

IMPACT OF VOCAL MUSIC TRAINING ON MENTAL HEALTH

Dr luxmi

Associate Professor RKMV Shimla

Dr Yuv Raj

IGMC Shimla

ABSTRACT

An growing number of people are beginning to acknowledge the healing potential of vocal music, which is a kind of expressive art that is firmly based in culture and emotion. The purpose of this research is to investigate the impacts that vocal music training has on mental health, with a particular emphasis on the ways in which it affects emotional well-being, anxiety reduction, and cognitive performance. The study reveals substantial increases in mood, self-esteem, and stress management among people who participate in regular vocal training. These gains were found using a mix of qualitative interviews and quantitative tests done with trained singers and non-musicians. Through the act of singing, neurochemical processes that are connected with pleasure and relaxation are activated. These processes include the release of endorphins and oxytocin, as well as the promotion of mindfulness and emotional control. In addition, taking part in group singing activities helps to develop social bonds and a feeling of belonging, which in turn contributes positively to psychological resilience. The results highlight how important it is to include vocal music into educational curriculum and therapies used in the field of mental health. The purpose of this article is to argue for a more widespread recognition of music-based treatments as supplementary tools in the search of holistic mental well-being.

Keywords: Vocal Education, Psychological Performance, Mental Health

Introduction

Over the last several years, mental health has become an increasingly important issue on a worldwide scale, with an increased focus being placed on holistic approaches to mental well-being practices. In spite of the fact that conventional treatments like psychotherapy and medicine continue to be essential, there is a rising interest in the role that alternative and complementary disciplines, such as the arts, play in fostering psychological well-being. In this category, vocal music training has garnered attention due to the significant impact it has on both the emotional and cognitive well-being of its participants. There is more to vocal music than simply an artistic expression; it is a multifaceted activity that stimulates numerous regions of the brain, including those that are responsible for memory, emotion, and language. Singing is a therapeutic activity because it requires regulated breathing, voice modulation, and emotional articulation, all of which add to the overall experience of engaging in singing. Throughout the course of human history, music has played an essential role in human society, serving as a medium for rituals, storytelling, and healing activities. In modern contexts, formal voice training not only serves as a creative outlet but also as a technique of releasing negative emotions and regulating one's own emotions. Research

conducted in the field of science has shown that participating in singing or vocal music may result in observable changes in key indices of mental health. Among them include decreased levels of stress hormones, better mood, elevated levels of self-confidence, and greater social ties. Furthermore, vocal training, especially when it is performed in a group environment such as choirs or workshops, promotes social connection and collaboration, which in turn reduces feelings of isolation and loneliness, which are elements that are often connected with melancholy and anxiety. The purpose of this study is to investigate the psychological advantages of vocal music training, investigate the processes by which it influences mental health, and give empirical data that supports the function of vocal music training as a therapy for mental wellbeing that is non-invasive, cost-effective, and easily accessible. The research also examines the ways in which regular vocal practice leads to mindfulness, emotional awareness, and cognitive advancement. It presents a persuasive argument for the incorporation of vocal practice into educational and therapeutic programs.

Literature Review

Over the course of history and in a variety of fields, the therapeutic benefit of music has been extensively established. A rising amount of research is starting to concentrate explicitly on vocal music training as a distinct kind of psychological intervention. While several studies have studied the wider influence that music has on mental health, this study is beginning to focus on vocal music training.

Juslin & Laukka (2004) the emotional power of music, especially vocal music, as a trigger for emotional catharsis and expression was highlighted as a significant factor. Individuals are able to express feelings that may be difficult to define verbally via the medium of singing, which provides a secure environment for the release and processing of these feelings. The findings of these investigations highlight the ability of vocalisation to regulate emotions and assist in the development of a feeling of emotional control.

