

Analysis of the role of visual discrimination of emotions in the training for social-emotional competencies of future teachers

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Abstract— Educators' ability to effectively manage and respond appropriately to emotional dynamics in the classroom is essential for creating an inclusive educational environment. In the era of digitalization in education, the growing importance of social-emotional competencies requires an emphasis on building relevant competencies in the education of future teachers. This study aims to investigate the role of visual discrimination of facial expressions of emotions on social-emotional competencies in general and on social engagement (Social Awareness) in particular. The study includes 122 participants, students in pedagogical majors, divided into a control and an experimental group. Both groups take a quiz consisting of three problem-solving scenarios involving situations that require the practical application of the teacher's social-emotional competencies. Immediately before taking the test, in the experimental group, another test was administered, requiring the subjects to recognize the facial expression of a given emotion, presented in the form of a photograph, an emoticon, and a schematic image. The results show that the experimental group performed significantly better in solving the cases. These data suggest that the introduction of additional training components related to the recognition of emotions facial expressions will contribute to improving the social emotional skills of future teachers and educational specialists.

Keywords— education professionals, emotional facial expressions, social-emotional learning, emotional intelligence

I. INTRODUCTION

Emotions are an intrinsic part of people's psychological life. They are the natural first language which children use to communicate. [1] The importance of emotions and their understanding for a productive, respectful, developing the personality and fulfilling learning process has been repeatedly emphasized by many different researchers [2] [3] [4] [5] [6] [7]. The importance of social and emotional competencies is not limited to the desirable improvement of the school learning environment; it is essential in certain specific situations [8] and is a prerequisite for the effective inclusion of children and students with various disabilities in school education [9]. This also determines the need for adequate and meaningful training in the area of skills for differentiation and processing of emotions and emotional stimuli for all those working in the field of pedagogy. The current trend of increasing digitization of the learning process once again brings to the agenda the need for solid emotional engagement management skills of the teachers and the students. The increasingly broad acceptance of the concept of inclusive education further raises the need to improve the socio-emotional skills of teachers and educational specialists with the fundamental goal of succeeding in mastering and building a positive and inclusive educational environment for all. [10] The role of a positive educational environment in modern education is fundamental and extremely important for the next step in the development of education. The establishment of such an environment is impossible without a positive psychological setting and a favourable psychological climate for the development of children's personalities. These are also the major underlying reasons why the present study focuses on the development of a methodology for improving the training of future teachers and pedagogical specialists in social-emotional competencies through additional training in the discrimination of facial expressions of emotions..

II. EMOTIONS IN SOCIO-EMOTIONAL PERSPECTIVE

A. Visual discrimination of emotions

The discrimination of emotions is a complex neuropsychological process that requires synchronized work and development of multiple distinct brain regions and brain structures [11] [12]. This complex processing is accomplished through separate, extremely rapid processes that involve different hierarchical structures. The processing of visual information is performed in parallel via two, and according to recent evidence, three pathways – the ventral and dorsal pathways and a third pathway directed straight to the Superior Temporal Sulcus (STS) [3] [13]. According to the existing paradigm, the processing of the interpretation of the emotional states of others is part of the ventral visual pathway (Ventral Stream) [13], which, unlike the Dorsal Stream (responsible for the spatial processing of visual information), begins in the inferior temporal visual association cortex and provides recognition of objects, colors, text, associative learning, and memorization of visual stimuli. [14] The emerging in recent years evidences for the existence of a third, specialized for face processing and social perception visual pathway, starting from the primary visual cortex (early visual cortex), considers the important role of the STS as the main structure that directly processes visual sensory information carrying all kinds of social context—facial expressions, visual synchronization of speech, moving faces and bodies, and their interpretation in a social context [13] [15]. This pathway of processing is also closely related to audio-visual stimuli related to speech comprehension and its social role [16]. In other words, the presumed third pathway for processing visual information (in addition to the ventral and dorsal pathways) is highly specialized in working with stimuli related to human social functioning. This allows the use of the link between visual discrimination of facial expressions and the processing of socially significant information to expand and improve social competence. This link begins in the primary visual cortex (early visual cortex), passes through motion-selective areas, and ends in the superior temporal sulcus (STS). [13] This processing includes the discrimination of faces from objects, individual differences, facial expression, nonverbal language encoded in various body movements [17], cognitive empathy, perspective-taking, and other social stimuli, such as specific social aspects of prosopognosis, trust, attention to social stimuli [18], the so-called social gaze, and some aspects of speech processing related to its social role [19]. The dysfunction in this region is associated with the development of autism spectrum disorders, which is considered in the context of another additional piece of evidence for the role of this stream in the processing of socially relevant information. [18] However, this type of processing refers to higher cortical processing of information, while the work of structures in the ventral visual pathway is more closely related to the direct, immediate, and preconscious response to visual stimuli, conditioned by the work of the autonomic nervous system. Emotions are fundamental and constitute the

