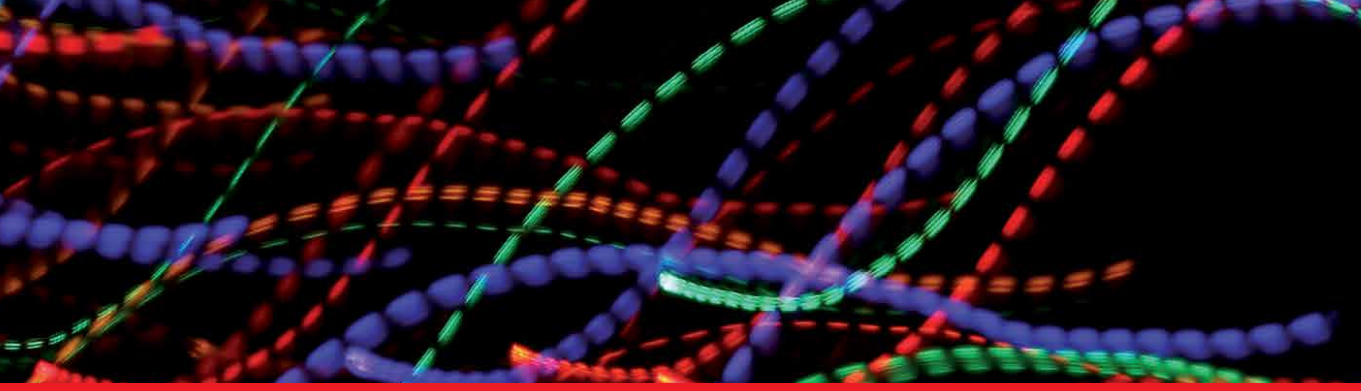

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The Science of Emotional Intelligence

Edited by Simon George Taukeni

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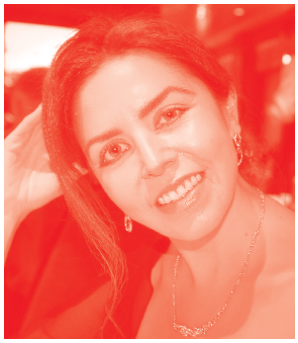

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The Science of Emotional Intelligence
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Edited by Simon George Taukeni

Contributors
Mohammad Zavid Parvez, Tasmi Tamanna, İlkay Ulutaş, Kübra Engin, Emine Bozkurt Polat, Lukman Setiawan, Tom Buqo, Mary Grace B. Lubguban, A. Rıza Sonkaya, Zeynep Z. Sonkaya, Carmen Carpio De Los Pinos, Arturo Galán González, Ajay K. K Jain, Nazatul Shima Abdul Rani, K. Sarojani Devi Krishnan, Zurinah Suradi, Nurita Juhdi, Daniel Bernabé, Bruna Sarafim-Silva, Lorraine OB Madden, Rebecca Reynolds, Katarzyna Stapor, Krzysztof Kotowski, Ana Junça Silva, Tal Dotan Ben-Soussan, Patrizio Paoletti, Anjali Daisy, Kovvali Bhanu Bhanu Prakash, Appidi Adi Sesha Reddy, António Caetano, Rita Rueff Lopes

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Meet the editor

Simon George Taukeni is an author, editor, and academic. He has been working at the University of Namibia since 2011. He is also a part-time tutor at Namibia University of Science and Technology (NUST). He is a former post-doctoral research fellow at the University of Fort Hare, South Africa. Dr. Taukeni has a Ph.D., MPH, MEd, and BEd, as well as a specialized postgraduate diploma in Behavioral and Emotional Disorders. He has collaborated with many local and international researchers and scholars in his capacity as an editor, internal and external examiner, and principal project investigator.

Contents

Preface XIII

Chapter 1 1
The Science and Philosophy of Emotional Intelligence: A Pragmatic Perspective
by Ajay K. Jain

Chapter 2 21
The Process of Emotional Regulation
by Lorraine OB Madden and Rebecca Reynolds

Chapter 3 31
Emotional Intelligence, Identification, and Self-Awareness According to the Sphere Model of Consciousness
by Patrizio Paoletti and Tal Dotan Ben-Soussan

Chapter 4 47
Emotional Intelligence for Coping with the Consequences of Childhood Trauma
by Bruna Amélia Moreira Sarafim-Silva and Daniel Galera Bernabé

Chapter 5 57
Strategies to Develop Emotional Intelligence in Early Childhood
by İlkay Ulutaş, Kübra Engin and Emine Bozkurt Polat

Chapter 6 75
Machine Learning and EEG for Emotional State Estimation
by Krzysztof Kotowski and Katarzyna Stapor

Chapter 7 93
Cognitive Load Measurement Based on EEG Signals
by Tasmi Tamanna and Mohammad Zavid Parvez

Chapter 8 103
Neuromarketing: The New Dawn and Disruption in Marketing Research
by Kovvali Bhanu Prakash and Appidi Adi Sesha Reddy

Chapter 9 119
Emotional Responding and Adversity
by Tom Buqo

Chapter 10 129
Brain Networks of Emotional Prosody Processing in a Foreign Language Versus Mother Tongue
by Zeynep Z. Sonkaya and A. Riza Sonkaya

Chapter 11 137
Humor Daily Events and Well-Being: The Role of Gelotophobia and Psychological Work Climate
by Ana Junça Silva, António Caetano and Rita Rueff Lopes

Chapter 12 153
Emotional Intelligence as a Haruspex of Societal Aftermath in Adults with Asperger Syndrome
by Anjali Daisy

Chapter 13 161
Critical Dimensions of EQ among Malay Women Entrepreneur in Malaysia
by Nazatul Shima Abdul Rani, K. Sarojani Devi Krishnan, Zurinah Suradi and Nurita Juhdi

Chapter 14 177
Emotional Competence of Women Administrators
by Mary Grace B. Lubguban

Chapter 15 185
The Effect of Emotional Intelligent on Team Performance: A Case Study of a Government Hospital
by Lukman Setiawan

Chapter 16 195
Facilitating Accessibility: A Study on Innovative Didactic Materials to Generate Emotional Interactions with Pictorial Art
by Carmen Carpio de los Pinos and Arturo Galán González

Preface

This book is an edited volume consisting of chapters focusing on the science of Emotional Intelligence (EI). With the world facing the COVID-19 pandemic, people across the globe need their EI to battle and overcome the challenges and conflicts due to the pandemic and other social ills. EI is generally defined as the ability to understand, use, and manage one's own emotions in a positive way to relieve stress, communicate effectively, empathize with others, overcome challenges, and defuse conflict [1]. Nearly all chapters in this book are contextualized within the paradigm of this given definition.

It has been observed that the current pandemic has brought about a 'new normal', schools and higher education institutions are adversely affected putting learners, students and staff under overwhelming pressure and stress. It is therefore important to justify the significance of EI, which can help people build stronger relationships, succeed at school and work, and achieve career and personal goals. It can also help an individual to connect with one's own feelings, turn intentions into action, and make informed decisions [1]. Indeed, the book unearths the best ways to mend broken relationships and loss of hope. The book was informed and based on the four common attributes of EI, namely: self-management, self-awareness, social awareness, and relationship management.

Chapters cover such topics as the science and philosophy of EI; the process of emotional regulation, EI, identification, and self-awareness; EI for coping with consequences; strategies to develop EI in early childhood education; machine learning and EEG for estimating emotional state; cognitive load measurement based on EEG signals; neuromarketing; emotional responding and adversity; brain networks of emotional prosody processing; humor events and wellbeing; EI as a haruspex of society; critical elements of EQ among Malay women entrepreneurs; motional competence of women school administrators; the effect of EI on team performance; and facilitating access to generate EI.

The book is useful for readers in different sectors and professional disciplines, including education, business management, law, psychology, public health, mental health, and other health sciences, among others.

As academic editor of this book, I would like to thank the technical staff of IntechOpen, specifically Commissioning Editor Ms. Dajana Pemac and Author Service Manager Ms. Maja Bozicevic, both of whom contributed significantly to the editorial process. Thank you so much.

Simon George Taukeni
University of Namibia,
Namibia

References

[1] Segal J, Smith M, Robinson L, Shubin J. Improving emotional intelligence. Accessed online. 2020.

Chapter 1

The Science and Philosophy of Emotional Intelligence: A Pragmatic Perspective

Ajay K. Jain

Abstract

This article is aimed at exploring the relevance of the concept of emotional intelligence (EI) from a pragmatic perspective. Although the empirical and conceptual articles are written and published on EI, however it does not suffice the purpose for a practitioner of EI who is naïve to the field of EI, either s/he does not understand the psychological literature or does not have time to study EI in great details. Hence, this article is written from a naïve perspective to make the concept useful and that could be used in our daily life. Drawn from psychological literature, this article is simplifying a complex relationship between human intelligence and emotions and clarifies our understanding about the cognitive and affective spheres of human personality. Further, the article also explains the evolutionary or biological basis of EI and also suggests a managerial use of EI for the field of leadership and decision making. The chapter concludes with a developmental focus of EI. The article is mainly using observations and anecdotes based on the author's personal experience from his training programs with more than ten thousand managers in India and taught students in Denmark, Italy and South Africa.

Keywords: Cognitive Intelligence, Emotions, Evolutionary Perspective, Role Modeling, Managerial Perspective, Leadership and Decision Making, Developmental Perspective

1. Introduction

The word emotional intelligence (EI) has been popularized by two psychologists from Yale University, Peter Salovey and John Mayor in the year 1990 [1]. Later, Goleman [2, 3] has published two books on this concept and its relevance in our daily life and Bar-On [4] has developed a psychometric test consisting of 133 items to measure emotional intelligence. Although the word EI seems to be relatively new, however it has its roots in the literature on cognitive intelligence. Researchers argued that the definition of intelligence, an ability to adapt with the one's environment [5, 6], give space to the construct of emotional intelligence. Researchers have argued that there are multiple intelligences [7]. Since research papers are relatively difficult to understand for managers and practitioners of management to understand and utilize the concept of EI in their daily life, therefore I am aiming at explaining the concept of emotional intelligence by adopting the following perspectives; (1) Intelligence and Emotions: A real misunderstanding (2) Psychological Perspective (3) Evolutionary Perspective (4) Managerial Perspective and Laws of Decision Making (5) Developmental Perspective.

To explain these perspectives, the article adopts a very pragmatic approach to make the concept useful and relevant for people in general. I have adopted various anecdotes and stories to explain these various approaches based on my extensive training experiences with more than several thousand managers over two decades.

1.1 Intelligence and emotions: Does intelligence solve emotional problems?

The word emotional intelligence seems to be an oxymoron because if someone is intelligent then s/he is not emotional and if someone is emotional then s/he is not intelligent. Else, do emotions have intelligence or intelligence uses emotions (hot cognitions)? It is a long standing belief held by behavioral scientists, researchers and practitioners of management that "intelligent people should not be emotional and emotional people are lacking in intelligence". Nevertheless, Intelligence has evolved as a scientific construct [8] then research studies on emotions. Mostly researchers have ignored working on the concept of emotions at the work place, except job satisfaction and work stress. Meanwhile several intelligence quotient (IQ) tests were developed by psychologists to measure one's IQ and it has become a major determinant of one's success in school education or at work place. However, not much tests were developed to measure the role of emotions at the work place.

What psychologists believe is that history of psychology is the history of cognitive intelligence. Psychologists, teachers, and parents all got obsessed with the concept of IQ in Indian context and which they want to develop among their students and children. In schools, it has become the criteria of admission in the schools/colleges/universities and for the selection at work place. Most of the entrance tests (GRE, GMAT, JEE, CAT) are heavily inclined to measure one's IQ or memory. IQ has been defined as a ratio of mental age to chronological age multiplied by 100. If someone scores 110 unit of IQ then it means s/he is better than individuals who posses 90 units of IQ. Moreover, Math, Physics, Chemistry, Biology, Finance and Accounting etc. have become the parameters of someone's IQ over those who study arts, games, painting, music, sculpture etc. All parents want their children to focus on Math then on other subjects related to Arts, Sculpture, Music, Paintings, Sports, etc. Most Indian parents want their children to become either an engineer or a Doctor. IQ has become a differentiating factor between successful and non successful students or employees based on the normative structure of the Indian society. Indian society defines a successful person as who possesses high IQ and gets into top institutions or organizations. IQ and social success were made to be related to each other.

However IQ does not explain much variance in health, happiness, psychological well being, satisfaction, commitment, loyalty, altruism and helping behavior, cooperative behavior, kindness, ethics and transformational leadership behavior etc. Hence IQ model of human development has got a few limitations whether high IQ person would be happier or high IQ person are more motivated or high IQ persons have a better interpersonal relationship with family, friends and colleagues or do they manage conflicts better. High IQ model does not answer these questions satisfactorily.

Furthermore, Simon [9] has proposed the concept of "bounded rationality" to explain the decision making phenomena and suggested that human being look for a *satisfying* solution rather an optimal solution of any problem due to the limitations of their intelligence, information and time. A satisfying solution is fundamentally based on heuristics rather rational approaches. So one cannot be fully aware of all the facts and details required to make a certain decision rather one look for an optimum solution based on limited facts and data. Also, human mind has a limited capacity to processes the information available to it so it depends on several

heuristics models of decision making. The concept of "heuristics and decision making" is popularized by Kahneman [10] while working on models of human irrationality. He claimed that "cognitive biases" (unconscious error of our reasoning) distort our judgment of the world in which we live and operate. They have also used the word, "*affect heuristic*" to explain why leaders frame their message to activate emotions than those framed in a purely factual way. Therefore, psychologists started looking at the role of emotions with regard to human decision making process. Once someone gets emotional, s/he loose rationality. Practically it is impossible to distinguish between cognitive and affective bases of decision making in a problem situation. Consequently, psychologists have shifted their attention to non-IQ factors of success in life and to other attitudinal and dispositional variables which gets regulated by affective processes. Thus IQ does not remain an absolute concept rather becomes a relative concept. It means that IQ becomes ratio between "how much IQ someone possesses" and "how much IQ someone uses" for practical purposes under emotional and other situational constraints. To explain this logic, I will narrate an incident that took place with me.

1.1.1 An anecdote

I, along with my family, shifted to Aarhus University, Denmark on a post doctoral assignment for a period of two years. The event took place with me on 3rd September 2013 that is my wife's birthday and I am always under some psychological pressure with a thought of how to celebrate to please her. On that day, I bought a gift, flowers and a cake and reached to VRI football club in Risskov by six pm, where my 6-year old son was going to play football. The idea was to cut a cake and go for dining somewhere in the main town by a local bus scheduled at 6.10 PM from the VRI club. When I reached the playground, my wife did not like the cake and gift and started arguing with me and uttering the same sentences, "you will never learn how to celebrate wife's birthday." I become upset and started defending myself. Meanwhile we walked to the bus stand to catch the bus and started changing the clothes of my son to put on some normal dress in place of football uniform.

What went wrong during this period while we were arguing is that we were standing on the wrong side to catch the bus rather than standing on the side where the bus will go toward the town? Since we were arguing and did not realize our mistake that we are waiting on the wrong side. We saw that bus is leaving and next one is scheduled after an hour. You can imagine my plight what would have happened afterwards. Still I have not forgotten while writing this chapter in 2020.

This story clearly indicates that I might be high in IQ but it did not help me take a rational decision of choosing the right side to wait for the bus. Thus having IQ is not enough rather how much we use under difficult conditions is a relative IQ available with us for all practical purposes. IQ is not a fixed concept, "one time high on IQ, all time high on IQ", rather it varies due to the impact of emotional and situational reasons.

1.1.2 A real misunderstanding

Since most parents want their children to possess high IQ and for all practical reasons the examination scores, especially in math and science, as they are considered to be an indicator of their high IQ. In India, many students score 100 percent during their 10th and 12th standard. According to data shared by Central Board of Secondary Education [11], 1,99,884 students scored 90 and above marks in the Mathematics paper. "The number of students with 100 marks in

Mathematics is 3,131. The highest number of perfect scorers is for Social Science, in which 6,469 students secured 100 marks. Of total number of students from 12th Grades in 2018, 1,818 candidates scored a perfect 100 in economics, while in psychology and political science the same feat was achieved by 659 and 660 candidates, respectively. A total of 726 candidates scored 100 in mathematics [11]. However, according to the data compiled by National Crime Record Bureau (NCRB), "Every hour one student commits suicide in India, with about 28 such suicides reported every day and the NCRB data shows that 10,159 students died by suicide in 2018, an increase from 9,905 in 2017, and 9,478 in 2016. According to Lancet report [12], suicide rates in India are highest in the 15–29 age group — the youth population.

The question is if the students have received very high marks in 10th and 12th standard and that is an indicator of his/her superior mental capacities, so why do such students commit suicide? So what goes wrong with those students who committed suicide or suffer with psychological disorders, despite very high marks, but they might be failed in some entrance test even after scoring good marks. So can we argue that they were unable to control their negative affective state and are not ready to accept the situation of a failure because they were consistently getting good marks since their childhood days? So they were not prepared to meet with such a sudden failure as they have never seen high protective and supportive environment in their family and schools. It is also possible that cognitive skills are easier to teach than emotional skills or development of emotional skills is compromised over cognitive skills.

According to an estimate, a pool of 13376 seats were available across twenty three Indian institutes of technology for the population of 9, 41,000 applicants [13]. So it means 1.4% students have chance to get into a top ranked engineering institutes. How to cope and what to do under the situation of failure due to high parental expectations or peer pressure or social status. Thus IQ perspective does not explain why a student with high IQ commits suicide or fall mentally sick? Why highly educated leaders or entrepreneurs become abusive? Why rich people are corrupt? Why powerful people involves in extra marital affairs at the cost of their career or image? To explain it, I would like to adopt psychological perspective to explain a complex relationship between cognition and affect.

2. Psychological perspective

Psychology has traditionally identified and studied three components of human personality: cognition, affect, and conation [14]. Cognition refers to an implicit process of knowing the real world and it is related to our rational and logical thinking, learning and remembering, analysis and prediction etc. The concept of intelligence belongs to cognitive aspect of human personality wherein "*Intelligence is the aggregate or global capacity of the individual to act purposefully, to think rationally and to deal effectively with his environment* [5].

Affect refers to the *emotional interpretation* of perceptions, information, or knowledge. It is generally associated with one's attachment (positive or negative) to people, objects, ideas, etc. Mood and feelings are related to affective aspects of human personality. In several social psychological experiments, it is confirmed that mood or emotion directly affects the cognitive skills or functioning of memory. For example, people tend to forget things quickly when they are exposed to highly irritating or depressive movie while remembering things better under a positive mood condition. It means there is a complex interrelationship between cognitive and affective processes.

Conation (or motivation) refers to the personal, intentional, planned, deliberate, goal-oriented, or striving component of motivation, the proactive (as opposed to reactive or habitual) aspect of behavior [15]. Cognitive, affective and conative aspects interact with each other in any situation but one may dominate other in some cases. Out of above three components, cognitive aspects were emphasized more because of its link with IQ and decision making. However, as discussed above, rationality has its limitations in the process of understanding and explaining the events. It ignores emotional side of decision making and each one of these components has their own merits. To understand EI, cognitive and affective aspects are more important than conative aspect. Let me explain how cognitive and affective processes work with the help of three cases.

2.1 Case A. when an individual behavior is purely driven by his/her cognitive processes

This case is of a teacher who was living in small village near to capital of Uttar Pradesh, Lucknow. He was an excellent teacher of math, physics and chemistry. He had three sons and taught math and science to his children. After getting good marks in their 10th and 12th standard, they all qualified the IIT-JEE and get into the IITs to pursue their engineering course. After their B Tech, they went to the USA to pursue their dreams of higher education on scholarships. They all did their master and got a wonderful job in the USA itself. Subsequently, they got married and settled down in America. Back home, the poor teacher has become old and got retired from his job in the age of 58. On several occasions, he requested his children to come back to India. But none of them have entertained his request. He was completely ignored by his three sons. All of them they stayed in the USA. After few years the poor teacher passed away and they came to attend his funeral and returned to the USA.

Similar to this case, there are many incidences where adult children have tried to get rid-off their parents in a planned and unusual ways in India, where parents are integral part of a person's life. Thus the question which can be asked is whether these children were lacking in cognitive intelligence or lacking in emotions of love, respect, empathy, kindness or gratitude. Why none of them offered help? Does it mean that when we are focused on the development of cognitive intelligence then the emotional development gets hampered? Is it more likely that cognitively intelligent doctors, engineers or civil servants end up their career in becoming more selfish or obsessed with their own career success? Is life all about the career success? Now we turn to Case 2 to understand the role of affective processes (emotions, feelings, and mood) to explain and understand human behavior.

2.2 Case B. when an individual behavior is purely driven by his/her affective process

On October 27, 2018, Deepika Chauhan, assistant vice-president of a private bank in Cyber City of Gurugram, died after falling from the balcony of her apartment in Valley View Estate condominium. The police had arrested her husband Vikram Singh Chauhan and his paramour Shefali Bhasin Tiwari in connection with the case. (From Hindutan Times).

Vikram has planned a murder of his wife (Deepika) because he was in love with Shefali. He has allegedly pushed her from the balcony of their eighth floor apartment on the night of Karvachauth (wives are fasting for their husband's long life). Few days before, Shefali and Vikram failed to push her (Deepika) off a cliff in Nainital. Investigators probing the case had said that at 7.43 pm on that day, Shefali

had sent a message to Vikram that read, "Balcony se phek do (Throw her from the balcony)" (Hindustan Times).

This is a case of an illicit relationship of a married man with another woman. He was in love to that extent he planned the murder of his wife and did not find anything wrong in committing such a crime. Vikram is a senior executive in a multinational company.

Similar to this, the world is full of such incidences where husband or wife has planned a murder of their own spouse. The mindboggling question is, "how emotion of love has taken over the cognitive capacities of such successful people". Does it mean that emotions ruin our cognitive intelligence? Does it make us blind of facts and repercussion of our own actions? What is the power of emotions of love or hate, greed, jealousy, ego, sense of absolute power etc. Let us turn to case 3 to understand an adequate mix of cognitive and affective processes in decision making.

2.3 Case C. when an individual behavior is driven by a mix of cognitive as well as affective processes

A young man was pursuing his Bachelors of Arts degree from Patna University along with his childhood girl friend. Once they have decided to disclose their love to their parents to seek their permission for the marriage. The boy approached girl's father, who was a professor of History, in the same university, to take his permission for the marriage. But the girl's father clearly refused, although he knew the boy and his family for many years, and told him that he would marry his daughter only to an IAS officer (Indian administrative service). After having some discussion, the boy asked girl's father, whether it would be acceptable for him if he becomes an IAS within two years period. Since the girl was pursuing the bachelor's degree so she had enough time before her marriage. The Girl's father agreed to his request and chose to wait for until next two years for her daughter's marriage. Surprisingly, the boy has become an IAS within two years and got married to his childhood girl friend. Today he is at the secretary level position in the central government of India.

There are many such stories of love affairs wherein a normal person got inspired to an extent to become a doctor, engineer or IAS officer because of his or her love toward someone. Does it mean that love makes someone more responsible or a better citizen or a nice human being? How the love of Vikran (Case B) is different from love of this boy, who became IAS. Does it mean emotions can enhance cognitive functioning on the one hand and conative processes on the other hand, to the extent that he set a challenging goal and dedicated his efforts in achieving that goal.

First case indicates that cognitive intelligence makes us selfish, second case indicate that affective process can make us blind but a combination can develop a sense of balance and a holistic approach to human behavior. Obviously third case is related to **"the power of emotional intelligence".** Here emotions are not hurdle rather they become a source of motivation and risk taking, and help adopting a long term perspective in life.

2.4 Definition of emotional intelligence

Based on the above cases, we can now define, "what is emotional intelligence"? Emotional intelligence, in contrast to cognitive intelligence, is an ability to perform under stressful conditions through cognitively controlled affective processes [16]. In this definition, one can note that cognitive and affective aspects of human personality are of primary importance while conative is secondary to emotional intelligence. Thus an appropriate combination of cognitive and affective processes leads to a better understanding of the situations and problems before attempting to solve

them. Thus EI makes people more aware of emotions in one self and emotions of others. The basic skills of "awareness of emotions in self and others" lead to a higher order of skill that is "regulations of emotions in self and others" for the purpose of achieving their goals under any stressful conditions. So cognitive intelligence works well under normal conditions of life, however emotional intelligence is needed under stressful conditions. Cognitive intelligence can work well only when someone remains cool and calm under a difficult situation. Otherwise stress can lower down the functioning of our mental capacities. Emotional intelligence help creating the environment in which cognitive intelligence would play its role more effectively. The challenge for a human being is to learn, "how to control emotions and focus on long term goals before letting cognitive intelligence should perform? In brief, the idea of Emotional Intelligence (EI) is related to the ability to accurately perceive and identify emotions in one self and others, understand and use of emotions to enhance cognitive (conative) processes, and effectively manage one's own emotions as well as those of others to produce performance or results under high stressed conditions. Thus emotions purify cognitions while cognition gives directions to emotions. Thus emotional energy becomes a long term and consistent source of motivation for the individual's cognitive functioning e.g., Case C. The boy has become a senior government office by regulating over his emotions and performed through his cognitions keeping a long term perspective to his life and career.

3. Evolutionary or biological perspective

Psychological perspective is limited to interplay of cognitive, affective and conative aspects of emotional intelligence. But a question is often asked, whether EI has any biological or evolutionary base or whether EI is a psychological skill without any biological origin. Many biological psychologists have explored the neurological basis of EI and relate it with the structure of human brain. According to neuroscientists, human brain has three major parts: 1. brain stem, which controls motor function, 2. limbic or emotional brain and 3. prefrontal cortex or rational thinking brain. According to biologists, prefrontal cortex (PFC-located near the front part of the head) is responsible for cognitive functioning (e.g., problem solving, decision making, logical thinking etc) and the researchers state that the prefrontal cortex controls what decision a person makes when faced with an emotional reaction and also regulates anxiety.

However, limbic system plays a critical role in the activation of emotions like fear and love. While the limbic system is made up of multiple parts of the brain, the center of emotional processing is the amygdala, which receives input from other brain functions, like memory and attention. The amygdala is responsible for multiple emotional responses, like love, fear, anger and sexual desire and any damage to the amygdala can result in abnormal emotional responses or overstimulation causes excessive reactions. The other parts of limbic system are hippocampus and hypothalamus that sends information to the amygdale and acts as a regulator of emotion, controlling levels of sexual desire, pleasure, aggression and anger. Thus limbic system (emotional center) is a pathway to prefrontal cortex (rational center). However, in a study on combat veterans from the Vietnam Head Injury Study, psychologists also showed that any damage to prefrontal cortex hinders the perception and integration of emotional information, and damages the ability to understand and regulate emotions. Thus human brain plays a critical role in the decision making under highly volatile and complex conditions and PFC and limbic systems acts as a unit to process emotional information and the subsequent decision making.

However, when the situation is emotionally volatile then it is more likely that decision can be made by the limbic system alone, without PFC processes the

information. According to evolutionary biologists, limbic system is a primitive part of the human brain and prefrontal cortex or neo cortex has evolved much later. Limbic system may create a tendency to spend and consume without any regard to the long term consequences, the addiction to instant gratification and the rejection of self denial and sacrifice, lack of patience and civility in society, micro term decision making by business and political leaders and on and on. Human brain has a capacity to process the emotional information faster than the logical information. Therefore, under high stress condition, limbic system may react faster than prefrontal cortex. Decision made by limbic system is not necessarily based on facts and available information. So limbic system can keep you away from making a good decision.

Thus the reactions made by limbic system are necessarily originating from extreme emotions of love, greed, rage, jealousy or ego. One can understand the effect of limbic system on our behavior with a story from Mahabharata. When the war of Mahabharata was over; Ashwatthama (last warrior from Kaurav's camp) planned an attack on Pandava's camp at night. He wanted to please his commander, Duryodhana, with this attack or action. Ashwatthama butchered all five children of Pandavas in their sleep. This act of cowardness of Ashwatthama was not even approved by Duryodhana. In the entire story of Mahabharata, this act was highly criticized by those who have written a commentary on Mahabharata. The story depicts an example of human behavior under the influence of extreme emotions of rage, revenge and jealousy. In fact, the entire Mahabharata can be summarized into two emotions that are **insult and revenge.** Kaurav's had hated Pandavas since their childhood days. Under the conditions of lust, jealousy, ego, greed etc. one can lose control over his behavior and may do sinful acts of harming weak or incapable person or animal or plants.

Another example of instinctual aggressive behavior is of a rape victim, a 23-year-old woman, Jyoti Singh. While she and her male friend, were returning home on the night of 16 December 2012 after watching the film Life of Pi in Saket, South Delhi. They boarded the bus at Munirka for Dwarka at about 9:30 pm. There were only six others on the bus, including the driver. One of the men, identified as minor, had called for passengers telling them that the bus was going toward their destination. Her friend became suspicious when the bus deviated from its normal route and its doors were shut. When he objected, the group of six men already on board, including the driver, taunted the couple, asking what they were doing alone at such a late hour. During the argument, a scuffle ensued between her friend and the group of men. He was beaten, gagged and knocked unconscious with an iron rod. The men then dragged Jyoti to the rear of the bus, beating her with the rod and raping her while the bus driver continued to drive. A medical report later said that she suffered serious injuries to her abdomen, intestines and genitals due to the assault, and doctors said that the damage indicated that a blunt object (suspected to be the iron rod) may have been used for penetration. That rod was later described by police as being a rusted, L-shaped implement of the type used as a wheel jack handle (from Wikipedia).

In the court trial, four of the accused were executed to the death penalty on 20th March 2020. This incident is nonetheless is not less aggressive then incidence of killing children in sleep by Ashwathamma. This is not just one case of the rape of a girl rather clearly evident that "what people can do once they are under the influence of extreme emotions of "lust, violence and aggression" and unable to understand the long term repercussion of our own actions.

3.1 The concept of Amygdala Hijack

These two abovementioned case are a good evidence of highly charged emotional behavior when rational thinking is completely ceased. This is termed

by scientists as Amygdala hijack where in a person is involved to satisfy his/her immediate emotional urge without considering its long term impact on their career and life.

The amygdala hijack is an immediate, overwhelming emotional response with a later realization that the response was inappropriately strong given the trigger. Goleman [2, 3] coined the term based on the work of neuroscientist Joseph LeDoux, which demonstrated that some emotional information travels directly from the thalamus to the amygdala without engaging the neocortex, or higher brain regions. This causes a strong emotional response that precedes more rational thought.

Under normal circumstances, you process information through your neocortex or "thinking brain" where logic occurs. The neocortex then routes the information to the amygdala, a small organ which lies deep in the center of your "emotional brain." On occasion, there is a short circuit whereby the "thinking brain" is bypassed and signals are sent straight to the "emotional brain." When this happens, you have an immediate, overwhelming emotional response disproportionate to the original event. The information is later relayed to higher brain regions that perform logic and decision-making processes, causing you to realize the inappropriateness of your original emotional response.

Why does this happen? Hundreds of thousands of years ago this type of immediate emotional response served a purpose. Imagine you were out collecting food for your family. Along the way, you found yourself face-to-face with a ravenous, four-legged creature that also happened to be out looking for a snack. In this situation, your brain would waste no time in rational thinking. Thanks to the amygdala hijack, you would bust be thrown into a flight or fight response, and hopefully survive to tell the story.

In modern life, of course, we are unlikely to encounter ravenous, blood-thirsty beasts. We are, however, almost certain to encounter drivers that cut us off, disrespectful colleagues, children that misbehave, and countless other situations that may very well lead to the occasional amygdala hijack. So what to do to prevent the negative effect of amygdala hijack on our behavior and use the same to safeguard ourselves? The short answer lies in becoming more emotionally intelligent human being rather driven purely by emotions which have a strong biological origin on which you do not have direct control. Similarly, individuals who are high on EI can cope better with the problem of COVID-19 keeping a long term perspective in mind.

4. Managerial perspective and principles of decision making

The managerial perspective is based on the idea of managing emotions for the purpose of taking effective decision under highly stressful conditions. Managers, police officers, army personnel, doctors, and other fire fighter staff perform their job under tough conditions. So the concept of emotional intelligence is directly beneficial to them. To derive the principles of decision making for such professionals, let me share a case then discuss those principle for a better understanding.

4.1 Case study

It is the year 2008 when I was living with my family in MDI campus. My family is consisting of myself, mother, wife and a two year old son. My mother was almost 60 and having a problem of high blood pressure. One day, she asked to me take her to a Doctor for the medical check up as she was feeling little anxious and nervous on that day. It was 9.00 am so I told her that I have a class at 9.45 am so we can go to see the doctor in the evening. She agreed for that and I came back from office at 6 PM and my wife also drove back to home. She was working in Siemens, located in IFFCO tower.

We all drove to the doctor's clinic and reached by 6.15 as clinic starts at 6.00 PM. The clinic is of Dr. Vinod Wadhwa in sector 14, just 2.5 KM away from our residence in MDI. The compounder put us in a queue and our number is 23. Since we went up there for the first time so did not know that patients can call over phone and can take a number. Since we have no other works so decided to wait and were watching television. Our turn came at 8.35 PM after waiting more than 2 hours. Doctors had given enough time to see my mother and gave prescription. After the check up is over, I asked my mother to go downstairs and sit inside the car. In the meantime, I paid the bill and took receipt. While I came down and saw that my mother is standing outside the car and keys were left inside and it got locked. When I asked my mother then she said that first she sat inside but it was very hot inside (it was the month of June). So she came out and but did not know that it will got locked automatically.

Now I am really upset because we were stuck with doctor so long and now have to face this problem so I was feeling angry, upset, and irritated. So I stopped talking to my family and started thinking how to solve this problem. After a while I thought let me get a scale (one feet measurement) as many people told me that if you are in such a situation the car can easily be get unlocked using a scale. But I was not carrying the scale so started looking for it in the market place. After 10 minutes I got one scale and tried to unlock the door putting the scale from the driver's door. However I failed and then requested few more people if they knew to unlock the car using scale. But we failed; thereafter I realized that I was having a mobile phone so let me call Hyundai on road service person for help. When I called, he said that he will reach in 20 minutes. Its 9.10 PM and we waited for until 9.30 PM. When he reached and saw that he has got a similar scale and put inside the door and unlocked the car so easily. We were pleasantly surprised. I said thank you very much but he asked for 200 bucks. I paid Rs 200 and drove back to home and reached home around 9.50.

It was bad evening as nobody was talking to the other and everyone was silent. My son was the happiest person as he got some extra hours to play around. My wife seems to be busy in looking after the kid but mother was looking upset and feeling guilty of making this mistake. After coming back, my wife cooked the meal and we ate and then went to bed.

Next day, when I was sitting in my office and working on a research paper, a sudden thought strikes me related to the episode of previous night. While I was struggling to unlock the door, I did not realize that my house keys were in my pocket. I felt so bad for my inability to solve that problem more effectively as we all could have immediately come back to home on rickshaw and I could have taken the spare key to bring that car back. It was a simple and direct solution. Why I could not solve this problem more effectively and what went wrong with my cognitive capabilities? What principles of decision making you can derive from this case and highlight the biases (heuristics) in decision making? What are the managerial implications (leadership and conflict management styles, employees' health and well being, attitude of job satisfaction and commitment) of this case in organizational context?

4.2 Principles of decision making

4.2.1 Primary principles

1. Whenever you are upset, you should take a pause or relax.

   I did not take a pause rather started feeling nervous, anxious and irritated that might have lowered down my problem solving capacity. Under such situation, we must relax before taking any decision. Otherwise we might suffer with a bed choice. This pause can vary from 30 second to few minutes.

2. Whenever you are upset or irritated or nervous or happy, you should not take any decision.

   I immediately took a decision to unlock the door using a scale without thinking of the availability of scale or competency to use the scale. So the solution that comes to our mind in a highly emotional situation may suffer with the cognitive bias, called availability heuristic. Ultimately we take decision even under stress but the one which is easily available at the top of the mind. A rigors training may help developing such a heuristic based solution to work under a crisis situation.

3. Whenever you are upset, you can postpone a decision.

   I did not postpone the decision even for 5–10 minutes. Are we comfortable in postponing the decision, sometime, leaders have to live without taking a decision. It means, not taking a decision, is also a decision. For example, when we receive a mail that puts an allegation on us then we quickly get nervous and want to send a quick reply to be relieved from our anger. However it does not solve rather aggravate the problem. Still if you have to take decision then apply following rule.

Case: Whenever I get a chance to meet a CEO, I often ask one question and that is, "what you do when you are upset at work?"

An interesting response I got from chairman and CEO of big business house is, "I do one thing that I do not take any decision and postpone all my meetings." Then I ask, how do you manage your work if you postpone all your meetings? Rather answering my question, he had shown a red color diary in which he used to write, Ram, Ram, Ram. He said, "I keep writing Ram-Ram until my mind is at a complete peace. Once I feel peaceful then I call for all my meetings. But it is unlikely that I can take a good decision with a disturbed mind."

4.2.2 Secondary principles

1. Define the problem using various perspectives in a given situation.

   I have defined the problem partially, not holistically. Whether the problem was to unlock the door or how to go back to home? I could have also defined the problem situation how to get back to home. So If I would have thought of going back to home then the solutions would have come accordingly.

2. Do not jump to a solution rather think of alternative solutions.

   I could have thought of several alternative solutions in that situation. First, I should have realized that I have never used a scale so it is unlikely that I can open the door. Second, I had a cell phone and could have called to on road service person. Third, it was almost 8.50 PM so we could have taken the Dinner as we all were very hungry. Fourth, I could have also realized I have house keys in my pocket and we can go to home without a delay. But I could not think of these alternative solutions because stress narrows down our focus and makes less flexible to alternative one. The mind becomes less thoughtful and more rigid.

3. Do not get obsessed with one solution rather apply alternative ones to save time, energy or money.

I spent almost 50 minutes on solving the problem using the scale although it was not a good solution. I could have directly opted for on road service solution to save time. But I got obsessed with my solution. The practitioners of management suggest that if you fail then fail quick and cheap. Nothing is wrong in accepting the failures but the wisdom lies in accepting the mistake and moving quickly to the next solution. However it did not happen because of volatility of conditions we are surrounded with that damage our intelligence and increase emotionality in terms of ego, lust, greed, rage etc. As emotionality goes up, rationality goes down. But if emotions are kept under control then rationality works better.

4. You can consult and talk to those who are not upset to seek their opinion on the problem.

   Interestingly I did not seek any advice from my mother or wife rather acted on my own. Probably you may suffer with "ego syndrome" especially when you think you are the only one who is capable enough to solve and undermine the other's talent. Due to cultural reasons, many times, man does not seek advice from their mother or wife or children. For example, Ravana has never accepted the advice of his wife, "Mandodari" though he knew she is correct in her arguments in suggesting that he should return Maa Sita to Lord Ram. But he chose to die rather adopting a flexible approach. Similarly, Krsna tried convincing Douryodhana to return the kingdom of Pandavas but he told Krsna that you forget five villages I will not give them even the land equal to the size of a needle. Ravana and Douryodhana were unable to switch to flexible ways to adjusting with the circumstance due to which they lost their glory, kingdom etc. The concept of power corrupts our thinking ability that is why Lord Krsna demonstrates that a king should leave the battle field if he is not well prepared to fight the battle. Similarly, Gandhari tried to convince Dhritrasthra to make Yudhister as the crown prince. But Dhritrastra was in a deep love with his son and always ignored his son's mistake.

5. One should learn to regulate negative emotions in a stressful condition.

   Moreover, I could have avoided blaming my mother for this problem. However it was just a mistake and any one of us can commit such mistake. Once you blame others the problem gets further aggravated. One should avoid blaming the team members during the time of crisis to prevent the breakup of the team. So when team fails one must take the responsibility rather blaming others. Even sometimes, the commander or the captain of an army/team knows that they may lose a war/match but they hide their fears and insecurities so that the soldier or team members should not feel discouraged. In a movie, "Life is Beautiful" father made the holocaust as a big game and hide his emotions in order to protect the innocence of his son. Hiding negative emotions is a wise idea under the crisis.

6. One should express positive emotions in a stressful condition.

   Furthermore, controlling negative emotions are not enough; rather one should learn to express positive emotions to make the situation lighter. I could have suggested it as an opportunity to dine outside. Under worst circumstances of life, leaders should be able to create hope and optimism by using positive jargon or language e.g. We will win, Good Days will come, We are a great team etc. Leader should always trust their people and must use a positive language.

Case: Controlling negative emotions and expressing the positive one.

Once I was talking to a CEO who had been the CEO of a public sector bank and the bank was not performing well. So his challenge is to transform it to make it profitable. He took an initiative and inducted high valued client on the board. In one of the meeting of the board, an old lady (high valued client) raised her hand and said "Mr. CEO, I think my money is not safe in your bank". The entire board took a back and got silent. Nobody dared to say anything. Then the CEO said, "madam can you look at me" CEO is relatively a heavy weight person "do you think I can run away with your money." She started laughing after hearing this remarks and kept laughing for a while and then she uttered that she thought her money is safe. Sometimes, CEO also understands the reality that the bank is not in a good position but it is his job to transform. So before he transform anything, he needs to learn to keep negative emotion under control otherwise team or organization may lose the morale or positivity. Be aware of your negative and other's negative emotions and then regulate yours as well as others emotions.

Sometime, leaders know that no rational explanation of a problem can convince the people. Then they prefer to shape the emotions of their followers by cracking a joke or by telling a story or reciting a poem. Atal Bihari Vajpayi, former PM of India, used to recite a poem while he was not willing to share an opinion. In the world of leadership, shaping follower's emotions is equally relevant task for which high EI leaders use all the tricks to keep them calm and quiet. Former PM Dr. Man Mohan Singh used to a keep a very plain facial expression not to disclose his feelings. Probably it is difficult to find a pic when he is smiling.

Case of a young police officer

It is another example on the importance of learning the expression of positive emotions. Once I got an opportunity to be the program director for a management development program on leadership and motivation for the newly recruited Assistant Commandants of CRPF. The biggest training centre of CRPF is located in Kadarpur, Gurugram. After completing a session on emotional intelligence for leadership development, I assigned a task to them. The task was that after going back to the academy and each one of them has to call the parents over the phone and convey a "thanks" or a feeling of gratitude. They are also allowed to say anything positive. Out of 76 officers, most did not show a willingness and finding it a difficult task. So they asked for any alternative task should be given to them and some have asked the reasons for doing this task. So I told them that CRPF is an internal peace force and deployed mostly within the India, especially in highly violent and conflicting places e.g. Naxalities Area. In contrast BSF is deployed at the border and the enemy is known and defined, but CRPF has to work through the people of India. So they need to work carefully without hurting them. So I told them that you need to develop a good relationship with the communities in order to win the trust and protect them. For which you should learn to express the positive emotions and the best place is to learn from home. Finally they agreed and said we shall try it. The next morning, a sharing session was organized.

Next morning when I asked how has been your experience of sharing the positive emotions then most denied that they could not say anything special like thanks or gratitude. They perceived it as it was not an easy task for them, although they called their parent but could not convey their warm of feeling of love or gratitude. The conversation went on as usual like other days. We kept thinking of saying something positive to them. Out of 76, only 20–22 were able to convey thanks.

Here I quote the experience narrated by one of the officers and he said. "Yesterday when I went back from MDI, I was very firm that I should not miss this opportunity. However, I was little nervous. After taking dinner, I called at home

around 10 PM, my father has picked the phone. He uttered the same sentence in Hindi, "ruko teri maa ko bulata hu" (wait, let me call your mom). Actually if I call at home and mother picks up the phone then we used to talk at length. However if father picks up then he used to say the same sentence and never talks to me. So I thought let me talk to my father today. So I said, do not call her. I phoned you only. He said, "mujse kya baat karni hai" (what do you want to talk to me). I said no I just wanted to share that we are attending an interesting training at MDI on leadership and motivation. So I thought of asking you, if you have got a chance to attend any such training while you were serving the Army (he was a JCO). But he did not say anything but I kept sharing and started feeling how to say thanks. After talking to him for 5–10 minutes, I realized, aaj nahi to kabhi nahi (if not today then never). So I told him the real reason of calling him. I said, "aaj aapki yaad aa rahi thi and mein jo kuch bhi hu aapki wajh se hu". (I was missing you today and whatever I am because of you). Suddenly my father got silent and could not say anything and uttered one thing, "muje lagta tha ki tu apni maa se hi pyar karta hai, lekin ab mein chain se mar paoonga" (I thought you love your mom only, but now I can die peacefully). It seems he was crying on the other side then he kept the phone off. I realized that my relationship with my father is so distant. Thankfully mein kar diya tha (I did it).

The above case indicates son-father relationship is not that straight or simple. Mostly boys are comfortable with their mother but more neutral toward their father in their expression of positive emotions. But the moment you express a positive emotions, it breaks ice so easily. I shared this story at many platforms. One day another student of mine, Sachin Malhotra told me that his father has asked him to leave the house after a conflicting episode. He left his house and staying away from him for last two years. After listening to this story, he went back to home after finishing his part time class in MDI. He reached around 11 PM and called his Dad and said, "papa, sorry, meri hi galti thee us din" (it was my mistake on that day). His father reached to his house in the mid night, said pack up and get back to your home. It took 2 long years to realize that he can still say sorry. A simple sorry and thanks has a wonderful impact on our relationship.

An expression positive emotions and controlling negative emotions are of tremendous importance in the context of a team. Leaders should hone their skills to regulate emotions in self and others under a crisis situation.

5. Developmental and sociological perspectives

What is the difference between IQ and EI based on the developmental perspective? Psychologists believe that the development of IQ stops by the age of 17 while the development of EI is an unending process and remain active until the age of 45 [4]. Does it mean that elderly people are naturally more emotionally intelligent?

It is not true that all elderly persons are emotionally intelligent because the development of EI depends not only on age but other attitudinal and dispositional variable. For example, married people might be more emotionally intelligent because of their ability to live in a relationship. Temperamental changes occur with new social experiences in the life. However the personality of an individual plays a central role in the development of EI. For example, the personality traits, e.g., openness to experience, conscientiousness, extroversion, agreeableness and neuroticism [17] are closely associated with the development of EI.

