positive emotion -- negative emotion -- positive emotion. The dynamic balance of the development process. Given the opportunity, students may go through multiple cycles around each quadrant until they have completed all the exercises in the course, each track representing the time evolution of the emotional experience cycle of learning.



**Figure 2** The four stages of learning process and related learning emotions.

## 2. THE DEVELOPMENT OF STUDENTS' FACIAL EXPRESSION ANALYSIS SYSTEM IN THE PROCESS OF CLASSROOM LEARNING

### 2.1 Design of students' facial expression analysis system during classroom learning

Since the six basic emotion categories proposed by Paul Ekman, facial expression analysis (emotion

recognition) has attracted the focus and in-depth research of researchers, and is in a state of continuous development, from the pure facial muscle movement to evaluate and recognize facial expression (FACS system), To rely on face feature point analysis (machine learning emotion virtualization) and algorithmic simulation of large data sets (deep learning emotion model). Facial expression analysis has achieved great success in non-spontaneous expression recognition and has a high recognition accuracy for all kinds of spontaneous expression data sets. But for the field scene, due to the external natural environment factors, the face collection and recognition has great limitations. Especially for the students of class environment facial emotion recognition, such as hand, books and study partner keep out, the influence of face images collected is often incomplete, and facial expressions more subtle change, students in the process of learning different expression difference degree is small, makes study of face facial expression and emotional connection between has the certain difficulty. The biggest problem in the study of facial expression analysis in classroom teaching environment is the need to detect specific emotion categories in specific environment, but currently there is a serious lack of publicly available emotion data sets in classroom environment. How to recognize students' emotions and achieve high accuracy under the condition of face occlusion is another key point of system development. Based on the analysis of the above problems, the author constructed a face facial expression analysis system in the classroom teaching environment.

In view of the specific classroom environment and classroom education activity process, the facial expression analysis system developed is mainly composed of the following parts: First, the expression information acquisition part. It is necessary to obtain the real-time video in the classroom teaching process through the camera, and use OpenCV and other tools to obtain each frame of the real-time video as the original picture, so as to establish the original expression information picture library for each learner. Second, face expression analysis part. It mainly carries on the corresponding emotion category label to the input face picture obtained by the emotion acquisition process, and carries on the recognition analysis to the classroom student emotion recognized in real time or within a period of time; Third, facial feedback support part. Statistical analysis or in-depth mining of the final facial expression recognition results will be conducted, and the results will be timely feedback to teachers or learners, so as to help teachers adjust their teaching strategies and support students to adjust their learning strategies.

## ***2.2 Development of students' facial expression analysis system during classroom learning***

The development of facial expression analysis system is mainly based on emotion recognition algorithm, and the flow of emotion recognition algorithm is mainly divided into the following three steps: face detection pretreatment, feature extraction and emotion recognition. The first is the pretreatment of face detection, that is, from the continuous teaching video classification of all kinds of original pictures containing students' emotional elements, and then some digital image processing operations on the original pictures (histogram equalization, etc.), so that it is easier to detect and extract in the process of face detection; The second is the feature extraction process. The features that represent the current facial expression are extracted from the obtained face by feature extraction method. This step needs to collect the face image of the students in advance, and then use the open source library of facial expression to locate the position of the face in the image, identify the key points of the face, compare the face in the video with the photo of the students, and output the emotional features of the face in the video. Finally, the emotion classification process, the existing classification method is used to classify the emotion features extracted from the feature extraction algorithm, and the corresponding emotion list label of the input face picture is given, so as to establish a special classroom expression database based on the real-time emotional state of students in class. In addition, the process of data statistics and visualization is also needed: the person, time and expression records in the classroom video are analyzed statistically for a certain person or a certain period of time, and the result data is presented visually to the teacher in real time. Teachers can make corresponding adjustments according to the current emotional state of students: when students are generally depressed, they can adjust the teaching schedule, activate the classroom atmosphere, improve students' learning enthusiasm and improve their learning efficiency; When students' general mood is high, the teaching progress can be accelerated, and the teaching efficiency of the course and the learning effect of students can be further improved.

## **3. TEACHING DESIGN AND APPLICATION PRACTICE OF LEARNING EMOTION EXPERIENCE BASED ON ANALYSIS OF STUDENTS' FACIAL EXPRESSIONS**

### ***3.1. Teaching design of learning emotion experience based on analysis of students' facial expressions***

Based on the problem solving teaching model and learners' facial expression analysis technology, the author designed and developed a new classroom teaching activity flow to try to realize the organic combination of students' cognitive activities and emotional factors in the classroom teaching process. The process of classroom teaching activities oriented to learners' learning emotional experience is divided into six stages: problem definition, task analysis, information processing, problem solving, evaluation and feedback, and summary and consolidation. First, the problem definition stage: students use various information technology tools and all available teamwork methods to communicate with teachers, classmates or others to identify the problem to be solved and determine the type and amount of information needed to solve the problem. In this stage, students' learning emotion is aroused by using certain problem situations. Second, task analysis stage: according to the key points contained in the problem, determine the scope of relevant resources to be queried, and determine the priority and processing sequence of each information according to the strength of the resource relevance. After the students' emotion is aroused, they can put forward the learning task appropriately, and let the students evaluate the task according to the existing knowledge reserve, which can effectively promote the continuous occurrence of students' active learning emotion. Thirdly, information processing stage: use effective information retrieval strategies to obtain sufficient relevant information from various types of information sources, and process it to form corresponding problem solving ideas or solutions. This stage is an important link in the implementation of students' autonomous learning activities, and also a key period for their deep learning in knowledge construction. Fourth, the problem solving stage: in the cooperative discussion activities, detailed analysis and in-depth systematic analysis of the collected information, to refine the key points of problem solving, and the implementation of specific problem solving activities. In this stage, students' communication with each other will seriously affect the emotion of learning; Fifthly, evaluation and feedback stage: continuously implement various problem-solving measures in application practice, and constantly adjust and improve problem-solving activities according to the feedback information, until the problem is solved perfectly. In this stage,

students should be guided to correctly view their problem-solving activities and stimulate positive learning emotions through proper evaluation. Sixth, summarize and consolidate stage: encourage students to show their achievements in a diversified way, advocate to share their process experience with others, feel positive emotions in the sharing, and form new problem situations and active exploration activities.

