The application of emotion regulation strategy in classroom teaching

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Abstract. China's double reduction policy has placed greater demands on the all-round development of students. While Chinese education has been excellent in influencing students at the cognitive level and has been prominent in various international competitions, can classroom teaching, which is one of the most important aspects that directly affect students, continue to meet the needs for students' emotional development? This paper reviews three mainstream models of emotion regulation teaching in China with Gross' Process Model of Emotion Regulation and related emotion regulation theories, which are currently well-established internationally. The theoretical analysis reveals that the use of emotion regulation strategies in teaching and learning in China has changed from the regulation of a single emotion to the integrated regulation of multiple complex emotions, and finally to the simplification of emotions and the shift of focus to indirect effects on cognition. This also points to the next issue that needs to be addressed as a specific strategy for implementing models related to the teaching of emotion regulation in the classroom and for teachers to be able to use them successfully.

Keywords: Emotion regulation; Teaching Model; Classroom Teaching.

1. Introduction

In 2021, China released the "Double Reduction Policy", which targets the compulsory education stage with a series of work to reduce the burden. Under the guidance of quality education, how to promote the all-around development of students' bodies and minds has become a hot topic. The burden of schoolwork and social anxiety has long been a burden on student's minds and bodies [1], and to ensure a sound mind, proper emotional guidance is indispensable. In China, there is an imbalance between the theory and practice of teaching and learning, with a focus on knowledge rather than emotion [2]. Shi Ou & Hou Jingmin points out that the traditional Chinese curriculum is based on outcomes, knowledge, and goals, and although this approach makes the curriculum more efficient and simpler, it cuts off the link between process and outcome, often ignoring the feelings and experiences of the individual and making the whole lesson too instrumental at the expense of its intrinsic value [3]. At the same time, in the new curriculum reform launched around 2000, an innovative view of the curriculum became one of the key reform directions, aiming to address the traditional Chinese education in which curriculum knowledge was fed to students in a linear, monolithic manner, and to change the concept of teaching towards one that integrates curriculum texts with students' emotions and life experiences to produce a deeper internalization of knowledge [4]. As pioneers of change, teachers need scientific guidance on emotion regulation to enable students to develop their emotions and cognition equally well.

The relationship between emotion and cognition has gradually evolved from one-sided studies to a stage where the two are intertwined [5]. Emotions have a catalytic effect on cognition. Bower suggests that word learning is more effective when the mood is pleasant [6]. In terms of cognitive processes, Hoffman suggests that emotions can selectively regulate cognition [7]. Similarly, the interaction between cognition and emotion is valued. Derryberry & Reed concluded that cognitive processing and the brain's emotional system work together to produce goal-driven behaviour [8], and Savizky argued that only the combination of feelings and cognitive activity can produce awareness of phenomena [9].

To better manage emotions, some scholars have started to propose relevant emotion regulation strategies. According to Eisenberg & Fabes, emotion regulation refers to the process by which individuals adjust and operate in response to emotions and their interrelated behaviors [10]. For the more abstract aspects of emotion regulation, the mainstream emotion regulation strategies are currently classified in terms of "way-of-coping" and emotional processes [11]. In terms of coping styles, Lazarus & Folkman divided the strategies into Problem-focused coping and Emotion-focused coping, in terms of the direction of changing the facts [12]. The model suggests that the former is oriented towards changing external things, while the latter is oriented towards changing internal things. In terms of emotional processes, Gross proposed Antecedent-focused Emotion Regulation, arguing that theories of emotion regulation are divided according to their processes (when) [13]. It is proposed that the two main strategies for reducing emotional responses during emotion genesis are cognitive reappraisal and expression suppression.

At the same time, educationalists are beginning to focus on emotion regulation in teaching and learning in the classroom. Spielberger & Starr suggest that the dominant emotions in classrooms today are anxiety and curiosity, which together motivate students to explore and avoid behavior [14]. The integration of emotions in the classroom suggests that teacher moderation is essential if students are to engage in specific and productive explorations. On the other hand, Bonanno proposed a model of emotional self-regulation, which argues that every aspect of emotion production can be regulated according to self-balance [15], emphasizing the importance of self-regulation. The relationship between teacher regulation and student self-control has received similar attention from scholars. Vermunt & Verloop argue that having both process-oriented can promote coherence [16]. At the same time, emotion regulation as a pedagogical tool, Westling & Suvi Krista analyzed the implementation strength of the strategy and concluded that lessons in which teachers and students share norms are more likely to keep students motivated [17].