Gick (2011) a detailed meta-analysis was carried out on the psychological advantages of singing in a choir. The results of the study indicate that those who participated in choral activities reported increased levels of life satisfaction, decreased levels of anxiety, and a stronger feeling of community. The systematic aspect of vocal training, which places an emphasis on breathing, posture, and vocal expression, has been related to enhanced mindfulness as well as a decrease in stress.

Kreutz et al. (2004) The physiological consequences of group singing were investigated, and it was shown that regular vocal engagement considerably lowered levels of cortisol, which is a fundamental marker of stress. This is consistent with the results that Kenny (2006) discovered, which demonstrated that vocal performance has the potential to boost one's self-esteem and create a feeling of success, particularly in teenagers and young adults respectively.

Livesey et al. (2012) emphasised the cognitive advantages of singing, stating that singers demonstrated increased memory recall and attention spans as a result of listening to and singing. The systematic repetition that is a part of voice training helps to strengthen auditory memory as well as executive processes, which further supports mental resilience.

In India, **Rao & Nair (2015)** attempted to investigate the possibility of using Indian classical voice music as a kind of treatment for those who are suffering from anxiety and depression. Based on their research,

they came to the conclusion that Raga-based vocal workouts not only helped improve mood but also lowered the physiological signs of stress, such as an elevated heart rate and blood pressure.

METHODOLOGY

Image Feature Extraction

In the process of creating video information, many frames of pictures are combined in a certain sequence. The process of investigating how to collect useful information and data from photos and how to produce digital image representation is referred to as feature extraction of images. These pieces of digital information that are taken from the picture are known as features. Using these vector or symbolic style characteristics, it is feasible for the computer to learn and recognise these features, which will allow it to accomplish correct identification and categorisation of pictures.

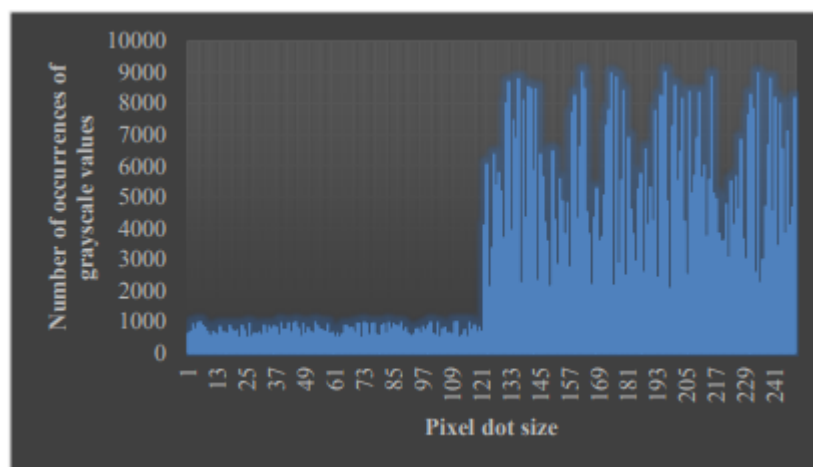


Figure 1: Grayscale Histogram.

There is a greyscale value associated with each every pixel in the greyscale picture. Figure 1 shows that the abscissa is used to indicate the size of the greyscale value of the pixel, and the ordinate is used to represent the number of times the greyscale value occurs in the picture. The intensity of a picture is reflected in the degree of grey value that is present in the greyscale. The most important method for determining whether or not an item or human body is present in a picture is to determine the gradient of the image. The edge is the most important component of the gradient. In most cases, we begin by converting the colour picture into a greyscale image, and then we proceed to determine the gradient value of the greyscale image. The colour in the picture, on the other hand, is readily impacted by the light intensity and angle; hence, turning the original image into a greyscale image can extract image characteristics more correctly and effectively than converting the image to either colour or greyscale. Following the extraction of the picture's feature information, the information may then be used for the purpose of applying image recognition. A method that may be regarded as the classification of photographs is known as image recognition. When we need to categorise photos, we often have to extract distinctive characteristics from them in order to represent the differences between them and other images. Therefore, in order to accomplish the goal of image classification, the characteristics of the picture should not only be able to represent the information that is exclusive to this image, but they should also be able

to differentiate themselves from other images based on this feature. While this is going on, the criteria that is used to determine whether or not a particular image feature is qualified is whether or not the feature has a lower degree of discrimination in picture groups that all belong to the same category. On the other hand, the degree of discrimination that exists between picture groups that belong to distinct categories need to be as high as it potentially may be.

