

Neuropsychological Peculiarities of Studying Future Psychologists' Emotional Intelligence

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Abstract: *The article considers emotional intelligence as a complex integrative formation, which includes cognitive, behavioural and emotional qualities. These qualities ensure awareness, understanding and regulation of their own and others' emotions and effect on the success of interpersonal interaction and personal development. A review of relevant scientific sources has revealed the insufficient study of brain correlates and the specifics of future psychologists' emotional intelligence. In turn, it has determined the purpose of the study, that is the neuropsychological study of features of future psychologists' emotional intelligence. The parameters of emotional intelligence in the first- and second-year students majoring in Specialty 053 Psychology are received due to the test-questionnaire at simultaneous registration of electric activity of the brain. The Neuron-Spectrum 5 electroencephalograph was used for the EEG registration. The recording was performed monopolarly in 32 leads, using samples “eyes closed”, “eyes opened” and filling out the test-questionnaire to identify the levels of emotional intelligence. The obtained results have made it possible to determine that the levels of psychology students' emotional intelligence are related to the activation indicators of different parts in the cortex of their brain. The students mostly are at average and initial levels of emotional intelligence, tend to show an interpersonal type of emotional intelligence and control their own and others' emotions rather than to differentiate the emotions and establish the cause of their occurrence.*

Keywords: *brain organization of emotions, electroencephalography of the brain, training of students, Specialty 053 Psychology, higher education.*

How to cite: Berezka, S., Panasenko, E., Zhukova, O., Radchuk, H., Sobolyeva, S., & Raievska, Y. (2021). Neuropsychological Peculiarities of Studying Future Psychologists' Emotional Intelligence. *BRAIN. Broad Research in Artificial Intelligence and Neuroscience*, 12(2), 38-52. <https://doi.org/10.18662/brain/12.2/190>

Introduction

The military conflict in the East of Ukraine significantly affects various aspects of the life of the entire Ukrainian society. In this regard, the sphere of psychological services and, accordingly, the training of highly qualified psychologists are becoming especially relevant today. To prepare and train a competitive psychologist, it is not enough to equip him/her only with theoretical knowledge and practical skills. The psychologist's personality is the main tool in his/her professional activities. Accordingly, at the stage of professional training, it is necessary to develop personal competence in future psychologists. Therefore, it is vital to find out which qualities are necessary for the psychologist's successful professional activities. The authors of the article believe that the provision of psychological assistance by a specialist is impossible without the psychologist's ability to recognize and analyze clients' emotions, influence their emotional states, provide emotional support. In turn, it requires the psychologist to verbalize emotions, be emotionally open and empathetic, be able to control their experiences and realize the cause of certain emotional reactions. All these abilities together form the emotional intelligence of the specialist. Emotional intelligence is included in the list of soft skills that ensure the success of self-realization and the success of professional activities for the psychologist. That is why it is important to study the peculiarities of forming emotional intelligence in future psychologists, as well as the specifics of purposeful influence on its development when obtaining higher education.

Thus, it is essential to study the peculiarities of forming emotional intelligence in psychology students. However, the study of only psychological features of emotional intelligence is insufficient for a comprehensive understanding of this phenomenon. It is necessary to thoroughly study the brain organization of emotional intelligence to effectively organize the purposeful development of emotional intelligence as a leading competence in psychology students during their higher education study. In modern science, the physiological basis of emotions, methods of studying the emotional sphere, its features in the norm, as well as local brain damages or various mental disorders are widely covered. At the same time, emotional intelligence is a complex integral phenomenon and the understanding of the brain organization of emotions only cannot provide scientific reasoning of the biological basis of emotional intelligence itself. The brain correlates of emotional intelligence are insufficiently explored and, therefore, their study and is becoming increasingly relevant today.

Accordingly, **the purpose of the article** is a neuropsychological study of the features of future psychologists' emotional intelligence.

Theory and Predictions

It is rather difficult to answer the question "What is emotional intelligence?". This is primarily because psychological science does not have a single approach to interpreting the definition of emotional intelligence, its components and factors influencing its development.

For the first time, the term "emotional quotient" is found in the works of Bar-On (2011) in the context of a set of one's non-cognitive abilities, knowledge, and competences. It is this interpretation of EQ that formed the basis of his model of emotional intelligence. The model by Bar-On (2011) includes five basic components of emotional intelligence which correspond to five spheres of competence:

- the intrapersonal sphere (assertiveness, emotional introspection, independence, self-esteem, self-actualization);
- the sphere of interpersonal relations (empathy, social responsibility, interpersonal relations);
- the sphere of adaptability (ability to solve problems, assessment of reality, flexibility);
- the sphere of stress management (stress tolerance, impulsivity control);
- the sphere of general mood (life satisfaction, optimism).