Openness to experience is the degree to which a person is curious, original, intellectual, creative, and open to new ideas. **Conscientiousness** refers to the degree to which a person is organized, systematic, punctual, achievement-oriented, and dependable. **Extraversion** is the degree to which a person is outgoing, talkative,

sociable, and enjoys socializing. **Agreeableness** is the degree to which a person is affable, tolerant, sensitive, trusting, kind, and warm. **Neuroticism** (emotional instability) refers to the degree to which a person is anxious, irritable, temperamental, and moody. Until a person demonstrates favorable personality traits required in order to develop EI skills than it is unlikely a person can grow to become an emotionally intelligent just because of biological age. In some case women are considered to be better emotionally intelligent than men because they are taught to be aware of any gender related exploitation or discrimination.

Development of EI through Role Modeling: The development of EI can take place by observing the behavior of emotionally intelligent people. So better to watch them and follow their behavior. In support I would like to narrate the following incidence.

5.1 An anecdote

Once I was traveling to Lucknow from Delhi to teach a course in IIM Lucknow in 2008. During my journey, I met two gentlemen sitting my both sides as I was on the middle seat. After a short while, we all started talking to each other, I noticed that both are elderly people, may be they are in their late sixties. One of them was a scientist and worked in CSIR and belonged to Lucknow. The other one was a businessman from Pune and going to Gola-Gokarnnath (a palce near to Lucknow, capital city of Uttar Pradesh) on a consultancy assignment for a sugar mill. Both had two sons and one daughter and all were married and well settled in their career. The scientist's son did his B.Com from Lucknow University and went to US for his master and PhD. After a while I realized these two gentlemen are really very successful in their personal and professional life. So I could not resist myself by asking a personal question on parenting skills because my son was just 2 years old at that time. So I asked from both of them **"what exactly you did to your children to make them so successful"**. Immediately they both got silent. We stopped talking for a while. After couple of minutes both spoke the same sentence at the same time is, "sir humnein aisa kuch khas to nahi kiya, apni life mein hum log to kafi busy rahe" – We have not done anything great as we had been so busy throughout our life and did not realize when our children grew.

So I got the answer for my question. Parents do not do anything specifically but they grow by watching them as they had been busy so children also learn to be hard working. Thus it means the biggest influence children or subordinate have on their behavior is of their parents, teachers or the immediate boss.

For example, while talking to them, the scientist shared one incident where his (who is now assistant professor in American University) son used to ask "*why do you often come late while other scientists from the same neighborhood come back home in time*." He tried to convince his son that he gets late in the office because of work. But he never understood this argument. Now his son is the assistant professor in an American university. So whenever he calls his son in USA, he asks where are you, he mostly says I am in office. Then he ask, what is the time, his son says 10 PM. Now it is his father saying, "beta ghar jaldi chale jaaya karo aur apni health ka bhi dhyan rakho" (my son you should go home in time). Thus he learned to be like his father. The biggest influence on the development of emotional intelligence is of our parents' behavior. Emotional awareness and emotional regulation both we learn from our parents.

5.2 Sociological perspective

Sociology is defined as a scientific study of social relationship in a society. Human behavior is directly impacted by all our relationship since the time of our

birth. So it should be inquired, what is the impact of social relationship on someone's EI?

Parents, siblings, teachers and superiors (significant others) have a potential to directly shape our personality, attitude and behavior. What should be considered normal and acceptable in a given situation is verified based on our elder's behavior. For example, if someone's father had been an angry person who commonly demonstrates anger by shouting and screaming then the children is more likely to accept this behavior as normal for their personal learning. At the same time, if someone's father has been controlling the expression of his anger and simply remain cool and calm under highly emotionally charged situation then children are more likely to become like them. Emotionally intelligent parents inculcate the traits of emotionally intelligent person in their children while it is opposite in case of emotionally unintelligent parents.

The parenting style or leadership style of the superiors also influences the development of emotional intelligence among the children and subordinates. Parents or superiors, with high autocratic style, are more likely to suppress the expression of emotional expression among their children and their staff. However, democratic parents and superiors demonstrate an ability to listen to diverse ideas and give opportunity to their children and subordinates to take lead or initiatives and provide emotional support if they meet with failures. So children or subordinates who are nurtured by democratic leaders are more likely to develop the traits of emotionally intelligent person.

We can take real life examples from the society. For example, Lord Krishna, Lord Mahaveer, Lord Buddha, Guru Nanak, Mahatma Gandhi are good examples of emotional intelligence at the spiritual level. If we watch their movies or listen to their stories it helps the development of EI skills in us.

In the field of corporate leadership, Azim Prem ji (owner of Wipro), Narayan Murti(Chairman of Infosys), Ratan Tata (chairman of Tata Group) all demonstrate emotionally intelligent behavior. Reading their autobiography and understanding how they deal with difficult situations will help designing our responses in various situations.

In sports, one can learn from the behavior Dhoni (captain of Indian cricket team who won ODI and T20 world cups), Dhyanchand (world's best Hocky player-has scored 101 international goals) etc. they all demonstrate the ability to remain cool and calm under the difficult conditions of a match and focus on the match in hand. Similarly the emotionally intelligent behavior is also demonstrated by Italian goalkeeper, Gianluigi Buffon. He always remains cool even under highly difficult conditions of a match. Buffon holds the record for the longest streak without conceding a goal in Serie A history: over 12 league matches, he went unbeaten for 974 consecutive minutes during the 2015–2016 season; achieving the most consecutive clean sheets [10] during that run.

In Indian politics, M.K. Gandhi, Atal Vihari Bajpayi, PV Narsimha Rao, Narendra D. Modi, all demonstrate the traits of emotionally intelligent leadership. They learn to be more tolerant, patient and decisive under highly volatile conditions. In Indian movies, Amitabh Bacchan and Rajnikant are biggest epitome of emotional intelligence. Both are very hardworking and sincere in their profession. They demonstrate humility toward their young colleagues from films and cinema. Both are living an exemplary life.

Moreover one can also develop EI skills by watching movies. For example, **Chak De India** is a good movie to learn several EI skills of understanding and managing the emotions of his team member as the coach. A Movie titled as **"Life is beautiful"** tells a story of a man who saves the innocence of his son in Nazi's camp. Another interesting movie is **"12 Angry Men"** that depicts how a jury member is successfully able to turn the decision of guilty to non guilty by remaining cool headed and

follows facts and data. Another interesting movie is "**Gandhi**" which shows several occasions where Gandhi has used his emotional intelligence in taking decision.

For example, Gandhi withdrew the non-cooperation movement in Feb 1922 after the chauri chaura incident in which police station was burnt by the agitated crowed keeping in mind the non-violent nature of the movement. Before taking this decision, he has been shown that he is spending time all alone near to a temple and giving grass to a goat to regulate his emotions.

Some interesting source of learning for EI skills are autobiographies of people like Gandhi (father of India), Mandela (president of south Africa), Abram Lincoln (American President), Martin Luther King, Akiro Morita (Sony), Lou Gerstner(IBM), Jack Welch (GE), Jack Maa (Alibaba), Colonel Sanders (KFC) etc. who had been transformational leaders. In this context, Albert Bandura's social cognitive theory and Tolman's Latent learning theory are useful to learn from other's direct and indirect experiences.

6. Conclusions

This article is exploring the relevance of the concept of emotional intelligence (EI) for people who are novice to this area. The empirical and conceptual articles are written for researchers and practitioner of management; however naïve people do not understand this field of EI. Thus this article is an attempt to simplify a complex relationship between human intelligence and emotions and clarifies how cognition should control affective processes and how affect can purify cognitive processes. Further, the article has also explained the evolutionary or biological basis of EI and also suggests that people are more prone to use limbic system under a crisis condition. Limbic system is more primitive in nature and prefrontal cortex has evolved much later among human beings. One should train his/her mind to take a pause or relax under highly chaotic or complex situations in life before taking any decision so that information should be well processed by rational centre of brain. Otherwise emotions can capture over rational thinking. All kinds of extreme emotions, love or hate, success or failure, attachment or jealously can completely ruin our thinking processes. Rational mind should regulate emotional processes but emotional processes should support rational mind to take a balanced approach. Hence article suggests few fundamental laws of decision making for the managers and practitioners of management. The chapter also suggest one can improve his/her EI skills by watching others' behavior who demonstrates better emotional intelligence in their personal life or at work. Role modeling can be an effective means for improving one's EI. If someone does not understand the concept of EI by reading literature than at least one can observe others' behavior, especially under crisis situation and can learn to remain cool, calm and composed. Many corporate and political leaders, film stars and sports persons demonstrate wonderful EI skills in their field of operations. EI is to be used rather just taught or discussed only.

Conflict of interest

The author declares no conflict of interest.

Author details

Ajay K. Jain
Management Development Institute Gurgaon, Sukhrali, Gurugram, Haryana, India

*Address all correspondence to: akjain@mdi.ac.in

References

[1] Salovey P, Mayer JD. Emotional Intelligence. Imagination, Cognition and Personality: 1990; 9(3):185-211.

[2] Goleman, D. Emotional Intelligence. 1995, New York Bantam books.

[3] Goleman, D. Working with Emotional Intelligence. 1998, New York Bantam books.

[4] Bar-On, R. The Emotional Quotient Inventory (EQ-i): A test of emotional intelligence: 1997; Toronto, Canada: Multi-Health Systems, Inc.

[5] Wechsler, D. The measurement of adult intelligence. 1939; Baltimore: Williams & Wilkins.

[6] Wechsler, D. Non-intellective factors in general intelligence. Psychological Bulletin, 1940; 37, 444-445.

[7] Gardner, G. Frames of Mind: The theory of multiple intelligences. 1983: New York Basic Books.

[8] Binet, A. New methods for the diagnosis of the intellectual level of subnormals. In E. S. Kite (Trans.), The development of intelligence in children: 1916: Vineland, NJ: Publications of the Training School at Vineland. (Originally published 1905 in L'Année Psychologique, 12, 191-244.

[9] Simon, Herbert A. Rational choice and the structure of the environment, Psychological Review, 1956; 63: 261-273.

[10] Kahneman, D. Thomas Gilovich, Dale Griffin. Heuristics and Biases: The Psychology of Intuitive Judgment. 2002; ISBN 978-0521792608

[11] HT Correspondent, 2018; https://www.hindustantimes.com/education/cbse-class-10-result-2018-nearly-two-lakh-students-scored-over-90-in-maths/story-QWVvSuXS0bqsIZuoKNGF0J.html

[12] Garai, S. 2020; https://www.thehindu.com/news/national/student-suicides-rising-28-lives-lost-every-day/article30685085.ece

[13] https://www.careers360.com/question-what-are-the-total-number-of-seats-in-iit-2019

[14] Huitt, W. The mind. Educational Psychology Interactive. 1996; Valdosta, GA: Valdosta State

[15] Baumeister, R.E., Bratslavsky, E., Muraven, M. Tice, D.M. Is the active self a limited resource? Journal of Personality and Social Psychology, 1998, 74(5), 1252-1265

[16] Jain, A. K., & Sinha, A. K. General Health in Organizations: Relative Relevance of Emotional Intelligence, Trust, and Organizational Support. 2005; International Journal of Stress Management, 12(3), 257-273.

[17] McCrae R.R., John O.P. An introduction to the five-factor model and its applications. 1992; Journal of Personality, 60(2), 175-215.

Chapter 2

The Process of Emotional Regulation

Lorraine OB Madden and Rebecca Reynolds

Abstract

Emotional regulation is a developmental skill that everyone must learn. It is the ability for you to tune into, make sense of and control your own strong feelings. It affectively influences how well you can adapt to situations and events in your life, as well as how you navigate and adapt to the world. A lack of healthy emotional regulation can lead one to become dysregulated. Two important phenomenon underpin our ability to regulate: emotional complexity and splitting. The more acknowledgment and understanding that we give to our emotions (not just the thoughts in our mind but the feelings in our better), the more control and problem solving skills we can harness to sustain a good standard of personal well-being.

Keywords: emotional, regulation, dysregulation, process, mind, body

1. Introduction

This chapter aims to explore the process of emotional regulation:

- What is it?
- How does this impact us in different areas of our lives?
- How can we encourage the development of healthy emotional regulation?
- How do we know when we have gotten it right!?

We also want to encourage others to explore:

- What happens when difficulties with emotional regulation emerge?
- How do we re-regulate the body and mind?

Hopefully this chapter will answer these questions providing you with an overview of what is involved in the process of emotional regulation – so let us get started!

2. What is emotional regulation?

Emotional regulation is a phrase that doctors, psychologists, and even teachers and parents are using more and more. However even though it is something that

everyone is talking about, lots of people are confused in regard to what emotional regulation actually is.

From our perspective, emotional regulation is all about recognising, understanding, influencing, controlling and experiencing and expressing emotions. Researchers such as Fresco, Mennin, Heimberg and Ritter [1] have carried out research to the same effect, defining emotional regulation in a similar way. Other researchers have explained that emotional regulation can at times be unconscious, or conscious. That means that sometimes we are aware of what we are feeling, and sometimes we are not. Oftentimes, we can influence which emotions we have, when we have them, to what degree they are felt and how they are expressed [2]. However, sometimes we lose control of our emotions and we become what scientists call "dysregulated". When this happens, individuals are typically less able to understand, influence and control their emotions.

Emotions in themselves indicate how we feel about what is going on around us. They have a functional purpose; to notify us to the relevance of our concerns, to highlight to us what we consider to be important, what our needs and wants are in a given moment, and to help us navigate the world. Emotions exist on a spectrum for everyone; we all feel certain emotions to varying degrees, at different times. In other words, we can have a little or a lot of an emotion at any given time. The importance of developing an ability to internally regulate our emotional state has been well documented in scientific research. Emotional regulation is not just the process of acknowledging our feelings, but also understanding them to control them. This process of feeling, understanding and controlling our emotional state involves both the body and the mind, the physical state and our thought processes. Once an individual develops an understanding of what they are feelings, what thoughts they have and the possible triggers for these thoughts the feelings, then they can begin the process of self-regulation; the ability to regulate oneself and alter one's own responses [2]. There is a positive relationship between how competent a person is regulating their emotional state, and how well they can adapt to both minor and major events in life. Those who are able to successfully tune into how they are feeling have a better change in being able to calm themselves down. Similarly, when a person understands the triggers for a particular emotion, then they will be better able to respond in a helpful manner. Let us look at this in a real life example.

A woman walks down the road, let us call her Alice. Alice sees a large dog coming towards her and she begins to feel anxiety and panic setting in. She feels her heart rate increase and the blood rush to her face. She thinks "I'm feeling anxious because I was bitten by a dog last year on holidays, it is still affecting me". Alice is able to rationalise her feelings in this moment. She successfully identifies how she is feeling and she links this feeling to a triggering experience. Alice them tells herself "That dog on holidays was an angry dog, and it was unusual that he bit a stranger. The dog in front of me now looks kind, and he is out walking on a lead with its owner. It's unlikely that he is going to bite me". Alice takes several deep breaths and says to herself over and over again "I'm going to be okay, just keep walking". Alice uses deep breathing to control her feelings of anxiety, thus linking her body and her mind. Her heartbeat drops, and she responds in a way which is helpful – she passes the dog. This demonstrates the process of recognising, understanding, influencing, controlling, experiencing and expressing emotions. Alice successfully engaged in emotional regulation – going through each stage of the process.

On the other hand, unhealthy emotional regulation patterns also exist. Unfortunately, when unhealthy emotional regulation develops – sometimes called dysregulation, it can negatively impact a person. It can impact how people interact with others, how they connect with others on a deep or intimate level, and it can also impact performance at work or other areas in a person's life. In other words,

the ability to regulate your own emotions is crucial to having effective and flexible responses, which influences how you deal with challenging situations in life [3].

Another concept in the area of emotional regulation is the idea of emotional complexity i.e. the co-occurrence of both positive and negative emotions simultaneously in the one individual [4]. This makes the topic of emotional regulation even more interesting (and complicated!) because people can have conflicting emotional states at the same time. People often have an easy time separating the good from the bad to divide them up, when actually they can exist together. For example, you could have a long-term relationship with someone who cares about you greatly; you have a nice time together, you have great memories and you have come to live together in a comfortable and safe home. But, this person also drove your car to work one morning and left a dent on the side of it. Healthy emotional regulation would look like someone who realises: it was probably a mistake, it is easily fixed and I do not believe that they meant to do it. Unhealthy patterns of emotional regulation now see this person as an inconvenience, that they care less about you and your belongings and that they do not care about stressing you out. Unhealthy patterns of emotional regulation can lead us to put certain things on pedestals and not others – without every questioning it. The reality is, good people can sometimes do "bad" things, and bad people may also sometimes do "good" things.

Emotional intensity also plays a role in the evaluation of one's ability to regulate themselves. The intensity of your emotions relates to how you perceive your own emotions. Do not forget – the consequence must match the crime. Poor emotional regulation will have you feeling overly stressed about minor things, viewing small blips as massive problems and internalising stressful situations as more tiresome and threatening than they actually are. That's the thing about seeing things as they "actually are" – the lens which will we look at life through is very much based on what we believe to be true, as conscious and independently thinking as human beings are, we do not always challenge these thoughts i.e. not all of your thoughts are true! Of course, at times, emotional intensity can be helpful to us; it gives us information about how we really feel about certain things. For example, if you felt more intense sadness at the passing of someone close to you, it is likely that you care deeply about this person and perhaps love them. Intense feelings give us a lot of information and it is our job to sieve through this information.

3. How does this impact us in different areas of our lives?

Having well developed or poorly developed emotional regulation skills can impact us in almost every area of our lives. As we all grow, to survive and function well in the world, we have to continue to progress with our own independence skills, otherwise referred to as our day-to-day adaptive skills. These skills include many different domains: communication skills, community use, leisure and social skills, healthy and safety, self-care and self-direction skills, and our work lives. As we list them, it can sound overwhelming, that we must continue to progress in all these areas of life all the time – but the thing is, it's a gradual process, like taking things step by step. Healthy emotional regulation will allow us to continue to make progress where we need to.

Alongside the development of emotional regulation skills comes emotional literacy; the actual naming of the emotions that exist for us. Emotional literacy is like letter or word literacy – it is a way of reading and understanding emotions in one's self and in others. Without it people struggle to understand what emotions they are having themselves and what other people are feeling. If difficulties in this area emerge, they will have a negative knock on effect on social interactions, which

in turn will negatively impact relationships. On the flip side, developing good emotional literacy will enable positive social interactions and healthy relationships.

Adults who generally describe their emotional states in clusters (e.g. feeling angry and frustrated) are said to have lower differentiation. Differentiation is the idea that we are precise and accurate when it comes to acknowledging, and describing, our own feelings. If we were to look at differentiation a different way: lets say our degrees of differentiation are not very broad i.e. we describe the majority of our lives events and situations using the words "happy", "sad" and "annoying" – the more vague the differentiation and the more general our labels, the less information it actually gives us, or anyone else for that matter. To make positive changes to your emotional state, you first have to know what you are dealing with. Individuals with high emotional differentiation may then describe their emotions in a more precise manner as a result (e.g. feeling rejection, disappointed and irritated) [4]. The level of differentiation that individuals have, reflects the degree to which they have the ability to distinguish different emotions from one another by being able to slot them into finer categories that is relevant to the experience at the time. As we know, knowledge is power, so the more precise we can be, the more ownership we can feel over controlling and altering how we feel. The more we understand our emotions, the better able we are to manage their manifestations, both mentally and physically. This understanding can then lead to better, more efficient communication when relaying how we feel to others.

Recognising & Acknowledging → Accurate Labelling → Understanding → Managing.

As the vocabulary surrounding one's emotions increases, the labelling process becomes clearer. This first step however is based on the idea that an individual is honest and frank about they feel. Throughout a lifetime, many will be aware (or not so aware) of the idea of suppressing emotions. Suppressing emotions often occurs when people cognitively suppress them i.e. "*I just won't think about it and it will go away*". What most often do not realise, is that feelings exist in our bodies just as much as they do in our brains. Suppressing an emotion is as helpful as pushing a light plastic ball underwater – it will continue to spring back up to the surface, usually where you do not expect it. By turning off our brain power to our emotions, we only scratch the surface, giving credit to the old saying "*feeling the* feels". Therefore, the fundamental key to emotional regulation is **getting out of the mind and into the body**.

4. How can one facilitate its growth?

All feelings live in our bodies and our minds – but everyone keeps them in different places though. Some people might keep strong feelings like sadness or disappointment in their heart, others might keep sadness in their throat or stomach. Some people keep anger in their heads or in their hands. It is different for everyone, and feelings can also move around in our body. If this sounds like a foreign concept, then it is best to first *tune in*. The purpose of tuning in is to first learn where your feelings manifest physically. By doing so, you can then pinpoint tailored strategies to help soother them and relieve yourself from negative repercussions. The key to tuning in? Mindfulness.

Mindfulness is the act of being mindful; to be present in the here and now, to use our sense to attune to our surroundings, and to feel grounded to exactly where we are. This subtle practise can look differently to different people. For example, some might like to do grounding exercises like the 5-4-3-2-1, or a relaxing body scan, others might prefer to do mindful eating with sweet or sour foods. Mindfulness is not such an alien concept as those who have not tried it yet may think. Those who read

in silence, enjoy listening to rain on the window, take part in yoga or daily stretches all are enjoying a real-life example of mindfulness. One of the least complex strategies is deep breathing. This exercise is all about taking some time to breath in slowly into your stomach, breathe in four 7 seconds, hold for 2 seconds and breathe out for 11 seconds. As the saying goes, "*in for 7 and out for 11*". An example of a script to carry out a body scan exercise is below:

1. Take a seat or lie down on your back: let your legs relax and you arms fall to your sides. Settle yourself in a comfortable position and allow yourself to be still.

2. Let us begin by taking three large breath, in through the nose, and out through the mouth. Notice how your chest expands and contracts with every breath.

3. Now we feel relax, we are going to start to pay attention to other parts of the body. Let us go right to the bottom and start with your feet. They might feel warm or cold, restless, or calm, wet, or dry. Try your best to relax your fit now. If you are finding it hard to do, that is okay too.

4. Allow yourself to be still. At this very moment, there is nothing to do. Try to pay attention as best you can. If you find that is hard to do, just keep coming back to how your breathing feels.

5. Move your attention to your lower legs. How are they feeling? Heavy, light, restless, or calm? Do your best to give yourself a few moments of rest.

6. Start to move your attention up to your upper legs. Whatever you feel there, or do not feel, is fine. Just try your best to let them relax. If you feel wriggly, that's okay, that happens.

7. Now move your attention to your stomach. It will always rise and fall as you breathe, like waves on the sea. You might feel something inside like hungry or full. You might even feel some emotion there too, like nervousness, sadness, excitement, or happiness.

8. Move your attention to your chest. Keep focusing on how it feels to take nice, deep breaths. Notice how your chest will rise and fall with every breath. If it is hard to maintain focus, that is okay. Just not ice how your breath feels in this moment.

9. Now bring your attention to your hands. There is no need to move them anywhere else right now. They might be resting on the floor, chair, or on your lap, stomach, or chest. Try relaxing them. Let your fingers go.

10. Bring your attention to your arms. Are they feeling heavy? Let go of any tension that is being held by your arms and let them feel calm, loose, and light.

11. Next, move your attention around to your back. Let is relax and sink into the chair or floor as much as possible. If you are finding it hard to focus, that's okay. Just bring your attention back to your breath.

12. Move your attention to your neck and shoulders. Let your shoulders drop and release any tension that is being held in your neck.

13. Now, move your attention to your face and head. Unclench your jaw if it feels tense. Relax your eyebrows. Allow your eyes to feel light. Whenever you feel yourself thinking about something else, just return to your body and breath.

14. Finally, spend the next few moments paying attention to your entire bod. How does it feel? If it's easier, continue to pay attention to your breath. If it is time to wake up, gently open your eyes and sit for a few moments before deciding its time to move again.

It is important to remember that no matter what comes out from any of the above exercises, it is crucial to accept whatever that may be. The aim is to reach a stage in which you can understand your own emotions in order to control them, not to eliminate difficult feelings altogether. All feelings are normal, and not all feelings need to be acted on. If you find yourself saying you *should* or *should not* feel a certain way – then it might be important to rephrase your narrative to *this is how I feel, how can I help?* Being honest about how you feel will allow you to tune into your own thought patterns; where does your mind drift off to when you allow it? Gently ask yourself, are these negative thoughts helpful? Do I give enough airtime to my positive thoughts? And **are all these thoughts true?**

5. What does healthy emotional regulation look like?

On the ladder of emotional regulation, acceptance of the emotional experience is step one. Acknowledge the feelings that are occurring. Less acceptance in the present moment can lead to less clarity about the nature of their current well-being, the situation that is occurring around them and the degree to which the individual can cope with it. By not fully understanding what is occurring emotionally, individuals will therefore feel less empowered to have any perceived control over the situation at all, let alone feel as though they can alter how the emotional experience plays out. There is motivational information to be found among our emotions. Our emotions often show us what is important to us, how we feel about ourselves and others and what we care about. For example, if we go to a new place that we have never been, and out gut feeling leaves us unsure if we would like to stay or not, what we could actually be feeling is fear, lack of security and discomfort. Our inner emotions guide us to that realisation.

There are two strategies that can help us emotionally regulate: preventative, and responsive strategies. A preventative strategy is when we try to modify what type of emotion we will experience and how much of it will occur **before** the onset of the emotion. We implement this my deciding who and what we give our energy to. Lending energy to situations that are not helpful to our well-being is literally handing over our brain power to that very thing. It is often helpful to take a step back and observe all facts in a situation before we react, without absorbing.

6. Observe, not absorb

Responsive strategies are used when a trigger has occurred and the emotion has already kicked in. They are used after the fact – to help tone down the intensity of the emotion, curtail it's manifestations or to eliminate it entirely [2]. The healthiest type of emotional regulation is the honest kind. As a society, we often feel we need to conform to how emotions should look i.e. "display rules". This is the idea that we feel one thing internally, and display something entirely different externally; either

a different emotion entirely that does not match, or an impaired version of how we feel as to behave and appear at a "socially acceptable" level of that emotion. For example, it may be socially accepted and welcomed that we are visibly very happy while out in public, in fact, this can be contagious for others, but it may not be viewed as positively to be upset in public. For us all, we feel that there is a time and place for specific emotions. However, when the line is crossed from not expressing an emotion, to not acknowledging it at all, that's when the process of dysregulation can begin.

7. What happens when difficulties emerge?

Emotional dysregulation occurs when an individual is unable to control their emotional responses to specific events or environments. A prolonged period of emotional dysregulation can present as excessive sadness, fear, or irritability, to give some examples. A presence of dysregulation has two main indicators: heightened emotional reactivity and psychological splitting [3]. Emotional reactivity is how responsive we are to an event, how intense our response is and how quickly we can return back to regulation once we have reached our peak. Splitting then, is the phenomenon that describes how emotionally dysregulated people fail to see the good in the bad, and the bad in the good. It is a defence mechanism that allows individuals to categories themselves and others as either "good" or "bad". By sorting and labelling in this way, individuals are unable to see themselves and others in their entirety; as their whole being. The process of splitting can result in some high and taxing emotional costs such as major mood swings and erratic and volatile emotional states [3].

Emotional dysregulation can cause psychological discomfort. When we investigate our emotions i.e. when we feel upset, anger, disappointment or emotional hurt, we tend to act impulsively. This act of impulsivity is commonly known as the 'fight-or-flight' response. Pairing this response with a heightened emotional state can cause us to overreact. This overreaction is emotional reactivity. The difficulty emerges when we go beyond the point of easy and minimal-effort emotional regulation, and we may say or do things that we eventually come to regret. This regret usually makes its way to the surface once our emotions have come back down the reactivity scale i.e. when we no longer feel such heightened emotions, or our perception of certain situations change. When our views and feelings on a situation in the present moment do not match how we reacted previously, this can in turn be very uncomfortable for ourselves and those around us. Those who have not learned how to regulate their emotions can be characterised as being highly emotionally sensitive. This causes difficulty for the individual to understand their emotional experience and possess and utilise skills that can minimise and retrieve emotions back to their baseline.

8. Re-regulating the body

Gratz and Roemer [5] acknowledge that one set of beliefs or attitudes in relation to emotions – the willingness to accept emotional experience – is an important aspect of emotional dysregulation [6]. Our mind and our bodies are connected, so we need to feel better in our minds and our bodies in order to be happier. In our bodies, we use our senses to take in information. There have been four different types of emotional regulation strategies outlined by Ochsner and Gross [7]:

1. Situation selection/ modification to modify appraisal inputs or cues regarding emotional situations

2. Attentional deployment to focus on some cues more than others

3. Cognitive change to change the meaning of cues

4. Response modulation to control the manner in which an emotion is expressed [3].

Re-regulating the body begins with breaking old habits. It is important to talk about your own feelings throughout the day to a trusting other, or if kept personal, write them down in a journal as a mindfulness practice. Explicitly label your own emotions; this can be done in very simple statements to others or into yourself. Allow yourself to accept your own emotions, and the mental and physiological response to these emotions. Try to be gentle, and show yourself compassion during this time. This also goes for when you respond to your own emotions – do so with kindness. Positive affirmations can help with the thought process of the emotion, and physical experiences can help ground the body. Once you have been honest about how you are feeling, the journey of problem-solving can begin. Encourage yourself to think of several different ways of responding to a problem and then brainstorm through each of the possible outcomes as consequences of the various courses of action.

9. Summary

Generally speaking, a child with typically developing social and emotional (regulation) skills is able to relate to and interact with peers and adults, and express themselves in an age appropriate manner. For a young child, this involves actively seeking out family and friends, initiating interactions with them, and responding appropriately to social advances. Actively engaging in peer relationships is also a key component of social–emotional development for young children, which involves an ability to play with other children and siblings. At this age, children learn how to express their emotions using facial expressions, their voice and their body, and they begin to understand and respond to the emotions of others [8]. Continuing into adolescents, teenagers with positive emotional regulation habits can bounce back quicker and more efficiently from stressors, form positive friendships and romantic relationships and reach goals that require more of their own independence skills. These individuals grow up to be independent, stable and achieving adults. They trust their own abilities and problem solving competencies, they have a good standard of self-worth and adapt functionally to various situations and contexts.

To recap, the steps of the process of emotional regulation are as follows:

1. Recognise and acknowledge the thoughts in the mind and feelings in the body

2. Label them – as accurately and descriptively as possible

3. Take some time to feel through what you are experiencing, by using your grounding and mindfulness techniques at this point

4. Begin to think about problem solving – be careful to not act irrationally or too quickly. Take time to think about the various courses of action that can be taken, and the consequences of each.

Author details

Lorraine OB Madden* and Rebecca Reynolds
The Education, Psychology and Therapy (EPT) Clinic, Kilkenny,
Republic of Ireland

*Address all correspondence to: psychology@eptclinic.ie

References

[1] Fresco, D. M., Mennin, D. S., Heimberg, R. G., & Ritter, M. (2013). Emotion regulation therapy for generalized anxiety disorder. Cognitive and Behavioral Practice, *20*(3), 282-300.

[2] Sutton, R. E. (2004). Emotional regulation goals and strategies of teachers. Social psychology of education, *7*(4), 379-398.

[3] Aldea, M. A., & Rice, K. G. (2006). The role of emotional dysregulation in perfectionism and psychological distress. Journal of Counseling Psychology, *53*(4), 498.

[4] Hay, E. L., & Diehl, M. (2011). Emotion complexity and emotion regulation across adulthood. European journal of ageing, *8*(3), 157-168.

[5] Gratz, K.L., Roemer, L. Multidimensional Assessment of Emotion Regulation and Dysregulation: Development, Factor Structure, and Initial Validation of the Difficulties in Emotion Regulation Scale. Journal of Psychopathology and Behavioral Assessment 26, 41-54 (2004). https://doi.org/10.1023/B:JOBA.0000007455.08539.94

[6] Gill, D., Warburton, W., Sweller, N., Beath, K., & Humburg, P. (2020). The Emotional Dysregulation Questionnaire: Development and comparative analysis. Psychology and Psychotherapy: Theory, Research and Practice, e12283.

[7] Ochsner, K. N., & Gross, J. J. (2008). Cognitive emotion regulation: Insights from social cognitive and affective neuroscience. *Current directions in psychological science*, *17*(2), 153-158.

[8] Sharma, A., & Cockerill, H. (2014). *Mary Sheridan's From Birth to Five Years: Children's Developmental Progress: Children's Developmental Progress*. Routledge.

Chapter 3

Emotional Intelligence, Identification, and Self-Awareness According to the Sphere Model of Consciousness

Patrizio Paoletti and Tal Dotan Ben-Soussan

Abstract

While emotion and cognition were previously considered separate concepts, current research demonstrates an interplay between them. In the current chapter, we discuss the importance of the body in relation to emotional intelligence (EI) and executive functioning. In particular, we address a specific movement meditation called Quadrato Motor Training (QMT), which has been shown to enhance emotion regulation and neurocognitive functions. We then examine the importance of emotion regulation in the context of the Sphere Model of Consciousness (SMC) and related neurocognitive studies. The SMC is a neuro-phenomenal model of consciousness based on three main axes: Emotion, Time, and Self-Determination. It presents all phenomenal experiences in a sphere-shaped matrix, aiming to account for different interactions among the axes. Through this model, the processes leading to improved EI can be framed in a general theory of consciousness and described in relation to the three axes. We discuss three key concepts in relation to the SMC: (1) EI; (2) identification, namely excessive self-involvement or feeling caught up by experience (3) self-awareness, or awareness and management of ongoing inner processes.

Keywords: emotional intelligence, regulation, executive functions, attention, Sphere Model of Consciousness (SMC), Quadrato Motor Training (QMT), waiting, identification, self-awareness

1. Introduction

Emotional Intelligence (EI) is a relatively new concept, related to emotion and cognition [1], which has been defined as the ability to (1) perceive accurately, appraise, and express emotion; (2) access and/or generate feelings when they facilitate thought; (3) understand emotion and emotional knowledge; and (4) regulate emotions to promote emotional and intellectual growth [2]. Emotional intelligence plays an important role in daily life and can significantly impact our own quality of life and that of those around us [3]. However, relatively little is known about the cognitive processes underlying EI, and about how EI can enable better management of cognitive resources.

In the present chapter, we aim to address the cognitive processes underlying EI and to suggest new ways to improve it. To this end, we attempt to place the building blocks of EI in the wider context of a model of embodied consciousness. In addition, we look at an example of EI "in action," namely, a specific movement meditation, to further investigate embodied consciousness and executive functions.

2. Emotion and consciousness

Many scholars view emotion and consciousness as conjoined (e.g., [4–8]), since each conscious state is endowed with some form of emotion, to the point that even the perceptual representation of everyday objects carries subtle affective tone [9]. Research indicates that emotions are manifested by physiological, cognitive, and behavioral changes [10], and that they can have both positive and negative valences [11]. If, for example, you are given an unexpected gift, you will probably be surprised. Your surprise will be expressed at three levels: physiological (e.g., accelerated heartbeat, which in different circumstances and interpretations can have either negative or positive valence); cognitive (e.g., thoughts about the person who gave it to you and maybe the reason why), and behavioral (e.g., impulsively open the box).

It is therefore generally agreed that emotional states bear two important phenomenal features, one mental and the other bodily. Schachter and Singer [12], for example, described emotional experience as a combination of general arousal and cognitive attribution regarding the cause of this arousal. Similarly, Damasio [4] views emotional experience as a combination of sensory changes that occur in the viscera and internal milieu (which he calls emotions) and the mental image of these sensory patterns (which he calls feelings). Similarly, Lambie and Marcel [5] define any emotional state as the combination of readiness for action (and its representation) and evaluative description (a mental representation). The first includes neural and somatic systems that are activated in response to stimuli, the second is an appraisal that leaves a record of how one's concerns, or one's self, have been affected. These theories, by linking together bodily states and cognitive features to explain emotions, create a body-emotion-mind triad (see **Figure 1**).

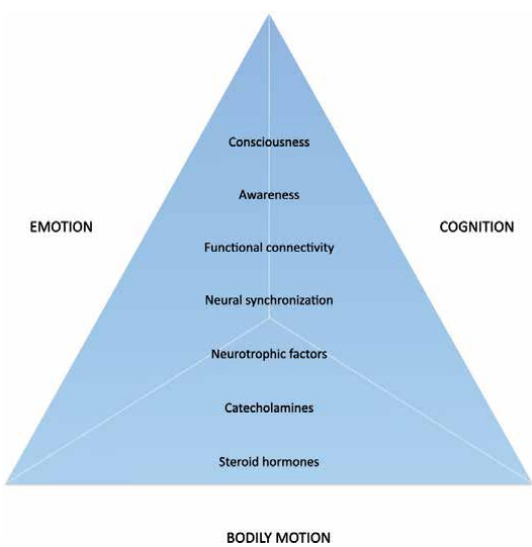

Figure 1.
Adapted from [13, 14].

3. The cognition-emotion-bodily motion triangle

To date, as noted above, EI has mainly been examined in the context of emotion and cognition. Yet, given that the body also has an important part in embodied cognition and consciousness, it should be considered part of the equation [13–15]. Our simplified model (see **Figure 1**) links the three trajectories of bodily motion, cognition, and emotion, to indicate their interdependent contribution to the enhancement of self-awareness, which is considered the basis of EI [14, 16].

Each of these three trajectories has been linked to increased neuronal synchronization, which in turn is considered a marker of brain integrity, and connected to enhanced moral problem-solving, greater emotional stability, peak experiences, and flow [17, 18]. In fact, neuroscientific studies have demonstrated that our brain can be regarded as fragmented, and that increased neuronal synchronization can enhance internal integrity [17]. This is especially the case within the alpha (8–12 Hz) band, which is related to cognitive flexibility, attention, and self-awareness [19, 20].

In the past, each trajectory has been examined separately in relation to neuronal synchronization: the connection between enhanced neuronal synchronization and cognitive change [21] and consciousness [22, 23]; the connection between increased neuronal synchronization, consciousness, and dopamine secretion following mental training [24]; and the importance of awareness and being embodied to awaken consciousness [25].

Considering the importance of embodied cognition and consciousness, to suggest new ways for improving EI, we now move on to examine a specific movement meditation practice called Quadrato Motor Training (QMT). QMT has previously been investigated from molecular, electrophysiological, and psychological perspectives, and has been found to improve perception of time and self-regulation of affect, and to enhance neuronal synchronization [26].

4. EI in the body: the case of quadrato motor training

QMT is a sensorimotor training protocol that is conducted on a 50 × 50 cm square placed on the floor (see **Figure 2**), and requires smoothly executed, goal-directed behavior in response to verbal instructions separated by short varied interstimulus intervals (ISIs), which are known to increase the duration of attention [27]. "Active waiting" is defined as the general state required of a QMT practitioner.

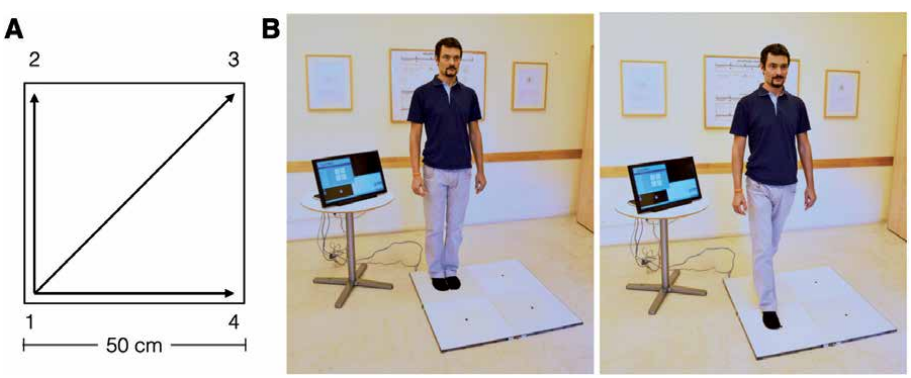

Figure 2.
Quadrato Motor Training (QMT). A. A graphical illustration of the QMT platform. B. A participant performing QMT (on the Quadrex electronic platform), stepping in response to a verbal command.

The practitioners is required to either produce or inhibit a motor response in the Quadrato space (which has four corners named 1–4) based on specific verbal instructions (e.g. "1–2," which leads the practitioner to take a step forward from corner number 1 to corner number 2; or "1–1" in which the practitioner should inhibit the impulse to move and wait for the following instruction).

Thus a main feature of the QMT is inhibitory control needed to make a decision related to the instruction, as well as required in continuing to the following instruction rather than stopping when a misstep occurs [28]. This type of inhibitory control is directly related to the ability to regulate emotions through attention when, for instance, a mistake occurs or a distracting thought or inappropriate emotion arises, requiring "active waiting" [29].

As we will see in more detail in Section 5.3, attention control and attention shifting, modulated with an optimal difficulty level, can allow practitioners to be more 'body-centered' and thus closer to a state of flow (see Section 5.4).

Diamond and Ling [30] have claimed that practices aiming to improve cognition in general, and executive functions in particular, must not only recruit cognitive resources but challenge them continually. Combining different skills appears to be beneficial, as evidenced by research indicating greater improvements in executive functioning as a result of combined cognitive, physical, and emotional engagement [31, 32]. Diamond and Ling [33] further found that, compared to conventional exercise, the addition of embodied mindful practices like QMT results in greater improvement in executive functions. QMT-induced gains in ideational flexibility likely result from motor and cognitive inhibition acquired through the cognitively engaging motoric practice. We discuss this important topic, and its relationship with attention, below in 5.3 and 5.4.

QMT has further been found to enhance self-efficacy [34, 35] and affect balance [34], which are both closely related to higher-order cognitive functions and self-regulation [36, 37]. The acquisition of emotion regulation abilities, one of the main features of EI [1], is considered a critical developmental milestone. Emotion regulation is closely related to attention [38, 39] and contributes to a healthy lifestyle [3].

For example, emotional stimuli can modulate the time course of temporal representations. In the context of QMT, this could suggest that the required emotion regulation (e.g. the necessity to deal with uncertainty and the fear of making an error, call yourself back and go on with the QMT session when making a mistake) could be related in a way to temporal precision essential in the task.

Noteworthy in this context is the fact that studies report improved emotional regulation [40] following different mental attention training regimens, in parallel to activation in neural areas that are closely linked to motor learning, including the cerebellum [41–43]. When the cerebellar timing function is disrupted, the information processing stream becomes desynchronized, which can lead to a range of psychopathological conditions [44]. Enabling or actively stimulating cerebellar oscillations through specifically structured sensorimotor training, such as the QMT, can normalize cerebellar activity and therefore enhance emotional and cognitive functions [23].

In the following section, we detail the connection between state of awareness, attention, flow, and increased emotional well-being, utilizing the Sphere Model of Consciousness.

5. The sphere model of consciousness

The Sphere Model of Consciousness [45] offers a symbolic representation of the phenomenology of consciousness based on the geometrical properties of spatial coordinates within a sphere (see **Figure 3**).

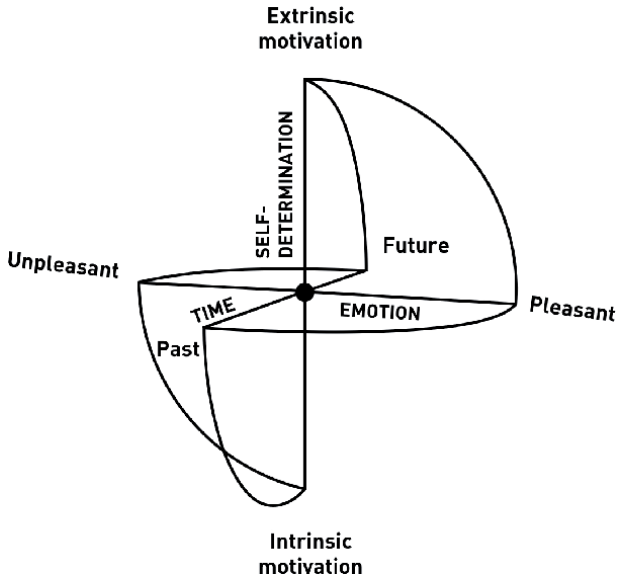

Figure 3.
The Sphere Model of Consciousness (adapted from [45–48]).

Each axis of the SMC represents the deployment and polarity of an aspect of experience. The central place in the sphere represents an equilibrium point of the three axes of time, emotion and self-determination [45], and it is regarded in the model as a state of "Overcoming the Self," that is, a state of neutrality and detachment from the usual experiences of future-past (time axes), pleasant-unpleasant (emotion axes) polarities of the Narrative self, as well as of the more embodied Minimal Self [45, 49]. Briefly, the Minimal Self has a short temporal extension and is endowed with a sense of action, property, and first person nonconceptual content, while the Narrative Self involves personal identity and continuity through time and includes conceptual content. Overcoming of the Self constitutes a third state designated by the SMC, in which all sense of self disappears.

With this model as a foundation, we can now deepen our discussion of the emotion axis and its interaction with the other two axes.

5.1 Emotion axis and the conditioning of emotions

According to the SMC, the possible interactions between the emotion axis and both the time and self-determination axes express all the phenomenology of emotional experience. Autobiographical experiences do not exist as a neutral recording of a set of perceptions, nor does the brain normally produce emotionally neutral predictions. Rather, these recordings and projections inevitably have a certain emotional coloring [4–8, 45, 49]. Even in the case of emotions, there is a crucial interpretative function, which might be related to EI.

As noted above, several proposed models converge in describing an interpretative process that is integral to emotional experience. This interpretative process, in the case of emotions, is based on two polarizations: pleasant versus unpleasant and, from a psychological viewpoint, reward versus punishment (**Figure 3**). In fact, both reward and punishment are characterized by a specific brain system, and can reinforce behavior and perception [50, 51]. Experiential avoidance is related to punishment/reward system, and is namely a set of strategies aimed to control and/or alter internal experiences (e.g. thoughts, emotions, sensations, or memories) [52] which

may provide a way to enhance EI abilities and neuronal changes, and thus perception [53]. To apply strategies aimed at controlling and/or altering our internal experiences, the following abilities are necessary: (1) to perceive accurately, appraise, and express emotion; (2) to access and/or generate feelings when they facilitate thought; (3) to understand emotion and emotional knowledge; and (4) to regulate emotions to promote emotional and intellectual growth [1].