Speech Feature Extraction

The mel-frequency cepstral coefficients (MFCC), the linear prediction coefficient (LPC), and the perceived linear prediction parameter (PLP) are the primary categories that are included in speech characteristics.

In most cases, an impulse response filter is used to preprocess the information that was originally derived from speech, frame the audio, and then optimise it via the utilisation of the windowing function. As a window function, the band-pass filter has the ability to evenly distribute each frame of speech and to produce an audio curve that is reasonably smooth. At the moment, the Hamming window function is the one that is used the most often. The sharpness of sound waves is enhanced, speech signals are made more continuous and smooth, and the spectral distortion that is generated by speech overlap is reduced as a result of this. One of the first applications of mel-frequency cepstral coefficients was the recognition of words in voice signals that were provided without interruption. Mel-frequency cepstral coefficients are able to successfully complete the job of voice recognition on account of their ability to simulate the principle of human hearing. A change in essential bandwidth may have a significant impact on the human ear's sensitivity. There are many various tones that may be found in a speech, and the frequencies that correlate to these tones are distinct from one another. The conversion connection between frequency and MFCC may be reflected by nonlinear transformation, and the computation of the conversion between the two is illustrated in Formula 1, where f represents the linear spectrum:

$$Mel(f) = 2595 * \lg(1 + f / 700) \quad (1)$$

Basic Bp Algorithm Formula Derivation

The basic BP network algorithm contains two propagation directions: forward propagation of the input signal and backward propagation of the output error, which means that the calculation of the actual network output is carried out in the direction from input to output, but the correction of the weights and thresholds of the network layers is carried out in the reverse direction from output to input, as shown in Figure 2.

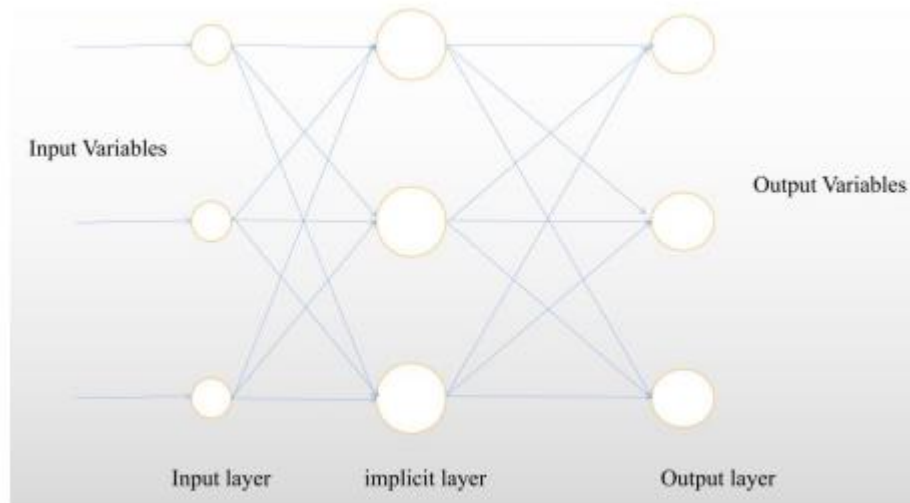


Figure 2: BP Neural Network Structure.