A similar vision of emotional intelligence as a set of certain skills and abilities is presented in the studies of Salovey & Mayer (1990). Their model includes three basic categories of adaptive abilities:

- assessing and expressing emotions;
- regulating emotions;
- using emotions in thinking and activities (Salovey & Mayer, 1990).

However, they expanded their model afterwards. A significant difference in the new model was the emergence of a cognitive component associated with the processing of information about emotions. The presence of the cognitive component has given a new twist in defining emotional intelligence itself as the ability to perceive, understand and identify emotions, assimilate them in thoughts and exercise self-control and self-regulation of behaviour under the emotions of the individual and his/her environment.

Goleman (1995) refined the model by Salovey & Mayer (1990), adding enthusiasm, perseverance and social skills to it, thus combining cognitive abilities with personal characteristics. Today, his model includes

four main components, namely, self-awareness, self-control, social sensitivity, and 18 skills. Moreover, it is one of the most popular models in modern psychology. In his research, Goleman (1995) emphasizes the importance of EI for human success in various spheres and provides advantages over IQ. It was the works of Goleman (1995) that popularized studying emotional intelligence, even outside of psychological science.

Liusin & Ushakov's (2004) approach to interpreting emotional intelligence is rather thought-provoking. Their model includes intrapersonal and interpersonal emotional intelligence and assumes the ability to understand the person's and other people's emotions and manage them (Liusin & Ushakov, 2004). According to Liusin & Ushakov (2004), the formation of EI is influenced by many factors, and its development occurs throughout the life of the individual.

In modern studies of emotional intelligence, the following main definitions of this phenomenon can be identified:

- the set of mental abilities to identify, understand and manage emotions (Andreeva, 2011);
- the integral category in the structure of the intellectual and emotional-volitional sphere of the individual, which determines the success of his/her activities and relationships with other people (Davydova, 2011);
- the integral formation that provides awareness, understanding and regulation of the person's emotions and the emotions of other people, and allows performing successful interpersonal interaction (Meshcheriakova, 2011);
- the inner emotional resource of emotional regulation which allows individuals to control their behaviour, keep emotions under control in difficult situations and achieve economic well-being (Kiseleva, 2015).

Despite the differences, all the definitions of recent years have got common key positions. Thus, emotional intelligence is a complex integral construct that includes:

- the ability to perceive, identify and interpret one's own emotions and the emotions of other people;
- the ability to assimilate emotions in thoughts and stimulate thinking processes with the help of emotions;
- the capacity for self-control and self-regulation of behaviour under the emotions experienced by the individual or his/her environment;
- the ability to use all the above-mentioned abilities to build effective activities.

The analysis of relevant scientific sources shows that most studies are devoted to socio-psychological aspects of emotional intelligence only. Its biological basis, however, remains not enough studied. Brain mapping with different types of tomography was performed mainly in investigated persons with brain damage or affective disorders and mental pathologies. It revealed the areas of the brain associated with emotional intelligence, including left posterior temporal cortex, left posterior superior temporal sulcus, left temporal-parietal node, left orbitofrontal cortex, left anterior lumbar cortex, anterior islet (Barbey et al., 2012). Also, the influence of the limbic parts, cerebellum, visual and dorsolateral frontal cortex on the indicators of emotional intelligence was revealed (Gerasymova et al., 2019; Krueger et al., 2009; Maksymchuk et al., 2020a; 2020b; Melnyk et al., 2019; Nerubasska & Maksymchuk, 2020; Nerubasska et al., 2020; Onishchuk et al., 2020; Palamarchuk et al., 2020; Sheremet et al., 2019).

In a few studies, one can find a correlation between the frequency of brain oscillations when using different stimuli with the level of emotional intelligence (Knyazev et al., 2013). In particular, high synchronization of gamma and theta rhythm of EEG and low desynchronization of alpha rhythm EEG in investigated persons with a high level of emotional intelligence when viewing the faces with different emotions are installed. However, the studies of brain organization are just beginning to appear in modern science, so it is important to study the neuropsychological basis of emotional intelligence.

Emotional intelligence is one of the top 5 universal skills and is an integral part of a successful career and personal life. The development of emotional intelligence depends on both genetic and socio-psychological factors. The sensitive period of its development is considered to be childhood. Nevertheless, it is necessary to form emotional intelligence throughout life.

The purposeful development of EI in an adult is a more complex process and requires a thorough in-depth study of the existing level of already formed abilities.

