BILINGUAL PUBLISHING GROUP

Journal of Psychological Research

https://journals.bilpubgroup.com/index.php/jpr

ARTICLE

Research on Emotional Expression of Students in Different School Stages Based on Speech Emotion Recognition

Qianwen Yuan , ***Yujie Chen, Wei Wang*** *

School of Education Science, Nanjing Normal University, Nanjing 210000, China

ABSTRACT

From children to teenagers and then to adults, individuals' emotional expression ability has undergone significant changes. From the compulsory education stage to the general senior middle school stage, students' cognitive and emotional needs will change greatly. Students of different school stages show significant differences in their vocal emotional expression, which not only affects their social skills but also has important guiding significance for educational practice. Therefore, this study focuses on the vocal emotional expression of students at different school stages. This study explores the differences in vocal emotional expression among students at different school stages (primary school, junior high school, and senior high school), with a focus on the expression characteristics of different emotional types and the situation of inconsistent internal and external emotions. The research results show that in terms of emotional types, students at different school stages have a relatively high accuracy rate in expressing sadness, while the accuracy rate for expressing anger is the lowest, and the accuracy rate for expressing anger is significantly lower than that for other emotions. In terms of school stages, the overall accuracy of emotional expression among students improves with the increase of school stages, but the differences between school stages are not significant. In the task of expressing inconsistent internal and external emotions, the study found that senior high school students have significantly better emotional conversion ability than primary and junior high school students, indicating that as the school stage increases, students' adaptability in complex emotional expression tasks gradually improves.

Keywords: Voice Emotional Expression; Grade Differences; Types of Emotions

*CORRESPONDING AUTHOR:

Wei Wang, School of Education Science, Nanjing Normal University, Nanjing 210000, China; Email: wangwei5@njnu.edu.cn

ARTICLE INFO

Received: 10 May 2025 | Accepted: 15 June 2024 | Published Online: 30 July 2025

DOI: https://doi.org/10.30564/jpr.v7i3.10275

CITATION

Yuan, Q., Chen, Y., Wang, W., 2025. Research on Emotional Expression of Students in Different School Stages Based on Speech Emotion Recognition. Journal of Psychological Research. 7(3), 9–20. DOI: https://doi.org/10.30564/jpr.v7i3.10275

1. Introduction

Emotional expression ability is an important component of an individual's comprehensive quality. During the growth process from childhood to adolescence and adulthood, the ability of emotional expression through voice undergoes significant changes. Voice is not only a tool for information exchange but also an important medium for emotional communication. At different age stages, individuals show differences in the use of these voice features, which not only reflect the development trajectory of emotional expression ability but also influence an individual's social interaction, learning experience and mental health. From the stage of compulsory education to ordinary senior high school, students' age range is from 5 to 20 years old, and their cognitive levels, emotional needs and expression methods are constantly changing. Some studies have found that in junior high school, girls' emotional regulation ability and emotional expression ability are lower than boys' ability, but in high school, when they successfully pass puberty, their ability is basically the same[1]. For the individual's own development, in the childhood stage, the individual's emotional expression ability is mainly affected by the family atmosphere: such as parents' upbringing, attachment relationship, family expression, marriage relationship[2]. For teenagers, the rapid physiological development and gradually reach maturity, but the speed of psychological development is relatively slow, and the psychological level is also in the transitional stage from childish to mature development. Psychological development is prone to contradictions, especially in emotional aspects. Their emotional fluctuations and reaction intensity are large, so adolescent students The adjustment ability is weak, and the emotional expression ability is uneven. In adolescence, school is the place where people spend the most time apart from family. Zhu Xiaoman believes that teachers with a high level of emotion and interpersonal relationships can teach knowledge to students more effectively. Teachers express their emotions in the right way and at the right time, and talk about students' learning, friendship and school life. Emotional responses will affect students' emotional experience and emotional expression[3]. In the investigation of emotional expression in the college stage, some studies found that there was no significant difference in the emotional expression of college students in different grades[4], but junior college students showed stronger emotional expression ability than undergraduates[5]. The research of Gross and others found that compared with young subjects, older subjects reported less negative emotional experiences, more emotional control, and less expression of their emotions. Whether it is self-reporting on daily emotional expression or laboratory demonstration, there is evidence that emotional expression behavior declines with age[6]. At the same time, it also shows that the possibility of emotional expression declines with age[7]. It can be seen that the research on age or section still needs to be further verified. Therefore, studying the characteristics of emotional expression of students at different educational stages and exploring their commonalities and differences is of great significance to educational practice.