foundations of any interaction, including pedagogical and support the process of understanding and making sense of the learning experience. [6] The importance of emotions in school education is also related to the social development of the child. Emotions are the primary language for communication, through which many nuances of cognitive processing of information are realized. And since both visual pathways, as well as the presumed third, pass through the subcortical structures of the amygdala and hippocampus, it can be argued that the emotional response is an integral, preconscious part of visual processing, which is why the emotional mind's response is so much faster than that of the rational mind. [2] This reaction can be interpreted through the universal facial expressions of the basic emotions [20]. There is also evidence that in relying on facial expressions of emotions, in addition to STS structures [13] [15], structures in the right hemisphere of the brain are also being activated. [21] These structures are involved not only in interpreting and generating emotional expressions, but also in maintaining social orientation and in interpretation of relevant social information. [21] This fact makes interpreting the facial expression of the other person's emotion a particularly important part of the process of communication and interpreting the reaction of the emotional mind. Since conflicts in everyday life arise mainly on an emotional basis and are accompanied by intense affective colouring, the correct interpretation of the emotions of others is a fundamental part of conflict management. Within the context of school education, teachers rely even more on their ability to interpret the facial expressions of their students' emotions during the learning process. The position of students in the classroom and the rules for communication during the teaching process make facial expression the main tool for communication of the students with the teacher. Very often the external manifestation of the student's emotional reaction remains only within the framework of a specific facial expression and does not receive any verbal sign. On the other hand, the facial expression of the teacher's own emotions during the teaching process is also a subject of sophisticated processing by the students. Through the above-described mechanisms of processing of socially significant information, it exerts a direct, though in most of the cases unconscious, influence on the emotional state of the students. Therefore, the teachers' ability to recognize and manage their own emotions is a particularly important competence and a necessary condition for the successful implementation of social-emotional learning.

B. Socio-emotional learning paradigm

In most models of social-emotional learning, the emotional aspects of human functioning in a social environment occupy a central place. The importance of teachers' social-emotional competencies is emphasized in all frameworks used in the practice. In the Collaborative for Academic, Social, and Emotional Learning (CASEL) framework for social-emotional learning, discrimination of the emotions can be identified in the domains of Self-awareness, Self-management, Social Awareness, and, to some extent, Relationship Skills. [22] [23] With regard to emotionally-related competencies, it can be said that there are frameworks that prioritize the development of this type of competency and those that prioritize social and cognitive competencies in the social-emotional learning model. The CASEL model remains the most commonly used framework for implementing social-emotional learning in schools, and although it places a strong emphasis on emotions, the Four Branch Model of Emotional Intelligence is the one that most closely describes emotions in the context of social-emotional learning. In this framework, emotion recognition skills are at the centre, as the first domain of the framework is entirely devoted to perception, appraisal, and expression of emotions, while the second and third domains are devoted to emotional facilitation of thinking and understanding and analysing emotions; employing emotional knowledge. In other words, this model focuses primarily on emotional functioning and emotional regulation of the personality. In such a framework, the interpretation of facial expressions of emotions is of paramount importance. Other frameworks closely related to emotional competencies are the K-3 SEL Standards (Connecticut) The Social, Emotional, and Intellectual Habits framework, where one of the main domains is "identify and understand emotions of self and others," and the K-12 SEL Standards (Anchorage) Social and Emotional Learning: Standards and Benchmarks, whereas emotional competencies are highlighted in the first place in three separate domains, Self-awareness, Self-management, and Social awareness, competencies for identifying and respectively managing one's own and other's emotions, and reading the emotions and perspectives of others. Some popular frameworks, such as 21st Century Learning, Big Five Personality Traits, and ACT Holistic Framework of Education and Work Readiness, include competencies for identifying and controlling emotions only indirectly and do not emphasize the ability to recognize and understand emotional functioning as a separate important domain. [23] This fact, however, does not diminish in any extent the importance of emotional regulation not only for everyday human interactions in general, but also for the highly specialized educational interaction between teacher and student in particular. Emotion inevitably accompanies the learning experience, and yet even if negative emotion is a strong enough motivator for information retention, it is also an equally strong motivator for avoidance of similar experiences. The positive emotional colouring of the learning experience contributes to the creation of an environment of curiosity, free exploration and, ultimately, a positive and open environment for working with knowledge. Furthermore, the existence of appropriate and sufficiently good emotional competence in teachers has a significant positive impact on other aspects of their work, such as building a sense of emotional self-efficacy. This self-efficacy, in turn, has both a direct and indirect effect on teachers' empathy. [24] An improved capacity for empathy among teachers improves the overall learning environment and emotional competence quality. Better emotional competence of teachers also contributes to better conflict management skills [25]. These two aspects are crucial in the management of the modern classroom and are particularly important in the overall competency profile of teachers and educational specialists. The positive links between teachers' emotional competencies and their ability to manage and resolve conflicts [26] also contribute to coping with stress in the professional environment, which is high among teachers and constitutes a significant factor for retention in the profession. [27] This is one of the main reasons why empathy and the ability to recognize and manage students' emotions are an essential part of a teacher's personality profile [4] in any educational setting. Therefore, this study focuses on the use of the capacity for facial expression discrimination as a primary means for improving the overall social-emotional competence of future teachers and educational specialists.