### ***3.2. Teaching practice results of learning emotion experience based on analysis of students' facial expressions***

First, the problem definition stage: if it is slightly challenging and closely related to real life, students will feel interesting, wonderful and satisfied, and then stimulate the corresponding positive learning emotion. The statistics show that anxiety - confidence and boredom - infatuation are the two main dimensions, especially the positive emotions of both dimensions (curiosity and interest) are dominated. Second, task analysis stage: after students' emotions are aroused, appropriately propose learning tasks and let students evaluate the tasks according to their existing knowledge reserves, which will more continuously and effectively promote the occurrence of students' active learning emotions (comfort and inspiration). If students think they can complete it, they will enter the self-directed learning with confidence. If you think that you can not complete, there will be fear or worry about the emotions, and even a certain degree of anxiety and negative emotions; The third stage is the information processing stage, which is an important link in the implementation of students' autonomous learning activities, and also a key stage in the deep learning of their knowledge construction. When students are cognitively confused or emotionally frustrated, if they can get timely inspiration and help from classmates or teachers, the negative and negative emotions will be transformed into positive and positive emotions. Without immediate help, emotions can shift to negative emotions like boredom and boredom; Fourth, problem solving stage: in the process of discussion, if there is cynicism or impatience, it will hit students' learning emotion, make them have negative emotion or deep negative emotion, shame and even fear. On the contrary, the discussion atmosphere is active and enthusiastic, students can get full respect and understanding, students' emotional experience will turn from negative to positive, and produce satisfactory and happy learning emotional experience; Fifthly, evaluation feedback stage: when the evaluation of others is inconsistent with self-evaluation, students will have negative emotions such as dissatisfaction and depression. At this point, if students can be helped to find the attribution, correct their cognitive errors, and obtain positive evaluation of the students, the self-confidence of the students will be enhanced and the sense of achievement will be generated, and then they will be

more interested in learning activities and more sustainable; Sixth, summarize the consolidation stage: When students' expectation and reality, will produce the negative emotions, such as frustration, dissatisfaction and disappointment need timely help students to summarize knowledge, let the students have a new understanding, encourage students to study with the positive emotion to task to explore, find and solve the problem of difficult, and actively promote the student to the new knowledge internalization and effective migration.

Classroom teaching activity is a cognitive process and the emotion process interwoven, complement each other of a process, and interest and pleasant interaction and complementary more students' intellectual activities provided the best mood background, it can change the nature of the emotions in the process of teaching activities, students become passive status to active status, improve the efficiency of classroom teaching and students' learning. At any given moment, students may be in many different learning emotion quadrants, which are related to different learning emotion state axes. They may be suffering from frustration in the second quadrant; Meanwhile, in quadrant i, the emotion of learning is positive interest upsurge. In the real learning process, a series of different natures of emotional experience transformation is naturally generated. Moreover, it is not only positive emotions that are good. When students' emotions fall in the negative semi-negative emotional space, it does not mean decline or bad, but in fact, these are only part of the learning emotional experience cycle. In the process of classroom learning, the goal of student learning emotional experience analysis is to help students continue to fly around the circle smoothly, so that students can learn how to push themselves, especially in the post-flight frustration to learn how to adjust. On the whole, in the teaching process of this project, students' learning emotional experience has gone through multiple cycles. First, in the initial stage of the classroom learning process, students adopt positive emotions because of curiosity to meet the beginning of learning. Subsequently, with the new knowledge of the incomprehension and confusion, students began to produce certain negative feelings. Especially when encountering difficulties or experiencing setbacks and not getting effective help, there will be a variety of negative emotions, and even learning termination phenomenon. If teachers or learning partners help students in a timely and effective manner, students' negative emotions will be relieved, and learners will return to the original state of curiosity and have a strong desire for knowledge and exploration. Therefore, in the process of classroom learning, learners' emotions generally experience a continuous cycle of change from positive to negative, and then from negative to positive. Timely support and help in the critical stage of students' emotional changes will greatly improve their learning

initiative, thus playing an important role in supporting the cognitive process of students, and ultimately produce a good learning effect.

#### 4. CONCLUSIONS

- Teaching is not the imparting of single knowledge, and the emotions, attitudes and values in teaching are not the add-ons of knowledge dimension, nor are they just tools to achieve the goal of knowledge dimension. From the perspective of whole person development, the application of affective factors in learning endows classroom teaching with new significance.

- Emotional factors in classroom teaching are a complex system with positive, negative and neutral factors. The role of each factor is different, and not from one end, but constantly experiencing changes, transformation.

- In the process of classroom teaching, students' learning emotions as a whole experience a continuous cycle of change from positive to negative, and then from negative to positive.

- Through scientific and reasonable design, students' emotions can be maintained and played a positive role in the whole teaching process. In the process of classroom teaching, with the help of the tools of technology and cognitive support, it can realize the statistical record and timely feedback of the factors of students' learning emotion.

- Understanding the complex relationship between cognition and emotion, and developing effective interventions to regulate student emotion, is a highly interdisciplinary effort involving psychology, education, computer science, engineering science, neuroscience, and artifact design.

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