2. Problem Statement

Emotional expression is a process in which individuals manifest and transmit their internal emotional states to others through facial expressions, voice intonation, body language or language description[8,9]. This process is an important part of emotional communication, which not only contributes to the self-regulation of individual emotions, but also can deepen others' understanding of their emotional states[10]. Emotional expression has both universality and individual differences. Among them, the expression of basic emotions (such as happiness, sadness, anger, etc.) shows consistency in many usage scenarios, while the expression of complex emotions is often affected by culture, social norms and situations[11].

Emotional expression can be classified from multiple perspectives such as the mode of expression, the nature of emotions and the source of information. According to the way of expression, emotional expression can be divided into verbal emotional expression and non-verbal emotional expression. Emotional expression through language conveys emotions directly through written or oral language, such as praise or complaints towards others. This way of expression relies on semantic information and non-semantic information[12], directly reflecting the emotional state of the speaker. According to the information source, emotional expression can be divided into semantic emotional expression, intonation and prosodic emotional expression, and non-verbal physiological emotional expression. Semantic emotional expression conveys emotions through the language content it-

self, for example, directly saying "I'm very happy" to express pleasant emotions[12]. Emotional expression conveys emotional information through acoustic features such as speech rate, intonation, volume and pauses[13]. For example, when saying "I'm fine" in an angry tone, the intonation of the voice can reveal emotions more than the semantics. Non-verbal physiological emotional expression conveys emotions through sighing, crying, laughter, etc. This form of expression is directly related to physiological behaviors and is a cross-cultural and universal way of emotional expression[14]. The perception of emotional cues in semantic information varies among different age groups. Mccluskey and Albas' research found that children aged 3 to 12 tend to confuse the rhythms of happiness and anger, while participants aged 13 to 43 do not confuse these two emotions. Participants over 45 continue to confuse the sounds of happiness and anger[15]. Young children rely more on semantic information. Children around the age of 13 start to pay attention to both semantic and non-semantic information simultaneously, while adults mainly rely on non-semantic information for emotional judgment. Current research focuses more on an individual's inner experience and willingness to express emotions. In previous studies, most researchers have adopted the interview method in qualitative research and the questionnaire survey method in quantitative research to study emotions, while there are relatively few research and measurement tools for emotional expression in speech data. Based on this, this study proposes the following two research questions:

1. What are the similarities and differences in the accuracy of expressing basic emotions among students of different educational stages and different emotional categories?
2. When the inner emotional experiences of students at different educational stages are inconsistent with their external emotional expression needs, what similarities and differences exist in their emotional expressions?

3. Literature Review

3.1. The Structure and Measurement of Emotional Expression

Emotional expression is the process by which an individual conveys their internal emotional state to others through facial expressions, tone of voice, body language or verbal description[9]. Looking at the various viewpoints proposed by researchers on the structure of emotional expression, it is evident that the research on emotional expression has evolved from a single dimension to multiple dimensions, and from simplicity to complexity. Kring[16] et al. studied the expressiveness of emotions from the perspective of observable external features of emotions and designed the Emotional Expression Scale; Friedman et al. examined emotional expression and individual differences in non-verbal communication from the perspective of non-verbal expression. However, these studies all explained emotional expression from a single dimension. Some other studies adopted a multi-dimensional structure to explain emotional expression. King and Emouns developed a three-dimensional model: positive emotional expression, negative emotional expression, and intimacy expression; Gross & Jolm established a five-factor structure of general emotional expressivity by examining six self-report emotional expressivity questionnaires. According to different structural dimensions of emotional expression, researchers have developed different measurement tools, such as the Emotional Expression Questionnaire (EEQ); the Emotional Expressivity Scale (EES); and the Berkeley Expressivity Questionnaire (BEQ). These self-report scales are all used to measure non-verbal emotional expression rather than emotional expression through speech, and they focus more on an individual's inner experience and emotional expression willingness. There are relatively few studies and measurement tools on emotional expression in voice data.