5.2 Identification as a lack of self-determination

According to SMC, the intersection of the time and emotion axes produces a two-dimensional flat, circular and repetitive life in which the repetition of experience is due to the dependence and the need for gratification, conditioned by the interaction between emotional memories and projective experiences (**Figure 4**).

Dependence and need for gratification can each be seen as a lack of EI, which results in a phenomenon that bonds together emotion and attention in what is called, in this model, "identification" [54]. Visually speaking, identification is represented in the SMC as the "decentralization" of the central point of the sphere that takes place when the third axis is not involved in the experience.

If self-determination (vertical axis) is not involved through intentional sustained attention, the intersection will be expressed only by the first two axes, time and emotion, and the intersection point can be "decentralized" and conditioned through identification with memories and emotion. For example, if a person's mind is projected to a past unpleasant memory, it would be placed in the model at an intermediate point between the past and the unpleasant polarities (see **Figure 5**).

In terms of the SMC, identification is described as an imbalance along one of the axes. Attention is identified, from time to time, with elements of the past or the future that are connected to emotional experiences, aspirations, or values, but it is rarely divided between these elements and something else [15, 48]. In this regard, a refinement of the concept of absorption is required, especially in differentiating it from the concept of identification.

5.3 QMT, SMC, attention and self-awareness

As mentioned above, QMT is a sensorimotor training protocol that is conducted on a 50 × 50 cm square, and requires smoothly executed, goal-directed behavior in response to verbal instructions separated by short varied interstimulus intervals (ISIs).

Posner and Petersen [55] have defined attention as a complex cognitive system encompassing three independent but related networks: (1) alerting, (2) orienting, and (3) executive control, heightening (1) internal awareness, (2) focus towards selective and salient inputs, and (3) towards conflict resolution and facilitating

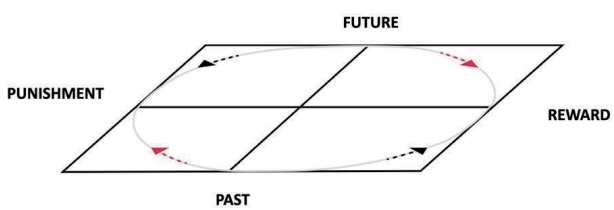

Figure 4.
The "flat life" in which the repetition of experience cycles is determined by the interaction between emotional memories and projective experiences; that is, a circuit that moves between dependence and the need for gratification. Adapted from [45].

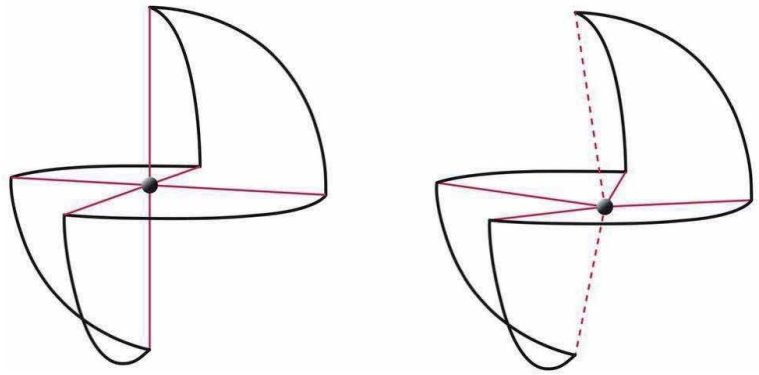

Figure 5.
(A) The balanced condition, in which all three axes meet at the center of the sphere. (B) A unbalanced condition, in which the intersection is only between the first two axes, that of time and emotion axes, and no intentional self-determination (depicted by the dotted lines symbolizing the state of lack of voluntary activation of the self-determination. Adapted from [54].

deconstruction of habitual responses, and planning, error detection, decision-making, and novel-response formation, respectively. In relation to this, it is important to note that the cerebellum and the prefrontal cortex are preferentially activated during difficult and/or new tasks that require our full attention, and they are less activated during tasks in which the 'automatic pilot' is satisfactory [56, 57].

In fact, training to improve attention through mental practice and verbal labeling might recruit emotion regulation processes associated with the prefrontal cortex. Consequently, training might disrupt or inhibit automatic affective responses, diminishing their intensity and duration [58, 59].

Utilizing Posner and Petersen's [55] model of attention as a theoretical framework, we suggest that it is valuable to add attention control and attention shifting, at an optimal effort level, to physical training paradigms, in a way which can allow practitioners to be more 'body-centered' in a state of flow (see Section 5.4) empowering increased creativity, motivation, and enjoyment [18, 21].

Particularly in the context of movement meditations, it is worth mentioning that attention is known to alter the appearance of objects and can affect facial attractiveness [60] and emotional information [39, 61, 62]. Studies suggest that attention levels (i.e., automatic, identified, focused, or divided, [15, 48, 54] and related brain frequencies and states can significantly alter emotional and cognitive perception [53].

More specifically, by working with the minimal bodily self through paradigms like the QMT, which require us to be present in the current moment, we can enhance emotional regulation and in turn increase EI. The tasks required of QMT practitioners involve time perception and timing [63, 64], emotional regulation [29], and the capacity to enhance self-determination through attention [65]. Keeping in mind that the central point in the sphere is thought to represent an equilibrium state in which attention is divided between extrinsic and intrinsic stimuli [45], it is notable that QMT requires intentional division of attention between the internal object - the body - and external surroundings, as well as sustained attention; together, these might lead to enhanced self-awareness, in which the somatic focus is mediated by alpha modulation. This can lead to sensitization of practitioners, allowing them to better detect and regulate when the mind wanders from its somatic focus [21, 66]. Bringing the self to the current bodily state, which is not projected by the Narrative Self to previous memories of the past, nor to future projections, might allow us to become self-aware of those memories and projections

and consequently free ourselves from their conditioning. As we will now see in detail, body-centering could be related in QMT participants to the ideational flexibility that we mentioned in paragraph 4.

5.4 QMT, attention and flow

The improvement in ideational flexibility could have occurred because QMT was more engaging than the tasks performed by control groups (verbal and simple movement trainings, [21]), allowing participants to become bodily-centered in a state of flow [67]. Flow can be defined as "a state of high attention occurring during active performance. It is characterized by high creativity, as well as excellent emotional, cognitive, and motor performance" [21, 67, 68]. In addition, previous studies demonstrated that positive emotions, as compared to negative emotions, are associated with enhanced divergent-thinking [69]. Furthermore, increased cognitive flexibility and creative thinking are associated with positive emotion, possibly reflecting a change in selective attention [70]. Flow is closely related to self-actualization "peak experiences," described by Maslow as memorable experiences of happiness, fulfillment, and achievement that create a feeling of realizing one's human potential [18, 71]. More recently, Csikszentmihalyi [72] defined flow by "an almost automatic, effortless, yet highly focused state of consciousness" (p. 110). Thus, in accordance with Dietrich's [18] claim that "only through the circuitous route involving actual behavior can the explicit system come to embody an implicitly learned skill" (p. 754), by increasing the connection between the Narrative and Minimal Selves, we can we improve self-awareness and, in turn, emotional regulation. Additional supporting evidence, although indirect, comes from the similarity between the electrophysiological correlates of creativity and those of flow and exercise; namely increased frontal alpha activity [18]. Indeed, a significant correlation between increased bilateral frontal alpha coherence and cognitive flexibility [21].

According to the SMC, self-awareness can be visually represented as a relationship between on one hand mind contents placed along the axes (polarities of time, emotion and self-determination) and, on the other hand, the concentric circles of the selves, that is how mind content are experienced in connection with which dimension of the self. The highest degree of self-awareness is represented as an equal relationship between the periphery and the center of the sphere, named consciousness-as-such. Based on the SMC, we hypothesize that an equal relationship between consciousness and contents can be reached only intentionally. Intentionality is needed to produce divided attention [15, 48, 54], which is needed to manifest an equal relationship between consciousness and contents. In psychological research, self-awareness is often considered an expression of EI because emotional ability is required in order to detach from emotional experiences, to observe them and become self-aware, as discussed by Salovey and Mayer [1]. In their model, there are four EI abilities that require self-awareness and lead to it.

6. Conclusion

Mayer, Caruso, and Salovey initially defined EI as the "ability to recognize the meanings of emotions and their relationships, and to reason and problem-solve on the basis of them" ([73], p. 267). In their view, EI "is involved in the capacity to perceive emotions, assimilate emotion-related feelings, understand the information of those emotions, and manage them" ([73], p. 267). Later, they discussed the "capacity to reason about emotions, and of emotions to enhance thinking," noting that "EI "includes the ability to accurately perceive emotions, to access and generate

emotions so as to assist thought, to understand emotions and emotional knowledge, and to reflectively regulate emotions so as to promote emotional and intellectual growth" ([74], p. 197).

All of these abilities are grounded in self-awareness [14, 16]. One of the most interesting things detected by research on self-awareness is the common illusion that have it, also in the case of its absence [75]. In fact, there is a significant discrepancy between participants who believed themselves to be self-aware and those who were actually found to be self-aware [75]. When we see ourselves clearly, we are more confident and creative, make sounder decisions, build stronger relationships, and communicate more effectively. We are also more likely to be honest, to be better workers who get more promotions, and to be more effective leaders with more satisfied employees and more profitable companies [76–78]. It is therefore extremely important to investigate how self-awareness and EI in general can be improved.

As illustrated by the case of QMT, specifically tailored movement meditation trainings can be effective in improving self-awareness, and consequently cognitive and emotional regulation throughout the life span, encouraging harmonious development of attentive and motivated minds in healthy bodies. This, in turn, is an essential requirement for personal and social well-being.

The SMC provides an overall framework through which we can describe the processes involved in improving self-awareness from a neurophenomenal perspective [45, 54, 65]. Accordingly, inner experiential self-awareness phenomena related to meditative practices like QMT, as well as still meditation, can be represented in terms of Time, Emotion, Self-determination and, most importantly, proximity to the center of the sphere. Moving toward the center of the sphere means moving from the more projective dimension of Narrative Self, in which rumination is related to DMN activity, to Minimal Self, in which we are more connected to the present through the body. Being present to oneself is a prerequisite condition for enhancing awareness of emotions and the ability to regulate them. The SMC has an educative element, as it provides the practitioner with visual feedback with respect to an inner position and, eventually, a way to move from it toward the center [45, 54, 65].

In turn, these findings may also have practical implications for people's daily life, instead of negating stress or denying it, observing and verbalizing it in a conscious way, can help move from the lower default way of reacting to stress to a more forgiving and empathic way with ourselves and to the other [79, 80] and containing way to approach the stimuli we are constantly receiving.

The current state of Covid pandemic, beyond its challenges, allows great opportunities for re-valuating life on our planet through strengthening resilience at an individual level and assuming more responsibilities from a personal social perspective [81]. Strategies for coping with current stress can be diverse, such as, practicing meditation and physical exercise [82, 83], and can be achieved for both adults and children alike [56, 84, 85]. In sum, promoting enhanced self-awareness to inner and outer experiences, regulation and acceptance [85, 86] can allow us to become more emotionally intelligent and cope better with the world's current requests.

Author details

Patrizio Paoletti and Tal Dotan Ben-Soussan*
Research Institute for Neuroscience, Education and Didactics, Patrizio Paoletti Foundation, Assisi, Italy

*Address all correspondence to: research@fondazionepatriziopaoletti.org

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References

[1] Salovey P, Mayer J D, Emotional intelligence. Imagin. Cogn. Pers. 1990;9,185-211. DOI:10.2190/DUGG-P24E-52WK-6CDG

[2] Mayer J D, Salovey P, "What is emotional intelligence?". In: Salovey P, Sluyter D (eds.), Emotional Development and Emotional Intelligence: Implications for Educators, New York, NY: Basic Books, 1997, pp. 3-31.

[3] Di Fabio A, Kenny M E, Promoting Well-Being: The Contribution of Emotional Intelligence. Front. Psychol. 2016;7:1182. DOI: 10.3389/fpsyg.2016.01182

[4] Damasio A R, The Feeling of what Happens: Body and Emotion in the Making of Consciousness. New York, NY: Harcourt Brace; 1999.

[5] Lambie J A, Marcel A J, Consciousness and the varieties of emotion experience: a theoretical framework. Psychol.Rev. 2002;109:219-259. DOI: 10.1037/0033-295X.109.2.219

[6] Panksepp J, Affective consciousness: core emotional feelings in animals and humans. Conscious. Cogn. 2005;14:30-80. DOI: 10.1016/j.concog.2004.10.004

[7] Barrett L F, Mesquita B, Ochsner K N, Gross J J, The experience of emotion. Ann. Rev. Psychol. 2007;58, 373-403. DOI: 10.1146/annurev.psych.58.110405.085709

[8] Tsuchiya N, Adolphs R, Emotion and consciousness. Trends Cogn. Sci. 2007;11:158-167.

[9] Lebrecht S, Bar M, Barrett L F, Tarr M J, Micro-valences: perceiving affective valence in everyday objects. Front. Psychol. 2012;3:107. DOI: 10.3389/fpsyg.2012.00107

[10] Lewis M, Haviland-Jones M, Barrett L F, Handbook of Emotions. New York, NY: The Guilford Press, 2008.

[11] Solomon R C, Stone L D, On "positive" and "negative" emotions. J. Theory Soc. Behav. 2002;32(4):417-435. DOI: https://doi.org/10.1111/1468-5914.00196

[12] Schachter S, Singer J E, Cognitive, social, and physiological determinants of emotional state. Psychol. Rev. 1962;69:379-399. DOI:10.1037/h0046234

[13] Ben-Soussan T D, Paoletti P, In: Béziau J Y, Gan-Krzywoszyńska K (eds.). Proceedings of World Congress on the Square of Oppositions, 5-9 May 2014, Pontifical Lateran University, City of Vatican.

[14] Pesce C, Ben-Soussan T D, "Cogito ergo sum" or "ambulo ergo sum"? New perspectives in developmental exercise and cognition research. In: McMorris T. (ed.), Exercise-cognition interaction: Neuroscience perspectives, London: Elsevier Academic Press. p. 251-282. DOI: https://doi.org/10.1016/B978-0-12-800778-5.00012-8

[15] Paoletti P, Crescere nell'eccellenza [Growing into Excellence], Rome, Italy: Armando Editore, 2008.

[16] Bar-On R, The Bar-On model of emotional-social intelligence (ESI). Psicothema, 2006;18:13-25.

[17] Travis F, Arenander A, Du Bois D, Psychological and physiological characteristics of a proposed object-referral/self-referral continuum of self-awareness. Conscious. Cogn., 2004;13(2), 401-420. DOI: 10.1016/j.concog.2004.03.001

[18] Dietrich A, Neurocognitive mechanisms underlying the experience of flow. Conscious Cogn. 2004;13:746-761. DOI: 10.1016/j.concog.2004.07.002.

[19] Ben-Soussan T D, Paoletti P, Philosophy, Art, Science, Economy (PHASE) of self and internal integrity. In: Béziau J Y, Buchsbaum A, Rey C (eds.), Handbook of the 6th World Congress and School on Universal Logic, 21-26 June 2018, Vichy, France.

[20] Ben-Soussan T D, Marson F, Piervincenzi C, et al., Correlates of Silence: Enhanced Microstructural Changes in the Uncinate Fasciculus. Front. Psychol. 2020;8,11:543773. DOI: 10.3389/fpsyg.2020.543773

[21] Ben-Soussan T D, Glicksohn J, Goldstein A, Berkovich-Ohana A, Donchin O, Into the square and out of the box: the effects of Quadrato Motor Training on creativity and alpha coherence. PLoS One, 2013;8:e55023. DOI: http://dx.doi.org/10.1371/journal.pone.0055023.

[22] Varela F, Lachaux J P, Rodriguez E, Martinerie J, The brainweb: phase synchronization and largescale integration. Nat. Rev. Neurosci., 2001;2:229-239. DOI: 10.1038/35067550

[23] Ben-Soussan T D, Berkovich-Ohana A, Glicksohn J, Goldstein A, A suspended act: increased reflectivity and gender-dependent electrophysiological change following Quadrato Motor Training. Front. Psychol., 2014;3. http://dx.doi.org/10.3389/fpsyg.2014.00055.

[24] Kjaer T W, Bertelsen C, Piccini P, Brooks D, Alving J, Lou H C, Increased dopamine tone during meditation-induced consciousness. Brain Res. Cogn. Brain Res., 2002;13:255-259. DOI: 10.1016/s0926-6410(01)00106-9

[25] Thompson E, Varela F J, Radical embodiment: neural dynamics and consciousness. Trends Cogn. Sci., 2001;5:418-425. DOI: 10.1016/s1364-6613(00)01750-2

[26] Ben-Soussan T D, Piervincenzi C, Venditti S, Verdone L, Caserta M, Carducci F, Increased cerebellar volume and BDNF level following quadrato motor training. Synapse. 2015;6:1-6. DOI: http://dx.doi.org/10.1002/syn.21787.

[27] Leckart B T, Levine J R, Goscinski C, Brayman W, Duration of attention: the perceptual deprivation effect. Percept. Psychophys. 1970;7:163-164. DOI: https://doi.org/10.3758/BF03208649

[28] De Fano A, Leshem R, Ben-Soussan T D, Creating an internal environment of cognitive and psycho-emotional well-being through an external movement-based environment: an overview of Quadrato Motor Training. Int. J. Environ. Res. Public Health. 2019;16:2160. DOI: 10.3390/ijerph16122160.

[29] Leshem R, De Fano A, Ben-Soussan T D, The Implications of Motor and Cognitive Inhibition for Hot and Cool Executive Functions: The Case of Quadrato Motor Training. Front. Psychol. 2020;11:940. DOI: 10.3389/fpsyg.2020.00940

[30] Diamond A, Ling D S, Conclusions about interventions, programs, and approaches for improving executive functions that appear justified and those that, despite much hype, do not. Dev. Cogn. Neurosci., 2016;18:34-48. DOI: 10.1016/j.dcn.2015.11.005.

[31] Pesce C, Shifting the focus from quantitative to qualitative exercise characteristics in exercise and cognition research. J. Sport Exerc. Psychol. 2012;34:766-786. DOI: 10.1123/jsep.34.6.766

[32] Tomporowski P D, Pesce C, Exercise, sports, and performance arts benefit cognition via a common process. Psychol. Bull. 2019;145.9:929. DOI: 10.1037/bul0000200

[33] Diamond A, Ling D S, Aerobic-exercise and resistance-training

interventions have been among the least effective ways to improve executive functions of any method tried thus far. Dev. Cogn. Neurosci. 2019;37:100572. DOI: 10.1016/j.dcn.2018.05.001.

[34] Paoletti P, Glicksohn J, Mauro F, Di Giuseppe T, Ben-Soussan T D, PHASE: from art to neuroplasticity: the case of embodied symbols. In : Beziau J Y, The Arbitrariness of the Sign, Le Cours de Linguistique Générale; January 9-13, 2017, Geneve. http://collegepublications.co.uk/contents/ las00001.pdf

[35] Piervincenzi C, Ben-Soussan T D, Mauro F, Mallio CA, Errante Y, Quattrocchi CC, et al. White matter microstructural changes following quadrato motor training: A longitudinal study. Front. Hum. Neurosci. 2017;11:590. DOI: 10.3389/fnhum.2017.00590

[36] Kessler E M, Staudinger U M, Affective experience in adulthood and old age: The role of affective arousal and perceived affect regulation. Psychology and aging, 2009;24.2:349. DOI: 10.1037/a0015352

[37] Schunk D H, Zimmerman B J, Influencing children's self-efficacy and self-regulation of reading and writing through modeling. Reading & writing quarterly. 2007;23.1:7-25. DOI: https://doi.org/10.1080/10573560600837578

[38] Viviani R, Emotion regulation, attention to emotion, and the ventral attentional network. Front. Hum. Neurosci. 2013;7:746. DOI: 10.3389/fnhum.2013.00746

[39] Mishra M V, Srinivasan N, Exogenous attention intensifies perceived emotion expressions. Neuroscience of consciousness, 2017;2017(1):nix022. DOI: 10.1093/nc/nix022

[40] Arch J J, Craske M G, Mechanisms of mindfulness: emotion regulation following a focused breathing induction. Behav. Res. Ther. 2006;44:1849-1858. DOI: 10.1016/j.brat.2005.12.007

[41] Hölzel B K, Carmody J, Vangel M, Congleton C, Yerramsetti S M, Gard T, et al., Mindfulness practice leads to increases in regional brain gray matter density. Psychiatry Research, 2011;191:36-43. DOI: 10.1016/j.pscychresns.2010.08.006

[42] Pagnoni G, Cekic M, Age effects on gray matter volume and attentional performance in Zen meditation. Neurobiological Aging, 2007;28:1623-1627. DOI: 10.1016/j.neurobiolaging.2007.06.008

[43] Vestergaard-Poulsen P, van Beek M, Skewes J, Bjarkam C R, Stubberup M, Bertelsen J, et al., Longterm meditation is associated with increased gray matter density in the brain stem. NeuroReport, 2009;20:170-174. DOI: 10.1097/WNR.0b013e328320012a

[44] Schutter D J, Van Honk J, The cerebellum on the rise in human emotion. Cerebellum, 2005;4,290-294. DOI: 10.1080/14734220500348584

[45] Paoletti P, Ben-Soussan T D, The Sphere Model of Consciousness: From geometrical to neuro-psychoeducational perspectives. Logica Universalis. 2019;13(3):395-415. DOI: 10.1007/s11787-019-00226-0

[46] Paoletti P, Flussi, territori, luogo [Flows, territories, place]. Madeira, Portugal: M.E.D. Ed., 2002.

[47] Paoletti P, Flussi, territori, luogo II [Flows, territories, place II]. Madeira, Portugal: M.E.D. Ed., 2002.

[48] Paoletti P, Selvaggio A, Osservazione—Quaderni di Pedagogia per il Terzo Millennio [Observation: Educational Notebooks on Pedagogy for the Third Millennium], Perugia, Italy, Ed. 3P, 2011.

[49] Berkovich-Ohana A, Glicksohn J, The consciousness state space (CSS)—A unifying model for consciousness and self. Front. Psychol. 2014;5:341. DOI: https://doi.org/10.3389/fpsyg.2014.00341

[50] Uscinska M, et al. The Brain Stress System in the Neurobiology of the "Dark Side" of Addiction and Its Relation to Neurodegeneration. In: Neurodegenerative Diseases-Molecular Mechanisms and Current Therapeutic Approaches. IntechOpen, 2020.

[51] Shulze W, Predictive reward signal of dopamine neurons. J. Neurophysiol. 1998;80(1):1-27. DOI: 10.1152/jn.1998.80.1.1

[52] Schultz W, Neuronal reward and decision signals: from theories to data. Physiol. Rev. 2015;95.3:853-951. DOI: 10.1152/physrev.00023.2014

[53] Davis Z W, Muller L, et al. Spontaneous travelling cortical waves gate perception in behaving primates. Nature. 2020;587.7834:432-436. DOI: 10.1038/s41586-020-2802-y.

[54] Paoletti P, Ben-Soussan T D, Reflections on Inner and Outer Silence and Consciousness Without Contents According to the Sphere Model of Consciousness. Front. Psychol. 2020;11:1807. DOI: 10.3389/fpsyg.2020.01807

[55] Posner M I, Petersen S E, The attention system of the human brain. Annu. Rev. Neurosci., 1990;13.1:25-42. DOI: 10.1146/annurev.ne.13.030190.000325

[56] Diamond A, Ling D S. Review of the evidence on, and fundamental questions About, Efforts to Improve Executive Functions, Including Working Memory. In: Novick J, Bunting M F, Dougherty M R, Engle R W (Eds.), Cognitive and Working Memory Training: Perspectives from Psychology, Neuroscience, and Human Development. Oxford: Oxford University Press, 2020, pp. 143-431.

[57] Rubia K, "Cool" inferior frontostriatal dysfunction in attention-deficit/hyperactivity disorder versus "hot" ventromedial orbitofrontal-limbic dysfunction in conduct disorder: a review. Biol. Psychiatry, 2011, 69.12: e69-e87. DOI: 10.1016/j.biopsych.2010.09.023

[58] Hayes A M, Feldman G, Clarifying the construct of mindfulness in the context of emotion regulation and the process of change in therapy. Clin. Psychol. 2004;11, 255-262. DOI: 10.1093/clipsy.bph080

[59] Lutz A, Slagter H A, Dunne J D, Davidson R J, Attention regulation and monitoring in meditation. Trends Cogn. Sci. 2008;12:163-169. DOI: 10.1016/j.tics.2008.01.005

[60] Störmer V S, Alvarez G A, Attention alters perceived attractiveness. Psychol. Sci. 2016;27.4:563-571. DOI: https://doi.org/10.1177/0956797616630964

[61] Pourtois G, Schettino A, Vuilleumier P, Brain mechanisms for emotional influences on perception and attention: what is magic and what is not. Biol. Psychol. 2013;92.3:492-512. DOI: 10.1016/j.biopsycho.2012.02.007

[62] Carretié L, Exogenous (automatic) attention to emotional stimuli: a review. Cogn. Affect. Behav. Neurosci. 2014;14.4:1228-1258. DOI: 10.3758/s13415-014-0270-2

[63] Ben-Soussan T D, Glicksohn J, Gender-dependent changes in time production following Quadrato Motor Training in dyslexic and normal readers. Front. Comput. Neurosci. 2018;29,12:71. DOI: 10.3389/fncom.2018.00071

[64] Ben-Soussan T D, Glicksohn J, De Fano A, Mauro F, Marson F, Modica M, Pesce C, Embodied time: Time

production in advanced Quadrato and Aikido practitioners. PsyCh journal. 2019;8(1):8-16. DOI: 10.1002/pchj.266

[65] Paoletti P, Ben-Soussan T D, Glicksohn J, Inner navigation and theta activity: from movement to cognition and hypnosis according to the sphere model of consciousness. In: Mordeniz C (ed.) Hypnotherapy and hypnosis. IntechOpen, 2020. DOI: 10.5772/intechopen.92755

[66] Kerr C E, Sacchet M D, et al., Mindfulness starts with the body: somatosensory attention and top-down modulation of cortical alpha rhythms in mindfulness meditation. Front. Hum. Neurosci. 2013;7:12. DOI: https://doi.org/10.3389/fnhum.2013.00012

[67] Mosing M A, Pedersen N L, Cesarini D, Johannesson M, Magnusson PKE, et al., Genetic and environmental influences on the relationship between flow proneness, locus of control and behavioral inhibition. PLoS One, 2012;7:e47958. DOI: 10.1177/1753193414548965

[68] Csikszentmihalyi M, Flow: The psychology of optimal experience. New York: Harper Collins; 1990.

[69] Vosburgm S K, The effects of positive and negative mood on divergent-thinking performance. Creat. Res. J. 1998;11: 65-172. DOI: https://doi.org/10.1177/2158244015592679

[70] Rowe G, Hirsh J, Anderson A, Positive affect increases the breadth of attentional selection. PNAS, 2007;104:383-388. DOI: 10.1073/pnas.0605198104

[71] Maslow A H, Cognition of being in the peak experiences. J. Genet. Psychol. 1959;94:43-66. DOI: 10.1080/00221325.1959.10532434

[72] Csikszentmihalyi M, Creativity. New York: Harper Perennial; 1996.

[73] Mayer J D, Caruso D, Salovey P, Emotional intelligence meets traditional standards for an intelligence. Intelligence, 1999;27,267-298. DOI: https://dx.doi.org/10.1016/S0160-2896(99)00016-1

[74] Mayer J D, Salovey P, Caruso D R, Emotional intelligence: Theory, findings, and implications. Psychological Inquiry, 2004;60:197-215. DOI: 10.1207/s15327965pli1503_02

[75] Eurich T, Insight: Why we're not as self-aware as we think, and how seeing ourselves clearly helps us succeed at work and in life. New York: Currency, 2017.

[76] Church A H, Managerial Self-Awareness in High-Performing Individuals in Organizations. J. Appl. Psychol. 1997;82,2:281-292. DOI: https://doi.org/10.1037/0021-9010.82.2.281

[77] Bass B M, Yammarino F J, Congruence of Self and Others' Leadership Ratings of Naval Officers for Understanding Successful Performance, Appl. Psychol. 1991;40,4:437-454. DOI: 10.1111/j.1464-0597.1991.tb01002.x

[78] Okpara A, Edwin A M, Self-Awareness and Organizational Performance in the Nigerian Banking Sector, EJRRES. 2015;3,1:53-70.

[79] Lamm C, Batson C D, Decety J, The neural substrate of human empathy: effects of perspective-taking and cognitive appraisal. J. Cogn. Neurosci. 2007;19(1):42-58. DOI: 10.1162/jocn.2007.19.1.42

[80] Paoletti P, L'intelligenza del cuore [The intelligence of the heart]. Milan, Italy: BUR, 2019.

[81] Aarts E, Fleuren H, Sitskoorn M, Wilthagen T, The new common: How the Covid-19 pandemic is transforming society. Tilburg: Tilburg University, 2020.

[82] Schutte N S, Malouff J M, Emotional intelligence mediates the relationship between mindfulness and subjective well-being. Psychol. Rep. 2011;*50*(7):1116-1119. DOI: https://doi.org/10.1177/0033294116649707

[83] Saklofske D H, Austin E J, Rohr B A, Andrews J J, Personality, emotional intelligence and exercise. J. Health Psychol. 2007;*12*(6):937-948. DOI: 10.1177/1359105307082458

[84] Tang Y Y, Posner M I, Rothbart M K, Meditation improves self-regulation over the life span. Ann. N. Y. Acad. Sci. 2014;*1307*:104.

[85] Chu L C, The benefits of meditation vis-à-vis emotional intelligence, perceived stress and negative mental health. Stress Health. 2010;26(2):169-180.

[86] Hyland P K, Lee R A, Mills M J . Mindfulness at work: A new approach to improving individual and organizational performance. Ind. Org. Psychol. 2015;*8*(4):576.

Chapter 4

Emotional Intelligence for Coping with the Consequences of Childhood Trauma

Bruna Amélia Moreira Sarafim-Silva and Daniel Galera Bernabé

Abstract

Childhood trauma has been a serious public health problem and its long-term repercussions are widely studied. Childhood trauma can deregulate the stress-related biological pathways, incapacitating the individual to process these experiences and, consequently, producing a lasting impact in later stages of life. Exposure to adverse childhood experiences has been associated with poorer quality of life and a higher risk for harmful behaviors and illness. The emotional consequences of childhood trauma are inevitable, and the development of strategies for their coping and manage become decisive and urgent. In this chapter we will cover the most current perspectives on childhood trauma, its impact on later life stages and the resulting emotional process. Finally, it will be discussed how emotional intelligence can be a useful resource for coping with stressful situations resulting from traumatic experiences in childhood.

Keywords: Emotional intelligence, Childhood trauma, Emotions, Stress, Psychological effects

1. Introduction: the childhood trauma and its implication in the physical and mental health

Stress is generally defined as an emotional experience in response to a stressor event [1, 2]. Chronic stress can produce physiological, cognitive, and behavioral dysfunctions [1, 2]. A stressful event or stressor is both a physical stimulus as imaginary that can threaten homeostasis [2]. When a stressful event occurs early in life (also called early life stress or childhood trauma), it has powerful consequences gain greater importance, seen the vast physiological and psychological repercussions, which can perpetuate throughout the individual's life [1–5]. Childhood trauma is configured in behaviors that pose a risk to the child's physical or emotional well-being [1–3]. The main childhood trauma subtypes are physical, sexual and emotional abuse; physical and emotional neglect; witnessing violence against a family member; living with drug users or alcoholics and low socioeconomic status [5, 6].

Abuse is characterized by hostile attitudes towards children with the potential to cause physical and emotional damage [5, 6]. Neglect occurs due to the inability to supply basic needs such as clothing, food and health, besides the failure to offer emotional support to children [1–3]. Moreover, the exploration physical and emotional,

with the possibility of resulting in damage to health, development or dignity of child, are also potentially stressful events [7]. Child adversity can include discrete events or circumstances that are beyond the control of children and are perceived as negative by them [8]. A large study evaluated the most common types of adverse childhood experiences (ACEs) in the United States [9]. Child abuse (emotional, physical or sexual), child neglect (emotional or physical) and domestic dysfunction (domestic violence, abuse of substances, parental absence or criminal activity) were the main events reported [9]. Other forms of child abuse include sudden and frequent house changes, death of a loved one, childhood illness life-threatening, serious accidents, prostitution, natural disasters, kidnapping, and terrorism [10].

Traumatic events experienced in childhood are extremely common. More than one third of the general population experience at least one event traumatic in childhood [11]. According to the World Health Organization (WHO) more than a quarter of adults worldwide reported having suffered physical abuse in childhood [7]. Twenty per cent of women and 5–10% of men reported having been sexually abused in the childhood [7]. The worldwide prevalence of child abuse and neglect ranges from 10–29% respectively and are strongly associated with a range of adverse results in adulthood [12]. In high-income countries, physical abuse ranges from 4–16%, and approximately 10% of children aged up to 15 years are neglected or suffer emotional abuse. Over 80% of these mistreatments are committed by parents or responsible [13]. In less developed countries like Brazil, 10% of children suffer some type of violence (representing 15 million of children). In addition, the majority of victims of rape are children, most of them girls between 5 and 10 years old [14].

Child abuse has been a global public health problem with long-term consequences for an individual, his family and society [10]. It is a global phenomenon that does not respect the limits of race, education, social class and religion [15]. Its occurrence can be both public and private, leading to the individual mistreated to serious physical, moral and emotional damages [15]. The psychological trauma experienced in childhood became the object of research in numerous fields of science, mainly in the psychology and psychiatry areas [15, 16]. Vast evidence indicates that childhood abuse exposure is strongly associated with a range of adverse outcomes in adulthood, contributing substantially to the global burden of numerous diseases and health risk behaviors [10]. For example, childhood trauma is predictive of obesity, inflammation, smoking, alcoholism, drug use, high-risk sexual behavior, among others [9, 13, 17]. Moreover, childhood trauma has also been associated to an increased risk of vascular disease, diabetes, and cancer [3, 9, 18–23]. Individuals who experienced more than four childhood trauma subtypes (for example, physical, emotional, sexual abuse and neglect) had 11.3 times more likely to abuse illegal intravenous substances, 7.4 to be alcoholics, 3.2 times to have sexual relations with 5 or more partners, 2.2 to be chronic smokers and 1.6 to be obese in adulthood [9]. Childhood trauma also predict addicted behavior in individuals with illnesses. For example, a study showed that cancer patients who reported experiencing emotional neglect in childhood had 2.32 times more likely to be alcoholics at the time of cancer diagnosis and 2.15 times more likely to have extensive tumors [3].

The occurrence of childhood trauma is also correlated with higher risk for anxiety and mood disorder, psychosis, personality disorder, and depression [24, 25]. Child maltreatment worsens the prognosis of several psychiatric disorders and is predictive for the worst psychopathological outcome, such as younger age of symptom onset, more episodes of mood swings and psychotic symptoms, history of suicide attempt and greater number of hospitalizations [16, 24]. Having a history of childhood sexual abuse has been linked with the development of post-traumatic stress disorder (PTSD) after attempts at sexual abuse or rape in adulthood [24]. In young people, physical

and sexual abuse are associated with crime and violence in relationships [25]. In addition, the young with a history of a higher occurrence of sexual abuse are more likely to commit rape [25]. An interesting study revealed that experiencing physical and emotional violence in childhood is a risk factor for reproducing abusive behaviors against children [26]. In addition to having a history of childhood trauma, other factors such as low education, low socioeconomic status, mental health problems and alcohol and drug abuse have been related to abusive behaviors [26]. These findings demonstrate that experiencing traumatic experiences in childhood predicts extremely negative outcomes throughout life.

2. Emotional processes resulting from childhood trauma

As previously mentioned, the occurrence of trauma in childhood activates stress-related pathways leading to a hyperactivation of the stressful response in adulthood. This mechanism mediates the various reflexes of trauma in childhood on physiological and behavioral dimensions. The outbreak of chronic stress induced by childhood trauma is directly related to the emotional processes derived from adverse experiences [9, 27]. A traumatic experience can cause anguish and suffering, leading the individual to a state of chronic emotional stress [27–29]. The emotional repercussions of trauma can be conscious or unconscious, since the individual perception will depend on the stimulus received from the environment since childhood [30, 31]. Beyond individual perception the occurrence and intensity of childhood trauma-derived emotional stress will depend on the exposure time and severity of traumatic experiences [11, 32]. Due the repercussions on the feelings and emotions, unbearable suffering is inevitable after exposure to severe trauma in childhood, such as physical, emotional, and sexual abuse [11, 32]. In addition, when the child is deprived of experiencing anguish and discomfort derived from natural adversities, such as denial of a toy, among others, there is a non-adaptation to stressful events [30]. Thus, it is possible that the child has greater difficulties in dealing with stressful situations in later stages of life [30, 31].

Sexual abuse in childhood can produce emotions and feelings of angry, deprotection, suffering, self-guilt and intense fear, which can extend for a lifetime [33, 34]. Victims of sexual abuse in childhood usually experience difficulties in interpersonal and loving relationships, such as relational and sexual intimacy problems, as well as having sex with several partners [33, 34]. In addition, in many cases, the victim feels intense guilt, believing that she or he is responsible for sexual abuse [34]. Physical abuse and neglect in childhood can exacerbate feelings of anger, aggressiveness, and emotional suffering later in adulthood [3, 35]. As a result of these emotional processes, it is common for victims of abuse to manifest violent behaviors, criminality, substance abuse and anxiety and depression symptoms [3, 35]. The emotional abuse and neglect experienced in childhood leads to feelings of rejection, guilt, inadequacy, and sadness, which can perpetuate for a long time [27, 35, 36]. It is also not uncommon for adults emotionally abused in childhood to display insecurity in solving problems and making decisions, as well as feeling easily offended or humiliated [35, 36].

The process of emotional dysregulation promoted by childhood trauma is mediated by neural systems and the inability to adapt to stressful events. Chronic exposure to traumatic events in childhood may impair the ability of the hypothalamic–pituitary–adrenal (HPA) axis in responding to stress in adulthood [37]. The limbic prefrontal system that encompasses the prefrontal cortex, amygdala and hippocampus, has a critical role for the individual's mental health [38]. The interaction among these regions is essential in the regulation of emotions and stress [38]. Experiencing trauma in the childhood changes the volume of the hippocampus

subfield, which depends on the severity of the traumatic event [38, 39]. For example, children exposed to severe trauma have a lower volume of left CA3 compared to children who experience lower occurrence of trauma [39]. These findings suggest that changes in the hippocampus induced by the childhood trauma may mediate deficits in emotional, cognitive and behavioral processes in later stages [39].

Emotional memory also has an underlying critical role in regulating the physiological and behavioral consequences of childhood trauma. For example, systemic levels of interleukin 1beta (IL-1β), a pro-inflammatory cytokine that acts on the hypothalamus, rise after intense traumatic experiences [40]. The emotion of anger is one of the main components associated with the increase in IL-1β levels when the adult remembers stressful events experienced in childhood [16]. Changes in the brain regions responsible for emotions modulate and directly affect the emotional response derived from childhood traumatic events [37–39]. Managing emotional processes can minimize the effects of childhood trauma, promoting adaptation or empowering the individual to face conflict situations. Emotional intelligence is an extremely useful resource for development skills to deal with emotions and stress resulting from childhood trauma.

3. Emotional intelligence as a strategy to deal with emotional stress resulting from childhood trauma

As previously described, childhood trauma has significant impact on the human emotional and physical health, predisposing harmful behaviors and illness. Experiencing traumatic events during childhood can incapacitate the individual to process unpleasant experiences and, consequently, can make a lasting negative impact in later life. The way in which the individuals interprets the traumatic experiences and how they manage their emotions depends on emotional support and the individual coping strategies. Evidence have shown that individuals who were mistreated during childhood had less empathy for the others' distress compared to people without a history of trauma [40, 41]. The adaptive response to stress derived from traumatic experiences may be in the capacity to understand and manage stressful situations. This adaptation mechanism is called emotional intelligence [42, 43].

Emotional intelligence is one of the main skills to manage emotions and enable conflict coping, as well as making mental and emotional contents become conscious [42, 43]. Developing this ability can promote impulse control, self-confidence, self-motivation and self-compassion against of impacting and stressful situations [42, 43]. However, how can the individual develop this ability to control and manage emotions against of conflicting events? One of the individual resources is the development of emotional intelligence. Deeply understand the emotions produced through stimulus received from the environment since childhood, implies using emotional intelligence to access the pleasant experiences (positive memories) and those nasty (emotional traumas).

In our experience, we consider the emotional intelligence to be the main strategy to develop emotional competence to deal with the effects of stressful events that occurred in childhood. The individual can develop emotional intelligence, training themselves to deal and resolve conflicts arising from childhood trauma. Self-knowledge can be achieved during adolescence, adulthood and old age. Its effectiveness will depend on the individual's willingness to get in touch with their emotional pain, beliefs and concepts that many times are the main components for the dullness and unconsciousness of emotional content derived from traumatic events.

Strategies for knowing and resolving emotional conflicts can be developed through specific instruments that assess occurrence and intensity of traumatic events experienced in childhood or adulthood. These instruments are based on self-responsive questionnaires or interviews focusing on stressful experiences [42, 43]. In addition, the clinical approach, such as psychotherapy, is a well-known evaluation method and used to treat the psychological consequences of trauma [44, 45]. Awareness and externalization of emotions and feelings derived from traumatic events can generate relief and consequently manage and control the response to stressful situations. This therapeutic approach allows the individual to identify and acknowledge unconscious content and its emotional impact, connecting life history (stimulus received from the environment) and sentimental manifestation. Thus, psychotherapy is an important instrument for developing emotional intelligence, promoting clarity and perception of psychological mechanisms resulting from traumatic experiences.

An interesting case we studied was of a woman who, through self-knowledge performed in psychotherapy, developed emotional intelligence to process and manage the consequences of a traumatic event experienced in childhood. At 12 years, Ana (fictitious name) was sexually abused by a stranger. This extremely traumatic event produced enormous emotional pain and, consequently, the experience was erased in her brain after a few months. Only at 21 years of age, after Ana had seen on the news the abuser being arrested for pedophilia, the memory of the traumatic event came to mind, triggering feelings of insecurity, fear, suffering and anger. According to the patient, these same emotional processes had been manifested in childhood after sexual abuse. Due to the exacerbation of these stressful emotions, Ana showed symptoms of depression and suicidal ideation. During the self-knowledge process developed by Ana, the perceptions of the repercussions of childhood trauma in the physiological, emotional, and social spheres became conscious for the first time. Along with these perceptions, the consciousness of the traumatic event and associated emotional process, enabled the management and coping with feelings arising. Thus, the symptoms of depression triggered after the memory of the trauma were minimized. This and other cases described in the literature [41–43, 46, 47] demonstrate that emotional intelligence regulates psychological content, promoting emotional clarity against of stressful situations [46, 47]. Therefore, emotional intelligence can be a protective resource for chronic stress and other emotional symptoms resulting from traumatic events experienced in childhood.

4. Conclusion

The occurrence of childhood trauma is extremely common in humans and occurs worldwide. The long-term consequences of childhood trauma have been a major health problem, in view of the enormous public spending on diseases and risky behaviors, which were previously mentioned. Moreover, develop strategies of self-knowledge to make conscious the emotional results of childhood trauma is decisive for controlling stress and its physical and behavioral effects. Emotional intelligence can be one of the main mechanisms in adulthood for identifying, managing, and adapting to conflict situations arising from traumatic childhood experiences.

Conflict of interest

The authors declare no conflict of interest.

Author details

Bruna Amélia Moreira Sarafim-Silva and Daniel Galera Bernabé*
Psychosomatic and Education Research Center, Oral Oncology Center, School of Dentistry, São Paulo State University (UNESP), Araçatuba, SP, Brazil

*Address all correspondence to: daniel.bernabe@unesp.br

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References

[1] Kuhlman KR, Robles TF, Bower JE, Carroll JE. Screening for childhood adversity: what and when of identifying individuals at risk for lifespan health disparities. *J Behav Med*. 2018;41(4):516-527. doi: 10.1007/s10865-018-9921-z. Epub 2018 Mar 30. PMID: 29603040; PMCID: PMC6031456.

[2] Llabre MM, Schneiderman N, Gallo LC, Arguelles W, Daviglus ML, Gonzalez F 2nd, Isasi CR, Perreira KM, Penedo FJ. Childhood Trauma and Adult Risk Factors and Disease in Hispanics/Latinos in the US: Results from the Hispanic Community Health Study/Study of Latinos (HCHS/SOL) Sociocultural Ancillary Study. Psychosom Med. 2017 Feb/Mar;79(2):172-180. doi: 10.1097/PSY.0000000000000394. PMID: 27606797; PMCID: PMC5285322.

[3] Sarafim-Silva BAM, Duarte GD, Sundefeld MLMM, Biasoli ÉR, Miyahara GI, Bernabé DG. Childhood trauma is predictive for clinical staging, alcohol consumption, and emotional symptoms in patients with head and neck cancer. Cancer. 2018;124(18):3684-3692. doi: 10.1002/cncr.31597. Epub 2018 Aug 6. PMID: 30079469.

[4] Waehrer GM, Miller TR, Silverio Marques SC, Oh DL, Burke Harris N. Disease burden of adverse childhood experiences across 14 states. *PLoS One*. 2020;15(1):e0226134. doi: 10.1371/journal.pone.0226134. PMID: 31990910; PMCID: PMC6986706.

[5] Mitchell AM, Porter K, Christian LM. Examination of the role of obesity in the association between childhood trauma and inflammation during pregnancy. *Health Psychol*. 2018;37(2):114-124. doi: 10.1037/hea0000559. Epub 2017 Oct 2. PMID: 28967771; PMCID: PMC5794605.