In the course of continuous theoretical analysis, more practical teaching models related to emotion regulation have been born in the educational world. At present, mainstream emotion teaching models such as the Pleasant Teaching Model, the Affective Model of Teaching, the Teaching Model of Fusing Cognition with Emotion, and the Emotion Regulation Teaching Model have mainly emerged in China to give theoretical guidance for the invocation of emotional regulation strategies in teaching.

Based on the above discussion, although this component has been widely noted in the educational community, it has not yet been possible to produce a range of emotion regulation teaching strategies that are relevant to the current, up-to-date Chinese educational context. Therefore, this paper presents three mainstream models of emotion regulation teaching that were all proposed at the beginning of the new curriculum reform in China, around 2000.

1). the Pleasant Teaching Model
2). the Emotion Regulation Teaching Model
3). the Teaching Model of Fusing Cognition with Emotion

These Chinese educational scholars were the first to integrate emotion regulation strategies into teaching practice, but in the following 20 years, the educational community has not adapted the content in line with the continually updated teaching policies and research findings. Therefore, this paper will review three dominant models of emotion teaching in Chinese classrooms, using emotion regulation strategies and educational policy as a guide.

2. Theoretical analysis: the link between emotion regulation strategies and teaching

Based on the discussion above, it is clear that emotion as an abstraction is complex in its regulatory role and that it can play different roles at multiple times and in multiple forms. However, the theoretical account of emotion regulation and the processes by which it occurs is incomplete. A relatively systematic and largely accepted model of emotion regulation is Gross's A Process Model

of Emotion Regulation. This model is used to relate emotion regulation strategies to classroom teaching and learning [18].

Gross makes three points about emotion regulation that need attention.

1). Emotional regulation is not just focused on reducing negative emotions, but on the various variations of positive and negative emotions [19].

2). Emotional regulation is sometimes unconscious and sometimes conscious.

3). Emotional regulation has different values in different situations and is not always good or bad [13].

Emotion regulation, therefore, involves not only avoiding negative emotions, but also being able to regulate positive emotions, and there should be a specific point in time.

At the beginning of the twentieth century, Gross introduced the Process Model of Emotion Regulation by emphasizing the concept of 'when' [20]. According to the model, there are different ways of regulating emotions at different stages of the process and different outcomes can be produced. The theoretical model is shown in Figure 1.

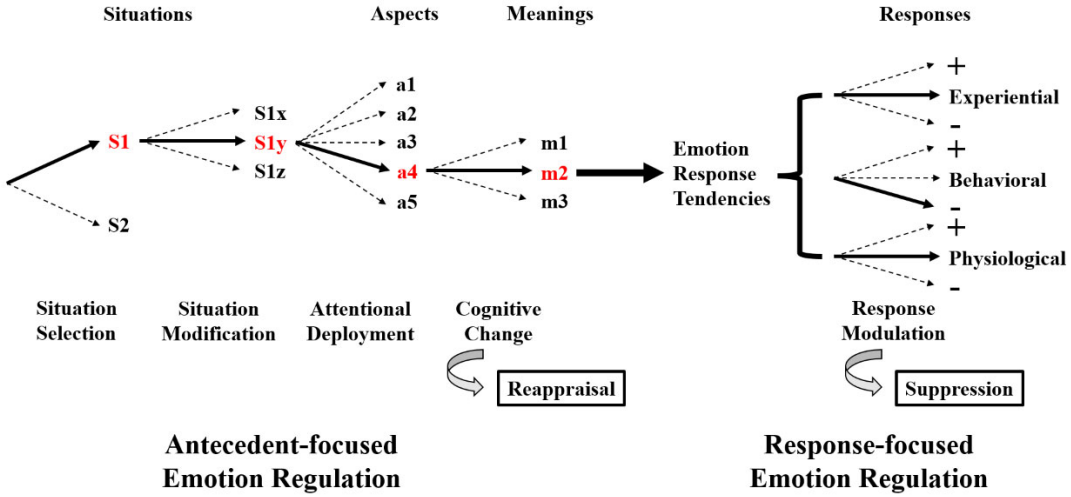

Figure 1. The Process Model of Emotion Regulation

According to this model, there are five stages, which are Situation Selection, Situation Modification, Attentional deployment, Cognitive Change, and Response modulation.