3.2. Voice Emotional Expression

Voice emotion expression refers to extracting the parameters of emotional features from the sound material based on the acoustic cues contained in the voice and determining the emotion type through specific methods, thereby obtaining the emotional information conveyed in the voice. The expression of voice emotion usually relies on semantic information and non-semantic information. Semantic information refers to the actual meaning at the content level of the voice, while non-semantic information further includes emotional prosody and non-verbal vocalizations[17]. Emotional prosody conveys emotions through speech rate, intonation, volume and pauses, and serves as a crucial clue for listeners to judge emotions. Prosodic information plays a significant role

in emotional communication, not only reinforcing the conveyance of semantic information, but also often dominating emotional judgment when there is a conflict between semantic and prosodic information. Non-verbal vocalizations are also important ways of emotional expression, which are unrelated to semantics and prosody and directly convey emotions through physiological sounds, such as sighing, laughing, crying and screaming.

3.3. Voice Emotion Recognition Technology

The development of speech emotion recognition technology has gone through a long period of evolution. Research on speech emotion recognition mainly focuses on emotion description models, construction of emotion databases, extraction of acoustic features, and improvement of classification algorithms. The selection and optimization of speech recognition research algorithms is a key research point in this field. After extracting acoustic features, machine learning methods or deep learning algorithms are needed to perform emotion recognition. Common traditional speech emotion recognition algorithms include Hidden Markov Model, Gaussian Mixture Model, and Support Vector Machine, etc. Compared with traditional machine learning algorithms, deep learning algorithms have stronger feature extraction and classification capabilities in the field of speech emotion recognition. Common deep learning methods include Convolutional Neural Network (CNN) and Recurrent Neural Network (RNN), etc. CNN can automatically extract local features from the spectrogram of speech, while RNN is better at capturing the temporal characteristics of speech signals and is particularly suitable for processing dynamic information where emotions change over time. Compared with traditional classifiers, deep learning methods do not rely on manually extracted features and can directly extract more discriminative features from raw data through end-to-end learning, achieving significant performance improvements in various speech emotion recognition tasks.

3.4. The Educational Value of Emotional Expression

Emotional communication is regarded as an important part of education. Tang Zeng, a Chinese scholar, proposed in "Qian Shu · Jiang Xue" that "teachers should be close to their students, as closeness makes it easier to understand them; students should also be close to their teachers, as closeness makes it easier for them to be influenced." This indicates that if students can actively express their emotions, such as interest, confusion or approval, they will be more likely to receive the attention and understanding of their teachers, thereby enhancing the effectiveness of education. Vygotsky's theory also emphasizes the importance of interaction between teachers and students for learning. Students' emotional expression enables teachers to better judge the timing and intensity of teaching intervention. Modern scholars such as Denham[18] have found that students who express their emotions positively are more likely to receive support, which has a positive impact on their academic performance and social skills; Meyer and Turner[19] found that positive emotional expression can promote classroom interaction, while negative emotional expression can inhibit participation; Saarni[20] pointed out that students' emotional expression can enhance emotional resonance in peer interaction and plays a key role in cooperative learning. Zhu Xiaoman[21] pointed out that students of different age groups have inconsistent emotional tendencies when expressing emotions, so different educational approaches are needed in emotional education. Therefore, it is very necessary to study the similarities and differences in emotional expression among students of different school stages.

4. Methods

This research comprehensively adopts literature research method, statistical analysis method, quantitative research method and comparative research method to ensure the scientificity and rigor of the research. Through the investigation of domestic and foreign journals, papers, books and other relevant literature, this study systematically composes the research background and development trend of speech emotional expression, deeply analyzes the research status of students 'emotional expression, and summarizes the current research results and existing problems of speech emotion recognition in the application of students 'emotional expression. After collecting a large number of students' emotional expression data, SPSS and other statistical analysis software were used to sort out, visualize and analyze the data. By horizontally comparing the emotional expression patterns of

students in different sections, the differences in emotional categories, emotional intensity and emotional transformation ability were analyzed. Finally, combining the results of manual evaluation and machine evaluation, the similarities and differences of different evaluation methods were discussed, so as to provide multi-dimensional reference for future research on emotional education.

5. Experimental Design

5.1. Experimental Objective

This study focuses on the emotional expression abilities of students at different educational stages and designs two experiments, respectively focusing on the classification of emotions and the impact of internal and external emotional experience conflicts on expression. Experiment one examines the accuracy of students in expressing basic emotions such as happiness, sadness, anger, and neutrality. Experiment two investigates emotional expression when there is a conflict in emotional needs, by inducing emotions and requiring the expression of opposite emotions, to study the performance of different educational stages in emotional regulation abilities. The main objective of this study is to explore the influence of educational stages on emotional expression, analyze possible cognitive and emotional development factors, and combine manual assessment with machine assessment to ensure the scientific and rigorous nature of the analysis.