[6] Tell D, Mathews HL, Burr RL, Witek Janusek L. During stress, heart rate variability moderates the impact of childhood adversity in women with breast cancer. Stress. 2018;21(2):179-187. doi: 10.1080/10253890.2018.1424132. Epub 2018 Feb 1. PMID: 29385886.

[7] World Health Organization. Violence and Injury Prevention. [Internet]. 2018. Available from: http://www.who.int/violence_injury_prevention/violence/child/en/. [Accessed: 2020-07-10].

[8] Shonkoff JP, Garner AS; Committee on Psychosocial Aspects of Child and Family Health; Committee on Early Childhood, Adoption, and Dependent Care; Section on Developmental and Behavioral Pediatrics. The lifelong effects of early childhood adversity and toxic stress. Pediatrics. 2012 Jan;129(1):e232-e246. doi: 10.1542/peds.2011-2663. Epub 2011 Dec 26. PMID: 22201156.

[9] Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, Koss MP, Marks JS. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study. Am J Prev Med. 1998 May;14(4):245-258. doi: 10.1016/s0749-3797(98)00017-8. PMID: 9635069.

[10] Dube SR, Anda RF, Felitti VJ, Chapman DP, Williamson DF, Giles WH. Childhood abuse, household dysfunction, and the risk of attempted suicide throughout the life span: findings from the Adverse Childhood Experiences Study. JAMA. 2001 Dec 26;286(24):3089-3096. doi: 10.1001/jama.286.24.3089. PMID: 11754674.

[11] Copeland WE, Keeler G, Angold A, Costello EJ. Traumatic events and posttraumatic stress in childhood. Arch Gen Psychiatry. 2007 May;64(5):577-584. doi: 10.1001/archpsyc.64.5.577. PMID: 17485609.

[12] Sethi, D., Bellis, M., Hughs, K., Gilbert, R., Mitis, F., Galea, G. European report on preventing child maltreatment. Copenhagen, Denmark. World Health Organization 2013. p. 18. ISBN: 978 92 890 0028 4

[13] Gilbert R, Widom CS, Browne K, Fergusson D, Webb E, Janson S. Burden and consequences of child maltreatment in high-income countries. Lancet. 2009 Jan 3;373(9657):68-81. doi: 10.1016/S0140-6736(08)61706-7.

[14] National Household Sample Survey. Brazilian Institute of Geography and Statistics. [Internet]. 2018. Available from: https://agenciadenoticias.ibge.gov.br/. Accessed: 2020-07-10].

[15] Juruena MF. Early-life stress and HPA axis trigger recurrent adulthood depression. Epilepsy Behav. 2014 Sep;38:148-159. doi: 10.1016/j.yebeh.2013.10.020.

[16] Gill JM, Saligan L, Woods S, Page G. PTSD is associated with an excess of inflammatory immune activities. Perspect Psychiatr Care. 2009 Oct;45(4):262-277. doi: 10.1111/j.1744-6163.2009.00229.x. PMID: 19780999.

[17] Norman RE, Byambaa M, De R, Butchart A, Scott J, Vos T. The long-term health consequences of child physical abuse, emotional abuse, and neglect: a systematic review and meta-analysis. PLoS Med. 2012;9(11):e1001349. doi: 10.1371/journal.pmed.1001349.

[18] Sapolsky R, Rivier C, Yamamoto G, Plotsky P, Vale W. Interleukin-1 stimulates the secretion of hypothalamic corticotropin-releasing factor. Science. 1987 Oct 23;238(4826):522-524. doi: 10.1126/science.2821621. PMID: 2821621.

[19] Salmon P, Hill J, Krespi R, Clark L, Fisher J, Holcombe C. The role of child abuse and age in vulnerability to emotional problems after surgery for breast cancer. Eur J Cancer. 2006 Oct;42(15):2517-2523. doi: 10.1016/j.ejca.2006.05.024.

[20] Goldsmith RE, Jandorf L, Valdimarsdottir H, Amend KL, Stoudt BG, Rini C, Hershman D, Neugut A, Reilly JJ, Tartter PI, Feldman SM, Ambrosone CB, Bovbjerg DH. Traumatic stress symptoms and breast cancer: the role of childhood abuse. Child Abuse Negl. 2010 Jun;34(6):465-470. doi: 10.1016/j.chiabu.2009.10.007.

[21] Witek Janusek L, Tell D, Albuquerque K, Mathews HL. Childhood adversity increases vulnerability for behavioral symptoms and immune dysregulation in women with breast cancer. Brain Behav Immun. 2013 Mar;30 Suppl(Suppl):S149-62. doi: 10.1016/j.bbi.2012.05.014. Epub 2012 Jun 1. PMID: 22659062; PMCID: PMC3492527.

[22] Bower JE, Crosswell AD, Slavich GM. Childhood Adversity and Cumulative Life Stress: Risk Factors for Cancer-Related Fatigue. Clin Psychol Sci. 2014 Jan;2(1):108-15. doi: 10.1177/2167702613496243. PMID: 24377083; PMCID: PMC3873097.

[23] Crosswell AD, Bower JE, Ganz PA. Childhood adversity and inflammation in breast cancer survivors. Psychosom Med. 2014 Apr;76(3):208-14. doi: 10.1097/PSY.0000000000000041. PMID: 24632893; PMCID: PMC4357419.

[24] Carr CP, Martins CM, Stingel AM, Lemgruber VB, Juruena MF. The role of early life stress in adult psychiatric disorders: a systematic review according to childhood trauma subtypes. J Nerv Ment Dis. 2013 Dec;201(12):1007-1020. doi:10.1097/NMD.0000000000000049. PMID: 24284634.

[25] van der Put CE, Lanctôt N, de Ruiter C, van Vugt E. Child maltreatment among boy and girl

probationers: does type of maltreatment make a difference in offending behavior and psychosocial problems? Child Abuse Negl. 2015 Aug;46:142-151. doi: 10.1016/j.chiabu.2015.05.012.

[26] Butchart A, Phinney Harvey A, Kahane T, Mian M, Furniss T. World Health Organization. Preventing child maltreatment: a guide to taking action and generating evidence / World Health Organization and International Society for Prevention of Child Abuse and Neglect. World Health Organization. [Internet]. 2006 Available from: https://apps.who.int/iris/handle/10665/43499. [Accessed: 2020-10-25].

[27] Teicher MH, Samson JA. Annual Research Review: Enduring neurobiological effects of childhood abuse and neglect. J Child Psychol Psychiatry. 2016 Mar;57(3):241-66. doi: 10.1111/jcpp.12507. Epub 2016 Feb 1. PMID: 26831814; PMCID: PMC4760853.

[28] Chigiji H, Fry D, Mwadiwa TE, Elizalde A, Izumi N, Baago-Rasmussen L, Maternowska MC. Risk factors and health consequences of physical and emotional violence against children in Zimbabwe: a nationally representative survey. BMJ Glob Health. 2018 Jun 26;3(3):e000533. doi: 10.1136/bmjgh-2017-000533. PMID: 29989051; PMCID: PMC6035512.

[29] Hodgdon HB, Suvak M, Zinoviev DY, Liebman RE, Briggs EC, Spinazzola J. Network analysis of exposure to trauma and childhood adversities in a clinical sample of youth. Psychol Assess. 2019 Nov;31(11):1294-1306. doi: 10.1037/pas0000748.

[30] Terr LC. Treating childhood trauma. Child Adolesc Psychiatr Clin N Am. 2013 Jan;22(1):51-66. doi: 10.1016/j.chc.2012.08.003. PMID: 23164127.

[31] Gamache Martin C, Van Ryzin MJ, Dishion TJ. Profiles of childhood trauma: Betrayal, frequency, and psychological distress in late adolescence. Psychol Trauma. 2016 Mar;8(2):206-213. doi: 10.1037/tra0000095. Epub 2016 Jan 18. PMID: 26783760; PMCID: PMC4767667.

[32] Roberts ME, Fuemmeler BF, McClernon FJ, Beckham JC. Association between trauma exposure and smoking in a population-based sample of young adults. J Adolesc Health. 2008 Mar;42(3):266-74. doi: 10.1016/j.jadohealth.2007.08.029. PMID: 18295135; PMCID: PMC2675188.

[33] Kellogg ND, Koek W, Nienow SM. Factors that prevent, prompt, and delay disclosures in female victims of child sexual abuse. Child Abuse Negl. 2020 Mar;101:104360. doi: 10.1016/j.chiabu.2020.104360.

[34] Hailes HP, Yu R, Danese A, Fazel S. Long-term outcomes of childhood sexual abuse: an umbrella review. Lancet Psychiatry. 2019 Oct;6(10):830-839. doi: 10.1016/S2215-0366(19)30286-X.

[35] Malinosky-Rummell R, Hansen DJ. Long-term consequences of childhood physical abuse. Psychol Bull. 1993 Jul;114(1):68-79. doi: 10.1037/0033-2909.114.1.68. PMID: 8346329.

[36] Christ C, de Waal MM, Dekker JJM, van Kuijk I, van Schaik DJF, Kikkert MJ, Goudriaan AE, Beekman ATF, Messman-Moore TL. Linking childhood emotional abuse and depressive symptoms: The role of emotion dysregulation and interpersonal problems. PLoS One. 2019 Feb 14;14(2):e0211882. doi: 10.1371/journal.pone.0211882. PMID: 30763360; PMCID: PMC6375578.

[37] Nemeroff CB, Heim CM, Thase ME, Klein DN, Rush AJ, Schatzberg AF, Ninan PT, McCullough JP Jr, Weiss PM, Dunner DL, Rothbaum BO, Kornstein S, Keitner G, Keller MB. Differential responses to psychotherapy versus pharmacotherapy in patients with

chronic forms of major depression and childhood trauma. Proc Natl Acad Sci U S A. 2003 Nov 25;100(24):14293-6. doi: 10.1073/pnas.2336126100. Epub 2003 Nov 13. Erratum in: Proc Natl Acad Sci U S A. 2005 Nov 8;102(45):16530. PMID: 14615578; PMCID: PMC283585.

[38] Godsil BP, Kiss JP, Spedding M, Jay TM. The hippocampal-prefrontal pathway: the weak link in psychiatric disorders? Eur Neuropsychopharmacol. 2013 Oct;23(10):1165-1181. doi: 10.1016/j.euroneuro.2012.10.018.

[39] Malhi GS, Das P, Outhred T, Irwin L, Gessler D, Bwabi Z, Bryant R, Mannie Z. The effects of childhood trauma on adolescent hippocampal subfields. Aust N Z J Psychiatry. 2019 May;53(5):447-457. doi: 10.1177/0004867418824021.

[40] Bock BB, Bastos CR, Ardais AP, Grellert M, de Carvalho HW, Farias CP, Jansen K, Oses JP, da Silva RA, Portela LV, Kaster MP, Lara DR, Ghisleni G. Temperament traits moderate the relationship between Childhood Trauma and Interleukin 1β profile in young adults. Psycho neuroendocrinology. 2020 Jun;116:104671. doi: 10.1016/j.psyneuen.2020.104671.

[41] Levy J, Goldstein A, Feldman R. The neural development of empathy is sensitive to caregiving and early trauma. Nat Commun. 2019 Apr 23;10(1):1905. doi: 10.1038/s41467-019-09927-y. PMID: 31015471; PMCID: PMC6478745.

[42] Yılmaz M. Thinking Skill of Emotional Intelligence Education Programme. In: Fabio A D editor. Emotional Intelligence - New Perspectives and Applications. 1nd ed. IntechOpen; 2012. p. 261-278. DOI: 10.5772/31716.

[43] Ferrer CMS. How to Influence the New Technologies in the Emotional Intelligence and Communication of Higher Education Student. In: Fabio A D editor. Emotional Intelligence - New Perspectives and Applications. 1nd ed. IntechOpen; 2012. p. 279-288. DOI: 10.5772/31784.

[44] May K. Collaborating With the Fortress Around Early Childhood Trauma: A Depth Psychotherapy Process. Perspect Psychiatr Care. 2018 Jan;54(1):39-45.

[45] Rubin DC, Boals A. People who expect to enter psychotherapy are prone to believing that they have forgotten memories of childhood trauma and abuse. Memory. 2010 Jul;18(5):556-562.

[46] Kaurin A, Schönfelder S, Wessa M. Self-compassion buffers the link between self-criticism and depression in trauma-exposed firefighters. J Couns Psychol. 2018 Jul;65(4):453-462. doi: 10.1037/cou0000275.

[47] Kwako LE, Szanton SJ, Saligan LN, Gill JM. Major depressive disorder in persons exposed to trauma: relationship between emotional intelligence and social support. J Am Psychiatr Nurses Assoc. 2011 May-Jun;17(3):237-245. doi: 10.1177/1078390311402498. PMID: 21653496.

Chapter 5

Strategies to Develop Emotional Intelligence in Early Childhood

İlkay Ulutaş, Kübra Engin and Emine Bozkurt Polat

Abstract

Children have many opportunities in early childhood education that support their emotions. These opportunities need to be transformed into learning situations appropriate to their development and developed. Learnings cannot happen independently of emotional intelligence. Social–emotional skills must be developed in education to achieve both academic success and success in life. It is important to support emotional intelligence in early childhood education to enable children to be emotionally healthy, to cope with difficulties, to respect differences, and to gain a social perspective by working in collaboration with others. Emotional intelligence training helps not only children but everyone in the classroom setting, especially educators who are unsure of how to work with a child with an emotional or behavioral problem. Since emotional intelligence can be developed and strengthened by training at all ages, it can be a way of teaching for educators as they regularly include methods and techniques in the program. Based on this, in this section, the emotional intelligence of children, programs methods and strategies will be discussed in terms of supporting emotional intelligence in the early years.

Keywords: Emotional intelligence, Early childhood education, Early childhood teacher, Emotions, Socio-emotional learning

1. Introduction

In recent years, the difficulties experienced by children are increasing with many rapid changes such as cultural interaction, COVID 19 pandemic, distance education that have come with globalization, and efforts to improve children's emotional intelligence are gaining importance. OECD states that the quality of education must be high for children to be "well-being" and to be effective, responsible, and interactive individuals in a complex and uncertain world [1].

On the other hand, it is emphasized that "life and career" skills such as flexibility, initiative and self-orientation, social and intercultural relations, leadership, and responsibility must be acquired for children to adapt to the economic environment and acquire a profession that can sustain their lives. It is also stated that the development of 21st-century skills is related to the early learning environment [2]. Child development is faster in the first five years and the experiences and interventions acquired during this period can affect children's brain development, personality, and success in life [3, 4]. As well as meeting their basic needs such as nutrition and care, how their emotions are met and what kinds of experiences are offered are determinants of children's emotional intelligence in the early years. This reveals the

need to support emotional intelligence abilities from early years and develop the emotional intelligence of children through social experiences to progress towards their goals unabated despite difficulties [5–9]. Supporting emotional intelligence in the early years contributes to the development of basic competencies such as recognizing, understanding, and managing emotions and achieving permanent gains. It has been determined that children with higher emotional intelligence manage their emotions better, resort to aggression less, have more positive general moods, are more successful academically, move away from negative habits, establish positive social relationships with their family, peers, and social circles, and show social adaptation [7, 10–13]. Emotions are the determinants of the reactions. For example, anger, fear, and disgust increase attention and agility at the moment of danger, astonishment enables focusing on understanding the environment, sadness allows to pause and think and adapt to the situation, and happiness enables to enjoy the moment with relaxation response and move forward to new goals [14]. Individuals can adjust their emotions by improving their emotional intelligence. Emotional intelligence is a type of intelligence that includes abilities such as recognizing, identifying, expressing, understanding, and regulating the emotions of the individual and others [15]. As the expected correct ratio between IQ level and success could not be achieved under all conditions, it was determined that academic intelligence did not give a privilege to the person in terms of being prepared or adapting to positive or negative changes in life. Researchers emphasize that emotional intelligence has a determining effect on how well an individual can use his or her existing abilities [14].

Emotional intelligence, which affects both the social and academic life of the individual, has been studied in different dimensions by different researchers. Mayer and Salovey define emotional intelligence as perceiving, evaluating, and expressing emotions, using emotion to facilitate thought, thinking with, and understanding them, and managing emotions [15]. Bar-On describes emotional intelligence to be aware of the emotions of oneself and others and to express emotions (personal skills), to understand the feelings of others required for establishing and maintaining relationships (interpersonal skills), solving personal and interpersonal problems, and making correct sense of emotions during the reaction (adaptation), stress management, and the ability to feel positive emotions to oneself and others (general mental health) [16]. Goleman explains emotional intelligence in the dimensions of self-awareness, emotion management/ self-regulation, self-activation/motivation, understanding others' feelings /empathy and conducting relationships/social relations. According to these definitions, emotional intelligence can be interpreted as being aware of emotions and using emotions effectively for personal development, and being able to continue despite the obstacles encountered in life [14].

Early childhood settings are emotionally rich environments in which each child reflects their emotions specific to their personality and culture. Children spend most of their time in the school environment after the home environment. When they come to school, they bring their feelings to the classroom. They are in search of trust; they try to understand each other and adjust their feelings by transferring their feelings and experiences. If they can find support for their emotions in this environment, they feel safe, and their adaptation increases over time. The teacher should be able to recognize the child's emotions to respond effectively to the needs of the child [17, 18]. Children may tend to express themselves with different behaviors when their emotions are not understood. This situation can cause difficulties for both teachers and the child. It is necessary to support emotional intelligence abilities with education programs in many aspects such as feeling safe, being happy, and increasing the effect of learning. Supporting emotional intelligence in early childhood education increases the quality of education. High-quality education

also aims to give children positive, safe, and healthy behaviors; contribute to peer groups, families, schools, and communities ethically and responsibly; and teaches to have basic competencies, habits, and values as a foundation for the sensible citizenship [19]. When social–emotional skills are systematically supported in the school programs, academic success will also be provided, as the quality of teacher-student interaction will increase and problematic behaviors will decrease [9, 20]. For this reason, strategies, methods, and techniques that will support emotional intelligence abilities in early childhood settings should be determined and implemented according to the needs of children, educators, and families. In this section, the emotional intelligence abilities of children, programs,, strategies to support emotional intelligence will be discussed, and guidance will be provided in terms of supporting emotional intelligence in the early years.

2. Emotional intelligence in early childhood

Emotional intelligence includes three basic competencies such as recognizing, expressing, understanding managing and regulating emotions. These competencies strengthen the child's empathy and social relations with others [7].

The ability of recognizing and expressing emotions involves awarness the emotional changes of the person himself and then those around him and labeling emotions. This process is revealed through verbal and non-verbal information [21]. Emotions are recognized and expressed by making use of the similarities between situations, after obtaining verbal and non-verbal information through experiences. Emotional recognation and expression have key importance to build and maintain the social relationships [22].

The ability of understanding emotions includes establishing a relationship between emotions and situations and making sense of the changes and expressions of emotions in the body. It helps to carry out interpersonal relationships by interpreting messages from verbal and non-verbal forms of communication [23]. It develops through recognizing the emotions and their reasons, evaluating the environment and the situation, realizing that the same situations both create different effects and emotions in different people and may evoke multiple emotions [24].

The ability of managing and regulating emotions enables the individual to observe and control himself. It includes skills such as managing and expressing emotions with positive results, showing flexibility and adaptation, and delaying pleasure [21]. The intensity of the emotions and the duration of action are adjusted in such a way that the person can proceed following his goals. As socially acceptable behavioral expressions are learned, they emerge as behavior and social competence are provided [25].

When children reach the age of 2–3, they start to realize that others will have different feelings and thoughts from them; In the following years, they learn to put themselves in the shoes of others and find the source of their troubles. With the development of emotional abilities, they begin to make sense of complex emotions such as disappointment and betrayal and to empathize with a wide variety of emotions [26]. Over time, they regulate their emotions and help their peers and those around them in stressful situations to help them relax.

Although emotional intelligence abilities affect each other, the ability to recognize emotions can be considered as the basis of all abilities. When children do not recognize emotions, they cannot be successful at understanding and managing them. For this reason, children should recognize them starting from basic emotions, and social interaction experiences should be allowed to understand and manage emotions.

With social experiences, the child's ability to recognize the emotions of others, to reflect and express the emotion appropriate to the content will improve.

3. Emotional intelligence training programs for children

Children may be vulnerable to emotional difficulties that hinder their academic achievement [27, 28]. Fuller stated that the first years at school are more important than any other stage of school life in developing a child's perception of success. In addition to the perception of success for young children, regulating their emotions and developing basic social skills also increase their primary school readiness and academic skills [29]. Research stated that when children are not socially and emotionally competent, they may experience problems in communication skills, friendship relations, and conflict resolution [27]. Therefore, Stone-McCown et al. emphasized that integrating emotional skills-related programs into the curriculum is an important preventive solution for school problems [30]. Examination of the programs that support emotional intelligence in the early years will guide in developing strategies for children to recognize, understand and manage their emotions [31]. Many of these programs are evidence-based, many studies are supporting their impact on emotional intelligence [32–34]. Below, information about programs and strategies frequently encountered in the literature such as Strong Start, RULER, PATHS are given to guide educators in developing emotion strategies.

3.1 Strong start

The Strong Start Program was developed to increase the emotional skills of children aged 3–5 with emotional behavioral disorders [35, 36]. The content of the program is "Exercising Emotions", "Understanding Emotions", "Angry Times", "Happy Times", "Anxious Times", "Understanding Others' Emotions/Empathy", "Being a Good Friend, Solving People's Problems", "It consists of 10 sections, namely "Completing the Task" [37].

Mascot animals are used in the program as an effective technique in developing children's emotional skills and provides ease of application. The mascot animal is determined in line with the interests and desires of the children, and a teddy bear is generally preferred. It is placed in a suitable place in the classroom to help children develop their emotional understanding during the activities and to ensure the permanence of the skills they learn [38].

3.2 RULER

The preschool RULER Program was developed to increase the emotional skills of children, to regulate the social and emotional climate of the classroom, and to ensure effective teacher-child communication [39]. In the content of the program, activities aimed at increasing children's skills of recognizing emotions (Recognizing), understanding the causes and consequences of emotions (Understanding), labeling emotions with correct words (Labeling), expressing emotions in different situations (Expressing), and regulating (Regulating) emotions effectively [40]. There are also activities to develop the emotional skills of adults and teachers [41]. Tools such as mood meter, blueprint, meta moment were prepared to increase the emotional intelligence of children.

The teacher can use the Mood Meter tool while practicing and after the activity. For example, the teacher can examine the table with the children after a small group activity to create different creative models with blocks in the classroom. He may ask

children questions such as "Vera, how did your activity just make you feel?", "Tom, which of the colors did you feel like in the process of making mock-ups?" With this tool, children can be made to describe their emotions accurately and express them more concretely with colors (eg yellow when angry, blue when sad, etc.). In addition, children can add similar different emotions to the emotions in Mood Meter besides the existing emotions and increase their emotion vocabulary [42].

The Blueprint enables children to solve the emotional problems they encounter in their lives with the stages of "Recognition and Labeling", "Understanding", "Expression Editing" and "Planning" to increase their emotional skills. Children primarily using these stages when they encounter a problem; They can identify what they and others feel and show empathy, understand situations that cause their feelings, organize how they express them to another person, and evaluate their emotions more effectively [43].

Meta-Moment is aimed to prevent children from making instant wrong decisions when they encounter a problem and to give more effective reactions by prolonging the process. This tool consists of 6 steps: the occurrence of the event, the feelings about the event, pause, imagining yourself in the best emotional state, developing a strategy for solving the problem, and achieving it.

3.3 The preschool PATHS

PATHS (Promoting Alternative Thinking Strategies) aims to support social problem-solving skills, emotions, and self-control of children aged 3–5 [44] and to reduce problem behaviors [45]. The content of the program includes activities related to 30 different emotions. When the general framework of the program is examined, it is seen that it meets the structures of self-confidence, understanding emotions, problem-solving, self-control, and interpersonal communication. The program features various stories, the protagonist of which is a young turtle who behaves aggressively towards those around him. In the stories, the young turtle has problems due to his behavior, and he can solve these problems by controlling his emotions by using the emotional strategies he learned from the old and wise turtle. In addition, children are guided to make an "emotion box" so that they can recognize their emotions and control the process, and children fill this box according to their moods during the program. Besides, the "Control Signal Poster" is also used [10].

In the Control Signal Poster, the red light stands for "stop and calm down," the yellow light represents 'slow down and think', the green light represents 'go and try your plan'. The material also includes the self-evaluation phase of the children at the end of the process. Using this material, children can control themselves gradually in problem situations and evaluate their behaviors [46].

3.4 Zippy's friends

Zippy's Friends Program is designed to increase the emotional skills of children aged 5–7 and acquire the skills to solve the problems they encounter [47]. In this program, strategies to cope with emotional problems in children at an early age were taught to prevent them from getting harmed when they encounter problems in adolescence and adulthood [48, 49]. The content of the program includes modules such as "recognizing emotions", "communication", "establishing and ending relationships", "problem-solving", "dealing with change and loss", "using strategies to cope with problems" [49].

Zippy's Friends Program features a bug named Zippy and his friends, who are young children. The sessions in the program consist of stories in which Zippy

experienced emotional conflicts and friendship problems that children may encounter throughout their lives. Children think about these problems and perform role-playing activities to gain skills to cope with their emotions [47]. Also, the stories in the program have a certain chronological order and are related to the previous story. In addition, the problems experienced are prepared for the current events that the child may encounter in his life [48].

3.5 Roots of empathy/Roe

Empathy skill is the basis of the Roots of Empathy Program [50] as well as crying, care, and planning, emotions (including bullying), sleep, and communication [51]. It is important to increase children's awareness of infant development [52]. In the program, emotions are integrated with life by visiting the baby and their parents throughout the year [51]. By interacting with this baby, children can learn about the baby's needs. Children ask questions to their parents about the emotional state of the baby and get information about the reasons that make up the emotional state. When they return to the classroom, they can make animations on this subject and express themselves about how they feel when they are in a similar emotional state [51, 52].

3.6 The self-science approach

The self-science approach underlines children's discovery of emotions, understanding themselves, expressing themselves, establishing healthy relationships, and managing conflict [30]. The program includes three stages: "Know Yourself", "Choose Yourself" and "Give Yourself". In the "Know yourself" stage, children are provided to recognize emotions, create meaning and personal awareness [28]. In the "choose yourself" phase, children's emotion regulation skills, emotional competence, and responsibility skills are strengthened. In the "give yourself" stage, children are encouraged to show empathy [30].

During the implementation of the program, the day starts with the 'Rating Scale'. The teacher and the children say an emotional word, express this feeling with metaphors or by grading themselves between 1 and 10. This practice continues until all children express their feelings. This way, children become aware of their own emotions, their friends 'and teachers' emotions. Then, a specific subject is introduced by drawing attention to it, and activities prepared for acting and experiencing this issue are realized. In the next stage, all stages are completed by talking with children about the emotions that occur during the application and closing [30].

4. Teaching strategies for emotional intelligence of children

The teaching strategies that support the emotional intelligence of children include the integration of methods, techniques, and approaches that improve the ability to recognize, understand and manage emotions. Emotional intelligence training can be done not only when children need it but at every moment of learning. Emotions arise or emotional interaction is made with children in many activities. For example, welcoming the child who comes to the class with a smiling face or a special greeting gesture, saying "I miss you" to the child who has not been to the classroom for a few days, moments of emotion sharing in the form of "what did you experience and feel at the weekend" during the circle time, facial expressions drawn on numbers or figures in mathematics, astonishments during the science experiment excitement of the play, sharing the feelings of the

hero during the story. Although routines and coincidences carry many messages about emotions, a concrete, gradual and systematic path must be followed for the emotional intelligence development of children. In this way, it is necessary to answer many questions such as which emotions to start, which situations to be associated with, which type of activity to benefit from, which tools, methods, and techniques to use, which approaches to take during implementation.

Above all, teachers should have positive perceptions with emotional intelligence training and be open to self-improvement. When teachers are open to developing emotional competence in themselves, they can find numerous strategies to support emotional intelligence in the classroom. Plays, analogies, stories, or many images can be used to support emotional intelligence. However, the fact that the strategies that will support emotional intelligence are suitable for children's experiences and more creative and fun, far from monotony [53, 54]. Another point is that the visual materials to be used do not contain the emotional abuse of children. Sometimes children may be too sensitive to content that is normal for adults. Children may have critical periods, effective observations can be made to develop appropriate methods and strategies in terms of time, content, and frequency [14]. While applying the strategies, children's comprehension can be facilitated by following a step progressing from their own emotions to those of others [54]. Children differ in the difficulties they experience, the skills they have, and their interests. Therefore, the choice of method and strategy to be used can be adjusted according to individual differences [5, 55].

Every child needs to find an effective way to reveal their emotions. In the beginning, children may hesitate to express their emotions. If they do not know effective ways to regulate emotions they might response ineffective ways of expressing emotions such as avoiding (I'm fine, really!), denying (no, nothing), justifying (he's right, I should not have been like that), worrying (what if … very angry) [56]. For this reason, in the educational environment, it can be ensured that children express their emotions directly or indirectly by using many methods and techniques that will improve their ability to express, understand and adjust their emotions. Below are examples of some methods for recognizing, understanding, and managing emotions, and then approaches supporting emotional intelligence are explained.

4.1 Methods for recognizing emotions

Emotion recognition methods are effective for making sense of emotional clues and labeling emotions. In this way, the child can observe facial expressions and gestures and match them with emotions.

Observation and Discussion: It is a strategy where others and self-monitoring practices are made. It includes analysis and interpretation activities such as about the instant emotions of the characters in cartoons and books, analyzing the clues that enable the child to understand emotions, and allowing the child to experience and watch his emotions in front of the mirror.

Emotion Diary: It is a method that records the time of emotion, the situation that reveals the emotion, and the changes it creates in the body [57]. This method can be worked with children in a certain period (for example, two weeks) by specializing in an emotion. The child can record these situations through pictures or video recording. This technique allows the child to recognize the event that causes the emotion and the changes caused by the emotion.

Body Scan: It is a method applied by directing attention to each part of the body with eyes closed to notice the changes caused by emotions in the body [57]. When applying with a child, it may be beneficial for them to understand the term

"combing" to make concreteness primarily with the action of combing the hair. Then, when there are emotional changes, the child should scan/listen to his body by closing his eyes, tension or relaxation in his muscles, pain or discomfort, butterfly flutter, relief, difficulty in breathing or relaxation, weakness, etc. It can be encouraged to notice the changes and find the emotion that caused them.

In addition, emotion membranes, emotion thermometer, emotion graphics and posters (showing the name and degree/amount of emotion), emotion cards, game tools for emotions (bingo, matching card, puzzle, etc.), puppets, greeting and meeting cards, children's picture books and videos might also be used [58–60].

4.2 Methods for understanding emotions

Children should be able to define, make sense and express emotions correctly to exhibit appropriate social behaviors [61]. Emotions are one of the factors that determine the quality of life. Different emotions can be used in personal environments, family, friendships, and many areas of life, or they can arise in different contexts for the same emotions. Various theories explain understanding emotions. In the behavioral theory, emotions are accepted as four basic emotions and the physiological mechanisms of emotions are emphasized. The physiological theory states that emotions have the basis of biology. According to the social constructivism theory, the schemas created from social life form the basis for the emotional reactions of the person. Accordingly, there are two groups of emotions: basic emotions such as pleasure and fear, and complex emotions such as shame and guilt. In the etiology theory, it is emphasized that emotions enable individuals to survive and reproduce [62].

Methods and techniques used to support emotion understanding enable the child to notice the changes they create, and to establish a cause-effect relationship between events and emotions. Collecting affectionate words, interactive book reading, using puppets, interpreting visual material are among these methods.

Collecting Affectionate Words: Children are asked to collect pictures of love words used in their families for a week by drawing or representing them with pictures cut from newspapers or magazines. At the end of the week, an evaluation is made about which word of love they encounter the most and in what situations [54].

Interactive Book Reading: Emotional storybooks enable children to interact with the characters in the story [63]. In interactive reading, the child is tried to be included in the fiction as much as possible. While reading a book, children are asked about the feelings of the heroes ("how did they feel", "why are they so sad", "how are they showing their feelings?") or the problems they are experiencing. It is ensured that children take the perspective of the heroes in the story, try to understand their emotions, but develop appropriate emotion management strategies for themselves. Thus, children can understand the emotions of the individuals in their daily life, based on the emotional states of the characters in the story.

Using puppets: Puppets are effective learning tools in terms of both containing humor and being interactive. Children's emotional understanding can be supported by using puppets that reflect different emotions. Children perceive puppets as a friend, and when they are made to speak with content appropriate to their development, they spontaneously tend to understand, interpret and comfort the puppet's emotional state.

Interpreting visual materials: books, newspapers, and magazines contain many visual stimuli including emotions or emotional context. These stimuli give children various messages about understanding and managing. As with reading interactive books, visuals suitable for children (which do not reflect emotional abuse) can be selected, and interpretation can be made with many questions such as what they

see in the visual, which emotion is reflected, why this emotion is felt, how it might behave from now on. Moreover, emotes can be examined and visual and emotional literacy can be increased by ensuring their use during the event.

4.3 Methods for emotion management

Emotion management methods help to recognize the intensity and effects of emotions, coping with these effects, managing them, and relaxing. Exercise, breathing, cat awakening, self-talk, self-compassion, safety point are among them.

Exercise: Exercise helps the body return to its normal balance by releasing natural chemicals and hormones [57]. Therefore, exercises can be used as effective strategies in dealing with emotions. Nature walks, garden games and sports should be included in the child's daily routine at school and home.

Cat Awakening: Using the observations made with cats or videos of cats waking up, and stretching their bodies, it is aimed that children imitate these states of the cat and calm down by applying it when they encounter intense emotions [64].

Breathing exercises: Taking diaphragmatic breathing reduces stress and provides emotional relief by reducing heart rhythm and blood pressure by providing carbon dioxide gas release and oxygen gas intake [57]. For this reason, teaching children to take proper diaphragmatic breathing, including various breathing exercises during the day, and encouraging them to use breathing in moments when they need relaxation help the child to have an effective strategy in managing their emotions.

Positive and realistic self-talk: Children may be asked to talk about their emotions by going in front of the mirror, develop ways to cope with this by expressing their feelings, and giving a self-motivated speech [59]. This way allows the child to increase his self awareness and to motivate himself to manage his emotions.

Self-compassion: It is a method that allows a person to approach him/her in a gentle, loving way in the face of mistakes or negative emotions, to characterize what happened as a situation that can happen to the whole of humanity, and to accept the self and emotion as it is without underestimating or exaggerating with conscious awareness [65].

Safety point: A point of the body is taken as a reference point to cope with negative emotions such as stress and insecurity, and relaxation is aimed at stimulating the nerves with moves as touch and massage. The point is optional and can be used for various ways like finger rubbing, palms touching, etc. It can also be applied as assigning emotion to each finger [64].

Spatial reference/Safe Area: It is a technique based on the use of indoor or outdoor spaces that the child can use to rest, stay alone and calm down. This area need to be peacefull for the child, comforts him/her with favorite sight, sound (stream, bird, etc.), fragrance (strawberry, cinnamon, tree, etc.), and taste (fruit, cake, etc.) [57, 64].

Expressing Emotion: This method ensure that children express themselves not only verbally but also various ways of expression (dance, music, painting, sculpture, drama, sports, etc.)

Focus Change: It involves moving away from the present moment by imagining a special / beautiful moment in which positive emotions are experienced or a place one loves, listening to music or singing, reading a book, exercising, and forgetting the negative thoughts for a moment. It is also known as TV channel switching. To facilitate this change, the person can produce a motivational sentence (I am good, I am safe and calm, I can overcome it, etc.) [57]. Changing the channel can make it easier to practice with children by allowing concretizing the name.

Turtle Technique: When the child feels a negative emotion, the first step is to notice it, then stop and think about this emotion, then shrink, self-hug, turn inward

and calm down with breathing, and focus on the solution by leaving the shell when calmed. It can be embodied with images of the turtle [66].

Stairs: This is an imaginary activity. In this technique children descend ten ladder steps by breathing and counting down each ladder. While the children pretend to descend from the stairs, they are asked questions (E.g. You have come to a very special place for you, where have you come?") to help them imagine and relax. Moving through each step can also be implemented by adapting it as saying a word of love to yourself [67].

Pros and cons list: Children are asked to draw and concretize the positive and negative features of the situation by dividing cardboard into two to choose the appropriate option in cases where they are unsure [59].

Trust Walk: Children are told to choose a partner. Then the eyes of one of the partners are closed. The blindfolded child is the eye of his partner and helps the blindfolded friend navigate the classroom safely.

Draw and portray: Children are asked to draw an event that they experienced on the day they were most unhappy in the classroom. The completed pictures are collected and distributed to other children in a mixed way. Children who take the pictures are asked to animate the event in the picture.

In addition to these techniques, emotion analysis posters (What do I feel?, Why do I feel this feeling?, How can I cope with the emotion?, Who can support Nan?, which is the most appropriate option?), Problem-solving cards, empathy cards, relaxation bag (through senses) might be used. Children can regulate their emotions and behaviors by using tools such as paints and pencils that will provide expression, breathing exercise cards, favorite scents, exercise cards, photos of a favorite environment or person, list of things they like to do, sponge or stress ball to be pressed [37, 58, 59].

5. Approaches to support children's emotional intelligence

Children need adult understanding and guidance to acquire skills such as recognizing, understanding, and expressing their emotions. The fact that emotional intelligence can be supported and developed with childhood experiences and education, teachers, and parents who provide basic experience and opportunities to the child, impose an important role in the process.

When teachers and parents have enthusiasm, patience, flexibility, respect for differences, creativity, humor, cooperation, empathy, effective communication, openness to innovations, they achieve more successful results in supporting children's emotional intelligence skills [18, 68]. Approaches that support the emotional intelligence of children are discussed under the subtitles as recognition and acceptance of the child, active listening, emotional literacy in the classroom, being a model, emotion talks, emotion coaching.

5.1 Recognition and acceptance of the child

Children are a whole with all their developmental characteristics, positive and negative emotions, and they need to be recognized and accepted as they are. It is important to develop expectations appropriate to the developmental characteristics of the child and to satisfy the interests and needs of the child. Developmental characteristics will determine the amount and type of emotional support children need individually [69].

Accepting the child is important in terms of the development of self-esteem, self-acceptance, expressing and managing their feelings, and reaching social and

emotional competence. Behaviors such as rejection, blaming, criticizing, threatening, embarrassing, mocking cause the child to think that he is not accepted. The child avoids expressing his feelings with insufficiency anxiety and shame. Children who cannot express their emotions start to show inward or outward-oriented behaviors and their social relationships deteriorate [17, 70].

When children feel accepted, they will be open to accepting others, showing respect and tolerance. Planning activities appropriate to the characteristics of children, allowing them to make decisions, criticize, and evaluate will make the child feel valued.

5.2 Emotional literacy in the classroom

The classroom environment, which includes elements such as the layout, equipment, and classroom management methods of the classroom, conveys the messages about belonging to the child and whether it is safe [18]. Emotion graphics, diaries, children's pictures, and products enable the child to recognize himself. Emotion and behavior regulation tools should provide the child's intrinsic motivation. Self-regulation should be achieved through respect and empathy through relationships based on love and trust; strategies based on the reward-punishment system should be avoided. The behavior of the reward causes the child to be realized with extrinsic motivation rather than intrinsic motivation and damages the permanence of the behavior. Rather than the consequences of children's behavior, it would be more effective to draw attention to feelings, the process, and the reflections of behaviors on themselves and society.

Considering the developmental characteristics of children while organizing behavior, discussing the causes and consequences of the limits with the child, determining the limits/rules together, giving consistent responses to behaviors, graphics, etc. and visualization, are strategies that provide motivation and experience for the child to adopt social norms, regulate their emotions and express them appropriately [59].

5.3 Active listening

Expressing what the child says as it is by reflecting it without comment is called mirroring, and children feel understood when faced with this type of active listening. Feeling that the child is understood helps him to know and accept himself, to express himself, to increase his self-confidence, and to be motivated for solutions [4]. When the child is unable to control his emotions, the teacher telling that he understands his emotions, waiting for the appropriate time and not being compelling, showing closeness, using a loving tone, making eye contact, giving reflective and positive feedback to the child, and being a guide are basic strategies in communication with the child [71, 72]. Sometimes there are emotional ups and downs in the classroom, empathetic listening can help children calm down. This style of communication prevents the development of feelings of shame and guilt caused by negative behaviors in the child, enables the child to feel accepted, to accept himself, to express himself comfortably, to make self-regulation by receiving feedback.

5.4 Being a model

Children learn by observing their social environment. The adults' reactions, gestures, and behaviours give them information about the nature of emotion, when and how to express it. The child tries to reveal what he learned through imitation in similar situations. Through trial and error, they learn to use the most appropriate

emotional skill for the situation. Modeling the right behaviors and a positive environment increases the likelihood of children adjusting their emotions and behaviors [18, 70, 71]. Studies show that the reactions of children to emotions are related to the reactions of adults.; It has been revealed that children who grow up in a positive environment reflect positive communication in the games, when they are given stress, tense, and punitive reactions to their emotions, and they have difficulty in managing their emotions and behaviors [73, 74]. Therefore, educators should provide children with a positive, calm, and safe model, especially in terms of managing emotions.

5.5 Emotion conversations

Emotional conversations are talks based on evaluation, understanding, and interpretation beyond the speech that includes actions such as examining the emotional indicators of both themselves and others, making statements about emotions, interpreting feelings, evaluating causes and consequences between adults and children [70, 75, 76].

Such emotion-sensitive discussions enable children to recognize, understand, and express their emotions, and thus initiate and maintain healthy social relationships and empathize [74, 76–78]. Emotion discussions prevent the child from developing internalizing behavior and provide conscious development [79, 80]. For this reason, it is necessary to listen to the emotional speeches of children, to review the process while telling, and to make them feel the reasons or consequences of the reactions. While speaking relaxes the child, it enables the educator to understand the child's point of view.

5.6 Emotion coaching

Emotion coaching consist of communicative strategies such as explaining the observed event and emotion, managing the child's attention with emotional clues, helping the child to understand his feelings and behaviors, analyzing social interactions, and providing guidance. Educators who are emotion coaches recognize the child's negative emotions and see this as an opportunity to support the child's emotional development. The process starts with accepting all emotions of the child, recognizing and distinguishing complex emotions, naming emotions, giving information about emotions and their effects, encouraging the child for emotional expression, developing strategies together to manage and express negative emotions, to solve problems encountered at the end of negative emotions. It continues with conversation and encouragement for the social relationships. Teachers see the child as a subject and keep themselves in a helper position, pay attention to using a descriptive and solution-server language instead of the routing language [71, 80].

Emotion coaching improves the child's ability to express his emotions, prevents him from showing inward or outward-oriented behaviors as a result of his negative emotions, enables him to develop social communication, and increases success by improving attention skills [4, 17]. Educators and parents give positive feedback to children about their positive behavior, encourage them to participate in various activities, appreciate their efforts, encourage behaviors such as taking responsibility, planning, leading, sharing, and helping, emphasizing the importance of togetherness and friendship, self-knowledge. They can support by directing them to share emotions with their friends and to establish sincere social relationships [77].

Although educators work with a team spirit and try to support children's emotion and behavior regulation as a coach, there may be situations where the expected changes are not achieved (for example, self harming harming animals, etc.). Such

situations can reduce educators' determination to support emotional intelligence. In such cases, the child's emotions and behaviors are observed, and recorded. It may be necessary to follow up with frequency forms as well as tools, and follow-up of the child with a psychological counselor [81].

6. Conclusion

Early childhood is a critical period for the development of emotional intelligence. Emotional intelligence can be developed through experiences and education. The development of emotional intelligence abilities contributes to the psychological and physical well-being, social relations, and academic achievements of the individual both in childhood and adulthood. Teachers can use methods and techniques suitable for children's developmental characteristics to strengthen children's emotional intelligence. Concrete, systematic, and continuous support of emotional intelligence ensures effective results. Acceptance of children, active listening, emotion conversations, and emotion coaching can help children control their emotions. Emotional intelligence training reduces children's emotional and behavioral problems and makes learning more enjoyable.

Author details

İlkay Ulutaş*, Kübra Engin and Emine Bozkurt Polat
Gazi Education Faculty, Early Childhood Education Department,
Gazi University, Turkey

*Address all correspondence to: uilkay@gazi.edu.tr

References

[1] OECD (2018) The future of education and skills *education 2030*. https://www.oecd.org/education/2030/E2030%20Position%20Paper%20(05.04.2018).pdf

[2] P21 ELF. 21st century learning for early childhood. http://static.battelleforkids.org/documents/p21/P21EarlyChildhoodFramework.pdf

[3] Gabard-Durnam, L., McLaughlin, K.A. (2020). Sensitive periods in human development: charting a course for the future. Current Opinion in Behavioral Sciences. 36, 120-128. https://doi.org/10.1016/j.cobeha.2020.09.003

[4] Kremenitzer, J. P., & Miller, R. (2008). Are you a highly qualified, emotionally intelligent early childhood educator?. Young Children, 63(4), 106.

[5] Bahman, S., & Maffini, H. (2008). Developing children's emotional intelligence. Bloomsbury Publishing.

[6] Colverd, S., & Hodgkin, B. (2011). Developing emotional intelligence in the primary school. Oxon: Routledge

[7] Gershon, P. & Pellitteri, J. (2018). Promoting Emotional Intelligence in preschool education: A review of programs . International Journal of Emotional Education, 10(2), 26-41.

[8] Raver, C. C., Garner, P. W., & Smith-Donald, R. (2007). The roles of emotion regulation and emotion knowledge for children's academic readiness: Are the links causal? In R. C. Pianta, M. J. Cox, & K. L. Snow (Eds.), School readiness and the transition to kindergarten in the era of accountability (p. 121-147). Paul H Brookes Publishing.

[9] Minney, D. (2021). Social and emotional learning (sel) assessment in after-school care: how accessible evaluation can lead to widespread quality implementation. In Leading Schools With Social, Emotional, and Academic Development (SEAD) (pp. 202-230). IGI Global.