Situation Selection is the initial selection of a situation by an individual to reduce negative emotions and increase positive ones. In classroom teaching, the context of teaching is the situation in which the teacher and students are associated with the content and the organizational process, and the primary consideration for the context of teaching should be to motivate students to learn and to arouse attention and interest [21]. Zhao Mengcheng defines an effective teaching context as one that is designed to help students learn more effectively and that is characterized by suspense, life, authenticity, complexity, emotion, typicality, subjectivity, and variability [22]. As China's education continues to reform, 'human-centredness' is beginning to become the direction of change in teaching philosophy. Shi Ningzhong points out that if the classroom is to move from the traditional knowledge-based education philosophy to a human-centred one, teaching needs to focus on the development of core literacies, which requires teachers to create appropriate teaching contexts that focus on the nature and inspiration of knowledge. This requires teachers to create appropriate teaching contexts that focus on the nature and inspiration of knowledge and help students to accumulate better thinking and practical experience [23].

Situation Modification is the individual's control of a situation, or in more concrete behavioural terms, the individual's control of a problem or emotional event, similar to Problem-focused Coping. According to Lazarus & Folkman, Problem-focused Coping can be understood as an approach to problem-solving. Efforts to address the problem often lie in the identification of the problem, the

identification of the approach, and the options before finally embarking on implementation. However, the problem-focused coping approach is more extensive than the problem-solving approach described above. While problem-solving focuses more on an objective analysis of the environment, problem-centred coping also includes internal strategies [12], and Kahn notes that there are two main types of coping strategies around problems, those directed at the environment and those directed at the self. Individuals can cope by changing barriers, processes, and experiences in the environment. They can also cope by changing motivations or cognitions, for example by finding new points of satisfaction, changing expectations, and reducing self-involvement [24]. In the classroom, this points to the cognitive and solution processes of the most common textbook knowledge or practice problems. At this stage, according to the above definition, the teacher's moderation of the environment can be reflected in helping students to reduce barriers to learning, making connections to prior learning experiences, and other ways of making sense of students' existing knowledge. Of course, self-directed strategies are also very important. Zhang Weijian also suggests in his problem-solving-based knowledge construction that the revision of teaching contexts is also interrelated with interest and value awareness, which should also be focused on to help students strengthen prior knowledge and skills, facilitate understanding, and promote the integration and application of sequential knowledge [25]. In addition to the intrinsic components of interest and value, Pang Weiguo argues that students' self-directed learning is based on the premise that they want to learn, and are intrinsically motivated to learn [26], one of the influencing factors is self-efficacy, which is a judgment of whether students can carry out a learning task and is an expression of self-confidence. Research has shown that the higher the self-efficacy of students, the more willing they are to solve problems on their own to achieve learning expectations [27]. It is therefore important that students' learning states are appropriately regulated at this stage.

Attentional deployment emphasizes the process of focusing an individual's attention on a particular topic, and according to Simon, attention is the process by which an individual focus on something to the exclusion of other things [28]. In educational research, Zhang Manhua & Liu Qing have linked the quality of attention to the academic performance of primary school students, and through comparative experiments, they found that cultivating and exercising students' good attentional quality is very important to improve attention and academic performance [29]. Many frontline teachers in China have summarised their attention management strategies in practice, such as focusing students' attention on the teacher through visualization, setting an example, naming teaching objectives appropriately, and shifting attention to specific, focused learning content [30].

Cognitive change is the individual's interpretation of an emotional event, and different interpretations can have a huge impact on behavior and reactions in a given situation. Based on this, the first four components make up Antecedent-focused Emotion Regulation. This is where cognitive reappraisal comes in. Cognitive reappraisal is the process of changing one's understanding of things to understand negative emotions more positively, or to actively rationalize some of the emotional events. The opposite of cognitive reappraisal, expression suppression, is in the response modulation stage and is part of Response-focused Emotion Regulation. The expression suppression phase is part of Response-focused Emotion Regulation. Expression Suppression focuses on the suppression of ongoing or impending emotional expression. It is more effective to define the emotion before it occurs than to suppress it after it has occurred [13]. Reassessment can reduce the expression of bad emotions and misbehavior without affecting cognition, whereas under expression suppression, students must engage in timely suppression of bad behavior after experiencing bad emotions, but this can affect students' memory levels [31], and even contribute to the psychological experience and expression of negative emotions, which can have a more negative impact on social communication and interaction [13, 32].