Material and Methods

This study involved 135 students in Years 1 and 2 majoring in Specialty 053 Psychology at the state higher education institution “Donbas State Pedagogical University” (Sloviansk, the Donetsk Oblast, Ukraine). The students’ age was between 17 and 19 years old. Gender differences were not taken into account during the experiment. All investigated persons had no significant health problems, voluntarily agreed to participate anonymously in

the experiment and had the opportunity to withdraw from it at any time of their choice.

To achieve this purpose, the authors of the article analyzed the brain activity of future psychologists using electroencephalography and the "EmIn" questionnaire by Liusin (2006). Electroencephalography was chosen since it is one of the most accessible and informative methods of brain activity research and is safe for the investigated persons. Liusin's (2006) method provides a complex and comprehensive wide assessment of the features and level of emotional intelligence.

The Neuron-Spectrum-5 electroencephalograph "was used for the EEG registration (32 channels; "Ukrmedspectrum", Ukraine). This device can perform amplitude, spectral, bispectral, periodometric, correlation, cross-correlation, coherence, comparative, wavelet analysis, as well as analysis of independent components and epileptiform activities. The registration took place in an isolated room. EEG recording was performed according to the international standard of 10-20%, with a monopolar scheme using (in 32 leads with two auricular referents). The resistance did not exceed 20 kOm, the sampling frequency of the signal – 1000 Hz. The functional tests were performed according to the following scheme: "open eyes", "closed eyes", "filling out a questionnaire aimed at diagnosing the level and features of emotional intelligence."

To diagnose the peculiarities of emotional intelligence in future psychologists, one used the (EmIn) test (questionnaire) of emotional intelligence (Liusin, 2006). This questionnaire contains 46 statements concerning which the person under investigation is to express the level of his/her consent. All the statements are combined into five subscales, which are then added to four more general scales (intrapersonal and interpersonal emotional intelligence, ability to understand emotions and manage emotions). The questionnaire allows diagnosing both the general level of emotional intelligence and its components of the construct (Liusin, 2006).

Results and Discussion

The data received by questionnaire by Liusin (2006) were analyzed according to two subscales measuring interpersonal emotional intelligence ("understanding other people's emotions", "managing other people's emotions") and to three subscales measuring various aspects of intrapersonal emotional intelligence ("understanding the person's own emotions", "managing the person's own emotions", "personal expression"). The values by the scales were calculated by adding the number of points scored according to the corresponding sub-scales. The total number of points was

compared with the scale of the norm according to Liusin (2006) (separately for each component) and related to the corresponding level of a certain component.

The obtained results on the scales of comprehension (CE) and emotion management (ME) are presented in Table 1.

Table 1. Levels of CE and ME in the 1st and 2nd-year Students Majoring in Specialty 053 Psychology

Scale	Subscale “Understanding and Managing Other People’s Emotions” (UME)					Subscale “Understanding and Managing the Person’s Own Emotions” (UMPOE)				
	Low level	Initial level	Average Level	Sufficient Level	High Level	Low level	Initial level	Average Level	Sufficient Level	High Level
CE	8,9	18,5	60	8,9	3,7	14,1	23,7	54,8	6	1,4
ME	7,4	11,8	63,7	11,1	6	9,6	18,5	59,3	8,9	3,7

Systematized by the authors

From Table 1 it is seen that future psychologists are better able to understand and manage other people’s emotions, that is, the ability to understand the emotional states of others based on external manifestations (facial expressions, gestures, etc.), the ability to provoke emotional reactions in others, the ability to empathize with others, as well as willingness to support them. These subscales belong to interpersonal emotional intelligence.

The indicators on the subscales “Understanding the Person’s Own Emotions”, “Managing the Person’s Own Emotions and Controlling Expression” are less expressed, which indicates that the students cannot always be aware of their own emotions, control their external manifestations, understand their causes. These subscales belong to intrapersonal emotional intelligence.

Thus, the students’ interpersonal emotional intelligence is more developed than the intrapersonal one. This fact is proved by the quantitative data presented in Figure 1.