[10] Greenberg, M. T., & Kusché, C. A. (2006). Building social and emotional competence: The PATHS curriculum. In S. R. Jimerson & M. Furlong (Eds.), Handbook of school violence and school safety: From research to practice (pp. 395-412). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers.

[11] Nix, R. L., Bierman, K. L., Domitrovich, C. E., & Gill, S. (2013) Promoting children's social-emotional skills in preschool can enhance academic and behavioral functioning in kindergarten: Findings from Head Start REDI. Early Education and Development, 24(7), 1000-1019.

[12] Reyes, M. R., Brackett, M. A., Rivers, S. E., White, M., & Salovey, P. (2012). Classroom emotional climate, student engagement, and academic achievement. Journal of educational psychology, 104(3), 700.

[13] Triniad, D. R., Unger, J.B., Chou, C. ve Johnson, C.A. (2004). The protective association of emotional intelligence with psychosocial smoking risk factors for adolescents. Personality and Individual Differences 36, 945-954.

[14] Goleman, D. (1995). Emotional intelligence. Bantam Books, Inc.

[15] Mayer, J. D., & Salovey, P. (1997). What is emotional intelligence. Emotional development and emotional intelligence: Educational implications, 3, 31.

[16] Bar-On, R. (2006). The Bar-On model of emotional-social intelligence (ESI) 1. Psicothema, 13-25.

[17] Jennings, P. A., & Greenberg, M. T. (2009). The prosocial classroom:

Teacher social and emotional competence in relation to student and classroom outcomes. Review of educational research, 79(1), 491-525.

[18] Powell, W., & Kusuma-Powell, O. (2010). Becoming an emotionally intelligent teacher. London: Corwin Press.

[19] Greenberg, M. T., Weissberg, R. P., O'Brien, M. U., Zins, J. E., Fredericks, L., Resnik, H., & Elias, M. J. (2003). Enhancing school-based prevention and youth development through coordinated social, emotional, and academic learning. The American psychologist, 58(6-7), 466-474. https://doi.org/10.1037/0003-066x.58.6-7.466

[20] Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions. Child development, 82(1), 405-432.

[21] Salovey, P. ve Mayer, J. D. (1990). Emotional intelligence. Imagination, cognition and personality, 9(3), 185-211.

[22] Bänziger, T., Grandjean, D. ve Scherer, K. R. (2009). Emotion recognition from expressions in face, voice, and body: the Multimodal Emotion Recognition Test (MERT). Emotion, 9(5), 691.

[23] Mayer, J.D., & Salovey, P (2004). What is emotional intelligence? In P. Salovey, M.A. Brackett, & J.D. Mayer (Eds.), Emotional intelligence: Key Readings on the Mayer and Salovey model (pp. 29-59). Port Chester, NY: Dude Publishing

[24] Harris, P. L. (2008). Children's understanding of emotion. M. Levis, J. M. Haviland-Jones ve L. F. Barrett (Ed.) Handbook of emotions (s. 320-331). New York: The Guilford Press.

[25] Denham, S. A., Blair, K. A., DeMulder, E., Levitas, J., Sawyer, K., Auerbach–Major, S. ve Queenan, P. (2003). Preschool emotional competence: Pathway to social competence? Child development, 74(1), 238-256.

[26] Hyson, M. (2004). The emotional development of young children: building an emotion-centered curriculum. Teachers College Press: New York.

[27] Elias, M. J., & Arnold, H. (Eds.). (2006). The educator's guide to emotional intelligence and academic achievement: Social-emotional learning in the classroom. Corwin Press.

[28] Fatum, B. A. (2008). The relationship between emotional intelligence and academic achievement in elementary-school children. Doctoral dissertation, The University of San Francisco, Sanfrancisco.

[29] Fuller, A. (2001). A blueprint for building social competencies in children and adolescents. Australian Journal of Middle Schooling, 1(1), 40-48.

[30] Stone-McCown, K., Freedman, J. M., Jensen, A. L., & Rideout, M. C. (1998). Self-science. The emotional intelligence curriculum, 2.

[31] Grewal, D., & Salovey, P. (2005). Feeling Smart: The Science of Emotional Intelligence: A new idea in psychology has matured and shows promise of explaining how attending to emotions can help us in everyday life. American scientist, 93(4), 330-339.

[32] Lopes, P. N., & Salovey, P. (2004). Toward a broader education: Social, emotional, and practical skills. Building academic success on social and emotional learning: What does the research say, 76-93.

[33] Weissberg, R. P., & O'Brien, M. U. (2004). What works in school-based

social and emotional learning programs for positive youth development. The Annals of the American Academy of Political and Social Science, 591(1), 86-97.

[34] Maurer, M., Brackett, M. A., & Plain, F. (2004). Emotional literacy in the middle school: A 6-step program to promote social emotional and academic learning. National Professional Resources Inc./Dude Publishing.

[35] Marchant, M., Brown, M., Caldarella, P., &Young, E. (2010). Effects of strong kids curriculum on students with internalizing behaviors: A pilot study. Journal of Evidence-Based Practices for Schools, 11, 123-143.

[36] Merrell, K. W., & Gueldner, B. A. (2010). Social and emotional learning in the classroom: Promoting mental health and academic success. Guilford Press.

[37] Merrell, K. M., Parisi, D. M., & Whitcomb, S. G. (2007). Strong Start: A social and emotional learning curriculum for students in grades K-2. Baltimore: Paul H. Brookes Publishing.

[38] Hetrick, M. R. (2018). Universal Implications for the Effects of Strong Kids Social and Emotional Learning Curriculum on Students' Social-Emotional Competency: A Quantitative Analysis. Graduate Theses and Dissertations. 41. https://pilotscholars.up.edu/etd/41

[39] Brackett, M. A., Bertoli, M., Elbertson, N., Bausseron, E., Castillo Gualda, R., & Salovey, P. (2013). Emotional intelligence: Reconceptualizing the cognition–emotion link. Handbook of cognition and emotion.

[40] Nathanson, L., Rivers, S. E., Flynn, L. M., & Brackett, M. A. (2016). Creating emotionally intelligent schools with RULER. Emotion Review, 8(4), 305-310.

[41] Brackett, M. A., Elbertson, N. A., Kremenitzer, J. P., Alster, B., & Caruso, D. R. (2011). Emotionally literate teaching. Creating emotionally literate classrooms: An introduction to the RULER approach to social and emotional learning. Port Chester, NY: NPR, 49-68.

[42] Gross, J. J. (2015). Emotion regulation: Current status and future prospects. Psychological Inquiry, 26(1), 1-26.

[43] Rivers, S. E. & Brackett, M. A. (2010) Achieving Standards in the English Language Arts (and More) Using The RULER Approach to Social and Emotional Learning, Reading & Writing Quarterly, 27:1-2, 75-100, DOI: 10.1080/10573569.2011.532715

[44] Joseph, G. E., & Strain, P. S. (2003). Comprehensive evidence-based social—emotional curricula for young children: An analysis of efficacious adoption potential. Topics in early childhood special education, 23(2), 62-73.

[45] Celene E. Domitrovich, Rebecca C. Cortes, and Mark T. Greenberg (2007). Improving Young Children's Social and Emotional Competence: A Randomized Trial of the Preschool 'PATHS' Curriculum, Journal of Pṁary Prevention 28 (2). 67-91, doi: 10. 1007/s 10935-007-008 1-0

[46] Riggs, N. R., Greenberg, M. T., Kusché, C. A., & Pentz, M. A. (2006). The mediational role of neurocognition in the behavioral outcomes of a social-emotional prevention program in elementary school students: Effects of the PATHS curriculum. Prevention Science, 7(1), 91-102.

[47] Rodker, J. D. (2013). Promoting social-emotional development of children during kindergarten: a zippy's friends program evaluation. Doctoral dissertation Pace University.

[48] Clarke, A. M. (2011). An Evaluation of Zippy's Friends: An Emotional Wellbeing Programme for Children in Primary Schools. Doctor of Philosophy (PhD), Galway, National University of Ireland Galway.

[49] Mishara, B. L., & Ystgaard, M. (2006). Effectiveness of a mental health promotion program to improve coping skills in young children: Zippy's Friends. Early Childhood Research Quarterly, 21(1), 110-123.

[50] Eisenberg, N., Fabes, R. A., & Spinrad, T. (2006). Prosocial development. In N. Eisenberg (Ed.), Handbook of child psychology: Social, emotional, and personality development (pp. 646-718). Hoboken, NJ: Wiley.

[51] Cain, G., & Carnellor, Y. (2008). Roots of Empathy: A research study on its impact on teachers in Western Australia. The Journal of Student Wellbeing, 2(1).

[52] Schonert-Reichl, K. A., Smith, V., Zaidman-Zait, A., & Hertzman, C. (2012). Promoting children's prosocial behaviors in school: Impact of the "Roots of Empathy" program on the social and emotional competence of school-aged children. School Mental Health, 4(1), 1-21.

[53] Dolev, N., & Leshem, S. (2017). Developing EI competence among teachers. Teacher Development, 21(1), 21-39

[54] Ulutaş, İ. ve Meralı, M. (2019). Okul öncesi eğitimde çocukların duygusal zekasını destekleyen yöntem ve teknikler. İ. Ulutaş ve E. Ömeroğlu (Ed.), Erken Çocukluk Eğitiminde Duygusal Zeka içinde, (s. 40-73). Ankara: Pegem.

[55] Shanker, S. (2013). Calm, alert and happy. Queen's printer for ontario, http://www.edu.gov.on.ca/childcare/shanker.pdf sayfasından erişilmiştir.

[56] Grose, M. (2015). Healthy ways to manage emotions. https://www.gslc.qld.edu.au/pdf/15_healthy_ways_to_manage_emotions.pdf sayfasından erişilmiştir.

[57] Davis, M., Eshelman, E. R. ve McKay, M. (2008). The relaxation and stress reduction workbook. New Harbinger Publications.

[58] Cornwell, S., & Bundy, J. (2008). The emotional curriculum: A journey towards emotional literacy. Sage.

[59] Lewkowicz, A. B. (Ed.). (2007). Teaching emotional intelligence: Strategies and activities for helping students make effective choices. Corwin Press.

[60] Merrell, K. W., Carrizales, D. C., Feuerborn, L. C., Gueldner, B. A., & Tran, O. K. (2007). Strong kids--Grades 6-8: A social and emotional learning curriculum. Paul H Brookes Publishing.

[61] Saarni, C. (1999). Developing emotional competence. New York: Guilford Press

[62] Strongman, K. T. (2003). The psychology of emotion: From everyday life to theory (5th ed.). West Sussex, England: John Wiley & Sons

[63] Doyle, B. G., & Bramwell, W. (2006). Promoting emergent literacy and social-emotional learning through dialogic reading. The Reading Teacher, 59(6), 554-564.

[64] Bowkett, S. (2007) Emotional intelligence Stafford: Network Continuum Education.

[65] Neff, K. (2003). Self-compassion: An alternative conceptualization of a healthy attitude toward oneself. Self and identity, 2(2), 85-101.

[66] Schneider M. R. (1974). Turtle Technique in the Classroom. Teachıng Exceptional Children, 7(1), 22-24

[67] Adams, M. (2017). Jin Shin Jyutsu/ Physio-Philosophy NJ: Inquiry Institute; Lambertville. https://inquiryinstitute.com/wp/wp-content/uploads/2017/05/Jin-Shin-Jyutsu-Resource-Pages-2017.pdf

[68] Colker, L. J. (2008). Twelve characteristics of effective early childhood teachers. YC Young Children, 63(2), 68.

[69] Leyden, R., & Shale, E. (2012). What teachers need to know about socialand emotional development. Pastoral Carein Education, 31(2), 191-196.

[70] Ahn, H. J. (2005). Child care teachers' strategies in children's socialization of emotion. Early Child Development and Care, 175(1), 49-61. doi:10.1080/0300443042000230320

[71] McLaughlin, T., Aspden, K. & Clarke, L. (2017). How do teachers support children's social–emotional competence? Strategies for teachers. Early Childhood Folio, 21 (2) 21-27.

[72] Miller, P. (2012). Ten Characteristics of a Good Teacher. English Teaching Forum, 50(1), 36-38.

[73] Friedman-Krauss, A. H., Cybele Raver, C., Morris, P. A. & Jones, S. M. (2014) The role of classroom-level child behavior problems in predicting preschool teacher stress and classroom emotional climate, Early Education and Development, 25:4, 530-552, DOI: 10.1080/10409289.2013.817030

[74] Morris, C.A.S., Denham, S.A., Basset, H.H. and Curby, T.W. (2013), Relations among teachers' emotion socialization beliefs and practices, and preschoolers' emotional competence, Early Educational Development, 24(7), 979-999.

[75] Alvarenga , P., Zucker, T. A., Tambyraja, S. & Justice, L. (2020) Contingency in teacher-child emotional state talk during shared book reading in early childhood classrooms. Early Education and Development, 31:8, 1187-1205, DOI: 10.1080/10409289.2020.1722786

[76] Bailey, C.S., Zinsser, K.M., Curby, T.W., Denham, S.A. and Bassett, H.H. (2013), Consistently emotionally supportive preschool teachers and children's social-emotional learning in the classroom: implications for center directors and teachers, Dialog, 16(2), 131-137.

[77] Denham, S. A., Bassett, H. H., Brown, C., Way, E., & Steed, J. (2015). "I know how you feel": Preschoolers' emotion knowledge contributes to early school success. Journal of Early Childhood Research, 13(3), 252-262. doi: 10.1177/1476718X13497354

[78] Yelinek, J. & Stoltzfus Grady, J. (2019) 'Show me your mad faces! preschool teachers'emotion talk in the classroom, Early Child Development and Care, 189:7, 1063-1071, DOI: 10.1080/03004430.2017.1363740

[79] Kochanska, G. (1991). Socialization and temperament in the development of guilt and conscience. Child development, 62(6), 1379-1392.

[80] Nelson, D. B., Low, G. R., ve Nelson, K. (2005). The emotionally intelligent teacher: A transformative learning model. Unpublished manuscript. Retrieved on September, 7, 2017.

[81] Dunlap, G., & Iovannone, R., & Wilson, K., & Kincaid, D., & Christiansen, K., & Strain, P., & English, C. (2010). Prevent-Teach-Reinforce: A schoolbased model of positive behavior support. Baltimore, MD: Brookes.

Chapter 6

Machine Learning and EEG for Emotional State Estimation

Krzysztof Kotowski and Katarzyna Stapor

Abstract

Defining "emotion" and its accurate measuring is a notorious problem in the psychology domain. It is usually addressed with subjective self-assessment forms filled manually by participants. Machine learning methods and EEG correlates of emotions enable to construction of automatic systems for objective emotion recognition. Such systems could help to assess emotional states and could be used to improve emotional perception. In this chapter, we present a computer system that can automatically recognize an emotional state of a human, based on EEG signals induced by a standardized affective picture database. Based on the EEG signal, trained deep neural networks are then used together with mappings between emotion models to predict the emotions perceived by the participant. This, in turn, can be used for example in validation of affective picture databases standardization.

Keywords: EEG, emotion recognition, emotion perception, machine learning, deep neural networks

1. Introduction

In psychological research, the most common method of measuring perceived emotions or emotional states is through self-assessment forms filled manually by participants. The information they give is useful but very subjective and dependent on many extraneous factors, i.e. the construction of the form, the instructions, and the level of emotional intelligence of the participant. Also, the forms cannot be used when working with children or mentally disabled people. The physiological signals can give a more objective view of the emotional reactions of the body. Among measurement techniques using galvanic skin response (GSR), facial electromyography (EMG), electrocardiography (ECG), breathing rate, or temperature; electroencephalography (EEG) is one of the most common in emotion recognition applications. It is non-invasive and offers high-resolution, high-dimensional data about the source of the emotions itself - the brain activity. In EEG, highly conductive electrodes placed on the scalp collect the electrical charge induced by the activity of the brain.

The correlation between emotional state and EEG is widely used in cognitive psychology, psychophysiology, and medicine [1] for the examination of mental disorders like depression [2], autism spectrum disorder (ASD) [3], attention-deficit hyperactivity disorder (ADHD) [4], or schizophrenia [5]. From a psychological point of view, EEG gives insights into the mechanisms of how emotions are made. Emotion recognition systems, like the one presented in this chapter, can be used to assess the emotional perception of humans. However, the analysis of complex

and high-dimensional EEG patterns and correlations would be virtually impossible without computers and computational methods like machine learning. The emotion recognition algorithms are a part of a special branch of computer science called affective computing [6]. It is also a part of the artificial intelligence field as it relates to the understanding and displaying emotions by machines. Automatic emotion recognition systems based on EEG have already shown outstanding accuracy in many different applications [7] and well-established benchmarks like DEAP (database for emotion analysis using physiological signals) [8]. Machine learning algorithms are used in the vast majority of these systems and are considered state-of-the-art in the domain. Among them, deep neural networks are the most promising emerging approach which does not require additional feature extraction steps [9].

The chapter presents the idea and design of the system for validation of affective picture databases by confronting its result with predictions of EEG-based artificial deep neural networks. Consecutive sections are a step-by-step guide for creating such a system. In Section 2, different psychological models of emotion are described, the problem of mapping between emotion models is introduced, and our new mapping is proposed. In Section 3, the instructions for designing a complete EEG experiment for machine learning emotion recognition are given, together with a list of affective picture sets, and state-of-the-art algorithms. In Section 4, the system for validation of affective databases is presented. The chapter ends with a summary and future work section.

2. Psychological models of emotion

Recognition of emotions must start from the definition of the model in which they are measured. This is the main dividing line in the field of emotion analysis [10]. The theory of emotions is still an open topic despite plenty of publications and research. The reason is that human emotions are mental states generated by the central nervous system [11], and as such, they are hard to assess, nondeterministic, and subjective phenomena. Individuals with different levels of emotional intelligence may not be able to assess their emotional state accurately [ref]. Moreover, similar stimuli may induce very different states in two similar people, and the same person may respond differently to the seemingly similar stimuli. The age, time of the day, mood, experience, fatigue may all affect the perception of emotions.

However, there is some evidence for neural circuits that are responsible for particular basic emotional events [3], so some assumptions and simplifications were made to extract several different emotion models. In general, they divide into discrete (or categorical) and dimensional (or continuous) models.

The discrete emotion models describe different numbers of independent emotion categories. One of the most popular models by Paul Ekman describes six universal basic emotions of anger, disgust, fear, happiness, sadness, and surprise [12]. The model is derived from the observation of universal facial expressions. The paper describing the model has been cited and discussed by thousands of researchers, but, the existence of basic emotions is still an unsettled issue in psychology, rejected by many researchers [13–15]. Another model by Plutchik describes 8 primary bipolar emotions: joy and sadness; anger and fear; surprise and anticipation; and trust and disgust [16]. But, unlike in Ekman's model, Plutchik's wheel of emotions relates these pairs in the circumplex model. Recently, the model consisting of as many as 27 classes bridged by continuous gradients was proposed [17].

The continuous models are usually represented in numerical dimensional space. The most popular dimensions were defined by Mehrabian and Russell in [18] as pleasure, arousal, and dominance (PAD model). The first dimension is frequently

called valence in the literature, it describes how pleasant (or unpleasant) is the stimuli for the participant. The arousal dimension defines the intensity of emotion. Dominance is described as a level of control and influence over one's surroundings and others [19]. Usually, less attention is paid to this third dimension in the literature [20]. However, only the dominance dimension enables to distinguish between angry and anxious, alert and surprised or relaxed from protected [19]. The model that includes only valence and arousal levels is called a circumplex model of affect [21] and is one of the most commonly used to describe the emotions elicited with stimuli. Currently, this model is facing some criticism, because complex emotions in particular are hard to define within only these two general dimensions [22, 23]. The effort to present scientific results in a simple and structured form may lead to a critical reduction of the phenomena. The newest research findings on the global meaning structure of the emotion domain pointed out that more than two dimensions are needed to describe the nature of the human emotional experience sufficiently [23, 24].

2.1 Mappings between models

Discrete and dimensional models are not defined as contradictory. Instead, they both can give unique value that can assist in understanding the functions of emotions [25]. There are multiple works on mappings between different, both discrete and continuous, emotion models [22, 26, 27]. They are usually based on self-assessment questionnaires of the group of participants who assesses the discrete emotions (induced or represented by words, images, videos, short stories, or facial expression) in a few continuous dimensions of circumplex, PAD, or similar models, i.e. Valence-Arousal-Control-Utility [22], Valence-Arousal-Approach/Avoidance [28]). Formerly, the questionaries were based on Self-Assessment Manikins (SAMs) [29] or several-point (usually 5, 7, or 9 points) Likert scale (like in IAPS [30] or OASIS [31] datasets). The new trend is to use more fine-grained continuous scales like selecting a point on the 10 cm line [22] or Affective Slider [32].

Two popular mappings based on emotion words are presented in **Figure 1**. The three-dimensional visualizations are adapted from [22]. The emotion words are placed in the position representing their average PAD assessment by 300 [19] and 70 subjects [27] accordingly. The length of the dashed lines is proportional to the

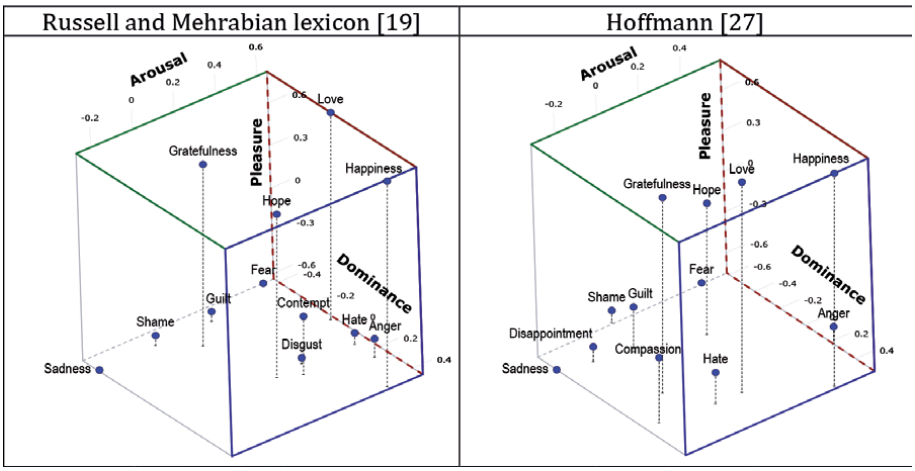

Figure 1.
Average locations of 12 emotion words in PAD dimensions according to Russell and Mehrabian lexicon [19] (on the left) and Hoffmann et al. [27] (on the right).

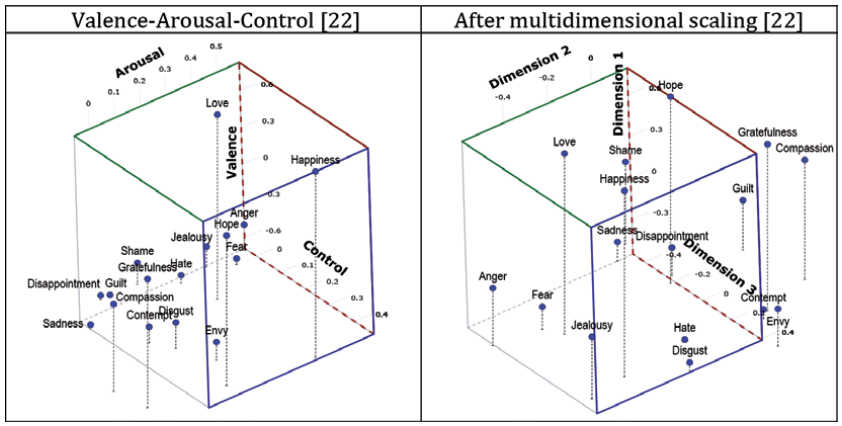

Figure 2.
Average locations of 16 emotion words in Valence-Arousal-Control dimensions before (on the left) and after multidimensional scaling (on the right) as calculated in [22].

pleasure/valence value. In both models, the most pleasure-inducing words are Love, Happiness, Hope, and Gratefulness. On the other end, we have highly-arousing Anger and Fear that can be differentiated only by the dominance dimension. The least arousing and pleasant word is Sadness which is also of low dominance. The main difference between mappings is the location of Hate which is relatively less arousing in the Hoffmann mapping. Some of the emotion words like Contempt, Disgust, or Compassion have equivalents only in the model presented in **Figure 2**.

Figure 2 is based on data from [22], it presents the average assessment of 16 common emotion words by 187 subjects in Valence-Arousal-Control dimensions (the dimension of Utility was also assessed, but is omitted in the figure) before and after multi-dimensional scaling (MDS) into 3 dimensions that results with a far more "honest" Euclidean space between emotion instances. As can be observed, the locations of emotion words after MDS are much more scattered across space, but they keep some basic relationships, i.e. Love, Happiness, Gratefulness, and Compassion have still larger values in Dimension 1 (similar to Valence); pairs of similar emotions like Sadness and Disappointment, or Happiness and Love are still relatively close to each other. Thus, this MDS mapping may be a good basis for machine learning algorithms based on dimensional proximities.

2.2 Own mapping between NAPS and CAP-D affective picture sets

In our example, we will use the set of 266 affective pictures from NAPS (Nencki Affective Picture System) [28] and NAPS BE (a subset of NAPS with 6 basic emotion labels added) [33] that were included in CAP-D (Categorized Affective Pictures Database) [34]. Subsets of images from this set were assessed in several emotion models by different groups of participants:

- valence, arousal, and approach-avoidance dimensions (266 images assessed by 119 female and 85 male subjects in NAPS)
- valence and arousal dimensions (144 images assessed by 67 female and 57 male subjects in NAPS-BE)
- arousal dimension (266 images assessed by 73 female and 60 male subjects in CAP-D)

- intensities of 6 basic Ekman emotions and dominant emotion (or emotions) per picture (144 images assessed by 67 female and 57 male subjects in NAPS-BE)

- categorization and intensity in 10 emotion categories including 6 basic Ekman emotions: anger, compassion, disgust, fear, happiness, love, peacefulness, pride, sadness, surprise (266 images assessed by 73 female and 60 male subjects, and 15 clinical psychologists in CAP-D)

Several mappings between dimensional and discrete emotion models can be built on this diverse set of responses. The diagram of possible mappings is presented in **Figure 3**.

Among the options presented in **Figure 3**, we selected three mappings from 10 emotions from CAP-D onto Valence-Arousal-Approach/Avoidance from NAPS (**Table 1** and **Figure 4**), Valence-Arousal from NAPS, and Valence-Arousal from NAPS-BE (**Figure 5**). In order to establish each mapping, the dimensional assessments for all images representing a specific discrete class in CAP-D (as the 1st emotion) were normalized to <−1, 1 > range, averaged, and placed in the calculated coordinates in the dimensional space (**Figures 4** and **5**). In practice, only 9 discrete emotions could be mapped for NAPS as there were no images representing *surprise* as the 1st emotion in CAP-D. And, only 8 discrete emotions for NAPS-BE (no *surprise* and *pride* as the 1st emotions). In all three mappings, two main groups can be observed: the group of higher valence, lower arousal emotion categories (*happiness*, *love*, *peacefulness*), and the group of lower valence, higher arousal emotions, with disgust and anger as the most extreme examples. The main difference from mappings in **Figure 1** (based on emotion words, not images) is that *love* and *happiness* have relatively low arousal. As commented by authors of NAPS, it is hard to induce highly arousing positive emotions using just still images (without using erotic content such as included in NAPS ERO [35]). Another observation is that pairs of emotions *sadness-compassion, love-peacefulness,* and *anger-disgust* are very close to each other in Valence-Arousal mappings. Considering the fact they are based on the assessment of different groups of people, it may suggest that these pairs of emotions are universally, closely related with each other when induced using images (or at least images from NAPS).

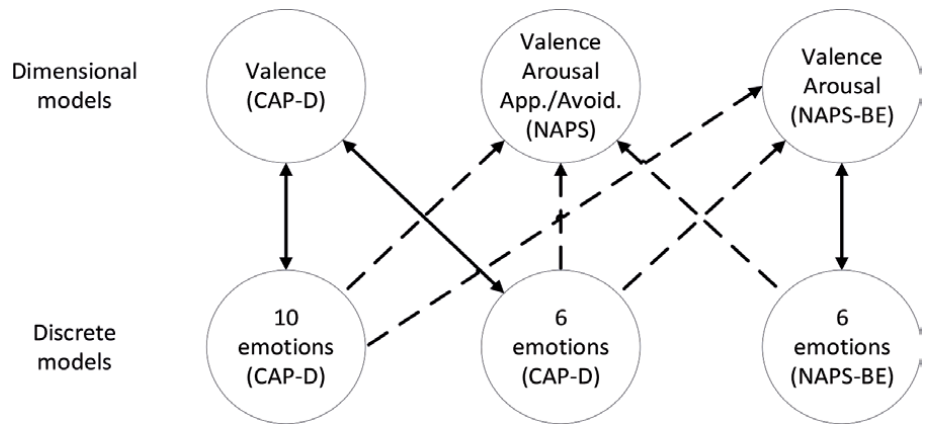

Figure 3.
The diagram of possible mappings between dimensional and discrete emotion models assessed by participants in NAPS, NAPS BE, and CAP-D. Arrows are directed from subsets to supersets of images. Solid/dashed lines represent mappings based on the assessment of the same/different group of participants accordingly.

	Anger	Compas.	Disgust	Fear	Happ.	Love	Peace.	Pride	Sadness
Valence	−0.50	−0.28	−0.47	−0.31	0.44	0.47	0.44	−0.11	−0.31
Arousal	0.38	0.25	0.36	0.34	−0.03	−0.21	−0.23	0.28	0.21
Appr/Avoid	−0.41	−0.17	−0.49	−0.17	0.36	0.38	0.42	−0.08	−0.20

Table 1.
Average assessment of 9 discrete emotions from CAP-D in Valence-Arousal-Approach/Avoidance dimensions as assessed in NAPS.

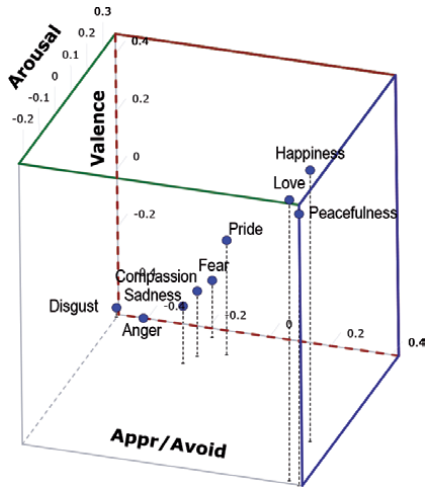

Figure 4.
Average locations of 9 discrete emotions from CAP-D in Valence-Arousal-Approach/Avoidance dimensions as assessed in NAPS.

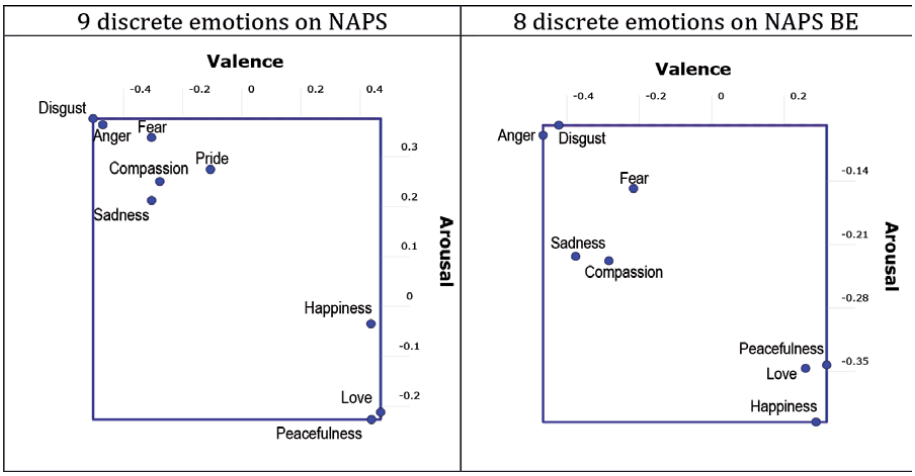

Figure 5.
Average locations of discrete emotions as assessed in CAP-D mapped to Valence-Arousal dimensions as assessed in NAPS (on the left) and NAPS-BE (on the right).

The presented mapping will be used in section 4. as a part of the EEG system for validation of affective databases standardization. When using this mapping in this system, we need also a specific method for the discretization of the coordinates. We can use the estimate which checks if the coordinates in the dimensional space predicted by the algorithm are closer than a standard deviation from the discrete emotion position in the mapping. Also, we can just limit to the nearest discrete emotion in the dimensional space. A detailed discussion about discretization and precision metrics in emotion recognition can be found in [26].

3. Machine learning for EEG-based emotion recognition

The emotion recognition from EEG is an example of a problem that wouldn't have a solution without the use of modern machine learning methods. Physiological

signals like EEG have very high dimensionality, high level of noise, and physiological artifacts. It is very hard to define simple hand-crafted algorithms to deal with this kind of data. This section is a short introduction to the design of machine learning classifiers, and a summary of current trends and applications of computer-aided emotion recognition.

Machine learning (ML) describes the methods of automatic knowledge extraction and drawing conclusions from the provided database. It is a part of the broader domain of artificial intelligence (AI) that is connected with automatic reasoning and higher cognitive functions in machines. The simplest ML algorithms like k-nearest neighbors (kNN) or k-Means just compare the test samples with the existing database and classify them based on the similarity. More complex ML algorithms induce general rules present in the database and use these rules to predict test samples (decision trees). Algorithms like support vector machines (SVMs) transform and divide the database using multi-dimensional planes that split samples of different categories.

All these traditional algorithms have one common disadvantage: they do not work well with massive amounts of high-dimensional data like EEG. Thus, it is usually necessary to extract some lower-dimensional features like power or frequencies of brain waves. This is not the case for deep learning methods that can operate on raw data. Deep learning is inherently connected with artificial neural networks. They are inspired by the biological model of neural networks in the brain. Such deep artificial neural networks can be seen as very complex non-linear functions translating input data into output data of any kind. They encode all the features and knowledge about the data in the connections between neurons in the network. Deep neural networks have shown outstanding accuracy in different EEG applications [9]. Thus, we use them as a "core algorithm" in our examples. However, it is possible to replace it with any other traditional machine learning method based on features like brain waves, event-related potentials (ERPs) and synchronization, frontal EEG asymmetry, or steady-state visually evoked potentials (SSVEPs) [7, 36].

The main part of the system is an emotion recognition machine learning algorithm. The algorithm learns to translate EEG signals into values (discrete, dimensional, or both) defined by each emotion model (or combination of models). The core (architecture, hyperparameters, initialization) of the algorithm is the same for each model, only the definition of the outputs and loss functions are changing. For discrete models, the traditional classification approach is applied. For dimensional models, emotion recognition becomes a regression problem [37]. There is also the possibility to design a multi-output algorithm based on both discrete and dimensional models. If this multi-target optimization increases the generalizability of the algorithm it may support the importance of both dimensional and discrete models of emotions [25]. In our example in **Figure 6**, we present an intra-subject learning approach where the neural network is trained on a representative sample of affective images – the distribution of pictures' features (e.g. picture categories, emotions induced, colors, brightness) used during training should be similar in the affective database validated in the final system. We keep the same set of participants in training and in the final system to ensure comparability of the physiological responses.

3.1 Designing an EEG experiment for emotion recognition

Perhaps, the hardest, but essential part of creating an EEG-based classifier is the design of proper experimental procedures for data acquisition. It is a crucial part that requires specialistic knowledge in psychology, hardware, and signal processing.

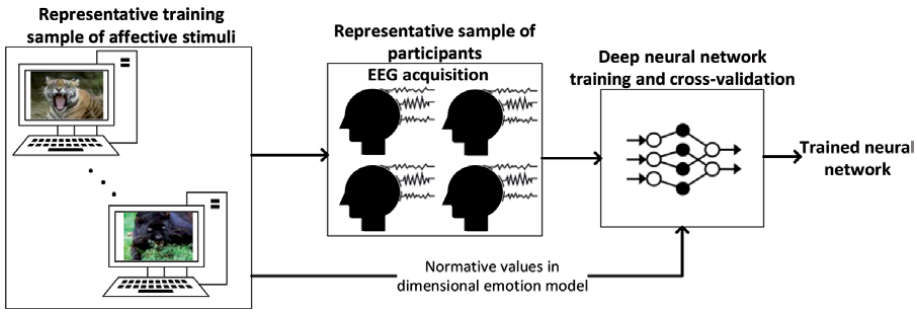

Figure 6.
The schematic diagram of the process of training deep neural networks for EEG-based emotion recognition from affective pictures. The presented stimuli come from the NAPS set [28].

One mistake in this phase may cause a failure of the whole study. The best way to start is to check the literature for similar experiments and learn from their ideas and mistakes. To train and then test EEG-based classifiers correctly, it is important to follow the same procedures and maintain the conditions of the experiments. Our knowledge about cognitive brain functions is incomplete, so potentially irrelevant confounding variables may have a strong impact on the brain response. The list of confounding variables typically includes: observer-expectancy effect (the way instructions are provided, presence of researcher during the experiment), age and gender of participants (many confirmed differences between women and men in the literature), the time of the day, the mood, fatigue, and motivation of the participant (usually increased by some reward), left/right-handedness (if the participant responds for stimuli), or impact of drugs and stimulants.

The dependent variable in the emotion recognition EEG experiments is usually defined in time or frequency space, and the independent variable is usually a class of emotion or a value in the dimensional model that intends to be induced using the specific stimulus. According to a thorough survey from [7], the most frequently used types of stimuli are affective images (in over 35% of articles) before videos, music, and other modalities like games or imagination techniques. This is partly because of the high availability of affective picture sets described in the next section.

3.2 Affective picture databases

There are several publicly accessible affective picture sets for emotion recognition (**Table 2**). Arguably, the most popular one in the literature is IAPS [38] (International Affective Picture System, pronounced "eye-apps"). It contains color photographs of objects, landscapes, and animals, but also dead bodies and erotic content in order to induce a wide range of emotional states. It uses three-dimensional scales of valence, arousal, and dominance/control. However, there are newer sets like NAPS (Nencki Affective Picture System) [28] and OASIS (Open Affective Standardized Image Set) [31] that contain many more pictures and/or assessments. The largest NAPS set also has scales in three similar dimensions of valence, arousal, and approach/avoidance, and may be easily extended by discrete emotion labels from NABS-BE [33], erotic pictures from NAPS-ERO [35], or fear-inducing pictures from SFIP [39] (Set of Fear Inducing Pictures). The pictures in NAPS are of high-quality, and represent 5 main categories (people, faces, animals, objects, and landscapes). The newest CAP-D dataset [34] aggregates subsets of pictures from IAPS, NAPS, and GAPED, and extended them with discrete emotional categories.

Dataset name [ref] (Year)	Number of pictures and assessments	Assessment method	Emotion models used
IAPS [38] (2005)	956 pictures, 100 subjects (50 women)	5-point Self-Assessment Manikin (SAM)	Dimensional model: valence, arousal, dominance/control
NAPS [28] (2014)	1356 pictures, 204 subjects (119 women)	9-point sliding scale	Dimensional model: valence, arousal, approach/avoidance 6 basic emotions (only for a subset of 510 images) [33]
OASIS [31] (2017)	900 pictures, 822 subjects (420 women)	7-point Likert scale	Dimensional model: valence, arousal
GAPED [40] (2011)	730 pictures, 60 subjects (no gender given)	100-points rating scale	Dimensional model: valence, arousal, congruence with moral and legal norms
CAP-D [34] (2018)	513 pictures, 133 subject (73 women), 15 clinical psychologists	Describing the picture with 1 of 10 emotion words	10 discrete emotions, arousal and intensity dimensions
SFIP [39] (2017)	288 pictures, 1671 subjects	5-point Likert scale for fear, 9-point Self-Assessment Manikin for valence	Intensity of fear, valence

Table 2.
The affective picture sets for emotion recognition.

3.3 EEG devices

The selection of an EEG device is dependent on the purpose and goal of the study. For sophisticated psychological or medical research in emotion recognition, it is crucial to use more expensive research-grade or medical-grade hardware. The examples of EEG caps of such devices are presented in **Figure 7**. However, the heart of the system is not the cap, but the amplifier. It should provide at least 32 channels for electrodes with at least 256 Hz sampling to record all relevant frequencies, and the voltage resolution of less than a few nanovolts to capture small differences in the

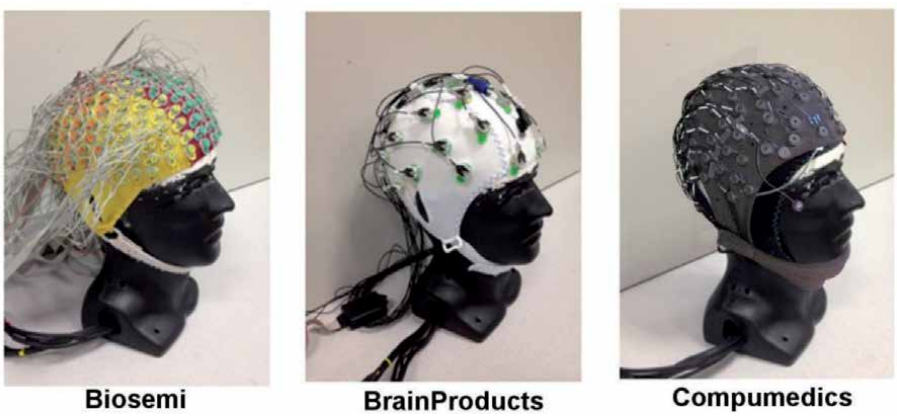

Figure 7.
Three most popular EEG caps from research-grade EEG systems. From left to right: Biosemi ActiveTwo 128 channels, BrainProducts ActiCap 32 channels, and Compumedics Quik-Cap 64 channels (image source: [1]).

signal between conditions. Additional channels for electrooculogram (EOG) and accelerometers are necessary for artifact filtering algorithms.

There is an emerging interest in low-cost solutions, especially for applications in brain-computer interfaces. One of the examples is Emotiv EPOC+ that was validated to work well with emotion recognition [41, 42].

3.4 State-of-the-art emotion recognition algorithms

There are a couple of thorough reviews of EEG-based emotion recognition systems in the literature [1, 7, 36, 43]. The vast majority of top-performing algorithms are based on machine learning approaches. The methods from the literature achieve levels of up to 94% for 2-class discrete problems (such as arousal vs. neutral or happiness vs. sadness) and up to 82% for 4-class classification (such as joy, anger, sadness, and pleasure). On the example of the DEAP (database for emotion analysis using physiological signals) [8], the paper [44] shows the comparison of different classifiers for 4 quadrants of the circumplex model: 63% for the kNN, 67% for the SVM, 70% for deep convolutional neural network and 75% for the deep hybrid neural network. On the example of the eNTERFACE06_EMOBRAIN database, the best classification accuracy among calm, exciting positive, and exciting negative emotional states achieved around 77% [45]. On the SEED dataset, the emotion classification into positive, neutral, and negative classes has achieved accuracy up to 83% [46]. Presented accuracies are virtually unreachable for humans.

4. EEG-based system for validation of affective picture databases standardization

In this section, we present the idea of the system for EEG-based validation of affective picture databases (**Figure 8**). The system consists of:

- a computer displaying affective pictures, collecting self-assessment responses, and providing feedback to the participant
- EEG device placed on the participant's head
- a set of trained deep neural networks (DNNs) for emotion recognition from EEG
- a set of mappings between emotion models

In our example, stimuli from the CAP-D picture set are displayed on the screen. Participant assesses each picture following the emotion categorization procedure from CAP-D. For each stimulus display period, the EEG signal is collected and passed to the input of trained DNNs for emotion recognition. The process of training such DNNs is described in Section 3. Based on the input EEG signal, each DNN outputs coordinates in the specific dimensional emotion model. They need to be mapped onto discrete emotions used in the emotion categorization of CAP-D. An example of such mapping is presented in Section 2.2. The mappings are crucial when operating on datasets described using different emotion models.

In the results validation phase, the information about the discrete emotion class labels from the emotion categorization, output of the selected mapping, and the ground truth label of the image are compared. There are several possible outcomes from such a comparison:

1. All the labels are the same – the normative label from the database is in agreement with the participant's categorization and physiological response.

2. The normative label alone is different – the emotion induced in the participant consistently differ from the normative label.

3. The participant's categorization alone is different – the physiological response is in agreement with the normative label but was assessed differently by the participant.

4. The output of the mapping alone is different – the participant's categorization is in agreement with the normative label, but the physiological response suggests a different label.