In summary, teachers' emotion regulation strategies in the classroom should switch precisely according to the stage at which students' emotions occur in the classroom. Before cognition is reached, effective teaching contexts are introduced, the context is regulated from within the environment and the students, and the teacher's classroom behavioral art is promptly combined to help students focus

on the main points of knowledge. In the process of knowledge construction, cognitive reassessment strategies should be proactively adopted to pre-empt negative factors rather than suppressing them after the onset of negative emotions, to ensure a reasonably informed interrelationship, and to minimize the expression of wrong behaviour.

3. Three mainstream models of teaching emotion regulation

3.1 The Pleasant Teaching Model

A pleasant teaching model is a specific form of teaching that has been summarised by frontline teachers and Lu Jiamei, a leading scholar of Chinese emotional teaching psychology, in their practical classroom teaching. The teaching model is shown in Figure 2 [33].

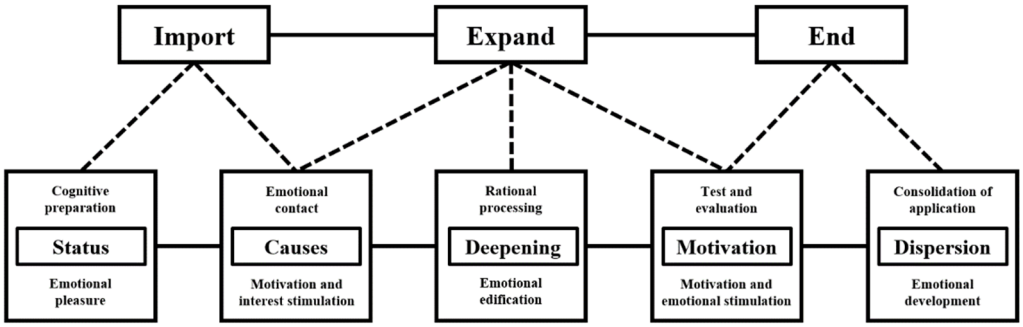

Figure 2. The Pleasant Teaching Model

The most distinctive feature of this model is the use of pleasure as the central factor in all types of positive emotion, emphasizing its role in teaching and learning and its operational status in teaching sessions, and the use of cognitive processes as the basic frame of reference to build an emotional thread that runs through the classroom and intertwines with cognitive threads.

The mood of the pleasant teaching model is dominated by pleasurable emotions. According to Guo Dejun, emotion is a positive emotion, a subjective feeling that the environment or something conforms to the individual's strengths, and is situational and volatile [34]. As can be seen, the "Status and Causes" aspects of the model emphasize the construction of a situation that promotes a happy mood to better motivate students and activate the perceptual material in the materials, all of which are reasonable ways to promote positive emotions in students.

According to Izard, the source of emotions does not only come from the satisfaction of needs but also the experience of the value of individual fulfilment [35]. Thus, students' pleasurable emotional experiences do not simply come from teacher moderation, but also need to be developed spontaneously. In the 'Motivation and Dispersion' section of the model, reference is made to students' participation in assessment, timely feedback, and the application of what they have learned to demonstrate personal competence and stimulate a sense of identity and value. According to Csikszentmihalyi, enjoyable tasks need to be something that students can complete, be clear, have feedback at the same time and expand individual abilities [36-37]. According to the above theory, the pleasant teaching model fits well with the conditions for the production of pleasure and involves not only the teacher meeting the needs of the students but also the process of their self-actualization.

In this teaching model, Lu Jiamei splits each teaching point into a cognitive point and an affective point, while noting that the primacy of affect and cognition depends on the context. This indeterminate typological distinction makes it impossible for Lu Jiamei to find terms that reflect both the cognitive and affective characteristics of the session when naming the sessions, and he has to use terms that favour the affective aspect to indicate the difference from other teaching models.

Here the question arises as to whether the presence of affective elements in enjoyable teaching is always justified and necessary.

The 'Deepening' aspect of the model requires teachers to focus not only on the cognitive aspects of students' mastery of methods and skills development but also on the affective aspects, requiring teachers to engage students emotionally as they process rationally. This is more likely to lead to emotional distraction, increasing students' costs and causing more input into the experience when crossing the zone of proximal development.