Forward propagation process of the input signal:

The input net_i of the i th node of the implicit layer of the network:

$$net_i = \sum_{j=1}^M w_{ij} x_j + \theta_i \quad (2)$$

The input y_i of the i th node of the implicit layer of the network :

$$y_i = \phi(net_i) = \phi\left(\sum_{j=1}^M w_{ij} x_j + \theta_i\right) \quad (3)$$

The input net_k of the k th node of the implicit layer of the network:

$$net_k = \sum_{i=1}^q w_{ki} y_i + a_k = \sum_{i=1}^q w_{ki} \phi\left(\sum_{j=1}^M w_{ij} x_j + \theta_i\right) + a_k \quad (4)$$

The input o_k of the k th node of the implicit layer of the network. :

$$o_k = \Psi(net_k) = \Psi\left(\sum_{i=1}^q w_{ki} \phi\left(\sum_{j=1}^M w_{ij} x_j + \theta_i\right) + a_k\right) \quad (5)$$

Voice Mfcc Parameters Calculation

The calculation process of MFCC parameters is shown in Figure 3.

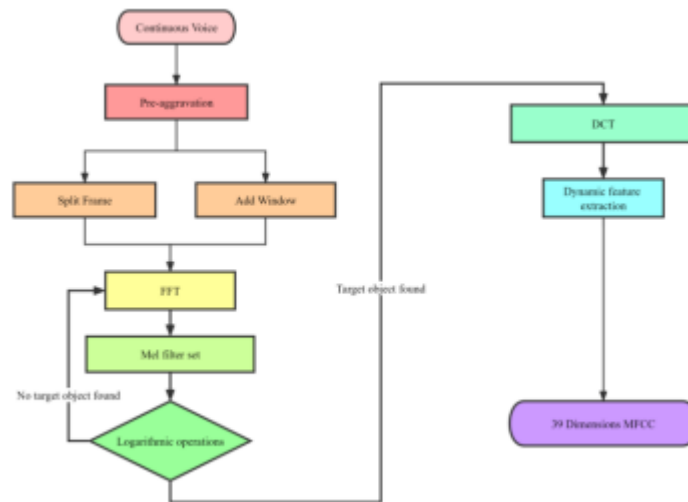


Figure 3: MFCC Flow Chart.

Before anything else, the procedure of pre-emphasis is used to amplify the high-frequency signal that is present in the speech. It is necessary to apply the pre-emphasis approach in order to provide a more balanced spectral signal. This is due to the fact that the amplitude of the high frequency signal in audio is lower than that of the low frequency signal. The technique of computation for the pre-emphasis is shown in the number (6).

$$y(t) = x(t) - ax(t-1) \quad (6)$$

Separate the signal into frames that are 20–40 milliseconds long, with 25 milliseconds being the typical length. A frame has a total of 400 sample points, which is equal to 16,000 times 25 divided by 1000, assuming that the sampling frequency of the voice stream is 16 kHz. In most cases, we will design subsequent frames to have sections that overlap, and we will move 10 milliseconds (instead of 25 milliseconds) each time. This indicates that the overlapping samples of adjacent frames are equal to (25 minus 10) divided by 1000 times 16000, which equals 240. Therefore, the first frame consists of the first 400 sample points, while the second frame is comprised of the sample points ranging from 160th to 560th total. In the event that the last frame does not have sufficient sample points for 400, we will often add 0 at the end. The DFT signal for each frame:

$$S_i(k) = \sum_{n=1}^N s_i(n)h(n)e^{-j2\pi n / N} \quad (7)$$

The length of the discrete Fourier transform (DFT) is denoted by K, and h(n) is an N-point window function (like the Hamming window). We are able to get an approximation of the power spectrum using S (k):