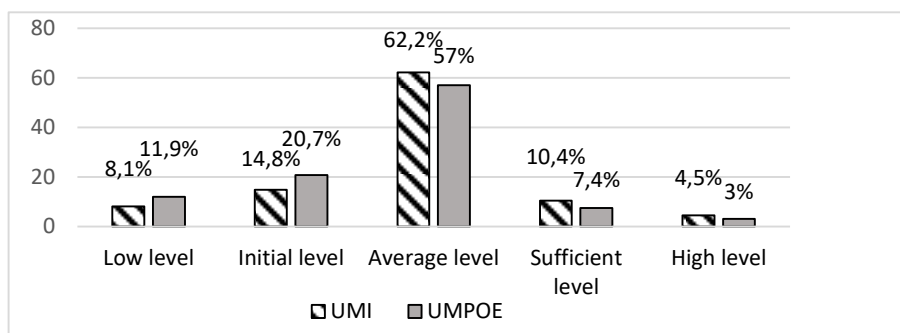


Figure 1. Levels of UME and UMPOE in the 1st and 2nd-Year Students Majoring in Specialty 053 Psychology
 Systematized by the authors

The scales “Understanding Emotions” and “Managing Emotions” also consisted of the sum of scores on the respective subscales (understanding the person’s own and other people’s emotions, managing the person’s own and other people’s emotions, respectively).

Both on the scale of intrapersonal and on the scale of interpersonal emotional intelligence, the obtained data (see Table 1) indicate that the students of better control their own and other people’s emotions compared to the ability to distinguish emotions and understand the cause of their occurrence. It proves that the structure of emotional intelligence is homogeneous.

The integral indicator of general emotional intelligence was calculated separately for each individual by adding the points scored by him/her on each subscale (understanding other people’s emotions, managing other people’s emotions, understanding the person’s own emotions, managing the person’s own emotions, controlling expression).

The quantitative data on the levels of general emotional intelligence are shown in Figure 2.

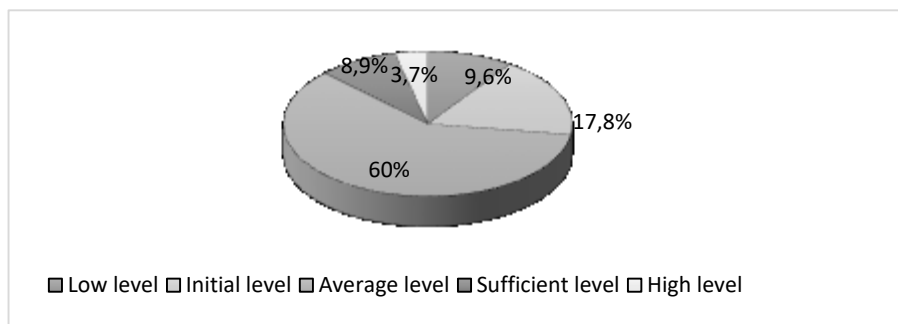


Figure 2. *Levels of General Emotional Intelligence in the 1st and 2nd-Year Students Majoring in Specialty 053 Psychology Systematized by the authors*

From Figure 2 it is seen that the authors of the article divided the levels of general emotional intelligence into five levels. Each level was established based on the ratio of the scored points of the student concerning the scales of the norm of development of the general EI according to Liusin (2006) and included the following qualitative characteristics:

– the high level (105 and more points): this group includes those students who can analyze their emotions and experiences and sensitive to the feelings and behaviour of other people; they can decode facial expressions and kinesthetic manifestations of emotions with high accuracy; they adequately (according to the situation) express their feelings and can control them; they do not admit of the negative impact of emotions on the process of communication and interaction with other people; they can evoke trust, inspire others, lead; they can also stimulate mental processes through emotions (the percentage of the students with a high level of EI development is shown in Figure 2);

– the sufficient level (93–104 points): the students of this group can easily recognize their own and other people’s emotions, can control them under common circumstances. At the same time, it is more difficult for them to understand the motivation for the emergence of certain emotional states (both their own and others’); such students may be negatively affected by emotions but can reflect on their feelings (the percentage of the students who form this group is presented in Figure 2);

– the average level (79–92 points): these students are more focused on people’s actions than on their ideas in interpersonal relationships; they can sometimes feel the mood of other people and navigate the situation but cannot always use such abilities; emotional attitudes can affect their reactions; they have an average level of awareness of their emotions; they

can successfully control their emotions in everyday life and yet, in the event of unusual situations, they temporarily lose control (the percentage of the students with an average level of EI is presented in Figure 2);

– the initial level (72–78 points): it is characteristic of those students who cannot productively use their emotional experience, cannot see and understand the emotional states of other people; they do not analyze the emotions and behaviour of others; they are not inclined to analyze their emotions and feelings; the control of emotions occurs through the process of their temporary suppression (the percentage of the students with an initial level of emotional intelligence is shown in Figure 2);

– the low level (0–71 points): this level is typical for those students who cannot differentiate and interpret their own and other people's emotions; they do not know how to control their emotional states; their emotions dominate over cognitive processes, which causes incorrect behaviour concerning the situation (the percentage of the students with a low level of emotional intelligence is shown in Figure 2).