5.2. Preliminary Preparations

5.2.1. Experimental Subjects

In this experiment, 30 students (15 boys and 15 girls) were randomly selected from each educational stage, totaling 90 students. The age range of the students in the primary school stage was between 10 and 11 years old, that of the junior high school stage was between 13 and 14 years old, and that of the senior high school stage was between 16 and 17 years old. All the students had the ability to communicate normally in daily life.

5.2.2. Experimental Materials

The participants need to express the four emotions of happiness, sadness, neutrality and anger through speech. The material selection for this task has the following steps:

First, design the emotional rhythm target sentence. The design criteria for emotional target sentences are as follows:

1. The semantic content of the sentence is neutral, without any semantic tendency, and can express different emotions with a high degree of emotional freedom. For example, “He knows about this matter” can express both happy rhythms and sad, angry rhythms, etc. The length of each emotional target sentence is seven syllables. Controlling the sentence length can ensure that the subjects will not be affected by the sentence length.
2. The selected emotional target sentences should be suitable for students aged 7 to 18 and close to life. In the relevant research conducted by scholar Ge Zhilin [22], emotional target sentences have been evaluated and screened. Finally, 10 target sentences that can express different emotions were selected and divided into four emotional prosodic categories: happiness, sadness, neutrality, and anger, totaling 40.

Secondly, design conversation scripts for the emotional target sentences to enable the subjects to better feel the emotional clues contained in the materials and help them express their emotions. Design conversation scripts of four different emotions - happiness, sadness, neutrality and anger - for each emotional target sentence.

After setting the conversation script, select voice actors with excellent professional skills and rich dubbing experience to record the conversation script in a quiet recording studio, and randomly select 30 college students to evaluate the recording materials. The average accuracy rate and average intensity of all sentences are shown in **Table 1**. Based on the assessment results, finally 10 target sentences capable of expressing different emotions were selected, divided into four emotional rhymes: happiness, sadness, neutrality and anger, as the target sentences for students’ emotional expression in this study.

Table 1. Mean correctness and mean intensity of emotional rhyming sentences.

Emotional Rhythm	Happiness	Sadness	Anger	Neutrality
average correct rate	96.3%	91.2%	87.8%	95.6%

It can be seen from **Table 1** that the average accuracy rate of each emotional rhythm is very high, all exceeding 85%. The selected emotional target sentences are shown in **Table 2** as follows.

Table 2. Emotional target sentences.

	Emotional Target Sentence
1	He knows about it.
2	We'll be leaving soon.
3	There's my name here.
4	My dad's coming home tomorrow.
5	Everyone's out.
6	He's always like this.
7	Mom's already off work.
8	It's almost noon.
9	There's only two people in the store.
10	The bell rang.

6. Research Results and Discussion

6.1. Analysis of the Differences in the Accuracy of Emotional Expression Classification among Students of Different School Stages

6.1.1. Manual assessment

1) Descriptive statistics

In the classification statistics table shown in **Table 3**, from the perspective of the average and median values of emotional expression scores, among the three different school stages, the accuracy of expressing sadness is the highest, followed by happiness and neutrality, and then anger. In the classification statistics by school stage, the expression accuracy rates of primary school, junior high school, and senior high school are not significantly different, basically ranging from 0.60 to 0.63.

2) Two-way analysis of variance

As shown in the two-way ANOVA in **Table 4**, there is no significant difference in the score rate among different school grades, but there is a significant difference in the score rate under different emotional conditions. The significance of the interaction between school grade and emotional type is 0.008, indicating that students of different grades perform differently in accuracy under different emotional types. To further analyze the specific differences in the score rate caused by emotions, the Tukey HSD test in post hoc tests was used to analyze the data. The results are shown in **Table 5** (The "*" in the table indicates a significant difference).

Post-event verification found that the recognition accuracy rate of anger among students was significantly lower than that of the other three emotions, with a considerable gap. However, there was no significant difference in the score rates among the neutral, happy and sad groups.

Table 3. Classification and statistics of school stages and emotional types.

Segments	Type Of Emotion	Average	Standard Deviation
primary school	happiness	0.753	0.314
	sadness	0.793	0.270
	anger	0.340	0.320
	neutrality	0.607	0.260
	figure	0.623	0.340
junior high school	happiness	0.707	0.233
	sadness	0.780	0.219
	anger	0.373	0.340
	neutrality	0.547	0.246
	figure	0.602	0.304
senior high school	happiness	0.573	0.374
	sadness	0.687	0.245
	anger	0.433	0.320
	neutrality	0.747	0.278
	figure	0.610	0.327
figure	happiness	0.678	0.318
	sadness	0.753	0.247
	anger	0.382	0.325
	neutrality	0.633	0.271
	figure	0.612	0.323

Table 4. Two-way analysis of variance.