$$P_i(k) = \frac{1}{N} |S_i(k)|^2 \quad (8)$$

The Interaction Between Vocal Music Teachers and Computers

In his role as a computer operator, he is expected to have a comprehensive awareness of the characteristics of the computer, as well as the ability to organise, construct, and manufacture his own works or teaching courseware in accordance with the computers' features. As an example, you may make use of the benefits that computers provide in order to organise details and arrange teaching materials or works. The work or courseware is primarily made up of nine components that are organised in accordance with several principles. These principles include pitch, intensity mode, time value, and location. The fundamental components that function in accordance with various rules form new rules and new elements, and the world is made up of all of these elements that are constantly shifting and moving in accordance with various levels of rules. It is only when the computer "plays" in a precise manner that each individual musical part may conform to its own principles. During the process of presenting each musical element in accordance with its own set of laws, a sound picture that is both rich and colourful has been created. Suddenly, there is melody, suddenly there is harmony, and the shape of rhythm has altered thousands of times. Suddenly, movies, animations, and other images arise. These guidelines must be adhered to in order to achieve "long-term interaction" on the basis of scientific principles in the interaction that takes place between music instructors and computers. As a result of the idea of passive acceptance and interaction between music and pupils, it is possible for each individual to have a unique musical experience. When it comes down to it, everyone of us has a unique perspective on the world. The dirt on the surface seems to be disorganised, yet under the surface, there are regulations that are quite rigorous. It will communicate all of the material that is being taught in the classroom to the instructors of vocal music in a timely and correct manner. The teachers will be able to adapt their teaching in a timely manner, and they will also be able to send back the new information to the computer, which will allow the cycle to continue. However, if we do not comprehend and use the features of the computer, and if we do not engage with the characteristics of the computer in the classroom, then the digital teaching of vocal music and all that it conveys cannot be discussed.

In order to strengthen the interaction between the technical form of computer music and the digital vocal teaching, to give more and richer colours to the digital vocal teaching, and to emphasise the interaction between the humanistic aspects of computer music, particularly the interaction between the musical curriculum, vocal training, vocal performance, or lesson production and the characteristics of the computer, Diaol has the potential to make the establishment of new aesthetic principles of computer music possible. As a consequence of technological advancements and the provision of essential technical and hardware support for a digital voice education environment, computer music production technologies and multimedia systems have emerged as desirable outcomes.

The term "computer music production technology" refers to the technology that, via the use of appropriate hardware and software, allows for the editing and organisation of music information. The multimedia system consists of a computer with a wooden body and many external equipment, including a sound card, a synthesiser (or MID worker keyboard), audio production software, a sound source, a mixer, a digital recorder and a MID worker connection cable, a projector, and other similar items. It is possible for the

computer to derive information from the sound source, which can then be processed appropriately and converted into digital information on the hard disc. After that, the computer can use production software for each track of music to adjust the rhythm, melody, timbre, image level, reverb, delay, and other aspects of the editing process. Through the sound source, mixer, and digital recorder, digital information can be converted into sound information and recorded onto tape or CD, as well as other sound carriers.

RESULT ANALYSIS AND DISCUSSION

Pre- and Post-Test Results and Analysis of Mental Health Level

This experiment is a pre- and post-experimental design with a fixed group. The independent variables are: music appreciation and background music, and the dependent variables are the teaching effect of the mental health course, that is, the development level of college students' psychological quality and the subjective experience of the classroom. In this study, by adding aesthetic appreciation of background music to traditional mental health courses, it can improve the teaching effect of music mental health courses, and improve the psychological quality of college students and their subjective experience in mental health classrooms.

This study adopts a combination of quantitative research and qualitative research. On the one hand, a standardized scale is used; and so on. In the academic world, the reliability of qualitative research is generally not discussed at present, but the validity is guaranteed by the selection and control of research objects and the standardization of the research process.

Table 1: Difference Test of Unselected Group, Traditional Group and Music Group on Pretest

Factors	Mean			F- Value	P - Value
	Unselected groups	Traditional groups	Musi c Grou p		
Somatization	1.88	1.64	1.65	1.29	0.6
Interpersonal relationships	1.83	1.97	1.44	1.22	0.23
Depression	1.9	1.5	1.53	0.8	0.99
Anxiety	1.98	1.52	1.99	0.4	0.57
Hostility	1.67	1.68	1.71	1.95	0.29
Psychotic	1.88	1.9	1.74	1.01	0.78

First, at the beginning of the course, we administered the SCL-90 pre-test to the experimental class and the control class, and the results, as shown in Table 1, showed that there was no significant difference ($P>0.05$) in the pre-test of each factor of the scl-90 in all three groups, indicating that there was no significant difference in the pre-experimental psychological well-being between the unselected, traditional and music groups.