During the processing and analysis of the electroencephalogram, one studied such indicators as power (MkB2) of theta-, alpha- and beta- rhythms in the anterior (averaging FP1, FP2, F3, F4, F1, F8, FZ), central (averaging FC1, FC2, C3, CZ, C4, CP1, CP2), temporal (averaging FT9, FT10, FC5, FC6, T3, T4, T5, T6, CP5, CP6, TP9, TP10) and posterior (averaging P3, PZ, P4, O1, OZ, O2) leads under three conditions: closed, open eyes and when filling the questionnaire by Liusin (2006).

The study of the power of EEG rhythms during the performing samples “eyes closed”, “eyes open”, as well as when filling the questionnaire by Liusin (2006), has shown a significant increase in the spectral power of high-amplitude rhythms (theta-, alpha-) during the test “eyes closed”, the increase in beta-rhythm power when filling the questionnaire ($p > 0.05$). It indicates the norm of the functioning of the brain structures in the students in question and makes it possible to transfer the results to the general totality.

Correlation analysis of psychometric indicators obtained from the results of the “EmIn” questionnaire by Liusin (2006) was aimed at studying emotional intelligence. It also revealed that psychology students at high and sufficient levels of emotional intelligence had less cognitive stress when working with the text of the questionnaire. The students from these groups were inclined to think and operate with abstract categories and make decisions based on logical analysis (as evidenced by the presence of higher rates of beta-rhythms power in the frontal lobes of the brain). The students

with below-average levels of emotional intelligence were at high levels of beta-rhythm power in the occipital leads.

EEG data have also made it possible to detect the weak left-hand desynchronization of alpha-rhythm and strong synchronization of theta-rhythm of the students with a high level of emotional intelligence.

These results coincided with existing studies on the features of emotional intelligence in the development norm (Barbey et al., 2012; Goleman, 1995; Krueger et al., 2009).

The scientific novelty of the obtained results is as follows: for the first time, theoretical approaches to studying emotional intelligence in scientific sources are systematized; the concept of “emotional intelligence” is deepened and specified; the criteria for development levels of emotional intelligence in the 1st and 2nd-year students majoring in Specialty 053 Psychology are defined; the neuropsychological features of future psychologists’ emotional intelligence are characterized.

The practical value of the obtained results lies in developing the model for studying neuropsychological features of emotional intelligence in future psychologists. The obtained results can be incorporated in professional training of future psychologists in higher education institutions, correctional and developmental programmes for forming emotional intelligence, manuals for psychology students.

Conclusions

The conducted study allows formulating the following conclusions.

The main factor in the psychologist’s work is direct communication with clients, which is based on the psychologist’s ability to control himself/herself and the situation, adjust and effectively build interpersonal interaction through understanding and sensitivity to the dynamics of emotional states and reactions, the ability to adapt to them. These abilities act as components of emotional intelligence.

Emotional intelligence is a complex integral quality that includes a set of cognitive, behavioural and emotional qualities and abilities that ensure awareness, identification, differentiation and regulation of one’s own and other people’s emotions (intrapersonal and interpersonal emotional intelligence).

A review of relevant scientific sources has identified areas of the brain involved in the activity related to emotional intelligence. However, the analysis of modern studies has shown that the biological basis, namely the brain correlates of emotional intelligence, are still insufficiently studied.

This article has shown that EI of the 1st and 2nd-year students majoring in Specialty 053 Psychology is mainly at average and initial levels. The peculiarities of developing EI in future psychologists at the beginning of their professional education are characterized by the following aspects:

- identification and differentiation of emotions is mainly due to understanding one's external manifestations, which determines the advantage of the development of interpersonal emotional intelligence over intrapersonal one;
- there are complications in understanding the motives and causes of both one's own and others' emotional reactions;
- insufficient understanding of one's own emotions causes difficulties in one's verbalization and formal reflection concerning emotions and feelings;
- the development of emotion management prevails over the development of understanding emotions; however, in the event of emotional situations, one can quickly lose control over one's emotional state.

The use of the EEG method has allowed the authors of the article to record the fact that the students with a high level of emotional intelligence in the state of rest are characterized by stronger excitation of the left anterior brain; the synchronization of some rhythms of electroencephalogram tasks under the perception of emotionally coloured information is more pronounced, which may indicate the advantage of EI over IQ.

Further research should involve the in-depth study of genetic correlates of emotional intelligence in future psychologists to further comprehensive programme created for forming and developing emotional intelligence in the 1st and 2nd-year students majoring in Specialty 053 Psychology.

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