Emotional Rhythm	Mean Square	F	Significance
school grade	0.014	0.172	0.842
emotional type	2.327	27.96	0.000
*school grade*emotional type*	0.244	2.93	0.008

Table 5. Tukey HSD.

Emotion	Mean Difference	Standard Deviation	F
happiness-sadness	−0.076	0.043	0.296
happiness-anger	0.296 *	0.043	0.000
happiness-neutrality	0.044	0.043	0.730
sadness-anger	0.371 *	0.043	0.000
sadness-neutrality	0.120 *	0.043	0.028
anger-neutrality	−0.251 *	0.043	0.000

The accuracy of students expressing basic emotions at different educational stages is shown in **Figure 1**.

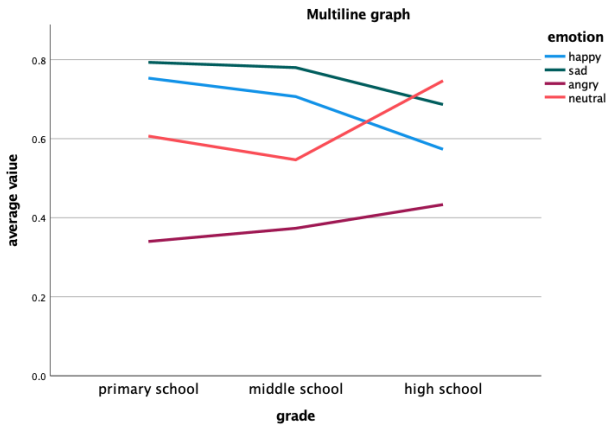

Figure 1. Average score statistics chart.

It can be intuitively seen from **Figure 1** that at the primary school stage, students' emotional expression tends to be explicit. The average scores of "happiness" and "sadness" are relatively high, especially the score of sadness is close to the highest level, indicating that students at this stage are emotionally sensitive and easy to express. In contrast, the scores of "anger" and "neutrality" were relatively low, especially the emotional expression of anger was the weakest. This reflects that the emotions of students in the primary school stage are mainly expressed positively and directly.

When entering junior high school, students' emotional expression gradually becomes more reserved. The scores of "happiness" and "sadness" both decline, while the score of "anger" begins to rise, and the score of "neutral" emotion drops to the lowest.

By the high school stage, emotional expression changes further. The scores of "neutral" and "angry" increase significantly, especially the score of "neutral" emotion jumps to the highest level, while the scores of "happy" and "sad" continue to decline.

Overall, as the academic stage progresses, the characteristics of students' emotional expression gradually shift from being overt to being introverted. The emotion of "happiness" weakens, while the emotions of "neutrality" and "anger" increase. The emotion of "sadness" is generally stable but slightly decreases. This trend reflects the psychological changes and the gradual improvement of adaptability of students during their growth process.

6.1.2. Machine Assessment

As shown in the **Table 6**, in terms of educational stages, the average accuracy rate of machine assessment results for each stage is within the range of 0.45 to 0.55, which is about 0.10 lower than that of human assessment, and there is little difference among the stages. This result indicates that the differences in emotional expression among students of different stages are not significant, which is consistent with the results of human assessment. Specifically, in terms of emotional types, primary school students have the highest accuracy rate in expressing the emotion of "happiness", and the accuracy rate of expressing this emotion in junior high school and senior high school stages drops significantly. Among the three stages, the accuracy rate of expressing the emotion of "anger" is significantly lower than that of other emotions, while the recognition rates of "neutral" and "sadness" emotions are relatively high in all three stages, with no significant

differences. The different emotional expression situations of students in different stages shown by machine assessment are roughly consistent with those of human assessment, further confirming the experimental results.

Table 6. Machine assessment.