At the same time, the degree of pleasurable arousal is a difficult issue for teachers to grasp. Hebb states that the relationship between the degree of emotional arousal and performance has an inverted U-shaped curve [38]. If classroom teaching is carried out with too much emotional arousal, students' overly full and pleasant emotions can hinder cognition, rather than defeating the principle of using cognitive processes as the basic reference for developing teaching models. Therefore, effective emotion management should keep students' emotions at an intermediate level to be the best way to enhance learning [39]. In 1990 Csikszentmihalyi introduced the concept of 'flow', or what is best suited to facilitate learning. He argued that if skills are overwhelmed by challenges, individuals will feel bored [37]. In the pleasant teaching model, excessively strong pleasant emotions can instead reduce thinking and tend to lead to distraction. In contrast, according to Gross's process model of emotion regulation, attentional regulation is required before cognition can take place [13]. Therefore, it remains to be seen whether the session needs to be forced to include emotional regulation.

3.2 The Emotion Regulation Teaching Model

The Emotional Regulation Teaching Model is a model of teaching and learning that was proposed by Chinese educationalists in 2000. According to Guo Dejun, the model emphasizes the positive effects of regulation and management in the form of stimulating the primary interests of students in the classroom to achieve an optimal emotional state to facilitate learning [34]. The teaching model is shown in Figure 3

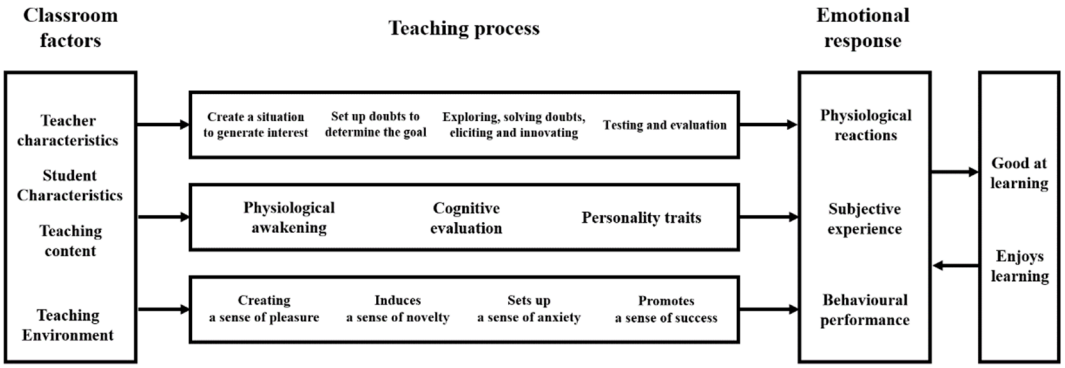

Figure 3. The Emotion Regulation Teaching Model

This model integrates a more diverse range of classroom emotions than the pleasant teaching model's focus on manipulating a single emotion. Spielberger & Starr argue that curiosity and anxiety are the dominant emotions in the classroom and that they have opposing processes and properties that modulate students' exploratory and avoidant behaviour through their interactions [14]. The relationship between classroom stimulation and students' emotions is reflected in the integrated model of classroom emotions. The theoretical model is shown in Figure 4.

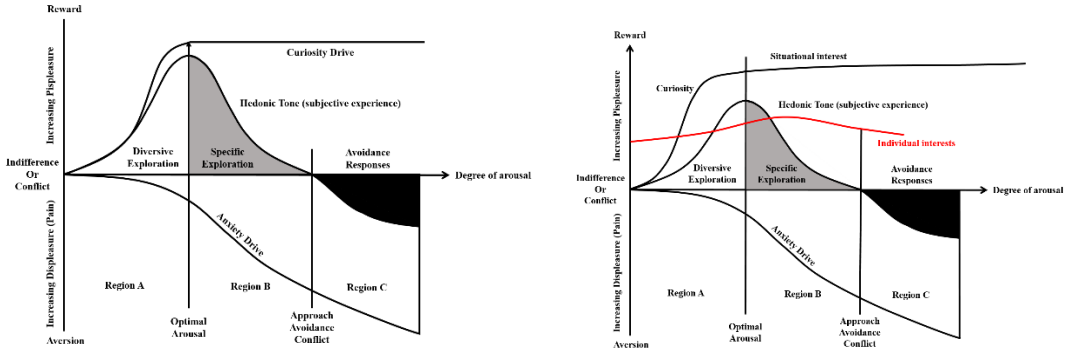

Figure 4-5. Two models of emotional integration in the classroom left from Spielberger & Starr (1994), right from Guo Dejun (2000)

The exploration of educational reforms in China, such as the enjoyable teaching model mentioned above, has similarly emphasized the positive effects of both enjoyable and interesting factors on learning in the classroom. Meng Zhaolan argues that interest and enjoyment complement each other and that complementing each other provides the best emotional context for intellectual activity [40]. Therefore, scholars in China have modified the model by adding a curve of individual interest and allowing curiosity to become situational interest when entering Region B. The relationship between the four emotions of curiosity, anxiety, pleasure, and interest and exploration is explored from a more comprehensive perspective, suggesting that the best psychological state for learning is in Region B, which is the process of exploration from reduced tension and fear towards pleasant emotions and excitatory goals [34]. The theoretical model is shown in Figure 5.