5. All the labels are different – there is no agreement between ground truth, self-assessment, and mappings.

Based on these outcomes several conclusions can be drawn and translated into the feedback about the database standardization. For outcome 1., the feedback should say about positive validation of the normative label. This is the desired outcome of the system. On the other hand, outcome 2. suggests a serious problem with the normative label for the particular participant, as both subjective and

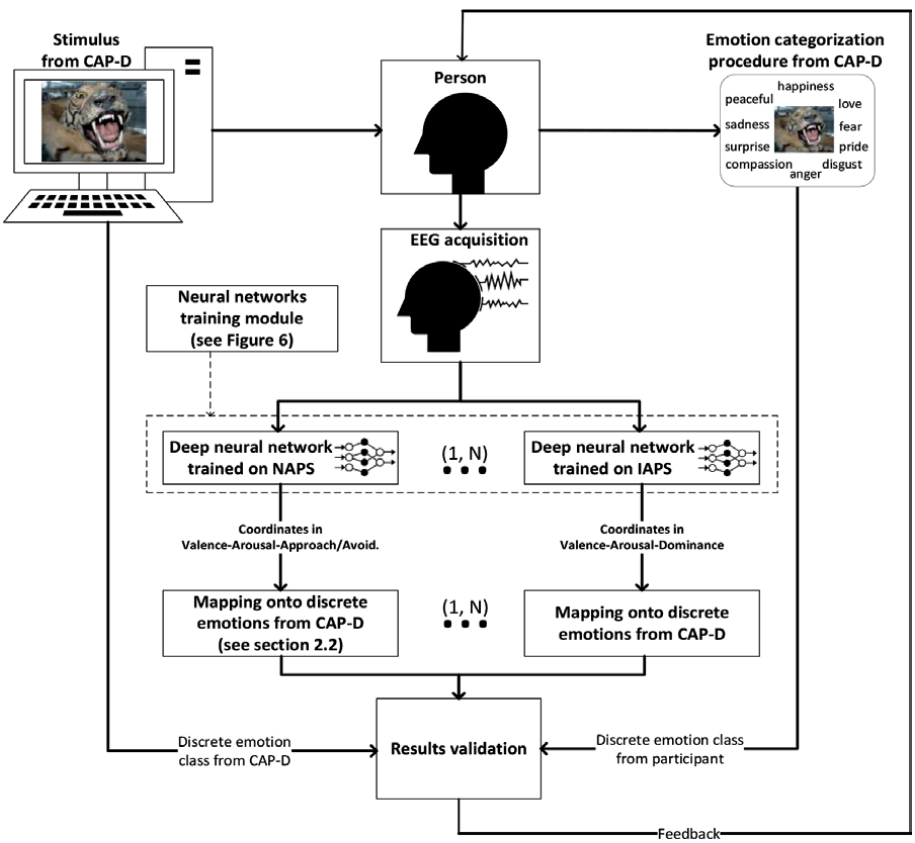

Figure 8.
The diagram of the system for validation of affective picture databases standardization.

physiological responses agree on a different label. This situation itself does not mean the validation is negative. Only if this problem persists among the majority of participants the label should be reconsidered. The supporting example here is the picture of a happy dog that should induce happiness according to the normative label but induces fear in individuals with cynophobia (the fear of dogs). Outcome 3., if consistent among the population, may suggest problems with naming the proper emotion on the picture. The physiological response is as expected for the normative label, but participants do not select the expected label. The supporting example here is the picture with a normative label of "fear" presenting the wolf eating its prey that induces fear in the physiological response. But, participants may focus on the prey's appearance in the subjective response and select the label "disgust". In this example, we may face the problem of ambiguous labeling of the image. If outcome 3. is present only in individual participants it may rather suggest their problems of emotion perception. Outcome 4. should be a suggestion for the authors of the database that the normative label of the picture may be biased by subjective responses of the participants (e.g. because of some cultural or ethical reasons), so their physiological responses disagree with conscious categorization. E.g., they cannot answer differently because it would put them in a bad light. Outcome 5 is the only one resulting with clearly negative validation where all participant's reactions are different. It may suggest that the normative label is too ambiguous or too weak to be perceived correctly.

The system was designed to be generic. The described validation may be performed for any discrete and dimensional models with little to no modifications of the flow. The only requirement is the existence of at least one algorithm trained to recognize the assessed emotions or at least one mapping which translates recognition results (in a different emotion model) into the target model. The more algorithms and mappings the more detailed validation results. Also, the system can be easily adapted to videos, sound, or text stimuli. Additionally, this system may select the most feasible emotion model for the participant and can be calibrated for him by fine-tuning the networks using his consecutive responses.

This system may be further adapted as a tool for training emotion perception - one of the branches of emotional intelligence that is measured in the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT) [47]. The feedback from the system provides suggestions of improvements in the emotional perception and points to the differences between self-assessment and normative benchmark that should be considered by the participant.

5. Summary and future work

The chapter presents a conceptual design of the computer system that uses EEG signals and deep neural networks to assess the affective picture databases standardization. According to the presented current state-of-the-art in psychology and machine learning, this kind of system is possible to create. All elements of the systems are ready to use. The only challenge is the selection of a representative population and collection of a significant amount of EEG data to train the deep neural networks.

As there are many models for describing emotions, we focused here on the mappings between emotion models. Such mappings allow using machine learning methods trained on one model for emotion recognition in a different model. There is a lack of emotion mappings for affective picture sets, so our new mappings between dimensions of valence, arousal, approach/avoidance, and discrete emotions are the value added by the chapter. There is also a possibility that one consistent and

dominant model of emotion will be established in the future. Then, the mappings may be deprecated, and one "general" model may be used to train the deep neural network.

The genericity of the system opens many possibilities for future work and adaptations to different applications. Besides emotion self-assessment validation, the system can be adapted for validation of emotion mappings, or emotional intelligence tests, e.g. emotion perception task from MSCEIT. It may be used in the future for the rehabilitation of people with emotion perception disorders like ASD. Also, the new machine learning methods can be inserted into the system and compared with existing deep neural networks. Even the EEG device may be replaced or extended with other physiological measurements without big changes in the system architecture.

The exploration of top-performing deep neural networks and emotion mappings may help to understand the underlying biological model of emotion, e.g. by using feature visualization approaches [48].

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Author details

Krzysztof Kotowski[1,2] and Katarzyna Stapor[2]*

1 Future Processing Healthcare sp. z o.o., Gliwice, Poland

2 Department of Applied Informatics, Silesian University of Technology, Gliwice, Poland

*Address all correspondence to: katarzyna.stapor@polsl.pl

References

[1] Kotowski K, Fabian P, Stapor K. Machine learning approach to automatic recognition of emotions based on bioelectrical brain activity. In: Simulations in Medicine Computer-aided diagnostics and therapy. DeGruyter; 2020. p. 15-34.

[2] Acharya UR, Sudarshan VK, Adeli H, Santhosh J, Koh JEW, Adeli A. Computer-Aided Diagnosis of Depression Using EEG Signals. Eur Neurol. 2015;73(5-6):329-36.

[3] Bosl WJ, Tager-Flusberg H, Nelson CA. EEG Analytics for Early Detection of Autism Spectrum Disorder: A data-driven approach. Sci Rep [Internet]. 2018 Dec [cited 2019 May 3];8(1). Available from: http://www.nature.com/articles/s41598-018-24318-x

[4] Adeli H, Ghosh-Dastidar S. Automated EEG-Based Diagnosis of Neurological Disorders: Inventing the Future of Neurology. 1 edition. Boca Raton, FL: CRC Press; 2010. 423 p.

[5] Isaac C, Januel D. Neural correlates of cognitive improvements following cognitive remediation in schizophrenia: a systematic review of randomized trials. Socioaffective Neurosci Psychol. 2016 Jan;6(1):30054.

[6] Picard RW. Affective Computing. Cambridge, MA, USA: MIT Press; 1997.

[7] Al-Nafjan A, Hosny M, Al-Ohali Y, Al-Wabil A. Review and Classification of Emotion Recognition Based on EEG Brain-Computer Interface System Research: A Systematic Review. Appl Sci. 2017;7(12).

[8] Koelstra S, Muhl C, Soleymani M, Jong-Seok Lee, Yazdani A, Ebrahimi T, Pun T, Nijholt A, Patras I. DEAP: A Database for Emotion Analysis ;Using Physiological Signals. IEEE Trans Affect Comput. 2012 Jan;3(1):18-31.

[9] Kotowski K, Stapor K, Ochab J. Deep Learning Methods in Electroencephalography. In: Tsihrintzis GA, Jain LC, editors. Machine Learning Paradigms: Advances in Deep Learning-based Technological Applications [Internet]. Cham: Springer International Publishing; 2020 [cited 2020 Jul 27]. p. 191-212. (Learning and Analytics in Intelligent Systems). Available from: https://doi.org/10.1007/978-3-030-49724-8_8

[10] Calvo RA, Kim SM. Emotions in Text: Dimensional and Categorical Models. Comput Intell. 2013;29(3):527-43.

[11] Panksepp J. Affective neuroscience: The foundations of human and animal emotions. New York, NY, US: Oxford University Press; 1998. xii, 466 p. (Affective neuroscience: The foundations of human and animal emotions.).

[12] Ekman P. Basic Emotions. In: Handbook of Cognition and Emotion. Wiley-Blackwell; 2005. p. 45-60.

[13] Gendron M, Roberson D, van der Vyver JM, Barrett LF. Perceptions of Emotion from Facial Expressions are Not Culturally Universal: Evidence from a Remote Culture. Emot Wash DC. 2014 Apr;14(2):251-62.

[14] Russell JA. Core affect and the psychological construction of emotion. Psychol Rev. 2003;110(1):145-72.

[15] Jack RE, Garrod OGB, Yu H, Caldara R, Schyns PG. Facial expressions of emotion are not culturally universal. Proc Natl Acad Sci U S A. 2012 May 8;109(19):7241-4.

[16] Plutchik R. The Nature of Emotions: Human emotions have deep evolutionary roots, a fact that may explain their complexity and provide

tools for clinical practice. Am Sci. 2001;89(4):344-50.

[17] Cowen AS, Keltner D. Self-report captures 27 distinct categories of emotion bridged by continuous gradients. Proc Natl Acad Sci. 2017 Sep 19;114(38):E7900-9.

[18] Mehrabian A, Russell JA. An approach to environmental psychology. Cambridge, MA, US: The MIT Press; 1974.

[19] Russell JA, Mehrabian A. Evidence for a three-factor theory of emotions. J Res Personal. 1977 Sep;11(3):273-94.

[20] Bakker I, van der Voordt T, Vink P, de Boon J. Pleasure, Arousal, Dominance: Mehrabian and Russell revisited. Curr Psychol. 2014 Sep;33(3):405-21.

[21] Russell JA, Lewicka M, Niit T. A cross-cultural study of a circumplex model of affect. J Pers Soc Psychol. 1989;57(5):848-56.

[22] Trnka R, Lačev A, Balcar K, Kuška M, Tavel P. Modeling Semantic Emotion Space Using a 3D Hypercube-Projection: An Innovative Analytical Approach for the Psychology of Emotions. Front Psychol [Internet]. 2016 Apr 19 [cited 2020 Nov 22];7. Available from: http://journal.frontiersin.org/Article/10.3389/fpsyg.2016.00522/abstract

[23] Fontaine JJR, Scherer KR. The global meaning structure of the emotion domain: Investigating the complementarity of multiple perspectives on meaning. In: Components of emotional meaning: A sourcebook. New York, NY, US: Oxford University Press; 2013. p. 106-25. (Series in affective science).

[24] Fontaine JRJ, Scherer KR, Roesch EB, Ellsworth PC. The World of Emotions is not Two-Dimensional. Psychol Sci. 2007 Dec;18(12):1050-7.

[25] Harmon-Jones E, Harmon-Jones C, Summerell E. On the Importance of Both Dimensional and Discrete Models of Emotion. Behav Sci. 2017 Sep 29;7(4):66.

[26] Landowska A. Towards New Mappings between Emotion Representation Models. Appl Sci. 2018 Feb 12;8(2):274.

[27] Hoffmann H, Scheck A, Schuster T, Walter S, Limbrecht K, Traue HC, Kessler H. Mapping discrete emotions into the dimensional space: An empirical approach. In: 2012 IEEE International Conference on Systems, Man, and Cybernetics (SMC) [Internet]. Seoul, Korea (South): IEEE; 2012 [cited 2020 Nov 22]. p. 3316-20. Available from: http://ieeexplore.ieee.org/document/6378303/

[28] Marchewka A, Żurawski Ł, Jednoróg K, Grabowska A. The Nencki Affective Picture System (NAPS): Introduction to a novel, standardized, wide-range, high-quality, realistic picture database. Behav Res Methods. 2014 Jun;46(2):596-610.

[29] Lang PJ. Behavioral treatment and bio-behavioral assessment: Computer applications. In: Sidowski JB, Johnson JH, Williams TA, editors. Technology in mental health care delivery systems. Norwood, NJ: Ablex; 1980. p. 119-37.

[30] Bradley MM, Lang PJ. International Affective Picture System. In: Zeigler-Hill V, Shackelford TK, editors. Encyclopedia of Personality and Individual Differences [Internet]. Cham: Springer International Publishing; 2017 [cited 2020 Nov 22]. p. 1-4. Available from: https://doi.org/10.1007/978-3-319-28099-8_42-1

[31] Kurdi B, Lozano S, Banaji MR. Introducing the Open Affective Standardized Image Set (OASIS). Behav Res Methods. 2017 Apr;49(2):457-70.

[32] Betella A, Verschure PFMJ. The Affective Slider: A Digital Self-Assessment Scale for the Measurement of Human Emotions. Tran US, editor. PLOS ONE. 2016 Feb 5;11(2):e0148037.

[33] Riegel M, Żurawski Ł, Wierzba M, Moslehi A, Klocek Ł, Horvat M, Grabowska A, Michałowski J, Jednoróg K, Marchewka A. Characterization of the Nencki Affective Picture System by discrete emotional categories (NAPS BE). Behav Res Methods. 2016 Jun;48(2):600-12.

[34] Moyal N, Henik A, Anholt GE. Categorized Affective Pictures Database (CAP-D). J Cogn. 2018 Sep 26;1(1):41.

[35] Wierzba M, Riegel M, Pucz A, Leśniewska Z, Dragan WŁ, Gola M, Jednoróg K, Marchewka A. Erotic subset for the Nencki Affective Picture System (NAPS ERO): cross-sexual comparison study. Front Psychol [Internet]. 2015 Sep 10 [cited 2020 Nov 25];6. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4564755/

[36] Kim M-K, Kim M, Oh E, Kim S-P. A Review on the Computational Methods for Emotional State Estimation from the Human EEG. Comput Math Methods Med. 2013;2013:1-13.

[37] Buechel S, Hahn U. Emotion analysis as a regression problem - dimensional models and their implications on emotion representation and metrical evaluation. In: Proceedings of the Twenty-second European Conference on Artificial Intelligence [Internet]. NLD: IOS Press; 2016 [cited 2021 Mar 24]. p. 1114-1122. (ECAI'16). Available from: https://doi.org/10.3233/978-1-61499-672-9-1114

[38] Bradley MM, Lang PJ. The International Affective Picture System (IAPS) in the study of emotion and attention. In: Handbook of emotion elicitation and assessment. New York, NY, US: Oxford University Press; 2007. p. 29-46. (Series in affective science.).

[39] Michałowski JM, Droździel D, Matuszewski J, Koziejowski W, Jednoróg K, Marchewka A. The Set of Fear Inducing Pictures (SFIP): Development and validation in fearful and nonfearful individuals. Behav Res Methods. 2017 Aug 1;49(4):1407-19.

[40] Dan-Glauser ES, Scherer KR. The Geneva affective picture database (GAPED): a new 730-picture database focusing on valence and normative significance. Behav Res Methods. 2011 Jun;43(2):468-77.

[41] Kotowski K, Stapor K, Leski J, Kotas M. Validation of Emotiv EPOC+ for extracting ERP correlates of emotional face processing. Biocybern Biomed Eng. 2018 Jan;38(4):773-81.

[42] Pham TD, Tran D. Emotion Recognition Using the Emotiv EPOC Device. In: Huang T, Zeng Z, Li C, Leung CS, editors. Neural Information Processing. Springer Berlin Heidelberg; 2012. p. 394-9.

[43] Zangeneh Soroush M, Maghooli K, Setarehdan SK, Motie Nasrabadi A. A Review on EEG Signals Based Emotion Recognition. Int Clin Neurosci J. 2017 Oct 8;4(4):118-29.

[44] Li Y, Huang J, Zhou H, Zhong N. Human Emotion Recognition with Electroencephalographic Multidimensional Features by Hybrid Deep Neural Networks. Appl Sci. 2017 Oct 13;7(10):1060.

[45] Z. Khalili, M. H. Moradi. Emotion recognition system using brain and peripheral signals: Using correlation dimension to improve the results of EEG. In: 2009 International Joint Conference on Neural Networks. 2009. p. 1571-5.

[46] Li X, Song D, Zhang P, Zhang Y, Hou Y, Hu B. Exploring EEG Features

in Cross-Subject Emotion Recognition. Front Neurosci. 2018 Mar 19;12:162-162.

[47] Mayer JD, Roberts RD, Barsade SG. Human Abilities: Emotional Intelligence. Annu Rev Psychol. 2007 Dec 21;59(1):507-36.

[48] Nguyen A, Yosinski J, Clune J. Understanding Neural Networks via Feature Visualization: A Survey. In: Samek W, Montavon G, Vedaldi A, Hansen LK, Müller K-R, editors. Explainable AI: Interpreting, Explaining and Visualizing Deep Learning [Internet]. Cham: Springer International Publishing; 2019 [cited 2020 Nov 29]. p. 55-76. (Lecture Notes in Computer Science). Available from: https://doi.org/10.1007/978-3-030-28954-6_4

Chapter 7

Cognitive Load Measurement Based on EEG Signals

Tasmi Tamanna and Mohammad Zavid Parvez

Abstract

Measurement of cognitive load should be advantageous in designing an intelligent navigation system for the visually impaired people (VIPs) when navigating unfamiliar indoor environments. Electroencephalogram (EEG) can offer neurophysiological indicators of perceptive process indicated by changes in brain rhythmic activity. To support the cognitive load measurement by means of EEG signals, the complexity of the tasks of the VIPs during navigating unfamiliar indoor environments is quantified considering diverse factors of well-established signal processing and machine learning methods. This chapter describes the measurement of cognitive load based on EEG signals analysis with its existing literatures, background, scopes, features, and machine learning techniques.

Keywords: cognitive load, EEG, machine learning, ERS, ERD

1. Introduction

To understand cognitive load, we must first understand the working memory and to understand working memory we have to know what memory is. The memory is the aptitude of brain that deals with encoding, storing and retrieving information as needed. These information are received and transmitted from external environment by sensory nervous system in the form of chemical or physical stimuli and processed by memory in central nervous system. Now memory is classified into two categories: (1) short term or working memory that holds information temporarily [1] and allows manipulation of stored information for reasoning, decision making, guiding behavior etc., (2) long term memory that can stock data for a long period.

Cognitive load is the quantity of working memory in use. There is another notion called "long term working memory" that is a set of rescue of parts of long term memory enabling continuous access to data required for daily activities [2]. Cognitive load is the basis of problem solving and learning [3].

Now comes the question, why do we need to measure cognitive load? Cognitive load is associated with learning new things whether be it a study matter or a new skill. So, to design a lesson plan it is important to understand how can a learner learn or memorize it easily and quickly where the measurement of cognitive load comes handy. The constructions and roles of human cognitive built have been used to develop a range of instructional means aiming for the reduction of load of working memory in learners and encouragement of diagram construction [4]. Furthermore, there are many other purposes of measuring cognitive load, such as, to know how a disease (neurodegenerative diseases, carcinomas etc.) or it's treatment (chemotherapy, radiotherapy, immunotherapy etc.) affects human cognition.

This measurement is also very important for different researches including age related cognitive declines, learning task performances and multiple document handling [5], Designing navigation aid for blind people [6] etc.

Researchers formulated many ways of measuring cognitive load such as subjective scales, task-invoked pupillary response [7, 8], EEG signals [9], fMRI etc. Distraction causes increase in cognitive load [10].

Subjective scales vary with varying perception in different individuals; thus, such scales are less reliable. Again, pupillary responses is equivalent to a range of events requiring psychological efforts which may be perceptual, cognitive and/or response related, thus it is not indicative of cognitive load being linked to task performance [11]. EEG and fMRI give more precise results regarding cognitive load related to task performance although they are expensive and complicated to operate. Compared to fMRI, EEG is easier to perform and read as various software are available now for EEG interpretation.

In this chapter Measurement of cognitive load based on EEG signals is discussed taking references from a study of learning processes of visually impaired people (VIP) while navigating through unfamiliar indoor environment using EEG signal [12].

2. Literature review

First, we review the prior research in the area of cognitive load measurement using EEG signals. Much work has been devoted in this area by extracting various features from EEG signals and then machine learning approaches have been applied to quantify cognitive load over years.

Fraser et al. [13] argued that intrinsic cognitive load needs to be adjusted to level of the apprentice, extraneous cognitive load needs to be abridged, and germane load needs to be augmented until the boundaries of working memory are not exceeded.

Gevins et al. [14] studied cortical activity throughout working memory tasks and found that a sluggish (low-frequency), parieto-central, alpha signal lessened as working memory load amplified.

Anderson et al. [15] designed user study performance based on measurement of cognitive load using EEG signals and these trials are used for quantitative evaluation the efficiency of visualizations.

Chandra et al. [16] extracted different features such as root mean square value, sub band energy, power spectral density, and engagement index and then used neural network for classification of the workload.

Kumar et al. [17] postulated that the cognitive load is possible to be quantified by measuring alpha and beta band events in the frontal, temporal and front-central regions of the cortex of cerebellum.

Antonenko et al. [9] computed Event-related desynchronization (ERD)/event-related synchronization (ERS) principles for individual partaker's alpha and theta rhythms under respective experimental conditions. Results illustrated that attainment of abstract and physical knowledge was meaningfully better in the lead-facilitated hypertext state.

Fournier et al. [18] illustrated that alpha ERD is insensitive to various workload weights in multi-task situations, it is operative in measuring variances in processing difficulties in the solitary interactive mission condition. Moreover, theta ERS is insensitive to workload and exercising the interactive of multiple task condition.

Klimesch et al. [19] illustrated the volume of power of theta and alpha frequency range in EEG is certainly associated with cognitive performance and memory in

specific, if a binary dissociation amid absolute and event-related fluctuations in alpha and theta wave is considered.

Ryu et al. [20] established technique based on several functional indices for evaluating the mental load all through arithmetic and tracking tasks. The suppression of alpha delivered appropriate data to deduce exertions for math task, but not in case of tracking task. On the other hand, blink intermission and heart rate variability allowed comprehensive readings about workload during tracking task, but not in case of arithmetic task.

Roy et al. [21] evaluated psychological exhaustion, ascending from mounting time-on-task (TOT), can pointedly affect the dispersal of the band power features. They exposed contradictory variations in alpha power spreading between Workload (WKL) and TOT settings, and reduction in WKL level discriminability by means of growing TOT in both figure of statistical alterations in band power and cataloguing act.

Krigolson et al. [22] demonstrated that bigger cognitive load lessens the functional efficiency of a recompence processing structure inside human medial–frontal cortex.

The performance of the quantification of cognitive load using EEG in real time seems to be more challenging due to diverse factors such as different environments, age, sex, social status, therefore, more research will be conducted.

3. Background study

In this section EEG system, event related synchronization/event related desynchronization (ERS/ERD), as well as different bands from EEG signals are discussed.

3.1 EEG system

The foremost International EEG assembly was held in 1947 when it recognized that standard electrodes appointment technique is required for the EEG recording [23]. This recognition resulted in the introduction of 10–20 electrode structure by H.H. Jasper in 1958. In this 10–20 system, 21 electrodes are placed utilizing the scalp size conferring to the external landmarks on cranium and their locations at distance of 10% and 20% of measurement of coronal, sagittal and circumference arcs from the nasion to inion. Electrodes are marked for identification according to their relative site on scalp. For instance, F, T, C, P and O represents frontal, temporal, central, parietal, and occipital lobes successively. Odd figures mean the electrodes of left side while even figures mean the right-sided ones, whereas the ground electrode is positioned at a unbiased site of the head such as midline of forehead. The two reference electrodes namely A1 and A2 are sited in dynamic zone (ear lobes) on left and right side respectively. The 10–10 system or International 10–20 system is an globally recognized technique for relating and localizing scalp electrodes in the context of EEG based experiments, which was established to guarantee standardized duplicability so that subjective researches as well as subjects could be compared to each other over time. This scheme is founded on the basis of association amid the position of an electrode and its underlying region of cerebral cortex. As for the designation of the scheme, the "10" and "20" actually refer to the real distances among adjacent electrodes which are either 10% or 20% of the entire front–back or right–left dimension of the skull. The 10–10 system, also acknowledged as the 10% system, is not only presented but also recommended by the standard of the American Electroencephalographic Society and the International Federation of Societies for Electroencephalography and Clinical Neurophysiology [23] where electrodes' situation occur at interval of 10% of measured coronal, sagittal and circumference arcs

amid the two points explicitly nasion and inion. The other stretched variety that is 10–5 system allows more than 300 electrodes to be placed [24]. Intracranial source of EEG signals is applied to facilitate the high-density EEG applications.

3.2 Event related synchronization/event related desynchronization

Cognitive load theory (CLT) refers to a hypothetical agenda which is founded upon human reasoning construction of long-term and short term (working memory) built [25]. CLT is a theory about information processing that relates working memory manacles to the effectiveness of instruction. Learning procedure is performed in the working memory which has restricted in both terms of capacity and duration as it can hold only upto 7 ± 2 portions of data at a specified time while novel data can be stored within about 15 to 30 seconds [26]. There are the three commonest categories of cognitive load, specifically intrinsic, extraneous and germane and these are defined by present CLT [27]. Intrinsic load is mainly imposed according to the intrinsic intricacy of the mission, while extraneous and germane loads are forced in accordance with the methods by which things are needed to be learnt. Event-related synchronization and desynchronization (ERSD) are measured to estimate the experimental participants' cognitive load. Antonenko et al. [9] demonstrated that the alpha band power is augmented in event-related synchronization (ERS) and diminished in event-related desynchronization (ERD) of the task interlude by means of baseline intermission. Hence, cognitive index (CI) of ERSD is designed via the following equation:

$$\partial = \left(\frac{\in_b - \in_t}{\in_b} \right) * 100 \tag{1}$$

where ∂ is cognitive index, $\in_b$ is the base-line intermission of band power, and $\in_t$ is the task internal of band power.

3.3 Different bands signals

In typical scenarios, the breadth of clinical EEG signals is from 10 to 100 μv as the frequency ranges from 1 to 100 Hz. EEG signal is catagorized into five broad rhythmic categories conferring to their frequency bands as clarified underneath:

Delta waves (δ): The frequency range is below 4 Hz with amplitude ranging from 20–200 μv. It arises at the time of deep sleep, infancy and grave organic brain disorders (He, 2013). It is documented from posterior brain in children and from front brain in grown-ups.

Theta waves (θ): The frequency ranges from 4 to 7 Hz as it is prominent in situations like sleep, psychological strain, and awakening in case of both children and grownups. It can be documented from both temporal and parietal regions of the scalp with an breadth ranging from 5–10 μv (He, 2013).

Alpha waves (α): It is periodic wave that is found in fit grownups during wakefulness, relaxation with eyes kept closed. Its frequency ranges from 8 to 13 Hz with usual voltage array of about 20–200 μv. It disappears during disease conditions like coma or normally in sleep.

Beta waves (β): Its frequency ranges from 13–30 Hz, although their breadths are lesser, ranging from 5–10 μv. It surfaces in situations like excessive excitement of the central nervous system when upsurge in alertness and watchfulness occur. It substitutes the alpha wave if cognitive damage ensues for any reason. It can be recorded placing electrodes on parietal and frontal regions of the scalp.

Gamma waves (γ): Frequency of gamma waves arrays from 30 to 100 Hz. It can be documented from the somatosensory cortex in instances of cross model sensory processing, short term memory processing to identify objects, sounds, palpable sensation and in some pathologies including cognitive deterioration, mainly when it relates to the θ band.

4. Cognitive load measurement

Measurement of cognitive load is typically consisting bands extraction, features extraction, calculation of ERS/ERD, and classification (see in **Figure 1**).

4.1 EEG signals

Nine VIPs with different degree of vision lose partaken this experiment wandering through a complex route of the University building which included students' units, class rooms, reading rooms, a book store and two restaurants [6]. The route was about 200 meters in length whereas the walking distance was roughly 5 minutes. Various environmental condition such as door, elevator, moving people and object, open and narrow space, as well as stairs were considered.

The study got its approval from the National Bioethics Committee of Iceland and data set was anonymized prior to analysis. The data set comprises of EEG recordings from nine healthy VIPs (6 female; average duration of visual damage = 30 yrs., range = 2–52 yrs) with different degrees of eyesight loss (see **Table 1**) as they strolled separately through a multifaceted course in an educational institute. The participants were asked to abstain from smoking, consuming coffee and sugar roughly 1 hour before the initiation of the experiment. The partakers were instructed to walk through the charted route thrice (i.e. trial 1, trial 2, and trial 3) as drills. Directions were provided for the first time only (i.e. trial 1) to aid the VIPs acquaint with the course. They were also prohibited from needless head activities and hand movements. They also asked to avoid using their O&M instructor except in case of emergencies.

EEG data was attained by the Emotiv EPOC+ system which is a portable headset containing 16 dry electrodes with 128 Hz sampling rate registering capacity over the 10–20 system locations specifically AF3, F7, F3, FC5, T7, P7, O1, O2, P8, T8, FC6, F4, F8, AF4, GYROX and GYROY (i.e. information about how the head accelerates during leaning sessions according to x-axis and y-axis, respectively). This system encompasses a sum of interior signal training phases. Analogue signals are at first filtered by high-pass filter with a 0.16 Hz cut-off, pre-amplified, then low-pass filtered with a 83 Hz cut-off, and tried at 2048 Hz. Digital signals are subsequently notch-filtered at 50/60 Hz and down-sampled to 128 Hz before broadcast. The EEG signal of each participant are firstly smothered by his own base signal and then bandpass butter worth filter is used on the signal for mining of gamma (30–60 Hz), beta (13–30 Hz), alpha (7–13 Hz), theta (4–7 Hz), and delta (0.5–4 Hz) bands respectively.

4.2 Bands extraction

Different bands like gamma, beta, alpha, theta, and delta are extracted to get appropriate features. The power of alpha band is grown in event-related activation and declined in event-related deactivation considering task interval with baseline interval [7].

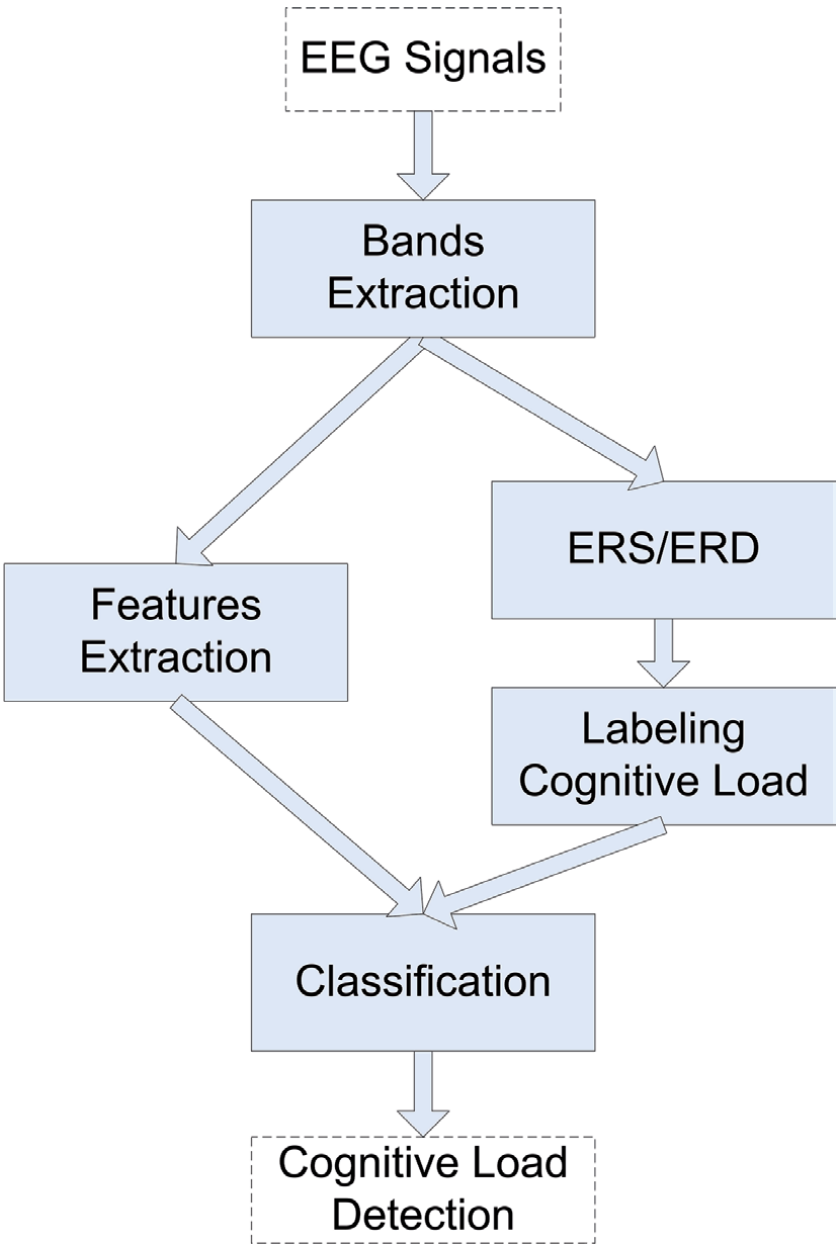

Figure 1.
Basic diagram for cognitive load measurement using EEG signals and machine learning approach.

4.3 Features extraction

Features extract play an important role for detection of cognitive load based on EEG signals. Different feature extraction techniques such as time, frequency, and time-frequency domains are considered for features extraction [28]. To analysis of the cognitive load, we have extracted entropy feature based on frequency domain analysis.

4.4 Labelling of cognitive load

Though alpha band (i.e., 7–13 Hz) power rises in event-related synchronization (ERS) and lessens in event-related desynchronization (ERD) of the task

Brain Location	Sensitivity	Specificity	Accuracy
Entire Brain	58.37	76.23	73.08
Left hemisphere	56.44	74.32	72.31
Right hemisphere	54.72	73.64	71.45
Left hemisphere and frontal lobe	56.98	72.61	71.64
Right hemisphere and frontal lobe	55.46	72.25	71.45
Left hemisphere and theta and alpha bands	70.11	71.35	70.65
Right hemisphere and theta and alpha bands	56.15	72.20	71.29

Table 1.
Calculate performance using signal processing feature and machine learning approach for cognitive load measurement in the indoor environment based different band from EEG signals.

intermission by means of reference line interval. So, alpha band power is used for the labelling of cognitive load based on measurement of cognitive index.

4.5 Classification

In this section, we discuss classification and cognitive load measurement. Classifier intent to categorize the EEG signals by applying machine learning method. Support vector machine (SVM) is implemented on spatio-temporal feature namely entropy that we extracted using frequency domain analysis. Classification processed revolving cross validation which execute its technique involving the test set and training set of data into complimentary subset and analyze how accurately the predicted model will perform [29]. In our case, we used five-fold cross validation (i.e., N = 5). One set is randomly chosen and reserved for testing and remaining N-1 is used for training and then average the results. Five-fold cross validation is operated upon training set to produce an ideal model of the SVM classifier. N-1 which means 80% of the training set is randomly selected to establish the SVM model and remaining 20% is observed to fit the model.

5. Results and discussion

Entropy features extracted from EEG signals using 16 electrodes and different bands. There performance metrics such as sensitivity, specificity, and accuracy are considered to evaluate and measure the performance [30]. The formulation of sensitivity, specificity, and accuracy are as follows:

$$Psen = \frac{\tau_p}{\tau_p + \varphi_n} \tag{2}$$

$$Pspe = \frac{\tau_n}{\tau_n + \varphi_p} \tag{3}$$

$$Pacc = \frac{\tau_p + \tau_n}{\tau_p + \tau_n + \varphi_p + \varphi_n} \tag{4}$$

where τ_p is the true positive, τ_n is the true negative, φ_p is the false positive, and φ_n is the false negative.

To observe the measurement of cognitive load, the performance metrices are considered. In the **Table 1**, the results demonstrated that accuracy is high when considering entire brain compared to consider partial brain locations.

6. Conclusion

In this study the chief aim of the measurement of cognitive load with emphasis on working memory load was to design a smart motion system for the visually impaired people (VIPs) for their navigation. To achieve this goal an experiment consisting of different phases such as bands extraction, features extraction, labelling of cognitive index using well-established metric, and finally use of the machine learning techniques was conducted to measure cognitive load. The performance of the prediction and/or detection of cognitive load using EEG signals in real time is more challenging, therefore, further research should be conducted for improved performance.

Author details

Tasmi Tamanna[1*] and Mohammad Zavid Parvez[2]

1 Bangladesh University of Health Sciences, Dhaka, Bangladesh

2 BRAC University, Dhaka, Bangladesh

*Address all correspondence to: tasmitamanna02@gmail.com

References

[1] *Miyake A, Shah P. Models of working memory. Mechanisms of active maintenance and executive control. Cambridge University Press; 1999.*

[2] Ericsson KA, Kintsch W. Long-term working memory. Psychological Review. 1995:102 (2): 211-245.

[3] Sweller J. Cognitive Load During Problem Solving: Effects on Learning. Cognitive Science. 1998:12 (2): 257-285.

[4] Sweller J, van Merrienboer JJ., Paas FG. Cognitive Architecture and Instructional Design. Educational Psychology Review. 1998: 10 (3): 251-296.

[5] Cerdan R, Candel C, Leppink J. Cognitive load and learning in the study of multiple documents. Frontiers in Education. 2018: 3: 59.

[6] Kalimeri K, Saitis, C. Exploring multimodal biosignal features for stress detection during indoor mobility. In: Proceedings of the 18th ACM international conference on multimodal interaction, 2016. P. 53-60.

[7] Skulmowski A, Rey GD. Measuring cognitive load in embodied learning settings. Frontiers in Psychology. 2017: 8: 1191.

[8] Paas F, Tuovinen JE, Tabbers H, van Gerven PW. Cognitive load measurement as a means to advance cognitive load theory. Educational psychologist. 2003: 38: 63-71.

[9] Antonenko P, Paas F, Grabner R, van Gog T. Using electroencephalography to measure cognitive load. Educational Psychology Review.2010: 22(4): 425-438.

[10] Paas F, Sweller J. An evolutionary upgrade of cognitive load theory: Using the human motor system and collaboration to support the learning of complex cognitive tasks. Educational Psychology Review. 2012: 24(1): 27-45.

[11] Kramer AF. Physiological metrics of mental workload: A review of recent progress. Multiple-task performance. 1991: 279-328.

[12] Afroz S, Shimanto ZH, Jahan RS, Parvez MZ. Exploring the cognitive learning process by measuring cognitive load and emotional states. Biomedical Engineering: Applications, Basis and Communications: 2019: 31(04):1950032.

[13] Fraser KL, Ayres P, Sweller J. Cognitive load theory for the design of medical simulations. Simulation in Healthcare. 2015:10(5):295-307.

[14] Gevins A, Smith ME, McEvoy L, Yu D. High-resolution EEG mapping of cortical activation related to working memory: effects of task difficulty, type of processing, and practice. Cerebral cortex. 1997:7(4):374-385.

[15] Anderson EW, Potter KC, Matzen LE, Shepherd JF, Preston GA, Silva CT. A user study of visualization effectiveness using EEG and cognitive load. In: Computer graphics forum. 2011: 30(3), p. 791-800.

[16] Chandra S, Sharma G, Verma KL, Mittal A, Jha D. EEG based cognitive workload classification during NASA MATB-II multitasking. International Journal of Cognitive Research in Science, Engineering and Education. 2015:3(1).

[17] Kumar N, Kumar J. Measurement of cognitive load in HCI systems using EEG power spectrum: an experimental study. Procedia Computer Science. 2016:84:70-78.

[18] Fournier LR, Wilson GF, Swain CR. Electrophysiological, behavioral, and subjective indexes of workload

when performing multiple tasks: manipulations of task difficulty and training. International Journal of Psychophysiology. 1999:31(2):129-145.

[19] Klimesch W. EEG alpha and theta oscillations reflect cognitive and memory performance: a review and analysis. Brain research reviews. 1999:29(2-3):169-195.

[20] Ryu K, Myung R. Evaluation of mental workload with a combined measure based on physiological indices during a dual task of tracking and mental arithmetic. International Journal of Industrial Ergonomics. 2005:35(11):991-1009.

[21] Roy RN, Bonnet S, Charbonnier S, Campagne A. Mental fatigue and working memory load estimation: interaction and implications for EEG-based passive BCI. In2013 35th annual international conference of the IEEE Engineering in Medicine and Biology Society (EMBC). 2013. p. 6607-6610.

[22] Krigolson OE, Hassall CD, Satel J, Klein RM. The impact of cognitive load on reward evaluation. brain research. 2015:1627:225-232.

[23] Oostenveld R, Praamstra P. The five percent electrode system for high-resolution EEG and ERP measurements. Clinical neurophysiology. 2001:112(4):713-719.

[24] Jurcak V, Tsuzuki D, Dan I. 10/20, 10/10, and 10/5 systems revisited: their validity as relative head-surface-based positioning systems. Neuroimage. 2007:34(4):1600-1611.

[25] Sweller J, Van Merrienboer JJ, Paas FG. Cognitive architecture and instructional design. Educational psychology review. 1998:10(3):251-296.

[26] Miller GA. The magical number seven, plus or minus two: Some limits on our capacity for processing information. Psychological review. 1956: 63(2):81.

[27] Van Merrienboer JJ, Sweller J. Cognitive load theory and complex learning: Recent developments and future directions. Educational psychology review. 2005:17(2):147-177.

[28] Hernández DE, Trujillo L, Z-Flores E, Villanueva OM, Romo-Fewell O. Detecting Epilepsy in EEG Signals Using Time, Frequency and Time-Frequency Domain Features. InComputer Science and Engineering—Theory and Applications. 2018. p. 167-182.

[29] Parvez MZ, Paul M. Seizure prediction using undulated global and local features. IEEE Transactions on Biomedical Engineering. 2016: 64(1):208-217.

[30] Parvez MZ, Paul M. Epileptic seizure detection by analyzing EEG signals using different transformation techniques. Neurocomputing. 2014:145:190-200.

Chapter 8

Neuromarketing: The New Dawn and Disruption in Marketing Research

Kovvali Bhanu Prakash and Appidi Adi Sesha Reddy

Abstract

The 21st Century is termed as the 'Century of the Brain' and the 'Human Brain' has 100 billion neurons and each neuron is connected to 10000 other neurons. 'Meme' is a unit of information that is stored in the brain and these units are effective at influencing a person who is making choices and decisions within 2.6 seconds. The 'Neuromarketing' is emerged from the realms of 'Neuro Science' as a new dawn and digi-driven disruption in the arena of 'Marketing Research' that studies the cognitive and emotional brain responses to marketing stimuli. The 'Consumer Neuro Science' by instigating brain wave tools figuring out what customers' thoughts and brain responses are towards a product, service, advertisement, or even packaging. Neuromarketing mapping the activities in specific regional strata of the brain, capturing and predicting the psychological as well as physiological behavioral changes of buyers and/or consumers at a point-of-sale. The chapter intends to present the conceptual focus of 'Buying Brain' *viz.,* Neuro Marketing, the role of 'Memes' in buying decisions, besides the tools and techniques adopted in persuading Buyers as Consumers and/or Prosumers that remain unearthed and unexplored.

Keywords: EEG, fMRI, MEG, PET, SST

1. Introduction

The 'Mind' is what the 'Brain' does and the 'Brain Science' was emerged from the realms of Neuro Sciences. The Neuro Science deals with the 'Mind' while Neuromarketing corroborates the 'Brain Responsiveness'. The impressions created in mind are stimulated and expressed by brain. A unit of information stored in 'Brain' is referred as 'Meme' *i.e.,* the basis for Neuro Science and 'Neurons' are the cells that fire together, wire together and responsible for the biological basis of our cognitive responses. 'Memes' influence buyers to make choices and decisions within 2.6 seconds and stayed in memory are targeted by Market Researchers (**Table 1**) [1, 2]. Neuromarketing is a relatively nascent and inter-disciplinary field in Marketing Research emanated from the Neuroscience, and Psychology. The Neuromarketing assesses the needs of consumers, monitors and measures the cognitive and emotional responses to various marketing stimuli [3, 4]. The Neuroscience is considered to be in its infancy, and Neuromarketing will be clearly at an embryonic stage [5].

• Human Brain weighs about 3.3 pounds (1.5 kilograms)
• Mass of a Human Brain is 2 per cent of Body Mass Index (BMI)
• Cerebrum makes up 85 per cent of Human Brain's Weight
• Neurons' are the cells that fire together, and wire together (Axons and Dendrites)
• Human Brain has 100 billion neurons, and each neuron is interconnected to 10000 other Neurons
• 'Meme' is a unit of information stored in Brain
• 'Memes' influence buyers to make choices and decisions within 2.6 seconds
Source: Ref. [3].

Table 1.
Human brain - the factsheet.

1.1 Neuromarketing: the premiere

The fusion of Neuropsychological and Marketing Sciences was trace back at the beginning of the 21st century when Neuroscience and Economics integrated as Neuro Economics [6]. Neuromarketing is an ontology of Neuroscience that reveals the true motives, real intentions, or inner essential truth of the naked, unconscious or intuitive consumer [7, 8].

The analytics and applications of Neuroscience have been facilitating the product marketing from the stages of introduction to decline *enroute* growth, and maturity [9–11]. Marketing is an activity and a kingpin that sets the economy revolving (Adam Smith) *prima facie* creating and delivering standard of living to society (Paul Mazur and Malcom McNair). The journey towards moment of truth to moment of promise is merely for the fulfillment of immediate needs and wants, promising customers, clients, partners, and society at large keeping in view the futuristic outlook and direction *i.e.,* Neuroscientific Research [12].

The term 'Neuromarketing' is at first coined by Gerald Zaltman of Harvard University and conceptualized by Ale Smitds of the Erasmus University of Rotterdam defined it as a 'Consumer Neuroscience' mapping the activity of conscious, sub-conscious and unconscious state of the brain stimuli [13]. The exhibited external behavior of the consumer is naked and unreliable, yet, the brain response *i.e.,* pre-frontal cortex is real and reliable [14–16].

Neuromarketing is an interdisciplinary and a relatively nascent field in Marketing Research that was connected by Neuro Science, Behavioral Economics and Social Psychology [17] to study consumer reactions and responses to specific marketing related stimuli [18]. The prime objective of Neuromarketing is to study how the brain is physiologically affected by advertising and marketing strategies. The application of 'Neuroscience' and adoption of 'Neuromarketing' tools and techniques intelligibly touched and touted the 'Marketing Mirrors' during 1990–2000 and thereafter gained momentum [19–21].