Segments	*Average Accuracy Rate*	*Emotional Types*	*Accuracy*
primary school	0.516	happiness	0.879
		sadness	0.518
		anger	0.167
		neutrality	0.500
junior high school	0.535	happiness	0.633
		sadness	0.445
		anger	0.270
		neutrality	0.792
senior high school	0.487	happiness	0.656
		sadness	0.435
		anger	0.167
		neutrality	0.688

6.2. Analysis of the Differences in Emotional Transitions Induced by Emotions among Students of Different School Stages

6.2.1. Manual Assessment

1) Descriptive statistics

According to the descriptive statistical results (**Table 7**), as the educational stage increases, students' performance in the accuracy of emotional expression gradually improves. Specifically, the average accuracy rates for primary school, junior high school, and senior high school are 0.380, 0.547, and 0.700 respectively. The accuracy rate of senior high school students is significantly higher than that of primary and junior high school students. Meanwhile, the standard deviations among different educational stages are relatively small, but the standard deviation of senior high school students is lower, indicating a stronger consistency. In contrast, the standard deviations of primary and junior high school students are higher, suggesting that the accuracy rates of emotional expression in these two stages fluctuate more. Overall, there are differences in the accuracy of emotional expression among different educational stages, and students' performance gradually improves as the educational stage increases.

Table 7. Manual assessment.

Segments	**Average**	**Standard Deviation**
primary school	0.380	0.312
junior high school	0.547	0.319
senior high school	0.700	0.215
figure	0.542	0.312

2) One-way analysis of variance

The results of the analysis of variance indicate that there are significant differences in the performance among the groups at different educational stages. Meanwhile, the data within each group show relatively small fluctuations and are relatively consistent.To further clarify which specific educational stages have significant differences, a multiple comparison analysis method in post hoc tests was adopted for the study. The research results are shown in **Tables 8** and **9** (The "*" in the table indicates a significant difference).

The post-experiment test results show that there are significant differences in the emotional expression scores among students of different school stages, and the score rate of high school students is higher than that of junior high school students, while the score rate of junior high school students is higher than that of primary school students. This indicates that the ability of emotional transformation under emotional induction gradually improves with the increase of school stage, especially with a significant improvement from primary school to high school.

Table 8. ANOVA.

		Sum of Squares	Mean Square	F
Segments	**inter group**	1.537	0.768	9.386
	within-group	7.123	0.082	
	figure	8.660		

Table 9. Multiple comparisons

Segments	Average Difference	Standard Error	Significance
primary school-junior high school	−0.167	0.074	0.068
junior high school-senior high school	−0.155	0.074	0.101
primary school-senior high school	−0.320 *	0.074	0.000

6.2.2. Machine Assessment

The accuracy rate of machine assessment of school stages are shown in **Table 10**.

Table 10. Accuracy rate of machine assessment of school stages.

Segments	Average Accuracy
primary school	0.366
junior high school	0.540
senior high school	0.660

6.3. A Comparative Analysis of Similar Studies at Home and Abroad

This study explores the accuracy of students' emotional expression at different educational stages and its comprehensive relationship with educational stages and types of emotions. By comparing with similar studies at home and abroad, it is found that the results of this study have many similarities with the conclusions in the relevant literature, but there are also certain differences. The following is an analysis of these similarities and differences and an exploration of the possible reasons.

6.3.1. Similarities and Differences in the Accuracy of Emotional Expression and Analysis of the Reasons

This study finds that the type of emotion has a significant impact on the accuracy of emotional expression. Especially, the expression accuracy of anger emotion is relatively low, and the score is significantly lower than that of other emotions. For comparisons at the educational stage level, although the accuracy of emotional expression among students at different stages does not vary significantly, the accuracy of emotional expression among high school students is slightly higher than that of junior high school and primary school students, especially in the expression of angry emotions. Domestic studies generally find that students are relatively weak in expressing anger. Chen Le [23] and Tan Haining et al. [24] pointed out that in terms of the accuracy of emotional expression, anger, as a rather complex emotion, has a relatively low expression ability among students. This is consistent with the research conclusion of this thesis. Regarding the comparison of the accuracy of expressing anger emotions, there are certain differences in the research results at home and abroad. In foreign research, especially in Western countries, the cultural atmosphere for emotional expression is relatively open, and the manifestation of anger is less suppressed.

The main reasons for the differences in research results at home and abroad lie in the differences in cultural background, educational intervention and social norms. In China, anger is often regarded as a negative emotion that needs to be suppressed, especially in the family and school environment. Students are encouraged to control their anger, so they may be more reserved in emotional expression, which leads to a lower accuracy in the expression of anger. In foreign countries, especially in Western nations, the emotion of anger is more easily accepted and expressed. Emotional education courses such as Social and Emotional Learning (SEL) focus on cultivating students' ability to appropriately express emotions like anger from an early age. The educational environment encourages students to freely express their emotions in appropriate situations, which makes the expression of anger more direct and accurate. Therefore, the differences in cultural expectations and educational systems are the main reasons for the differences in the accuracy of expressing anger emotions.