Therefore, the teacher constantly regulates students' emotions, provides physiological arousal (stimulates interest) through interesting situations, then leads to exploratory behaviour by setting questions and goals, allows students to perform efficient cognitive activities by constantly regulating the relationship between anxiety and interest, and finally carries out assessments that lead to personality traits.

Liu Li further refined the teaching and learning process based on this model, which is shown in Figure 5 [41]. It can be seen that the model places great emphasis on assessing the state of learning as well as the outcome of learning, and when the assessment does not match expectations, a re-adjustment strategy is adopted and new learning activities are carried out. Gross believes that teachers should primarily adopt cognitive reappraisal to reduce the emergence of negative emotions and facilitate cognitive activities [13]. The immediate assessment and turn-back strategies in the diagram are both manifestations of cognitive reassessment, which starts with changing the understanding of things by re-regulating emotional strategies to understand negative emotions more correctly.

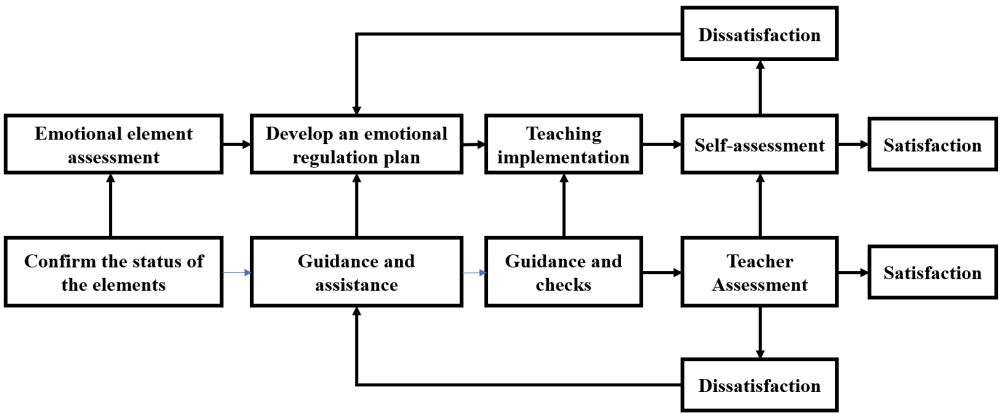

Figure 6. Teaching flow chart

However, the trade-off between emotion and cognition is a difficult point for teachers to grasp. Taking one of the anxiety strategies as an example, Liu Li states in his model that teachers can enhance or reduce students' anxiety by regulating the difficulty of the learning task and by setting a time limit for completion while giving only performance information without providing assessment content for the outcome of students' cognitive activities, i.e. the judgment of the answer to the problem, again to prevent emotional loss of control due to anxiety [41]. To maintain emotion, teachers are forced to regulate their cognitive activity, which may result in deviations from teaching objectives and a lower rate of completion. At the same time, avoidance strategies to avoid mood swings can easily lead to misunderstandings, such as students not understanding whether they are acting correctly or not and misrepresenting facts. This instead falls into expression suppression, which has certain side effects.

3.3 The Teaching Model of Fusing Cognition with Emotion

The Teaching Model of Fusing Cognition with Emotion is an emotion regulation-related teaching model proposed by Qiao Jianzhong of Nanjing Normal University in 2006.

The model emphasizes both the cognitive and emotional activities of students in the classroom and creates the conditions for informed interactions to lead to more effective mastery of the content in the process of stimulating learning and active learning [5]. The theoretical model is shown in Figure 7.