III. METHOD

A. Emotional facial expressions questionnaire

A questionnaire containing 24 images of facial expressions of basic emotions, based on the study by Cherbonnier and Michinov [28], was used to train participants in emotion discrimination. The subjects chose one of six possible answers, which presented the opportunity to classify the emotion as one of the basic emotions with its characteristic facial expression (joy, sadness, anger, surprise, disgust, and fear). The images consist of pictures of man and woman, schematic sketches and emoticons. The emoticons have been included because of the broad usage of that kind of emotional non-verbal signals in contemporary communication environment formed by the widespread digitalization. The images provided in the questionnaire are small in size, which aims to make perception more difficult and achieve maximum focus on the task of discriminating the given facial expression. All subjects used their smartphones to complete the study. After completing the test, a discussion is held on the six basic emotions, their facial expressions, and the mistakes made by the participants in the study.

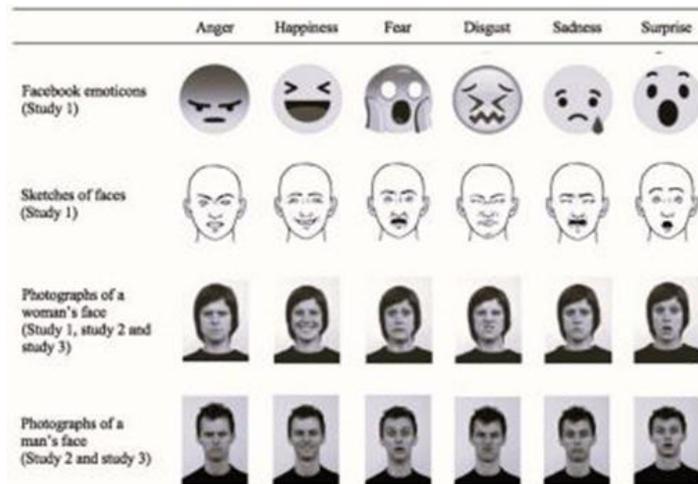


Fig. 1 Stimulus material for Emotional facial expression discrimination questionnaire. Source: [28]

B. Social situations questionnaire

A questionnaire containing three hypothetical school situations affecting the emotional functioning of students and its possible regulation by the teacher and educational specialist was used to assess social-emotional competence. The questions are as follows:

1. Situation 1: During class. The student constantly interrupts and speaks without permission, commenting loudly on every statement made by the teacher. (Correct answer c.)
 - a. Ignores him completely, hoping he will tire himself out.
 - b. Stop the lesson and says, „Look, if you know everything, you teach the lesson!"
 - c. Approach calmly: "I understand that you want to participate. Let's agree on when it would be appropriate."
2. Situation 2: A student stands at the door of the room and refuses to enter, remaining silent but visibly tense. (Correct answer b.)
 - a. "I'm not going to stand here begging you all day. Either you come in, or I'll mark you absent."
 - b. "Do you need some time? I can wait for you or come back in a little while to talk."
 - c. "What's wrong with you again?! Get in here now!"
3. Situation 3: In a group activity that you are conducting, a student refuses to participate, mocks the others, and disrupts the group's work. (Correct answer b.)
 - a. "Stop immediately! You will work alone from now on."
 - b. "It seems difficult for you to be part of the team today. Can you tell me why?"
 - c. I pretend not to see him/her so as not to interrupt the group work.

The control group is first given the social competence questionnaire, followed by the emotion discrimination questionnaire and discussion. The experimental group begins with the emotion discrimination questionnaire and discussion.

The main hypothesis of the study is that working on the improvement of facial expression discrimination skills improves social assessment skills and the ability to manage emotionally charged situations in pedagogical communication.

IV. RESULTS

The study was conducted with 122 first-year students majoring in pedagogy. Due to incomplete data, seven cases were excluded. The results of a total of 115 subjects were analyzed. The experimental group consists of 71 students enrolled in the courses of special and social pedagogy. The control group includes 44 students majoring in pedagogy and primary school pedagogy. All of the majors examined undergo universal initial pedagogical training in the first semester of their first year, which makes a comparative analysis between the groups of subjects possible. The conducted study provides information on the number of correct answers given by the subjects. With regards to the questionnaire on emotion discrimination, the control group had an average of 18.55 correct answers and the experimental group had an average of 18.92 correct answers (maximum number of correct answers: 24). With regard to social competence, the subjects in the control group gave an average of 1.11 correct answers out of a maximum of 3. In the experimental group, the subjects gave an average of 2.99 correct answers out of a maximum of 3.