6.3.2. Similarities and Differences in Emotional Transformation Induced by Emotion and Analysis

As the educational stage progresses, students' ability to transform emotions significantly improves. Especially high school students show a stronger ability to transform emotions compared to the primary school stage. Foreign studies such as Teodorescu et al.[25] have also verified this point, suggesting that as age and cognitive ability increase, students' emotional regulation and transformation abilities significantly enhance.

The reasons for this similarity and difference are mainly related to students' cognitive development, emotional regulation ability and cultural background. According to Piaget's theory of cognitive development, as students progress through different educational stages, their cognitive abilities gradually mature, enabling them to understand and express emotions more complexly. Especially in terms of emotional regulation, older students can better adjust and transform their emotions. Gross's emotional regulation model also indicates that students' emotional regulation ability significantly increases with age, especially when facing emotional conflicts, they can better regulate their emotional responses. In addition, cultural background and educational intervention also play an important role. In China, as the educational stage progresses, emotional education gradually increases, especially in the high school stage, where the training of emotional regulation and transformation is given greater attention. In contrast, the emotional expression of lower grade students is more direct, which is closely related to the tolerance and guidance methods of social culture towards children's emotional expression.

7. Conclusion

Firstly, regarding the differences in the accuracy of expressing basic emotions among students at different educational stages, the research found that the type of emotion has a significant impact on the accuracy rate of expression. Among the four basic emotions, sadness has the highest accuracy rate of expression, while happiness and neutrality have relatively high accuracy rates, and anger has the lowest accuracy rate, with its score significantly lower than that of other emotions. In terms of comparisons at the educational stage level, although the differences in the accuracy of emotional expression among students at different stages are not significant, the accuracy of emotional expression among high school students is slightly higher than that of junior high school and primary school students, especially in the expression of anger, where the differences are most obvious. Additionally, the results of machine assessment and manual assessment are relatively consistent, further verifying these findings.

Regarding the impact of inconsistency between internal and external emotions on emotional expression, this study found that high-grade students can better adjust and express emotions that meet external requirements when facing the inconsistency between internal and external emotions. Particularly in the high school stage, students' emotional conversion ability has significantly improved, while low-grade students perform relatively poorly in this aspect. This finding indicates the differences in emotional regulation ability among different educational stages and the improvement of the ability to adapt emotional expression to emotional experience as the educational stage increases.

Overall, this study reveals the multi-dimensional influence of educational stage and emotion type on students' emotional expression. The advancement of educational stage not only affects the accuracy of emotional expression but also plays an important role in emotional regulation and conversion ability.

This study mainly focused on the accuracy of students' emotional expression and the impact of inconsistency between internal and external emotions on emotional expression, but did not involve external factors influencing students' emotional expression, such as social and cultural background, educational methods, and individual personality traits. These factors may play a significant role in the process of emotional expression. Future research can combine methods from multiple disciplines such as psychology and education to further explore the underlying mechanisms influencing students' emotional expression.

Author Contributions

Q.Y. implemented the whole experiments, data analysis and wrote the paper. Y.C. was responsible for revising the paper, organizing its format, and submitting it. W.W. pro-

vided direct guidance on the topic selection, whole research process of the paper. All authors have read and agreed to the published version of the manuscript.

Funding

This research received no external funding.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

First, voice data from students of different school years (elementary, middle and high school) were collected through a WeChat applet, and the voice content was the students' emotional expression in a set context. Second, adult volunteers with normal emotion recognition ability were invited to categorize the emotional tendencies (happy, sad, angry, neutral) of the students' speech data through questionnaires and rate the intensity and accuracy of the emotions. In order to verify the reliability of adult volunteers' judgments, the study introduces a deep learning-based speech emotion classifier, which is pre-trained using the CASIA Chinese emotion dataset before classifying the students' speech data to assist in verifying the adults' judgment results. Finally, combining the subjective assessment of adults and the classification results of the machine, the accuracy of emotion expression of students from different school years was compared through statistical analysis to explore the differences and commonalities in the emotion expression of students from different school years.

Acknowledgments

This study acknowledges the possible suggestions and support from the editors and reviewers.

Conflicts of Interest

There is no conflict of interest.