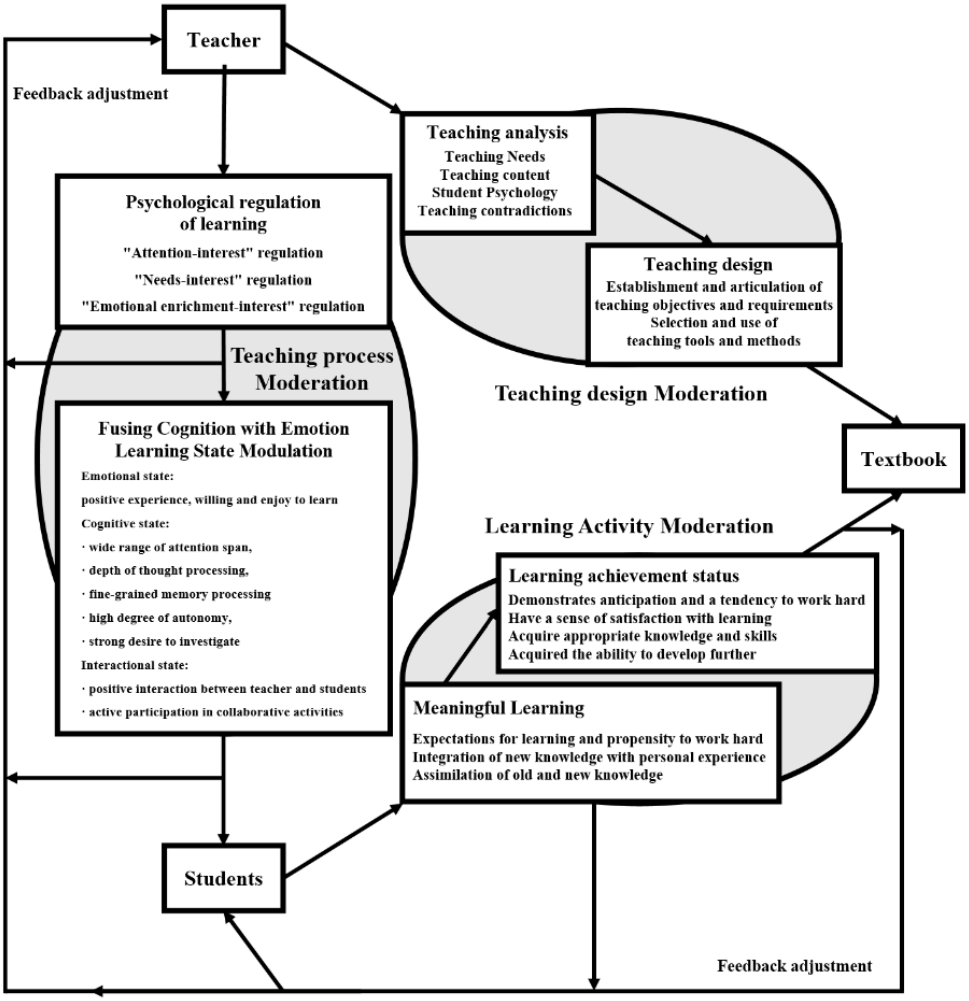

Figure 7. The Teaching Model of Fusing Cognition with Emotion

Compared to the 'Emotion Regulation Teaching Model ' mentioned above, more detailed demands are placed on cognitive activities (teacher teaching and student learning). However, the achievement of the functional goal of cognitive states depends on the teacher's ability to teach and have fun. The

psychological regulation of students in regulation of the teaching process in the diagram is central to the achievement of this goal.

The realization of learning to play revolves around 'interest' and includes potential links to the three factors of attention need and emotional enrichment. In constructing the model, Qiao Jianzhong does not subdivide the types of emotion, but rather uses 'interest' to cover classroom emotions in a more general way. Interest, as the psychological tendency of individuals to seek to investigate, has both cognitive and emotional characteristics. From a cognitive perspective, interest affects attention and the propensity to learn. From an emotional perspective, interest is accompanied by emotional experiences such as pleasure and satisfaction [42].

Thus, in the 'Attention-interest' moderation, the emphasis is on generating a tendency to learn with more lively and interesting content, which draws students' attention to what they already know and promotes knowledge transfer. In the 'Needs-Interest' approach, the emphasis is on identifying the content of teaching and learning with students' learning and developmental needs to promote interest and active engagement in learning, thus forming a virtuous circle. In addition, Qiao Jianzhong also proposes the 'emotional enrichment-interest' approach. Lazarus argues that an emotional charge is an emotionally charged characterization of an event that, when recreated, triggers previously shaped emotions and feedback as a result of emotional charge [43]. In the classroom, this is manifested in the form of an emotional experience or outcome that is matched by the student's emotions as they learn the corresponding content, creating a 'conditioned reflex' that reveals the emotional state held during previous learning.