The statistical analysis for hypotheses testing was performed using specialized statistical software IBM SPSS 25. The test of the hypothesis for normality of distribution shows a lack of normal distribution, which suggests the use of nonparametric criteria for assessment of the statistical interrelationships.

Group Statistics					
Group		N	Mean	Std. Deviation	Std. Error Mean
Emotion discrimination (correct responses)	Experimental group	71	18,92	1,880	0,223
	Control group	44	18,55	2,246	0,339
Social competence (correct responses)	Experimental group	71	2,99	0,119	0,014
	Control group	44	1,14	0,030	0,140

Fig. 2 Group statistics in the two groups of subjects studied. Prepared using IBM SPSS Statistics 25 statistical software. Source: Author

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Emotion discrimination (correct responses) is normal with mean 19 and standard deviation 2,026.	One-Sample Kolmogorov-Smirnov Test	,000 ¹	Reject the null hypothesis.
2	The distribution of Social competence (correct responses) is normal with mean 2 and standard deviation 1,072.	One-Sample Kolmogorov-Smirnov Test	,000 ¹	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is ,05.
¹ Lilliefors Corrected

Fig. 3 Normality distribution test. Created with IBM SPSS Statistics 25 statistical software. Source: Author

To test the main hypothesis that there is a statistically significant difference between the two groups in terms of their assessment of the emotionally appropriate response to the hypothesized pedagogical situation, the nonparametric Mann-Whitney U test was used. The results show that there is a statistically significant difference between the control and experimental groups in terms of the results of the social competence test. No such difference was found in terms of the results of the emotion discrimination questionnaire.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Emotion discrimination (correct responses) is the same across categories of Group.	Independent-Samples Mann-Whitney U Test	,368	Retain the null hypothesis.
2	The distribution of Social competence (correct responses) is the same across categories of Group.	Independent-Samples Mann-Whitney U Test	,000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is ,05.

Fig. 4 Test for the presence of a statistically significant difference in the variables in the two groups of subjects studied. Created with IBM SPSS Statistics 25 statistical software. Source: Author

In order to examine as fully as possible the observed effects, a correlation analysis (using a nonparametric criterion) was performed to trace the possible existence of any interrelationships between the results in the variables that manifest themselves independently of the experiment conducted in the control and experimental conditions. No such dependencies were found in the current sample, which leads to the conclusion that the differences between the control and experimental groups can be attributed to the specific experimental conditions.

Correlations

		Emotion discrimination (correct responses)	Social competence (correct responses)
Kendall's tau_b	Emotion discrimination (correct responses)	Correlation Coefficient	1,000
		Sig. (2-tailed)	,015
		N	115
	Social competence (correct responses)	Correlation Coefficient	0,849
		Sig. (2-tailed)	,000
		N	115

Fig. 5 Nonparametric correlation analysis. Created with IBM SPSS Statistics 25 statistical software. Source: Author

The obtained results indicate that there is a statistically significant difference in terms of social competence between the control and experimental groups, which, combined with the higher average score in social competence questionnaire of the participants in the experimental group, gives a reason to claim that the main hypothesis of the study is confirmed. In other words, based on the current data, it can be concluded that the additional training on facial expression of emotions discrimination positively affects the prospective teachers' social competence.

In conclusion, it can be said that the present study confirms the previously recognized neuropsychological parallels between the processing of visual information related to emotional expressions [17] [13] and the work of the associative cortex related to the interpretation of socially significant information and social relationships [16]. The existence of the universality of facial expression [20] is complemented by the existence of strong and evolutionarily conditioned bonds between that expressions and the overall cognitive processing of social and facilitated -learning, through the corresponding hierarchical organization of subcortical and cortical structures involved in the socio-emotional regulation of behaviour [12]. This provides a broad foundation on which additional methodologies can be developed to improve and expand the emotional and, therefore, social competence of teachers and educational specialists by specifically stimulating the neuroprocessual centres for the processing of visually coded emotional stimuli. Such methodologies, which use emotional learning to improve social functioning, can significantly enhance and reduce the time required for this training by utilizing the natural, evolutionarily formed neural pathways for social-emotional learning.

V. CONCLUSIONS

The recommendations to the conducted study are to repeat and expand the experience of application of the present methodology in a wider range of majors and to refine the tool for control and assessment of the social-emotional skills of future teachers by means of more hypothetical cases designed to create nuances in the results obtained.

Assessing the effectiveness of this methodology also requires a more detailed analysis, which could be carried out as part of the analysis of the discriminatory abilities for facial expression of the subjects.

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