The Neuromarketing or Consumer Neuroscience is defined as an application of Neuroscientific tools and techniques viz., fMRI, EEG, MEG, Eye Tracing, SST, PET, Eye Tracking, IAT, SC, Facial Coding and other brain wave tools to assess, analyze and gauge the consumer decision-making and brand consumption-comprehension processes and figuring out the customers, consumers as well as prosumers thoughts towards a product, service, advertisement, or even packaging [22–25]. The revolutionary and radical shift termed as Moment of Promise (SAS, Google) steering prosumers than targeting consumers or users. This seismic shift from near sighted Marketing Myopia (Theodre Levitt) *i.e.,* Moment of Truth ('I Want To Know-Go-Do-Buy) (A.G. Lafley, Pete Blackshaw - P&G, Google) to Moment of Promise (apple).

1.2 Neuromarketing: from the lens and mirrors of neuro science

The Human Cognitive Neuroscience and Psychology is the basis for Neuromarketing (Neuroco and Neurosense in UK, Bright House Neuro Strategies and Neuro Insights in USA Sales Brain in France, and Neuro Insight in Australia), and it studies the 'Consumer Behavior' from a brain perspective. Neuro Imaging as a standard tool or technique in Marketing Research adopted to analyze the situations-scenarios of Cognitive Psychology. The Neuroscience has widely applied by Economists in economic decision-making [26–30].

Neuro Science is in primitive stage while Neuromarketing still in infancy. The Frontal Lobe is the seat of Executive Function (EF) that controls short memory, and does the best of thinking *i.e.,* planning. The Frontal Lobe is responsible for the emotional instinctive behavior. The R-Complex or the Reptilian Brain is the critical component and responsible for buying behavior. The Reptilian Brain focuses on pre-verbal processes of virtual stimuli without the use of visual cortex *i.e.,* image preference over words and experiences over explanations. The mass of a 'Consumer Brain' is 2 per cent of Body Mass Index (BMI) and it burns 20 per cent of energy. The remaining 80 per cent of 'Brain Energy' is necessary to sustain rest state or default mode that continues to be perplexing for Neuroscientists (**Figure 1**).

The individual preference to brand familiarity [31, 32] and product preference [33, 34] have been correlated with neural activity in Neuromarketing. The 'Brand Image' awaken the emotions that can become more powerful than the direct effect of the product. The medial Pre-Frontal Cortex (mPFC) as a repository of linkages between factual knowledge and bio-regulatory states translating the product information into experiences and linked the positive affect in advertising [35, 36].

1.3 Neuromarketing: the triune signal system (TSS)

The Triune Brain is a signaling system and a key instigator of the 'fight and flight' mechanism [37, 38]. The Triune Brain (3-Imbricate Structures) consisting

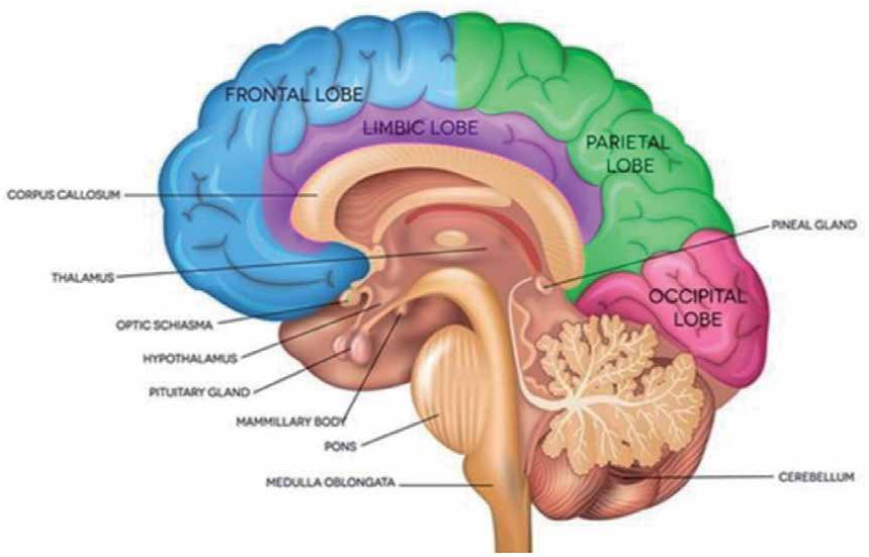

Figure 1.
Human brain—the anatomy.

of (i) R-Complex (Reptilian) or Primitive Brain; (ii) Limbic System or Emotional Brain; and (iii) Neo-Cortex or Rational Brain focus on primitive emotions that are overruled by conscious thoughts (**Figure 2**) [39].

1.3.1 The R-complex (reptilian) or lizard or primitive brain

The consumer psychology has been the bedrock for marketing strategies and R-Complex helps Marketing Researchers to understand how consumers' Reptilian Brain reacts and responds to the moment. In order to satisfy the 'Need Hierarchy' (physiological, safety and security needs), the Primitive Brain responds very quickly with a strategic intent (act, react, withdraw or wait). A well- developed and healthy Neo-Cortex monitors the R-Complex in smart and sentient buying [40–45].

1.3.2 The limbic system or emotional brain

The Limbic System or Paleomammalian Cortex is a set of brain structures that deals with emotions, feelings, attention, general attitude, pleasureor annoyance, agreeable or disagreeable experiences, and memory. It regulates autonomic or endocrine function in response to emotional stimuli [46–48].

The Limbic Structure is composed of hippocampus, amygdala, thalamus, and hypothalamus. The Limbic Brain is at the seat of the decision-making and value judgments that exerts a strong influence on Buyers' Behavior (**Figure 3**).

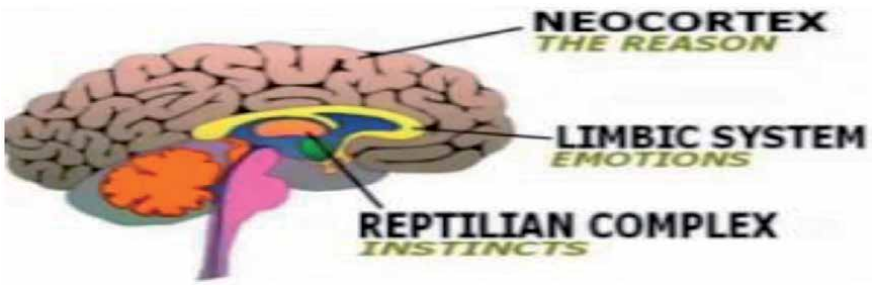

Figure 2.
Triune brain - the neuro warning signal (NWS). Source: The triune brain, science of psychotherapy, 26th Oct, 2016.

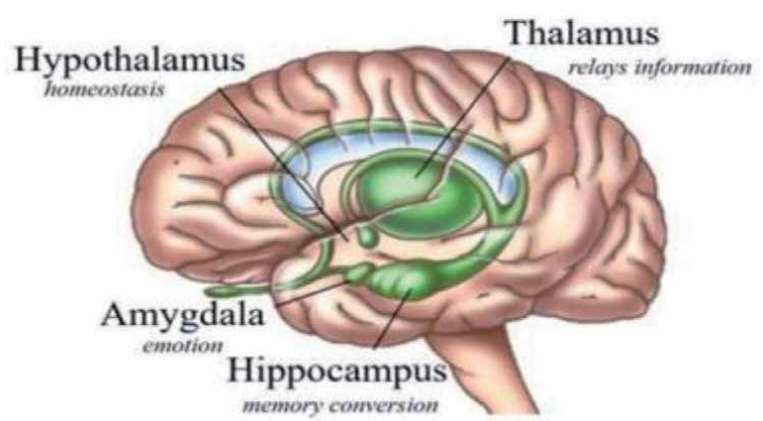

Figure 3.
Limbic brain - the anatomy. Source: Ref. [50].

1.3.3 The neo-cortex or rational brain

The Neo-Cortex or the Rational Brain positioned in between two large cerebral hemispheres that are playing a dominant and responsible role for the development of human language, abstract thought, imagination, and consciousness. It analyses the choices of the products and/or services and suggest the best choice amongst alternatives based on the need rather than the features of the product.

The Neo-Cortex has the features of rationality, flexibility and infinite learning abilities that are used to solve problems logically and develops innovative and rational thinking. The Rational Brain thinks, the Emotional Brain feels and the Reptilian Brain makes decisions (**Figure 4**) [49–52].

The activation of medial Pre-Frontal Cortex (mPFC) is an effective corollary measure that affects the fear conditioning [53], eating disorders provocation [54], and startle responses [55]. The reward system [56–59], money [60–63], brand preference [64], price and quality can also influence the consumers in a placebo-like manner [65].

1.4 Neuromarketing: the analytics & applications

Today's Experience Economy (EE) has been effectively monitoring and measuring the efficacy of emotions, feelings and opinions of Buyers as well as Consumers. The non-invasive and intrinsic to Neuroimaging Techniquesfor measuring and mapping the brain activity *inter alia* include: a) functional Magnetic Resonance Imaging (fMRI), b) Electro EncephaloGraphy (EEG), and c) Magneto EncephaloGraphy (MEG) [66, 67]. These 3-Neuro ImagingTechniques are non-invasive and therefore can be used safely for Marketing Research purposes (**Figure 5**).

The other prominent and prevalent Neuro Scientific Methods are: Steady State Topography (SST), Positron Emission Tomography (PET), Eye Tracking and Galvanic Skin Response (GSR). An fMRI peer deeps into brain by using strong magnetic fields to track changes in blood flow across the brain. But, an EEG reads the brain-cell activity using sensors over fractions of a second. Unlike both EEG and MEG, the fMRI modality scans and catches the BOLD Signal (Blood Oxygen Level Dependant) Flow Image of the brain *i.e.,* the prime source of intervention and intermediation [68, 69].

1.4.1 Neuromarketing: the functional magneto resonance imaging (fMRI)

The functional Magnetic Resonance Imaging (fMRI) has been widely used neuroimaging technique since mid-1980s'and its rapid application in mapping the

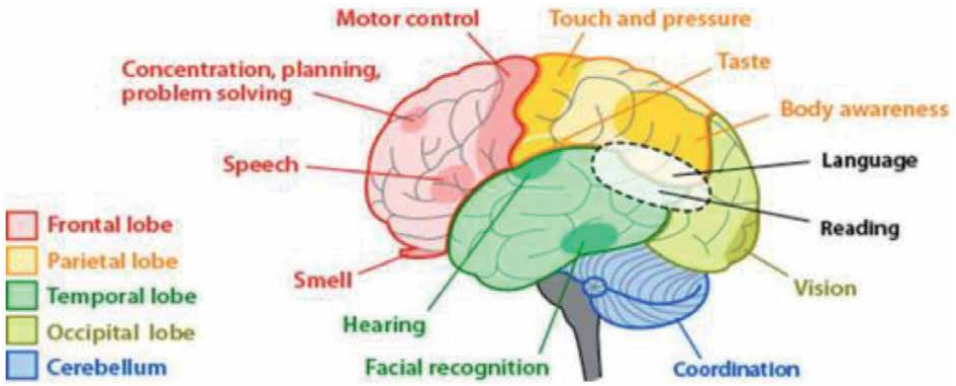

Figure 4.
Neo-cortex/rational brain - the regions. Source: Ref. [55].

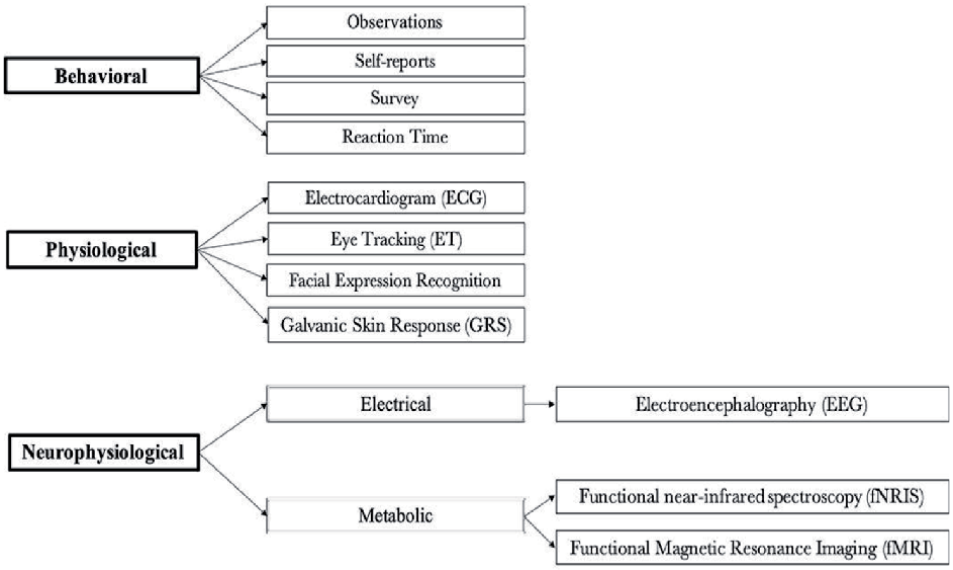

Figure 5.
Neuro-imaging tools and techniques - an overview. Source: www.frontiersin.org.

brain's circuitry fueled the growth of Neuropsychology (study of cognitive processes), Neurophysiology (study of nervous system), Neuroethology (evaluationary and comparative study of animal behavior and human nervous system) and Neuroanotomy (study of neural structures of human nervous system).

The fMRI studies the refractions of magnetic field and radio waves thereby producing a signal that allows viewing the brain structures in detail [70]. The first empirical study on fMRI and its impact and incidence on Neuromarketing inferred that different brain areas are activated when people know the 'Brand Consumed' compared to when they do not know it (Coca-Cola Vs Pepsi) [71]. Further, stated that when people knew the brand Coca-Cola over Pepsi their 'Frontal Lobe' was activated, an area that coordinates attention, controls short-term memory and directs thinking especially planning. However, when they did not know the brand, they have reported that they prefer Pepsi, and the 'Limbic System Structure' activated *i.e.,* responsible for emotional and instinctual behavior. The findings emerged from the study revealed that emotional stimuli used as a product brand affects the cortical activity in 'Ventromedial Prefrontal Cortex' and thus can influence the buying behavior (**Figure 6**) [72–74].

1.4.2 Neuromarketing: the electro encephalography (EEG)

The Electro Encephalo Graphy (EEG) is a non-invasive brain imaging technique detects the brain activity using different electrodes placed on the scalp [75]. An EEG reads and measures the brain-cell activity by using sensors and tracks the changes in brain activity over fractions of a second. The analytical insights and operational owes by adopting EEG can be helpful to assess triggers, and motivators in the entire brain. A left–right asymmetry of the Frontal EEG signals (an indication of happiness or amusement) reflects the consumer desirability of a product. The brain image of EEG is considered in Brand Selection Research i.e., shift in brand preference by a TV Advertisement, Brand Positioning and Processing and Product Selection. In Consumer Neuroscience Research, the EEG investigates the cognitive processes such as attention, arousal, emotion, engagement, excitement, memory, reward, sensory perception and valence [76–80].

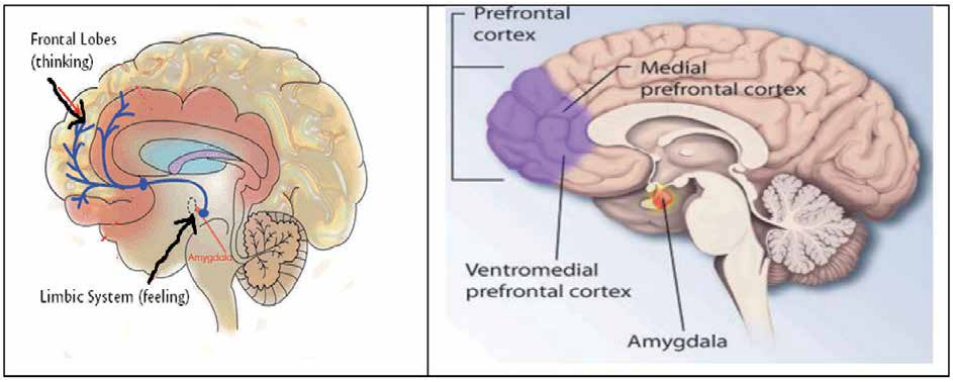

Figure 6.
Neuro science - the science of consumer behavior. Source: Ref. [78].

The functional Magnetic Resonance Imaging (fMRI) points out the changes in activity in parts of the brain while Electro Encephalo Graphy (EEG) and Steady State Topography (SST) measure the brain activity in specific regional spectra of the brain response. The bio-sensors gauge the changes in one's physiological state also known as Biometrics (Heart Rate and Respiratory Rate, Galvanic Skin Response) to know why consumers make the decisions? Which brain areas are responsible for making the decisions? [81].

1.4.3 Neuromarketing: the magneto encephalo graphy (MEG)

The neurophysiological and non-invasive technique *viz.,* Magneto Encephalo Graphy (MEG) presents an analytical view of brain mapping and the neuronal activity in the living human brain (VOXELS) with milli-second precision. The MEG is concerned with the upper most layer of the brain *i.e.,* Cerebral Cortex. By using Magnetic Field Tomography (MFT) the Market Researchers can assess and predict the cognitive processes that govern the buyer behavior. [82–85].

1.4.4 Neuromarketing: the steady state topography (SST)

The Steady State Topography (SST) is another tool used in Cognitive Neuroscience as well as in Neuromarketing Research for observing rapid changes in human brain activity [86]. The SST measures variations in delay (latency) between the stimulus and the steady state that is visually evoked potential response over extended periods of time. This offers new insights based on neural processing speed as opposed to the more common EEG amplitude indicators of brain activity. The following are some of the techniques adopted by the Market Researchers in order to obtain more insights about the buyers' response either to buy a product or to try a product.

1.4.5 Neuromarketing: the positron emission tomography (PET)

The Positron Emission Tomography (PET) maps normal human brain by taking physiological images with spatial resolution similar to fMRI and recording the radiation from the emission of positrons from the radioactive substance administered to the subject (the radio-active chemicals in blood).

1.4.6 Neuromarketing: the eye tracking methods

The Eye Tracking Methods study the behavior and cognition of buyers without measuring brain activity. The Eye movements fall into two categories *viz.,* Fixations

and Saccades. The pause in eye movement in a certain position is termed as a 'Fixation' and 'Saccade' deals with switching of eye movement to another position. The resulting series of Fixations and Saccades are called 'Scan Path', and they are used in analyzing visual perception, cognitive intent, interest and salience. The technique of Eye Tracking can be useful in promotion of advertisements and its impact assessment, concept testing, logo and package designing, online usability, micro-site development and in-store marketing [87].

1.5 Neuromarketing: the biological responses and reactions

The biological reactions to stimuli can also provide information about buying preferences, tastes and behavior of consumer. The Marketing Researchers can predict the emotional state by monitoring heart rate, blood pressure, skin conductivity (affected by sweat, measuring arousal level), stress hormone from saliva, facial muscles contractions and facial expressions of emotions *per se.*

An Implicit Association Test (IAT) can be used to measure individual behavior and experiences towards certain stimuli. The IAT measures the underlying attitudes (evaluations) of the subjects by assessing reaction times of two cognitive tasks and also identifying the speed of two different concepts (stimuli such as advertisements, brands, concepts) to different evaluative anchors (attributes) with which these can associate. It also measures the amount of time between stimuli appearance and its response (response time or reaction time).

The Skin Conductance Technique (SCT) analyses the subtle changes and measuring arousal in Galvanic Skin Responses (GSR) when the Autonomic Nervous System (ANS) is activated. It can also predict the market performance and perfections better than self-reports [88].

The Facial Coding identifies micro-expressions and record these in the form of 'Coding' and measuring non-conscious reactions based on the activity of the facial muscles. Facial expressions are spontaneous and provide real time insights but are based on subjectivity in deciding when an action has occurred or when it meets the minimum requirements for coding. The Facial Electro Myo Graphy (Facial EMG) evaluates the physiological properties of facial muscles, examines voluntary and involuntary facial muscle movements that reflect conscious and unconscious expressions of facial actions and emotions recorded in a bi-polar manner (on both sides of the face) (**Figure 7**) [89, 90].

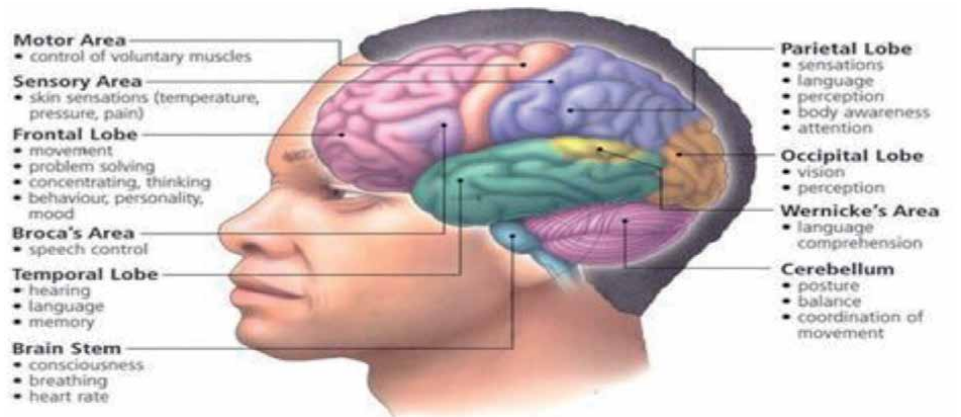

Figure 7.
Neuromarketing - The Functional Areas of Buying Button. Source: Ref. [78].

1.6 Neuromarketing: the dawn and disruption of marketing research

The 21st Century is termed as the 'Century of the Brain' and the Human Brain has 100 billion neurons, and each neuron is interconnected to 10000 other Neurons. The integration of 'Marketing' with 'Neuro Sciences' is undoubtedly a promising and progressive direction in the arena of 'Marketing Research'. Despite of flaws in Neuromarketing, it is evinced that the application of Neuromarketing Tools and Techniques to 'Product Marketing' has recently gained popularity because of Neuro Imaging will become cheaper, faster and it providesreal and reliable information and insights to the Market Researchers at right time, at right place that is not obtainable through conventional marketing methods.

The tools and techniques adopted to persuade the buyers are reliable and valid. However, each of these have specific strengths and weaknesses and also expensive. Keeping in view the ethical, sociological and technological implications, it is suggested that devise and develop new mechanics which are more appropriate to understand the thoughts, emotions, feelings, needs of consumers and prosumers in relate to the marketing of products and offering of services [91].

Neuromarketing provides indelible insights about the decision-making choices of buyers, consumers and prosumers [92], besides assessing their buying behavior, buying pattern, unconscious thoughts, emotions, feelings and desires about purchase decision [93]. The corporate giants *viz.,* Intel, PayPal, Pepsi, Coke, Google, HP, IBM, GITI, Micro Soft *per se* mining and hacking the brains and spending millions to plumb the brains of the buyers (**Figure 8**). Therefore, future research in this arena will focus precisely on understanding the cause-effect relation between the activities of a brain area in general and the (re) actions of the Buyers or Consumers in specific.

Neuromarketing is an ontology of Neuroscience with the dynamics of agility, accuracy and transparency. Mere, 'Humanoids' cannot transform the latent and latest talents and skills. Be ensure the 'Human in the Loop' (augmenting marketing skills by systems to deliver actionable and operational rich insights), ensue Marketing-as-a-Service (MaaS), infuse Emotional Intelligence and instil 'Human Touch'. Be a Market Intelligent and the be an Altruist and above all Be a Humane. The Promises transcend into realities will require a unique 'Customer Experience

Figure 8.
Source: Ref. [93].

Management' that spans channels i.e., the then-versus-now story. Undoubtedly, 'Neuromarketing' emerges as a hope, a utopia, a scintillating scientific and spontaneous drive and urge. This is reality and realism.

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Author details

Kovvali Bhanu Prakash[1*] and Appidi Adi Sesha Reddy[2]

1 MN Infra Pvt., Ltd., Tadepalligudem, Andhra Pradesh, India

2 School of Management Studies, Lakireddy Bali Reddy College of Engineering (LBRCE), Mylavaram, Andhra Pradesh, India

*Address all correspondence to: bhanucool@yahoo.com

References

[1] Ashwini. C.R. A Conceptual Study on Neuromarketing and Other Recent Trends.International Journal of Applied Management & Business Policy. 2015; p.p. 36-37.

[2] Tyler K. Perrachione and John R. Perrachione. Brains and Brands: Developing Mutually Informative Research in Neuroscience and Marketing. Journal of Consumer Behaviour. 2008; 7: p.p. 303-318.

[3] Lee, N. Broderick, A.J, & Chamberlain, I. What is Neuro-marketing? A Discussion and Agenda for Future Research. International Journal of Psychophysiology. 2007; 63: p.p. 199-204.

[4] Karmakar, U. Note on Neuro-marketing. Harvard Business School Marketing Unit Case. 2011; p.p. 512-031.

[5] Christophe Morin: Neuromarketing. The New Science of Consumer Behaviour. Springer Science. 2011; 48: p.p. 131-135.

[6] Garcia J.R & and G. Saad. Evolutionary Neuromarketing: Darwinizing the Neuroimaging paradigm for Consumer Behaviour. Journal of Consumer Behaviour. 2008; 7, 4-5, p.p. 397-414.

[7] Genco, Stephen, Andrew Pohlmann, and Peter Steidl. Neuromarketing for Dummies. New York; John Wiley: 2013.

[8] Larson, Erik. The Naked Consumer. How Our Private Lives Become Public Commodities? London, UK; Penguin: 1994.

[9] Krugman, H. E. Brain Wave Measures of Media Involvement. Journal of Advertising Research. 1971; 11: p.p. 3-9.

[10] Weinstein, S. Brain Wave Analysis - The Beginning and Future of Package Design Research. In: W. Stern (ed..,). Handbook of Package Design Research. New York; Wiley Inter Science: 1981; p.p. 492-504.

[11] Weinstein, S. Drozdenko, R.& Weinstein, C. Brain Wave Analysis in Advertising Research. Psychology & Marketing. 1984; 1: p.p. 83-96.

[12] Keefe LM. Marketing Redefined. Marketing News. 2008; 42: p.p.22-26.

[13] Smith, Pamela K. and McCulloch, Kathleen. Subliminal Perception. In: Encyclopaedia of Human Behavior. Elsevier; 2012: p.p. 551-557.

[14] Blakeslee, Sandra. If Your Brain Has a 'Buy Button,' What Pushes It? The New York Times:2018; Oct, 19. www.nytimes.com/2004/10/19/science/if-your-brain-has-a-buybutton-what-pushes-it.html

[15] Littlefield, Melissa M. The Lying Brain: Lie Detection in Science and Science Fiction. Ann Arbor; University of Michigan Press: 2011.

[16] Balmer, Andrew S. Telling Tales: Some Episodes from the Multiple Lives of the Polygraph Machine. In: Knowledge, Technology and Law Edited By Emilie Cloatre and Martyn Pickersgill.London, UK: Routledge: 2015; p.p.104-118.

[17] Lee, N., Broderick, A. J., & Chamberlain, L. What is Neuro-marketing? A Discussion and Agenda for Future Research. International Journal of Psychophysiology. 2007; 63:199-204.

[18] Jason Flores, Arne Baruca and Robert Saldivar. Is Neuromarketing Ethical? Consumers Say Yes. Consumers Say No. Journal of Legal, Ethical and Regulatory. 2014; 17: 2: 77-91.

[19] Rose, Nikolas, and Joelle M. Abi-Rached. Neuro: The New Brain Sciences

and the Management of the Mind. 2013; New Jersey: Princeton University Press.

[20] JonnaBrenninkmeijer, Tanja Schneider, and Steve Woolgar. Witness and Silence in Neuromarketing: Managing the Gap between Science and Its Application. Science, Technology & Human Values. 2019; Feb: 45: 2: p.p. 1-26.

[21] Plassmann, Hilke, Thomas Z. Ramsøy, and MilicaMilosavljevic. Branding the Brain: A Critical Review and Outlook. Journal of Consumer Psychology. 2014; 22: 1: p.p.18-36.

[22] Cacioppo J. T. Foundations in Social Neuroscience. 2002; New York: MIT Press.

[23] Ariely, D., & Berns, G. S. Neuromarketing: The Hope and Hype of Neuroimaging In: Business. Nature Reviews. 2010; 11: p.p. 284-292.

[24] Yoon, C., Gonzalez, R., Bechara, A., Berns, G. S., Dagher, A., Dube, L., Spence, C. Decision Neuroscience and Consumer Decision-making. Marketing Letters. 2012; 23: p.p.473-485.

[25] Plassmann H., Karmarkar U. R. Consumer Neuroscience: Revealing Meaningful Relationships between Brain and Consumer Behavior. In: Cambridge Handbook of Consumer Psychology, eds Lamberton C., Norton M., Rucker D. 2016; Cambridge University Press:p.p.152-179.

[26] Zak P.J. Neuroeconomics, Philosophical Transactions of the Royal Society. 2004; 359: p.p. 1737-1748.

[27] Kenning P., Plassmann H. Neuro-economics: An Overview from an Economic Perspective. Brain Research Bulletin. 2005; 67: p.p. 343-354.

[28] Rustitchini A. Neuroeconomics: Present and Future. Games Economic Behavior. 2005; 52: p.p. 201-212.

[29] Droulers O, Roullet B. Neuro-marketing: Cadre Theoriqueet perspectives. XXII Congress of the French Marketing Association. 2006; 11-12 May: Nantes: France.

[30] Christophe Morin. Neuromarketing - The New Science of Consumer Behaviour. Springer Science.2011; 48: p.p. 131-135.

[31] Campbell, M. & Keller.K.L. Brand Familiarity and Ad Repetition Effects. Journal of Consumer Research. 2003; 30: p.p. 292-304.

[32] Fugate D.L. Neuromarketing: A Layman's look at Neuroscience and its potential application to Marketing Practice. Journal of Consumer Marketing. 2007; 24: 7: p.p. 385-394.

[33] Morgan D, Grant KA, Gage HD, Mach RH, Kaplan JR, Prioleau O, Nader SH, Buchheimer N, Ehrenkaufer RL, Nader MA. Social Dominance in Monkeys: Dopamine D2 Receptors and Cocaïne Self-Administration. Nature Neuro-science.2002; 5: p.p. 169-174.

[34] Walter, H., Abler, B., Cliaramidaro, A., & Erk, S. Motivating forces of Human Actions:Neuroimaging Reward and Social Interaction. Brain Research & Bulletin. 2005; 67: p.p. 368-381.

[35] Damasio, A. R. The Somatic Marker Hypothesis and the Possible Functions of the Pre-Frontal Cortex. Philosophical Transactions of the Royal Society of London - Series B. Biological Sciences. 1996; 351, p.p. 1413-1420.

[36] Knutson, B., Rick, S., Wimmer, G. E., Prelec, D., & Loewenstein, G. Neural Predictors of Purchases. Neuron. 2007; 53: p.p.147-157.

[37] Selye Hans, McKeown Thomas. Studies on the Physiology of the Maternal Placenta in the Rat.

Proceedings of the Royal Society of London.1936; 119: p.p.1-31.

[38] MacLean, Paul D. 1998. In: Squire, Larry R. (ed.). The History of Neuroscience in Autobiographty. Bethesda, Md. Society for Neuroscience. 1996; p.p. 242-275.

[39] Peter Farley. A Theory Abandoned but still Compelling. Yale Medicine. 2008;p.p.1-3.

[40] Calvert, G.A. & Thensen, T. Multi-sensory Integration: Methodological Approaches and Emerging Principles in the Human Brain. Journal of Psychology. 2004; 98: p.p. 191-205.

[41] Lee, N. J., Senior, C., Butler, M. J., & Fuchs, R. The Feasibility of Neuroimaging Methods in Marketing Research. Nature Proceedings. 2009.

[42] Ariely, D. & Berns, G. Neuromarketing: The Hope and Hype of Neuroimaging in Business. Nature Reviews Neuroscience. 2010; 11: 4: p.p. 284-292.

[43] Du Plessis, E. The Branded Mind: What Neuroscience really tells us about the Puzzle of the Brain and Brand. 2011; UK. Kogan Page.

[44] Vlăsceanu Sebastian. Neuromarketing and Evaluation of Cognitive and Emotional Responses of Consumers to Marketing Stimuli. Social and Behavioral Sciences. 2014;127:p.p. 753-757.

[45] Neuromarketing: Using Your Customers' Biases to Your Advantage. Medium. 2018;19th Feb. https://medium.com/@avenewmedia/neuromarketing

[46] Schacter, Daniel L. Psychology. 2012; Sec. 3.20.

[47] Morgane, P J. A Review of Systems and Networks of the Limbic Forebrain/Limbic Midbrain. Progress in Neurobiology. 2005; 75,:2: Feb: p.p. 143-160.

[48] Eben Harrell. Neuromarketing: What You Need to Know. HBR. 2019; 23rd Jan.

[49] Charron, S. Fuchs, A.& Oullier, O. Exploring Brain Activity in Neuroeconomics, Revue d'EconomiePolitique. 2008; Jan-Feb: p.p.97-124.

[50] Morin, C. Neuromarketing: The New Science of Consumer Behaviour. Society. 2011; 48:2:p.p.131-135.

[51] Kumar, S. Neuromarketing: The New Science of Advertising. Universal Journal of Management. 2015; 3: 12: p.p. 524-531.

[52] Md.Hafez. Neuromarketing: A New Avatar in Branding and Advertisement. Pacific Business Review International. 2019; Oct: 12: 4: p.p. 58-64.

[53] Baratta, M. V., Lucero, T. R., Amat, J., Watkins, L. R., & Maier, S. F. Role of the Ventral Medial Prefrontal Cortex in Mediating Behavioral Control-Induced Reduction of Later Conditioned Fear. Learning & Memory. 2008; 15:2: p.p. 84-87.

[54] Uher, R., Murphy, T., Brammer, M. J., Dalgleish, T., Phillips, M. L., Ng, V. W. Medial Prefrontal Cortex Activity associated with Symptom Provocation in Eating Disorders. American Journal of Psychiatry. 2004; 161:7: p.p. 1238-1246.

[55] Day-Wilson, K. M., Jones, D. N. C., Southam, E., Cilia, J. & Totterdell, S. Medial Prefrontal Cortex Volume Loss in Rats with Isolation Rearing induced Deficits in pre-pulse inhibition of Acoustic Startle. Neuroscience. 2006; 141: 3: p.p.1113-1121.

[56] Phillips AG, Brooke SM, Fibiger HC. Effects of Amphetamine Isomers and Neuroleptics on Self-Stimulation from

the Nucleus Accumbens and Dorsal Noradrenergic Bundle. Brain Research. 1975; 85: p.p.13-22.

[57] Schultz W, Apicella P, Scarnati E, Ljungberg T. Neural Activity in Monkey Ventral Striatum related to Expectation of Reward. Journal of Neuro Science.1992; 12: p.p. 4595-4610.

[58] Erk S, Spitzer M, Wunderlich AP, Galley L, Walter H. Cultural Objects Modulate Reward Circuitry. Neuro Report. 2002; 13: p.p. 2499-2503.

[59] Schultz W. Neural Coding of Basic Reward Terms of Animal Learning Theory, Game Theory, Micro-Economics and Behavioural Ecology, Current Opinion. Neurobiology. 2004; 14: p.p. 139-147.

[60] Small DM, Zatorre RJ, Dagher A, Evans AC, Jones-Gotman M. Changes in Brain Activity related to Eating Chocolate: From Pleasure to Aversion. Brain. 2001;124: p.p. 1720-1733.

[61] Morgan D, Grant KA, Gage HD, Mach RH, Kaplan JR, Prioleau O, Nader SH, Buchheimer N, Ehrenkaufer RL, Nader MA. Social Dominance in Monkeys: Dopamine D2 Receptors and Cocaine Self-Administration. Nature Neuroscience. 2002; 5: p.p. 169-174.

[62] Karama S, Lecours AR, Leroux JM, Bourgouin P, Beaudoin G, Joubert S, Beauregard M. Areas of Brain Activation in Males and Females during Viewing of Erotic Film Excerpts. Human Brain Map.2002; 16:1: p.p. 1-13.

[63] Peterson RL. The Neuroscience of Investing: fMRI of the Reward system. Brain Research Bulletin. 2005; 67: p.p. 391-397.

[64] McClure SM, Li J, Tomlin D, Cypert KS, Montague LM, Montague PR. Neural Correlates of Behavioral Preference for Culturally Familiar Drinks. Neuron. 2004; 44: p.p. 379-387.

[65] Shiv B, Carmon Z, Ariely D. Placebo Effects of Marketing Actions: Consumers may get What they pay for. Journal of Marketing Research. 2005; 42: p.p. 383-393.

[66] Laybourne, P. & Lewis.D. Neuro-marketing: The Future of Consumer Research. Admap.2005; 461: p.p. 28-30.

[67] Bhanu Prakash. K. Neuro Marketing - The Hope or Utopia. Bangalore: Archers & Elevators Publishing House: 2015; May: p.p. 80-87. ISBN: 9789385640377

[68] Smidts. A. Brain Imaging: Opportunities for Neuro Marketing. Inaugural Address Erasmus University. 2002.

[69] Randall. Neuro Marketing a Hope or Hype. Five Brands Research. Fast Company. 2009.

[70] Zurawicki, L. Neuro Marketing, Exploring the Brain of the Consumer. Springer- Verlag. 2010; p.p.42-53.

[71] Morin, C. Neuro Marketing: The New Science of Consumer Behavior Symposium. Consumer Culture in Global Perspective. 2011; 48: p.p. 131-135.

[72] Kenning,P., Plassmann,H.,& Ahlert, D. Applications of functional Magnetic Resonance Imaging for Market Research. Qualitative Market Research. 2007; 2: p.p.135-152.

[73] Mohamed M.Mostafa. Brain Processing of Vocal Sounds in Advertising: A Functional Magnetic Resonance Imaging (fMRI) Study. Expert Systems with Applications. 2012; Nov: 39: 15: p.p. 12114-12122.

[74] Colin Camerer, Carolyn Yoon. Introduction to the Journal of Marketing

Research. Special Issue on Neuroscience and Marketing. 2019; 01st Mar. https://doi.org/10.1509/0022-2437-52.4.423

[75] H Berger. About the Human Electro Cephalo Gram (ECG). Psychiatry and Nervous Diseases. 1929; p.p. 527-570.

[76] Gil, Yeongjoon and Seo, Ssanghee& Lee, Jungtae. EEG Analysis of Frontal Lobe Activities by Decision Stimuli. International Conference on Bio-Science and Bio- Technology. 2008; 3: p.p.30-34.

[77] Khushaba RN, Greenacre L, Kodagoda S, Louviere J, Burke S, Dissanayake G. Choice Modeling and the Brain: A Study on the Electro Encephalo Gram (EEG) of Preferences. Expert System Applications. 2012; 39:16: p.p. 12378-12388.

[78] Guo G, Elgendi M. A New Recommender System For 3-D E-Commerce: An EEG Based Approach. Journal of Advanced Management Science. 2013; 1: p.p. 61-65.

[79] Charles Spence. Neuroscience Inspired Design: From Academic Neuromarketing to Commercially Relevant Research. Organisational Research Methods. 2019; 22: 1: p.p. 275-298.

[80] Liwei Hsu, Yen-Jung Chen. Neuro-marketing, Subliminal Advertising, and Hotel Selection: An EEG Study. Australasian Marketing Journal. 2020; 28:4: p.p.200-208.

[81] Ohme, R., Matukin, M., Pacula-Lesniak, B. Biometric Measures for Interactive Advertising Research. Journal of Interactive Advertising. 2011; 11:2: p.p. 60-72.

[82] Perrachione.T.K and J.R. Perrachione. Brains and Brands: Developing Mutually Informative Research in Neuro Science and Marketing. Journal of Consumer Behaviour. 2008; 7: 4/5: p.p. 303-318.

[83] Fernando Lopes da Silva. EEG and MEG: Relevance to Neuroscience. Neuron Primer. 2013; 80:5: p.p.1112-1128.

[84] Ferdousi SaberaRawnaque, Khandoker Mahmudur Rahman, Syed Ferhat Anwar, Ravi Vaidyanathan, Tom Chau, FarhanaSarker&Khondaker Abdullah Al Mamun. Technological Advancements and Opportunities in Neuromarketing: A Systematic Review. Brain Informatics. 2020; 7:10: p.p.1-9.

[85] N. Lee, A. J. Broderick, and L. Chamberlain. What is Neuromarketing? A Discussion and Agenda for Future Research. International Journal of Psychophysiology. 2020; 63:2:p.p.199-204.

[86] Richard B. Silberstein. Brain Activity correlates of Consumer Brand Choice Shift associated with Television Advertising. Journal of Advertising & The Brain Special Issue.1990; 27:3: p.p. 359-380.

[87] O'Connel, B., Walden, S., Pohlmann, A. Marketing and Neuroscience. What Drives Customer Decisions? American Marketing Association. White Paper. 2011.

[88] LaBarbera, P.A. &Tucciarone J.D. GSR Reconsidered: A Behavior-Based Approach to Evaluating and Improving the Sales Potency of Advertising. Journal of Advertising Research. 1995; 35: p.p.33-53.

[89] Dimberg, U. Thunberg, M. Elmehed, K. Unconscious Facial Reactions To Emotional Facial Expressions. Psychological Science. 2000; Vol.11, No.1, p.p.86-89.

[90] Dawson ME, Schell AM, ilion DL. The Electrodermal System, Handbook of Psychophysiology. Edited By Cacioppo JT, Tassinary LG, Bernston GG. 2000; Cambridge University Press: Boston: p.p. 200-223.

[91] Renvoise'P. and Morin C. Neuro Marketing: Understanding the Buy Button in Your Customer's Brain. 2007; T. Nelson: Nashville, TN.

[92] Dr. K. Bhanu Prakash and Dr. J. Chandra Prasad. Marketing Intelligence - The Moment of Truth To Moment of Promise. 2019; 14: 1&2: p.p. 40-43.

[93] Lindstrom.M. The Ethics of Neuro Marketing. Martin Lindstrom Fan of the Consumer. 2009; Apr. www.martinlindstorm.com

Chapter 9

Emotional Responding and Adversity

Tom Buqo

Abstract

The experience of emotions is a ubiquitous human experience, as is the experience of adversity. In the aftermath of an adverse life event, a variety of emotional experiences can occur. This chapter reviews the relationship between emotional responding and adversity within the science of emotion and resilience. Current literature on possible emotional responses to adversity are reviewed, including literature on both resilience and psychopathology. Multiple trajectories following the experience of various types of potentially traumatic events are outlined, including predictors for each of these trajectories. In addition, forms of psychopathology in emotional responding after adversity are discussed, including posttraumatic stress disorder, prolonged grief disorder, adjustment disorders, and other mental health conditions. Information regarding risk and resilience factors for each disorder are discussed, and evidence regarding treatment is briefly summarized.

Keywords: emotion, adversity, grief, trauma, adjustment

1. Introduction

The experience of emotions is ubiquitous to human beings across multiple cultures [1]. While the nature of emotions as biologically determined basic kinds or an epiphonema of language has a lengthy history of debate [2], the fact that emotions allow for human beings to respond to their external environments is not up to debate. One particular area of note is in the human response to adversity, defined as the experience of acute and highly aversive events, especially potentially traumatic events (PTEs) or losses [3]. Many individuals will experience some degree of loss or potentially traumatic, and the vast majority will not go on to develop psychopathology [4]. This chapter will review several of the trajectories of emotional responding to adversity, types of emotional pathology that can emerge in response to adversity, and what is currently known about risk and resilience factors.

2. Trajectories following adversity

Bonanno and Diminich [3] identified four trajectories observed in the data in response to adversity: resilience, recovery, delayed reaction, and chronic distress. In addition, two additional trajectories were mentioned: continuous pre-existing distress and distress followed by improvement. Within each of these trajectories, it is important to note that trajectories such as a resilience and recovery do not mean the global absence of negative emotional experiences. Rather, these trajectories

describe the change in functioning related to emotional experience and the presence or absence of psychiatric symptoms related to emotional responding. Human beings in and out of adversity experience negative emotional experiences with or without the necessary presence of psychopathology. Rather, psychopathological and emotional pathology is a function of the predominance of these negative affective states, associated symptoms, and impact on functioning over time.

Resilience is the most common form of response to adversity [3, 4], though previous clinical wisdom often assumed otherwise due to clinicians primarily interacting with people experiencing various forms of psychological distress. In resilience, when experiencing a potentially traumatic event (PTE) or aversive life circumstance, and individual remains at pre-event functioning and psychological health. While there may be the presence of a certain degree of negative emotion and psychological distress, this distress does not become functionally impairing, resolves naturally, and does not lead to a decrease in functioning when compared with baseline [5]. Bonanno and Diminich [3] also refer to this as *minimal impact resilience*, noting that, while total non-response is uncommon, the emotional stress response in this trajectory is brief and does not lead to functional impairment.

Resilience can be contrasted with a second trajectory following adversity: recovery. Recovery refers to a brief (several months to several years) decrease in functioning following a PTE or adverse event, followed by a return to pre-event functioning [3]. In contrast with resilience, recovery represents at least some degree of immediate impaired functioning whereas resilience represents minimal impact of the PTE or other adverse event. While these trajectories are clearly distinct with single incident PTEs, in those who experience chronic adverse events (e.g., on-going warfare) resilience is less clear and recovery (sometimes called *emergent resilience*) appears to be the most common pathway. Bonanno and Diminich [3] note that this pattern is best referred to as recovery when discussing single incident adverse events, and emergent resilience when following chronic adverse conditions and events.

A third, and somewhat more controversial trajectory, is called delayed reaction or delayed symptom elevations [3]. This pattern is defined as no or low level of symptoms following a PTE or other adverse event, followed by a later appearance of symptoms. While previous clinical wisdom attributed such presentations to theoretical "denial" of trauma and grief, consistent with previous understanding that resilience was rare. Modern understanding of this phenomena recognizes it as rare [6]. Furthermore, these delayed symptom elevations have not been observed in grief after loss [7, 8] and appear to not to occur. With regard to posttraumatic stress (PTS) symptoms after the experience of a PTE, the data suggest that while such reactions may occur, rather than following a period of no distress, such reactions represent initial moderate or subthreshold symptoms that worsen over time [9–11]. Taken together, the evidence does not support the idea that denial of trauma or grief experiences causes delayed expression, but rather that this represents a worsening of an initial psychopathology process over time. Among the trajectories of responses, resilience continues to represent the more common response with delayed symptom elevation being relatively rare.