Regarding the subject matter, the incorporation of background music into the curriculum for mental health is an all-encompassing experience that encompasses both artistic aesthetics and psychological understanding. Through the enjoyment of background music throughout the teaching process, students not only experience the information and concepts that are transmitted by the instructor, but they also give full play to their emotional guiding function and emotional suggestion function. In addition, they unintentionally join the atmosphere of musical learning. It is easier for individuals to awaken their positive emotions and experience a sense of spiritual relaxation and security when they are in a classroom environment that is lively and relaxed. This is in line with the psychological demands that college students have to enter the psychological classroom in order to seek introspection and emotional experience. Not only does the aesthetics of classroom music have a direct impact on the experience of positive emotions and improve the learning attention of college students in the classroom, but it also further improves the teaching effect of mental health courses through this experience, promotes mental health, and ultimately leads to an improvement in the quality of mental health among college students and the realisation of the combination of aesthetic education and mental education.

Conclusion

A strong medium for improving mental health and emotional well-being, vocal music training is not only an artistic endeavour but also a potent medium for promoting mental health. It is abundantly obvious that participating in systematic voice training leads to a decrease in stress, anxiety, and depressive symptoms, while simultaneously enhancing self-esteem, cognitive function, and social connection. This is shown by the data that has been given via study and literature. Singing is a comprehensive form of self-expression and awareness because it includes a mix of physical, emotional, and psychological involvement. Singing is a form of expression that combines this combination. By encouraging deep breathing, mental attention, and emotional articulation, regular vocal practice helps to create psychological resilience. All of these factors play a crucial role in the development of psychological resilience. A sense of connection and belonging is fostered by group singing, which is particularly effective in the fight against feelings of isolation and loneliness. This further intensifies the advantages of singing in social settings. The findings of this research highlight the need of integrating vocal music training within educational as well as therapeutic contexts. Through the implementation of vocal music programs as additional therapies, educational institutions such as schools and universities, rehabilitation centres, and mental health clinics may reap the benefits. For the purpose of quantifying the long-term influence, further longitudinal research and clinical trials are required; nonetheless, the data that have been obtained so far are encouraging and point to a significant junction between music and mental wellbeing. The conclusion is that vocal music training is a strategy to improving mental health that is natural, does not include any intrusive procedures, and is easily accessible. We should acknowledge and support its capacity to heal, elevate, and alter the human psyche as part of our collective efforts to cultivate a society that is healthier and more emotionally balanced.