References

[1] Wo, J.Z., Cao, L.Y., 2003. Development characteristics of middle school students' emotion regulation abilities. Chinese Journal of Applied Psychology. (02), 11-15.

[2] Morris, A.S., Criss, M.M., Silk, J.S., et al., 2017. The impact of parenting on emotion regulation during childhood and adolescence. Child development perspectives. 11(4), 233–238.

[3] Wang, H., Zhu, X.M., 2018. On the three main misunderstandings of teachers' emotional expression in the present. Educational Sciences Research. (01), 50–52.

[4] Lu, J.M., Chen, N.Q., Xu, L., et al., 2016. A survey on the current situation of emotional intelligence among Chinese college students. Journal of Psychological Science. 39(06), 1302–1309. DOI: https://doi.org/10.16719/j.cnki.1671-6981.20160604

[5] Lu, J.M., Liu, W., He, W., et al., 2017. The Current Status and Influencing Factors of Emotional Quality among Chinese College Students. Acta Psychologica Sinica. 49(01), 1–16.

[6] Gross, J.J., Levenson, R.W., 1997. Hiding feelings: the acute effects of inhibiting negative and positive emotion. Journal of Abnormal Psychology. 106(1), 95.

[7] Dai, J., Gu, X.Q., 2024. From Cognition to Emotion: Framework Construction and Application Research on the Impact of Feedback on Academic Emotions in Adaptive Learning Systems. China Educational Technology. (11), 78–86+122.

[8] Zeng, H., 2023. Action Research on Improving Young Children's Emotional Expression Ability through Creative Drama. Southwest University: El Paso, TX, USA. DOI: https://doi.org/10.27684/d.cnki.gxndx.2023.002197

[9] Ekman, P., 1992. An argument for basic emotions. Cognition & Emotion. 6(3–4), 169–200.

[10] Scherer, K.R., 2005. What are emotions? And how can they be measured? Social Science Information. 44(4), 695–729.

[11] Izard, C.E., 1994. Innate and universal facial expressions: evidence from developmental and cross-cultural research. Psychological Bulletin. 115(2), 288–299.

[12] Cowen, A.S., Keltner, D., 2017. Self-report captures 27 distinct categories of emotion bridged by continuous gradients. Proceedings of the national academy of sciences. 114(38), E7900–E7909.

[13] Scherer, K.R., 2003. Vocal communication of emotion: A review of research paradigms. Speech communication. 40(1–2), 227–256.

[14] Barrett, P.H., 2016. The Works of Charles Darwin: Vol 23: The Expression of the Emotions in Man and Animals. Routledge: London, UK.

[15] McCluskey, K.W., Albas, D.C., 1981. Perception of the emotional content of speech by Canadian and Mexican children, adolescents, and adults. International Journal

of Psychology. 16(1–4), 119–132.
[16] Kring, A.M., Smith, D.A., Neale, J.M., 1994. Individual differences in dispositional expressiveness: Development and validation of the Emotional Expressivity Scale. Journal of Personality and Social Psycholog. 66, 934–949.
[17] Ekman, P., Friesen, W.V., 1969. The repertoire of nonverbal behavior: Categories, origins, usage, and coding. Semiotica, 1(1), 49–98.
[18] Denham, S.A., 1998. Emotional Development in Young Children. Guilford Press: New York, NY, USA.
[19] Meyer, D.K., Turner, J.C., 2006. Re-conceptualizing emotion and motivation to learn in classroom contexts. Educational Psychology Review. 18(4), 377–390.
[20] Saarni, C., 1999. The development of emotional competence. Guilford Press: New York, NY, USA.
[21] Zhu, X.M., 2007. An Outline of Emotional Education. People's Publishing House: Beijing, China.
[22] Liang, D.D., Yan, X.M., Ge, Z.L., 2024. A study on the development of emotion recognition ability based on linguistic cues in 4-8 year-old Chinese children with high-functioning autism. Psychological Development and Education. 40(02), 169–175.
[23] Chen, L., 2025. The influence of anger emotion education and training on the anger expression of lower grade elementary school students. [2025-05-09].
[24] Tan, H.N., Yang, Y., Zhang, H.J., 2014. An investigation of anger in junior high school students. Chinese Mental Health Journal. 28(5), 6. DOI: https://doi.org/10.3969/j.issn.1000-6729.2014.05.008
[25] Teodorescu, D., Fyshe, A., Mohammad, S.M., 2023. Utterance Emotion Dynamics in Children's Poems: Emotional Changes Across Age. arXiv preprint, arXiv:2306.05387.