Qiao Jianzhong believes that by using emotional resources in teaching and emotional reinforcement in assessment to create a positive 'conditioned reflex' for students, the foundation for future emotional activity can be laid and students are more likely to develop a stable interest and attitude toward their own, without teacher regulation, thus The goal of informed communion is better achieved. This is an example of Gross's cognitive reappraisal strategy, in which a positive learning experience is maintained during the Antecedent-focused Emotion Regulation session to minimize the development of negative emotions [13].

At the same time, the model's high level of generalization of emotion types allows teachers to focus from complex emotion categories to the more observable and feasible 'interests', and this vague definition allows teachers to be more oriented in their teaching activities, without having to devote too much experience to perceiving and regulating the relationships between complex emotions, and to ensure sufficient stability and sustained emotional enrichment.

However, it is also because of this vague definition and the 3 types of moderation operations that teachers who are weaker in the study of emotion, even if they can perceive the meaning of informed intercourse in it and identify with the teaching model, have difficulty in carrying out effective teaching based on this model in the actual classroom, with a great deal of theory and derailment and failure to implement it. Based on this model, He Anming & Hui Qiuping have proposed some feasible guidelines, which include preparing lessons together to promote mutual understanding and open up a channel for informed interactions, using a short and concise introduction in the introduction stage, choosing students' existing experiences as the entry point to the classroom, focusing on the teacher's emotional impact in the teaching session, focusing on students' needs and democratic harmony in the questioning session, and guiding the backward and forward connection of knowledge in the closing session [44].

4. Conclusions

At present, the mainstream emotion regulation teaching models proposed in China match well with cutting-edge theories, and although they were proposed earlier, they still have sufficient scientific validity. Among them, the Pleasant Teaching Model starts with the conditions for the production of emotions and uses pleasure, a positive emotion, to promote learning motivation. The Emotion Regulation Teaching Model integrates a wider range of emotion types, and by flexibly regulating the

proportional relationship between the various emotions, students are motivated to maintain a productive state for specific explorations. The Teaching Model of Fusing Cognition with Emotion balances the cognitive and emotional content, leading to a virtuous cycle in which cognition and emotion are mutually reinforcing.

However, these emotion regulation strategies used in the classroom inevitably suffer from some theoretical shortcomings and a gap in the translation from theory to practice. Excessive attention to a single emotion can lead to the development of over-saturated emotions, which can affect cognitive processes, and the need for emotion regulation in some sessions is questionable. The combined regulation of multiple complex emotions forces the teacher to spend more energy focusing on non-cognitive activities, even at the expense of cognition to obtain a sufficiently stable emotional state, which can easily fail to achieve teaching objectives. The Teaching Model of Fusing Cognition with Emotion is relatively mature, but because of its theoretical refinement, its flexibility in manipulating emotions, and the requirement to control the delicate relationship between the two, cognition and emotion, it poses a challenge to the majority of frontline teachers who are not well versed in emotion theory and are unable to apply it successfully in the classroom.

Based on the results of the above discussion, this study, through an analysis of emotion regulation theories and an exploration of the three dominant models of emotion regulation teaching in China, draws out a trend in China for the use of emotion regulation strategies in classroom teaching: from single emotion regulation to a composite regulation of multiple emotions, to a blurring and simplification of emotions, and a shift in the focus of regulation strategies to indirectly emphasize the influence of emotions on cognition.

This highlights the three processes of exploring emotion regulation strategies in the classroom in China: linking theory from practice - refining theory - and returning to practice from refinement. Although the third stage of research into practical teaching strategies is still in its initial stages of exploration, several experienced frontline teachers and educational scholars have begun to emerge in China to provide their insights into the implementation of emotion teaching models. This positive trend of research and change reflects the increasing demand for quality education for students in China and the progress towards the new curriculum reform and the latest "double reduction policy" for the holistic development of students.

This study integrates mainstream emotion regulation teaching models from the perspective of classroom teaching, combining them with cutting-edge foreign theoretical research to verify their validity and point out their shortcomings at the theoretical level. The study will help frontline teachers to understand and use emotion regulation strategies more critically in classroom teaching, and also provide new research references for domestic education scholars to summarise the current state of research on emotion regulation in teaching.

Current research focuses on theoretical analysis and lacks fieldwork on frontline teaching. It remains to be seen whether some of the moderation strategies in the model are consistent with the theory and can achieve the same desired effect in the classroom. Future research should involve more classroom experiments to give a more realistic picture of how these models are used in the classroom and to give more practical implementation strategies to help frontline teachers to teach more smoothly and scientifically.

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