REFERENCES

- [1] Avidor, S.; Ayalon, L.: Changes in Positive and Negative Affect as Predictors of Change in Felt age: Results from the Health and Retirement Study, *The journal of Positive Psychology*, 12(6), 2017, 605-612.
- [2] Barker, E. T.; Howard, A. L. ; Galambos, N. L.: Tracking Affect and Academic Success Across University: Happy Students Benefit From Bouts of Negative Mood, *Developmental Psychology*, 2016(1), 2016, 10-15.
- [3] Beronio, K.: Intervention for Promoting Meaning in Life in Adolescents: Evaluation of the Process and Results, *Temas Em Psicologia*, 25(4), 2017, 1813-1828.
- [4] Brenner, V.: Drinking Under Control Programmes: Perception of Alcohol-Related Harm Reduction Measures in Poland. Results of Qualitative Study Among Outpatient Alcohol Treatment Providers, *Alkoholizm I Narkomania*, 30(3), 2017, 161-170.
- [5] Bunni.; Tobias.: From Social to Sale: The Effects of Firm Generated Content in Social Media on Customer Behavior, *Social Science Electronic Publishing*, 80(1), 2015, 47-51.
- [6] Gick, M. L. (2011). Singing, health and well-being: A health psychologist's review. *Psychomusicology: Music, Mind, and Brain*, 21(1-2), 176-207. <https://doi.org/10.1037/h0094011>
- [7] John, S.: Measuring the complex Syntax of School-Aged Children in Language Sample Analysis: A Known-Groups Validation Study [advance publication], *International Journal of Language & Communication Disorders*, 21(7), 2020, 65-66.
- [8] Juslin, P. N., & Laukka, P. (2004). Expression, perception, and induction of musical emotions: A review and a questionnaire study of everyday listening. *Journal of New Music Research*, 33(3), 217-238. <https://doi.org/10.1080/0929821042000317813>
- [9] Kreutz, G., Bongard, S., Rohrmann, S., Hodapp, V., & Grebe, D. (2004). Effects of choir singing or listening on secretory immunoglobulin A, cortisol, and emotional state. *Journal of Behavioral Medicine*, 27(6), 623-635. <https://doi.org/10.1007/s10865-004-0006-9>
- [10] Laura, H.; Alastair, C.; Daniel, F.: The Latent Structure of Negative Symptoms in the General Population in Adolescence and Emerging Adulthood, *Schizophrenia Bulletin Open*, 2022(1), 2022, 1.
- [11] Livesey, L., Morrison, I., Clift, S., & Camic, P. M. (2012). Benefits of choral singing for social and mental wellbeing: Qualitative findings from a cross-national survey of choir members. *Journal of Public Mental Health*, 11(1), 10-26. <https://doi.org/10.1108/17465721211207275>
- [12] Merry, M.; Silverman, M. J.: Effects of Patient-Preferred Live Music on Positive and Negative Affect and pain with Adults on a Post-Surgical Oncology Unit: A Randomized Study, *The Arts in Psychotherapy*, 72(3), 2021, 101-109.
- [13] Qi, Y.: Positive and Negative Affect in the Daily Life of world Trade Center Responders with PTSD: An Ecological Momentary Assessment Study, *Psychological Trauma : Theory, Research, Practice and Policy*, 12(1), 2021, 75-83.

- [14] Rachel, S.; Richard, E.; Adrian, W.: The Role Of Cognitive and Metacognitive Factors in NonClinical Paranoia and Negative Affect, *Psychology and Psychotherapy*, 91(2), 2019, 169-185.
- [15] Rao, M., & Nair, R. (2015). The therapeutic use of Indian classical music in the management of depression. *Indian Journal of Psychiatry*, 57(4), 403–405. <https://doi.org/10.4103/0019-5545.171826>
- [16] Sense,F.; Maab,S.; Gluck,k.; van rijm,H.: Within-Subject Performance on a Real-Life, Complex Task and Traditional Lab Experiments: Measures of Word Learning, Raven Matrices, Tapping, and CPR, *Journal of Cognition*, 2(1), 2019, 35-40.
- [17] Setyadharma, A.; Bowo, P. A.; Suseno, D. A.: A New Insight of Specification Error in Regression: Excluding Education Variable from a Model, *IOP Publishing Ltd*, 4(8), 2022, 125- 130.
- [18] SmithKline.: More Than a (negative) Feeling: Validity of the Perceived Stress Scale in Serbian Clinical and Non-Clinical Samples, *Psihologija*, 48(1), 2015, 5-18.
- [19] Volkhard, S.; Roland, J.; Wolfgang, J.: Results of the Statistical Linear Mixed Effects Model, Separately for (1) the Objective and Subjective Measures And (2) the Cross Test, Mallett Tests, and Nonius Bias Tests, 12(3), 2015, 19-21.
- [20] Young, K.S.: Neuroticism and Negative Affect Measures as Predictors of Psychological Distress, *Psychological Reports*, 75(1), 2016, 321-324.