The fourth of the traditionally common observed trajectories following adversity is chronic dysfunction or distress. This trajectory is represented by a sustained decreased in functioning and increase in psychopathology symptoms following exposure to a PTE or other adverse event. Of note, in defining this trajectory, Bonanno and Diminich [3] identify that this trajectory includes no pre-existing symptoms prior to the experience of a PTE or other adverse event. For these individuals, after a period of relatively healthy functioning, the experience of a PTE

or other adverse event leads to long term psychological dysfunction, captured in the psychopathology discussed later in this chapter. Of note, this course represents approximately 5–30% of individuals rather than the majority of individuals who experience adversity [3].

While the vast majority of the literature notes that the majority of responses fall into these categories, two additional trajectories have been observed. In continuous pre-existing distress, individuals experiencing high degrees of psychological distress and functional impairment before a PTE or other adverse event continue to experience impairment after such an event [6]. However, in the absence of pre-existing data, distinguishing this category from chronic dysfunction is not possible from a methodological standpoint. A final pattern observed is called the distress-improvement pattern, representing individuals with pre-event psychological distress that improves following an adverse event. This pattern has been observed in grief after loss [12] and combat deployment [13]. Such a response may represent a reduction in stressor related to caretaking in bereavement or removal of anticipatory anxiety to deployment, rather than a stress growth response.

In summary, the current literature on adversity suggests that resilience is the most common psychological response to adversity. While a large degree of clinical focus and attention has been devoted to chronic distress and dysfunction, these represent a smaller subset of emotional response to adversity. However, the emotional pathology that can follow PTEs and other adverse events represent a diverse array of emotional presentations. Comprising both trauma and stressor-related disorders as well as other forms of psychopathology, the various etiologies of these conditions must be considered for a complete picture of emotional responding in adversity.

3. Types of emotional pathology following adversity

3.1 Adjustment disorders

Adjustment disorders represent responses to stress that exceeded what is anticipated for an individual in response to a stressor but represent a particular stress reaction rather than constituting a more persistent mental health condition [14]. Adjustment disorders are characterized by emotional and behavioral symptoms that begin within three months of the onset of a stressor and remit within six months after the stressor or the consequences of the stressor have ended [15]. Adjustment disorders can present with a variety of emotional symptoms, notable depressed mood, anxiety, mixed anxiety and depressed mood, or mixed disturbance of emotions and conduct [15]. These disorders will often resemble a major depressive episode or an anxiety disorder, but their duration is relatively briefer, full criteria for these other disorders is not met, there is a clear adverse event or stressor associated with the event, and they often remit naturally over time [15].

Adjustment disorders are also separated from normative stress reactions by their intensity of symptoms and their functional impairment. As the American Psychiatric Association [15] notes: "When bad things happen, most people get upset. This is not an adjustment disorder" (p. 289). Similar to the pattern of recovery identified in the trajectories after adversity above, adjustment disorders represent a degree of distress and functional impairment exceed what would normally be expected within the individual's sociocultural context. Treatment of these disorders through psychotherapy most often involves assisting the individual in managing and minimizing the impact of the stressor [14]. These factors can help an individual return to pre-stressor emotional functioning.

3.2 Acute stress disorder/posttraumatic stress disorder

Acute stress disorder and posttraumatic stress disorder (PTSD) represent a particular response to PTEs over the course of time. These forms of adversity-related psychopathology arise in response to exposure of events of actual or threatened death, serious injury, or sexual violence through either direct experience, direct witnessing, or vicarious exposure [15]. These disorders are characterized by the following symptom clusters: intrusion symptoms (e.g., flashbacks, strong emotional reactions), alterations in cognition and mood (e.g., emotional numbing), avoidance symptoms, and arousal symptoms (e.g., hypervigilance) [15]. Of particular note, difficulties in emotion regulation are observed in a number of individuals who meet criteria for PTSD, particularly when exposed to chronic, early life traumas [16], though this may relate to PTSD symptoms severity rather than trauma type [17]. The distinction between acute stress disorder and posttraumatic stress disorder is a matter of time, with acute stress disorder being diagnosed in the timeframe three days to one month posttraumatic event, and PTSD being diagnosed when at least one month has passed [15].

While exposure to PTEs is relatively common, PTSD is relatively rare, and most individuals who experience a PTE do not go on to develop PTSD [18]. The current etiology of PTSD is not fully understood, but a combination of genetic, environmental factors (e.g., trauma type), psychological variables (e.g., appraisals), and coping strategies (e.g., avoidance) seem to influence the likelihood the exposure to a PTE will lead to PTSD. With regard to treatment, while numerous therapies exist for the treatment of PTSD, the most frequently recommended treatments by organizations providing guidance include prolonged exposure (PE) therapy, cognitive processing therapy (CPT), and cognitive-behavioral therapy for PTSD [19].

3.3 Prolonged grief disorder

Bereavement presents a particular subtype of adverse event, and multiple names have been proposed to described protracted grief responses that involve clinically significant distress and functional impairment, including prolonged grief disorder [20], complicated grief [21], and persistent complex bereavement disorder [15]. For the purpose of this chapter, the most common prolonged grief disorder will be utilized, particularly given its upcoming inclusion in the ICD-11 [22]. Prolonged grief disorder is characterized by continued separation distress and emotional pain following the death of a loved one along with preoccupation with the deceased exceeding a minimum of six months after the loss and characterized by functional impairment [22].

Prolonged grief disorder is a relatively new proposed form of psychopathology, with a specific associated symptom profile and response to treatment. In contrast to major depressive disorder, the painful emotions associated with prolonged grief disorder are loss-focused, associated with intense emotional pain and longing with regard to the deceased [20]. For those with prolonged grief disorder, grief-specific interventions have greater efficacy compared with more general interventions [23]. While an understanding of the full etiology of prolonged grief disorder is still the subject research, attachment [24], identity continuity [25], and integrative [26] models for prolonged grief disorder have been proposed.

3.4 Other psychopathology

While the aforementioned forms of emotional pathology have a direct diagnostic connection to forms of adversity, other psychiatric diagnoses and mental

illness include the experience of adversity as a predisposing factor to the onset of most mental health conditions [27]. In fact, diathesis-stress models of depression [28], generalized anxiety disorder [29], panic [29], and other anxiety disorders [30] generally identify adversity, intense stressors, and exposure to PTEs as common in the etiology of multiple forms of mental health problems. Of note, while the rate of psychopathology is increasing and may bring new more functional perspectives on diagnosis [31], resilience does remain the most common response to adversity. While the research is undoubtedly incomplete, a number of studies have examined factors that are likely to increase the likelihood of resilience rather than pathology.

4. Factors related to resilience vs. pathology

Bonanno and Diminich [3] identified a number of factors that related to increase likelihood of resilience in response to adversity and PTEs. Certain demographic variables frequently correlate with a lower degree of pathology following adverse events, such as increasing age and male gender. These factors are often explained that greater life experience allows older adults to adjust better to adversity [32], and women are more likely to experience a greater number of PTEs than men though some studies have not supported this later explanation [33].

In addition, certain personality factors reliably emerge in providing an increased likelihood of resilience. Bonanno and Diminich [3] identify: higher perceived control, trait resilience, low negative affectivity, a ruminative response style, and trait self-enhancement as particular personality variables that are likely to increase resilience. Low negative affectivity and trait self-enhance are particularly identified by multiple studies (e.g., [9, 34]). Further, other studies have identified emotional intelligence [35], self-esteem [36], extraversion, and conscientiousness [37] as personality factors promoting resilience. In addition, a higher degree of positive emotions has been associated with better adjustment following adversity [38].

In addition to these internal factors, certain environmental factors have also been identified as increasing likelihood of resilience. While the presence of social and economic resources has been identified as particularly helpful in recovery from disaster [39], evidence regarding the role of these resources in recovery from bereavement has been somewhat mixed [3]. In addition, greater degrees of past and present stress and higher frequency of exposure to PTEs has been associated with lower likelihood of resilience following an adverse event. In addition to these factors, the interaction between the individual and their environment plays an important role to the response to adversity.

Individual responses to the environment and resultant emotions can broadly be referred to as coping. Certain forms of coping, particularly avoidance, have long been associated with worse outcomes [40, 41], some nuance has begun to emerge in the literature. For example, in prolonged grief disorder, both approach and avoidance mechanisms have been identified in the development of prolonged grief after loss [42, 43]. Of emerging importance is the role of flexibility in coping strategies [44], emotion expression [45], and psychological flexibility more generally [46] in the human response to adversity, with all of these factors likely to lead to increased resilience in the face of adversity.

5. Conclusion

Adversity, as an environmental event, has a pronounced impact on emotional experiences. While the majority of individuals will return to emotional functioning

before any adverse event, including a PTE or loss, some individuals continue to have difficulties that constitute emotional pathology in the aftermath of adversity, including adjustment disorders, traumatic stress disorders, prolonged grief disorder, and other forms of pathology. Numerous factors modify the likelihood that any given individual under any given set of circumstances will go on to develop chronic dysfunction in response to an adverse event.

With regard to these factors, certain demographic, personality, environmental, and other factors may predict a higher likelihood of resilience including emotional intelligence and psychological flexibility, including both coping and expressive flexibility. In the event that resilience is not achieved, treatments for emotional problems in the aftermath of adversity exist with various degrees of evidence support at this time. While there is no need to provide treatment for the experience of adversity itself (and to do so without emotional pathology may be iatrogenic), treatments exist for the treatment of adversity-related emotional pathology and the accompanying functional impairment.

The experience of adversity, like the experience of emotions, is ubiquitous to the human experience. These two components of the human experience are closely intertwined and understanding their relationship will help continue the understanding of human emotional responding during both situations of stress and in the aftermath of stressful experiences. While this area of research is relatively recent, data continue to accumulate that broaden the understanding of emotional responding and adversity.

Author details

Tom Buqo
Hofstra University, Hempstead, NY, United States

*Address all correspondence to: tbuqo1@pride.hofstra.edu

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References

[1] Ekman, P. (1999). Basic emotions. Handbook of cognition and emotion, *98*(45-60), 16.

[2] Nelson, N. L., & Russell, J. A. (2013). Universality revisited. Emotion Review, *5*(1), 8-15.

[3] Bonanno, G. A., & Diminich, E. D. (2013). Annual Research Review: Positive adjustment to adversity–trajectories of minimal–impact resilience and emergent resilience. Journal of Child Psychology and Psychiatry, *54*(4), 378-401.

[4] Bonanno, G. A. (2004). Loss, trauma, and human resilience: Have we underestimated the human capacity to thrive after extremely aversive events?. American Psychologist, *59*(1), 20.

[5] Bonanno, G. A., Wortman, C. B., & Nesse, R. M. (2004). Prospective patterns of resilience and maladjustment during widowhood. Psychology and Aging, *19*(2), 260.

[6] Bonanno, G. A., Wortman, C. B., Lehman, D. R., Tweed, R. G., Haring, M., Sonnega, J., Carr, D., & Nesse, R. M. (2002). Resilience to loss and chronic grief: a prospective study from preloss to 18-months postloss. Journal of Personality and Social Psychology, *83*(5), 1150.

[7] Bonanno, G. A., & Field, N. P. (2001). Examining the delayed grief hypothesis across 5 years of bereavement. American Behavioral Scientist, *44*(5), 798-816.

[8] Middleton, W., Burnett, P., Raphael, B., & Martinek, N. (1996). The bereavement response: A cluster analysis. British Journal of Psychiatry, *169*(2), 167-171.

[9] Bonanno, G. A., Rennicke, C., & Dekel, S. (2005). Self-enhancement among high-exposure survivors of the September 11th terrorist attack: Resilience or social maladjustment?. Journal of Personality and Social Psychology, *88*(6), 984.

[10] Buckley, T. C., Blanchard, E. B., & Hickling, E. J. (1996). A prospective examination of delayed onset PTSD secondary to motor vehicle accidents. Journal of Abnormal Psychology, *105*(4), 617.

[11] deRoon-Cassini, T. A., Mancini, A. D., Rusch, M. D., & Bonanno, G. A. (2010). Psychopathology and resilience following traumatic injury: a latent growth mixture model analysis. Rehabilitation Psychology, *55*(1), 1.

[12] Bonanno, G. A., Moskowitz, J. T., Papa, A., & Folkman, S. (2005). Resilience to loss in bereaved spouses, bereaved parents, and bereaved gay men. Journal of personality and social psychology, *88*(5), 827.

[13] Bonanno, G. A., Mancini, A. D., Horton, J. L., Powell, T. M., LeardMann, C. A., Boyko, E. J., Wells, T. S., Hooper, T. I., Gackstetter, G. D., Smith, T. C., & Millennium Cohort Study Team. (2012). Trajectories of trauma symptoms and resilience in deployed US military service members: Prospective cohort study. The British Journal of Psychiatry, *200*(4), 317-323.

[14] Strain, J. J. (2015). Adjustment disorders. *Trauma-and Stressor-Related Disorders: A Handbook for Clinicians*, 59-79.

[15] American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. American Psychiatric Pub.

[16] Lanius, R., Frewen, P., Vermetten, E., & Yehuda, R. (2010). Fear conditioning and early life

vulnerabilities: two distinct pathways of emotional dysregulation and brain dysfunction in PTSD. European Journal of Psychotraumatology, *1*(1), 5467.

[17] Ehring, T., & Quack, D. (2010). Emotion regulation difficulties in trauma survivors: The role of trauma type and PTSD symptom severity. Behavior therapy, *41*(4), 587-598.

[18] McNally, R. J. (2003). Psychological mechanisms in acute response to trauma. Biological psychiatry, *53*(9), 779-788.

[19] Watkins, L. E., Sprang, K. R., & Rothbaum, B. O. (2018). Treating PTSD: A review of evidence-based psychotherapy interventions. Frontiers in Behavioral Neuroscience, *12*, 258.

[20] Prigerson, H. G., Horowitz, M. J., Jacobs, S. C., Parkes, C. M., Aslan, M., Goodkin, K., Raphael, B., Marwit, S. J., Wortman, C., Neimeyer, R. A., Bonanno, G. A., Block, S.D., Kissane, D., Boelen, P., Maercker, A., Litz., B. A., Johnson, J. G., First, M.B., & Maciejewski, P. K. (2009). Prolonged grief disorder: Psychometric validation of criteria proposed for DSM-V and ICD-11. PLoS Med, *6*(8), e1000121.

[21] Shear, M. K. (2015). Complicated grief. New England Journal of Medicine, *372*(2), 153-160.

[22] World Health Organization. (2018). *International classification of diseases for mortality and morbidity statistics* (11th Revision). Retrieved from https://icd.who.int/browse11/l-m/en

[23] Wittouck, C., Van Autreve, S., De Jaegere, E., Portzky, G., & van Heeringen, K. (2011). The prevention and treatment of complicated grief: A meta-analysis. Clinical Psychology Review, *31*(1), 69-78.

[24] Shear, K., & Shair, H. (2005). Attachment, loss, and complicated grief. Developmental Psychobiology: The Journal of the International Society for Developmental Psychobiology, *47*(3), 253-267.

[25] Papa, A., & Lancaster, N. (2016). Identity continuity and loss after death, divorce, and job loss. Self and Identity, *15*(1), 47-61.

[26] Maccallum, F., & Bryant, R. A. (2013). A cognitive attachment model of prolonged grief: Integrating attachments, memory, and identity. Clinical Psychology Review, *33*(6), 713-727.

[27] Callaghan, B. L., & Tottenham, N. (2016). The stress acceleration hypothesis: Effects of early-life adversity on emotion circuits and behavior. Current Opinion in Behavioral Sciences, *7*, 76-81.

[28] Eberhart, N. K., & Hammen, C. L. (2010). Interpersonal style, stress, and depression: An examination of transactional and diathesis-stress models. Journal of Social and Clinical Psychology, *29*(1), 23-38.

[29] Safren, S. A., Gershuny, B. S., Marzol, P., Otto, M. W., & Pollack, M. H. (2002). History of childhood abuse in panic disorder, social phobia, and generalized anxiety disorder. The Journal of nervous and mental disease, *190*(7), 453-456.

[30] Calkins, A. W., Otto, M. W., Cohen, L. S., Soares, C. N., Vitonis, A. F., Hearon, B. A., & Harlow, B. L. (2009). Psychosocial predictors of the onset of anxiety disorders in women: results from a prospective 3-year longitudinal study. Journal of Anxiety Disorders, *23*(8), 1165-1169.

[31] Hayes, S. C., Wilson, K. G., Gifford, E. V., Follette, V. M., & Strosahl, K. (1996). Experiential avoidance and behavioral disorders: A functional dimensional approach to diagnosis and

treatment. Journal of Consulting and Clinical Psychology, *64*(6), 1152.

[32] Knight, B. G., Gatz, M., Heller, K., & Bengtson, V. L. (2000). Age and emotional response to the Northridge earthquake: a longitudinal analysis. Psychology and aging, *15*(4), 627.

[33] Bonanno, G. A., Brewin, C. R., Kaniasty, K., & Greca, A. M. L. (2010). Weighing the costs of disaster: Consequences, risks, and resilience in individuals, families, and communities. Psychological science in the public interest, *11*(1), 1-49.

[34] Zautra, A. J., Johnson, L. M., & Davis, M. C. (2005). Positive affect as a source of resilience for women in chronic pain. Journal of consulting and clinical psychology, *73*(2), 212.

[35] Schneider, T. R., Lyons, J. B., & Khazon, S. (2013). Emotional intelligence and resilience. Personality and Individual Differences, *55*(8), 909-914.

[36] Balgiu, B. A. (2017). Self-esteem, personality and resilience. Study of a students emerging adults group. *Journal of Educational Sciences and Psychology*, *7*(1).

[37] Campbell-Sills, L., Cohan, S. L., & Stein, M. B. (2006). Relationship of resilience to personality, coping, and psychiatric symptoms in young adults. Behaviour Research and Therapy, *44*(4), 585-599.

[38] Papa, A., & Bonanno, G. A. (2008). Smiling in the face of adversity: The interpersonal and intrapersonal functions of smiling. Emotion, *8*(1), 1.

[39] Bonanno, G. A., Galea, S., Bucciarelli, A., & Vlahov, D. (2007). What predicts psychological resilience after disaster? The role of demographics, resources, and life stress. Journal of consulting and clinical psychology, *75*(5), 671.

[40] Dwyer, A. L., & Cummings, A. L. (2001). Stress, self-efficacy, social support, and coping strategies in university students. Canadian Journal of Counselling and Psychotherapy, *35*(3).

[41] Nakano, K. (1991). Coping strategies and psychological symptoms in a Japanese sample. Journal of clinical psychology, *47*(3), 346-350.

[42] Buqo, T., Ward-Ciesielski, E. F., & Krychiw, J. K. (2020). Do Coping Strategies Differentially Mediate the Relationship Between Emotional Closeness and Complicated Grief and Depression?. *OMEGA-Journal of Death and Dying*.

[43] Maccallum, F., Sawday, S., Rinck, M., & Bryant, R. A. (2015). The push and pull of grief: Approach and avoidance in bereavement. Journal of Behavior Therapy and Experimental Psychiatry, *48*, 105-109.

[44] Cheng, C. (2001). Assessing coping flexibility in real-life and laboratory settings: a multimethod approach. Journal of Personality and Social Psychology, *80*(5), 814.

[45] Westphal, M., Seivert, N. H., & Bonanno, G. A. (2010). Expressive flexibility. Emotion, *10*(1), 92.

[46] Kashdan, T. B., & Rottenberg, J. (2010). Psychological flexibility as a fundamental aspect of health. Clinical Psychology Review, *30*(7), 865-878.

Chapter 10

Brain Networks of Emotional Prosody Processing in a Foreign Language Versus Mother Tongue

Zeynep Z. Sonkaya and A. Riza Sonkaya

Abstract

Increased interest in the relationships between the brain and behavior over the past several decades has made brain network process of emotional prosody a topic of study in disciplines like neurology, psychiatry, neurolinguistics and neuroscience. Because emotional prosody has a key role to implication of timbre component, mood sense, and prosodic content. Also, it serves a highly important function for sense, the meaning to be reflected, and ability to provide effective communication. Therefore, the knowledge of how the emotional prosody sequence works in the brain will contribute to both language development and foreign language teaching as well as clinical evaluation of individuals with verbal communication difficulty. In the literature, neuroimaging and neurophysiological studies about investigating emotional prosody have produced controversial results in specifying similarities versus differences mother tongue acquisition and foreign learning neural networks. For this reason, this review study takes an interdisciplinary perspective to identify the neural networks of emotional prosody in mother tongue and foreign language learning process with different imaging modalities.

Keywords: emotional prosody, brain, first and second language, neurolinguistics

1. Introduction

Emotional prosody is taken place by marking the mood values in the language, using verbal and non-verbal languages together or separately [1]. It is stated in the literature that the effective use of emotional prosody in speech contributes to the comprehensibility of the message to be conveyed. As a matter of fact, Kimelman states that a speaker conveying his/her message in emotionless and monotonous way may affect understanding negatively and will not attract attention [2].

Early clinical studies have contributed tremendously to our present knowledge of the neural correlates of emotional prosody. In particular, lesion studies purposed to determine the respective hemisphere to emotional speech and language. The first comprehensive study known in the literature on processing of emotional prosody in the brain was conducted by Hughlings-Jackson. According to the study, it was assumed that the phonological component was processed in bilateral hemispheres of the brain. Also, the author highlighted that the prosody system, which contains emotional states, was located in the right hemisphere [3]. In a similar vein with this study, Heilman et al. reported that lesions in the right

hemisphere tend to disrupt emotional speech comprehension, while split-brain patients perform verbal deficiency when speaking about emotional stimuli [4]. Later work that was effected from Hughlings-Jackson [3] and carried out by Van Lancker it was reported that the prosody reflected emotional state was localized in the right hemisphere, but phonemes contained the sound string was located in the left hemisphere [5]. Also, in a similar way with these studies, Ross pointed out that the emotional prosody system was processed only in the right hemisphere, as well [6]. This early evidence about the predominant role of right hemisphere in emotional prosody was followed by subsequent patient researches in which the relative contribution of specific right hemisphere brain areas to these functions were determined [7]. Many studies based on patient data collected during intrasurgical electrocortical stimulation show the right fronto-central operculum sensitivity for emotional prosody [8]. In addition to this, not only patient data but also recent studies made by neuroimaging techniques as well, question a strong right hemisphere lateralization of emotional speech and language function. Although some data confirm a significant role of right cortical and subcortical structures [9], a great deal of fMRI studies used single word, verify the contribution of bilateral hemispheres or even the left hemisphere only to emotional prosody and language processing. For instance, in one fMRI study conducted by Buchanan et al. it was aimed to recognize the brain localization of emotional prosody and verbal components of spoken language. As a result of the study, authors reported the bilateral brain hemisphere domination in the processing of emotional prosody system [10]. On the other hand, Luo et al. demonstrated the left mid-fusiform gyrus activation for emotional words [11].

Emotional prosody is an important communicative element, pointed as one of the main extra linguistic attributes present in oral communication. It plays a crucial role during social communicative interaction in mother tongue acquisition and also second language learning process. Due to its important role in verbal communication, it has a critical relationship within many disciplines such as linguistics, neurology, psychiatry and computer sciences. A significant increase has been observed in studies on the relationship of emotional prosody, which is related to many disciplines, with laterization, localization, activation areas and other language components in the brain [12–15]. One of the main reasons of this subject may that the findings obtained from both neuroimaging and lesion studies on patients do not provide a consistent result confirming the right-hemispheric laterization of emotional prosody. As a matter of fact, in one comprehensive meta-analysis study on emotional prosody carried out by Kotz et al., it was stated that emotional valence is predominantly lateralized in the right hemisphere in studies made with neuroimaging techniques, but it was also stated that bilateral or left hemisphere laterization in studies conducted with electrophysiological methods [15].

Emotional prosody has a significant importance to implication of timbre component, mood sense, and prosodic content. Also, it serves a highly important function for sense, the meaning to be reflected, and ability to provide effective communication. Therefore, it is thought that the knowledge of how the emotional prosody sequence works in the brain may contribute to both mother tongue acquisition and foreign language teaching. In the literature, neuroimaging and neurophysiological studies about investigating emotional prosody have produced controversial results in specifying similarities versus differences in mother tongue acquisition and foreign learning neural networks. For this reason, this review study aims to present an interdisciplinary perspective to identify the neural networks of emotional prosody in mother tongue and foreign language learning process with different imaging modalities.

2. Brain networks of emotional prosody in mother tongue acquisition

The researches towards to determine the brain localization of emotional prosody in mother tongue acquisition were generally studied to be in patients with right hemisphere damage [16, 17]. It is thought that this can be due to the view that emotional function appearances of the language are localized in the right hemisphere. In the majority of studies this view was generally supported, and it was pointed out the right-hemisphere role in detail for expression of emotion through prosody. As a matter of fact, in one comprehensive review study scanned researches that carried out patients with right hemisphere damage which was conducted by Mitchell and Crow it was demonstrated some deterioration in the basic functioning structures such as perception of emotional states in the mother language [18]. Likewise, in another study carried out by Brådvik et al. and conducted on Swedish native language speakers with right hemisphere damage, it was showed that participants did not able to analyze the emotions. Authors determined the lower part of right hemisphere role to comment this result [19]. Also, Patel et al. , investigated a consecutive series of 41 English native speaker patients with acute ischemic right hemisphere. As a consequence of the study, authors reported two novel and important results. First, they identified abnormal patterns of acoustic features that contribute to diminished emotional expression of right hemisphere stroke survivors, as rated by healthy listeners. As the second, authors stated that the measures of acoustic features associated with impaired expression of emotion were associated with lesion load in right inferior frontal gyrus, pars opercularis or supramarginal gyrus, or associated white matter tracts, particularly inferior fronto-occipital fasciculus, superior longitudinal fasciculus, and uncinate fasciculus [20].

In the literature, although many researches about brain localization of emotional prosody in mother tongue acquisition shows right hemisphere domination, recent findings, especially obtained from neuroimaging and electrophysiological studies do not entirely confirm a strong right hemisphere only. For example, in one neuroimaging study made with fMRI technique conducted on English native speakers, participants were asked to pay attention to visually presented words but had to make no overt response to them. As a result of the study, authors reported the increased activation in the left amygdala for both positive and negative emotional words [21]. Similarly, in another fMRI study carried out by Lewis et al. nineteen right-handed English native speakers were included, and it was discussed a dissociation of valence in subregions of the orbito-frontal cortex and arousal in the amygdala for visual word stimuli. In fact, left-lateralized amygdala activation in response to visually presented emotional word stimuli has been stated repeatedly [22]. Again, Mayer et al. examined the different prosodic states in German using with fMRI technique. In the study fabrication sound sequence was listened to the participants and it was interpreted in terms of focus, accent and emotional prosody. As a consequence of the study, it was observed the bilateral activation in left lower frontal gyrus, left insula and premotor cortex for focus condition. Authors also reported the anterior cingulate, supramarginal and posterior upper temporal gyrus activation for phonological process of emotional prosody system as well as syntactic process [23]. Likewise, Goerge et al. used a PET technique in their study which aimed to investigate the brain regions involved in understanding emotional prosody in mother tongue processing. As a result of the study, authors reported significant left prefrontal activation when participants were instructed to listen for content of verbal sentences compared with listening for prosody. In addition, authors also documented significantly more activation in the left than right frontal cortex [24].

However, it has observed in the literature that many of the electrophysiological studies about emotional prosody on mother tongue acquisition generally support the results of neuroimaging studies as well [25–28]. For example, in one review study conducted by Kissler et al. scanned the Event-Related Brain Potential (ERP) researches. As a consequence of the study, authors reported enhanced Early Posterior Negativity (EPN) responses to emotional compared to neutral nouns during reading at left occipito-temporal electrode-sites [26]. In another ERP study, Herbert et al. demonstrated a bilaterally increased EPN for emotional prosody processing [28]. Likewise, in one comparative ERP study conducted by Pannekamp et al., emotional prosody process on English native speakers were evaluated, and authors stated that the prosody system can be seen not only in the right hemisphere of the brain but also in the left hemisphere [27]. The results of one electroencephalography (EEG) study findings obtained from Turkish native speakers also support the results of Pannekamp et al. [27] in a great extent. Similarly, in another EEG examination made by Arsic et al., it was showed the bilateral activation in both hemisphere for process of emotional prosody system as well [29].

Neither the aforementioned clinical studies nor neuroimaging and electrophysiological researches have established a clear picture of the neural substrates of emotional prosody in mother tongue acquisition. It is thought that varieties in methodology including different imaging techniques, different verbal stimuli and task instructions may be blame for these disparate findings.

3. Brain networks of emotional prosody in second language learning process

Although the mother tongue is a fast and effortless process, second language learning period includes some difficulties for many individuals [30]. Especially, "the expression and the perception of emotional states in a second language represent a difficult task for the learners. One of the reasons is the fact that, more than other aspects related to speech, the expression of emotional states in second language requires full control of the prosodic resources that contribute to their realization" [31].

Similar to studies investigated brain networks of emotional prosody on mother tongue, neuroimaging and neurophysiological studies about identifying brain localization of emotional prosody sequence in second language have produced controversial results in specifying resemblances versus differences as well. As a matter of the fact in one study conducted by Chen et al., it was investigated the neural mechanisms of emotional prosody processing in Chinese-English bilinguals by using both ERP and fMRI. According to ERP results, authors reported the reduced N400 for positive words compared to neutral words in second language. In fMRI, reduced activation was stated for mother tongue emotional words in both the left middle occipital gyrus and the left cerebellum whereas increased activation in the left cerebellum was reported for second language emotional words [32]. In another study, it was investigated the emotional prosody and verbal components of speech on English native speakers who learn Turkish as a second language using by fNIRS [1]. In the study four words (*sınıf, alarm, doktor, gazete*) were used for the experimental stimuli. The words were pronounced in angry, happy, neutral, and fearful tones. Among the four words, the phonetic pronunciations "alarm" and "doktor" have meaning in both Turkish and English. The other two words, 'sınıf' and 'gazete', although they were not a part of standard English lexicon but widely used in Turkish. As a consequence of the study, authors reported two novel and important results. First, they showed a strong right hemisphere laterization for emotional prosody in second language learning process, on the other

hand, they demonstrated an increased activation in the primary and secondary cortex of the left hemisphere and the posterior superior temporal cortex due to the emotional intonation of speech stimuli. As a second, they remarked the significant increase activation in the right hemisphere for the perception of stimuli consisting only of Turkish words in English native speakers and do not know Turkish. However, authors reported a strong activation in the left hemisphere for all participants in stimuli consisting of words used mutual in both Turkish and English [1]. This study results support the fMRI research conducted by Buchanan et al. [10]. In the study, authors aimed to examine brain localization of emotional prosody on German and Turkish individuals who learn English as a second language. At the result of the study, authors indicated that the contrasts comparing language detection with emotion detection resulted in significantly lateralized activity in the frontal lobes, with increased right frontal activity during emotional detection and increased left frontal activity during verbal detection. In addition to this, specific analysis of the anterior auditory cortices of both hemispheres revealed greater right hemisphere activation during detection of emotion compared to activity associated with verbal detection [10]. In a similar way aforementioned studies about emotional prosody process in second language learning, in one fNIRS study Zhang et al. [14] used the database included language-like pseudosentences in Mandarin Chinese, which were constructed by replacing content words with semantically meaningless words. At the end of the study, authors demonstrated that several cerebral areas are critical for emotional prosody processing. Also, they confirmed that "the superior temporal cortex, especially the right middle and posterior parts of superior temporal gyrus, primarily works to discriminate between emotional and neutral prosodies". Furthermore, according to the authors, the results suggested that categorization of emotions occurs within a high-level brain region the frontal cortex, since the brain activation patterns were distinct when positive (happy) were contrasted to negative (fearful and angry) prosody in the left middle part of inferior frontal gyrus and the frontal eye field and when angry were contrasted to neutral prosody in bilateral orbital frontal regions. These findings verified and extended previous fMRI findings in adult brain and also provided a developed version of brain activation for their following neonatal study [14].

Although the expression and the perception of emotional states in a second language process is notoriously difficult as opposed to mother tongue acquisition for learners, little is known about what changes are happening in the brain as decoding emotional prosody progress, when these changes occur during expression and perception of this sequence and how brain changes which reflect successes of learning can be determined. One of the reasons of this, in the literature, there are limited number of studies about brain networks of emotional prosody in second language learning. Also, these limited neuroimaging and neurophysiological studies have showed controversial results in specifying similarities versus differences foreign language learning neural networks. However; the knowledge of how the emotional prosody sequence works in the brain contribute to both mother tongue development and foreign language learning as well as clinical evaluation of individuals with verbal communication difficulty. Also, it is thought that determining brain networks of emotional prosody contributes to reorganize curricula for teaching emotional prosody in second language.

4. Conclusion

In this study, brain networks of emotional prosody in mother tongue acquisition and second language learning were tried to discuss according to the available results of electrophysiological, neuroimaging and clinical studies. Although different study

results suggest activation of specific brain patterns is significantly correlated with process of emotional prosody, neither clinical studies nor neuroimaging and electrophysiological researches have established a clear picture of the neural substrates of emotional prosody in mother tongue acquisition and foreign language learning. Therefore, it is needed further experimental studies.

Author details

Zeynep Z. Sonkaya[1] and A. Riza Sonkaya[2*]

1 Ankara University, Ankara, Turkey

2 University of Health Science, Gülhane School of Medicine, Ankara, Turkey

*Address all correspondence to: drrizasonkaya@gmail.com

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References

[1] Sonkaya, A.R. and Z.Z. Bayazıt, *A Neurolinguistic Investigation of Emotional Prosody and Verbal Components of Speech*. NeuroQuantology, 2018. 16(12): p. 50-56.

[2] Kimelman, M.D., *Prosody, linguistic demands, and auditory comprehension in aphasia*. Brain and Language, 1999. 69(2): p. 212-221.

[3] Hughlings Jacksons, J., *On affections of speech from disease of the brain*. Brain, 1878. 1: p. 304-330.

[4] Heilman, K.M., R. Scholes, and R. Watson, *Auditory affective agnosia. Disturbed comprehension of affective speech*. Journal of Neurology, Neurosurgery & Psychiatry, 1975. 38(1): p. 69-72.

[5] Van Lancker, D., *Cerebral lateralization of pitch cues in the linguistic signal*. Research on Language & Social Interaction, 1980. 13(2): p. 201-277.

[6] Ross, E.D., *The aprosodias: Functional-anatomic organization of the affective components of language in the right hemisphere*. Archives of neurology, 1981. 38(9): p. 561-569.

[7] Kotz, S. and S. Paulmann, *Emotion, language, and the brain*. Language and Linguistics Compass*, 5 (3), 108-125*. 2011.

[8] Montavont, A., et al., *Ictal dysprosody and the role of the non-dominant frontal operculum*. Epileptic disorders, 2005. 7(3): p. 193-197.

[9] Tabert, M.H., et al., *Differential amygdala activation during emotional decision and recognition memory tasks using unpleasant words: an fMRI study*. Neuropsychologia, 2001. 39(6): p. 556-573.

[10] Buchanan, T.W., et al., *Recognition of emotional prosody and verbal components of spoken language: an fMRI study*. Cognitive Brain Research, 2000. 9(3): p. 227-238.

[11] Luo, Q., et al., *Emotional valence of words modulates the subliminal repetition priming effect in the left fusiform gyrus: an event-related fMRI study*. Neuroimage, 2004. 21(1): p. 414-421.

[12] Alba-Ferrara, L., et al., *The neural correlates of emotional prosody comprehension: disentangling simple from complex emotion*. PLoS one, 2011. 6(12): p. e28701.

[13] Liebenthal, E., D.A. Silbersweig, and E. Stern, *The language, tone and prosody of emotions: neural substrates and dynamics of spoken-word emotion perception*. Frontiers in neuroscience, 2016. 10: p. 506.

[14] Zhang, D., Y. Zhou, and J. Yuan, *Speech prosodies of different emotional categories activate different brain regions in adult cortex: an fNIRS study*. Scientific reports, 2018. 8(1): p. 1-11.

[15] Kotz, S.A., et al., *Predicting vocal emotion expressions from the human brain*. Human Brain Mapping, 2013. 34(8): p. 1971-1981.

[16] Beaucousin, V., et al., *FMRI study of emotional speech comprehension*. Cerebral cortex, 2007. 17(2): p. 339-352.

[17] Vigneau, M., et al., *What is right-hemisphere contribution to phonological, lexico-semantic, and sentence processing?: Insights from a meta-analysis*. Neuroimage, 2011. 54(1): p. 577-593.

[18] Mitchell, R.L. and T.J. Crow, *Right hemisphere language functions and schizophrenia: the forgotten hemisphere?* Brain, 2005. 128(5): p. 963-978.

[19] Brådvik, B., et al., *Disturbances of speech prosody following right hemisphere*

infarcts. Acta Neurologica Scandinavica, 1991. 84(2): p. 114-126.

[20] Patel, S., et al., *Right hemisphere regions critical for expression of emotion through prosody*. Frontiers in neurology, 2018. 9: p. 224.

[21] Hamann, S. and H. Mao, *FMRI correlates of emotional memory and reactions to verbal and nonverbal emotional stimuli*. NeuroImage, 2001. 6(13): p. 415.

[22] Lewis, P.A., et al., *Neural correlates of processing valence and arousal in affective words*. Cerebral cortex, 2007. 17(3): p. 742-748.

[23] Mayer, J., et al., *Prosody in speech production: a fMRI study*. San Francisco, 1999: p. 635-638.

[24] George, M.S., et al., *Understanding emotional prosody activates right hemisphere regions*. Archives of neurology, 1996. 53(7): p. 665-670.

[25] Kanske, P. and S.A. Kotz, *Concreteness in emotional words: ERP evidence from a hemifield study*. Brain research, 2007. 1148: p. 138-148.

[26] Kissler, J., R. Assadollahi, and C. Herbert, *Emotional and semantic networks in visual word processing: insights from ERP studies*. Progress in brain research, 2006. 156: p. 147-183.

[27] Pannekamp, A., et al., *Prosody-driven sentence processing: an event-related brain potential study*. Journal of cognitive neuroscience, 2005. 17(3): p. 407-421.

[28] Herbert, C., et al., *Amygdala activation during reading of emotional adjectives—an advantage for pleasant content*. Social cognitive and affective neuroscience, 2009. 4(1): p. 35-49.

[29] Arsic, M., *Electrophysiology of emotional prosody production and perception*. 2008, Citeseer.

[30] Bayazıt, Z.Z., *Dilbilimsel Açıdan Yabancı Dil Olarak Türkçe Öğrenen Bireylerin Yaptıkları Çeviri Hataları*. MANAS Sosyal Araştırmalar Dergisi. 8(3): p. 2280-2293.

[31] De Marco, A., *Teaching the Prosody of Emotive Communication in a Second Language*, in *Second Language Acquisition-Pedagogies, Practices and Perspectives*. 2019, IntechOpen.

[32] Chen, P., et al., *Processing emotional words in two languages with one brain: ERP and fMRI evidence from Chinese–English bilinguals*. Cortex, 2015. 71: p. 34-48.

Chapter 11

Humor Daily Events and Well-Being: The Role of Gelotophobia and Psychological Work Climate

Ana Junça Silva, António Caetano and Rita Rueff Lopes

Abstract

This study aims to: (1) analyze the relationship between humor-daily events and well-being; (2) test the mediating role of positive affect in this relationship; (3) analyze the moderating role of gelotophobia between humor-daily events and positive affect, and; (4) explore the moderating role of psychological climate between positive affect and well-being. To test these goals, we conducted a quasi-experimental study with 93 participants. We used regressions and bootstrapping analyses to test the moderated mediation model. The relationship between the humor-daily events and well-being was mediated by positive affect and this relation was moderated by psychological work, such that this relationship was stronger when a positive psychological work climate was identified. Gelotophobia did not moderate the relationship between humor daily-events and positive affect, however, it significantly and negatively predicted positive affect. This paper adds considerable evidence of the relationship between humor-related daily events and its impact on well-being. Psychological work climate strengthens the association between positive affect and well-being, after humor daily events.

Keywords: gelotophobia, humor-daily events, psychological work climate, affect, moderated mediation

1. Introduction

Research on positive affect in organizations supports that humor is an important factor at work, due to its positive effects on several outcomes, like creativity and stress reduction [1]. However, humor can be a positive or negative event generating diverse outcomes at work. When a humor event is negative, it refers to a hostile use of humor, in which the self is enhanced at the expense of denigrating, disparaging, excessively teasing, or ridiculing others [2]. When it is positive, it refers to the tendency to tell jokes or engage in spontaneous witty banter to create amusement, lessen interpersonal tension, and facilitate relationship.

Despite its relevance, there is a lack of research exploring the conditions that might affect the influence of humor on workers' well-being. For instance, gelotophobia, defined as the fear of being laughed at [3], may influence the relationship between humor events and subsequent affective reactions. This effect may occur because gelotophobes may perceive humor events in an idiosyncratic manner.

Gelotophobes may be more sensitive to humor and perceive humor events as a form of humiliation or joke in front of others, even in situations in which humor may not be intended to be harmful. In line with this observation, it is likely that gelotophobia moderates the relationship between humor daily events and affective reactions.

In addition, the context in which these situations occur may also influence individuals' reactions. For example, several studies have demonstrated that psychological work climate is crucial for individuals' well-being [4]. Psychological work climate may provide social and psychological resources, such as, support from colleagues/supervisor, for individuals at work. Hence, the more positive is the work climate, the greater the well-being of employees [5]. Therefore, it is likely that psychological work climate influences the affective reactions of individuals to humor events and, consequently, their well-being.

Based on these assumptions, the present study seeks to examine the association between humor daily events and well-being in a sample of workers by examining the potential mediating effect of positive affect between this relationship. We also intend to explore the potential moderating effect of gelotophobia between humor daily events and positive affect, and the potential moderating effect of psychological work climate between positive affect and well-being. So, this study addresses the relevance of work-related humor on well-being and explores the moderating role of an individual characteristic and a contextual one on that relationship.

2. Theoretical background

2.1 Humor daily events and well-being

The humor-health hypothesis states that humor enhances individuals' functioning [6]. Diverse studies have shown that humor is positively associated to individuals' physical, psychological, and social well-being [7].

There are four different humor styles [6]. Accordingly, humor results from the interaction of the humors' target (oriented toward others or oriented toward oneself) with its effects (being conductive or detrimental) on well-being. Therefore, the authors suggested two positive humor styles (self-enhancing humor and affiliative humor), and two negatives ones (self-defeating humor and aggressive humor). Self-enhancing humor is directed to oneself and it is defined as the tendency to be amused by the incongruences of life and to have a genuine humorous outlook. Affiliative humor is directed to others and it is defined as the tendency to amuse others and create empathy [6]. Self-enhancing and affiliative humor have been consistently related positively to individuals' physical, psychological and social well-being, while self-defeating and aggressive humor have been shown to be negatively related with several aspects of optimal functioning [8].

Humor is an indicator of emotional intelligence, as emotional management ability has been demonstrated to be positively correlated with self-enhancing humor, and negatively correlated with trait bad mood [6]. In addition, the ability to accurately perceive emotions has been negatively related to aggressive and self-defeating humor. Consistently, it has been demonstrated that emotional intelligence predicted both affiliative and self-enhancing humor [8].

Humor can be conceptualized as an individual characteristic and as a discrete event. It is "any event shared by an agent (e.g., an employee) with another individual (a target) that is intended to be amusing to the target and that the target perceives as an intentional act" [9] (pp. 766–767). Humor produces affect and cognitions in the individual, group, or organization [10]. Underlying these assumptions, we highlight the discrete and affective nature of humor.

The Conservation of Resources Theory (COR) [11] proposes that disposing of resources is rewarding and adds to psychological and physical well-being, both by increasing resilience and by contributing to employees' potential to successfully control and influence the environment [12]. In addition, the theory also suggests that individuals strive to protect, maintain, and increase their own resources. Diverse authors have defined humor as a personal resource and have related it to employee well-being [13]. Based on these assumptions, we argue that humor events may be related to some elements associated to happiness, such as well-being. Therefore, we hypothesized that:

H1: Humor events are associated with well-being.

2.2 Humor daily events, positive affect, and well-being

The affective events theory proposes that work events stimulate affective reactions [14]. These affective reactions will influence work-related behaviors and well-being. Humor as an event may be considered as positive or negative, depending upon the triggered affective reaction. For example, an individual may amuse bosses or colleagues by making a joke before starting a meeting. It can be considered as a positive humor event. Positive humor events trigger positive affect (e.g., joy) refer to the tendency to tell jokes or engage in spontaneous witty banter to create amusement, lessen interpersonal tension, and facilitate relationship. On the other hand, humor may also be negative. For instance, a boss may make poor jokes at the expense of subordinates. Thus, negative humor events are referred to hostile uses of humor, in which the self is enhanced at the expense of denigrating, disparaging, excessively teasing, or ridiculing others [15].

Once positive humor events relate to positive affect, they may broaden individuals' thought-action repertoire. According to the broaden and build theory [16], positive affect improves creativity, novelty and actions, which may, in turn, stimulate individuals' durable resources regarding well-being and other aspects of optimal functioning [16]. Because positive humor events may rise creative ways of dealing with challenges and increase social bonding trough the stimulation of positive affect [17], it may boost individuals' well-being. On the other hand, negative humor events may have the opposite effect, by impairing individuals' well-being through negative affect. This is consistent with Cooper's suggestion [17] that humor events may act as a defense mechanism against stress by letting individuals relax from tensions built up by daily hassles. In sum, we hypothesized:

H2: The relationship between humor events and well-being is mediated by positive affect (see **Figure 1**).

2.3 The moderating role of gelotophobia

Based on clinical case studies, the concept of gelotophobia served to describe the pathological fear of appearing to others as a ridiculous object [18]. Therefore,

Figure 1.
A moderated mediation theoretical model: Gelotophobia moderates the relationship between humor events and positive affect, and psychological work climate moderates the mediated relationship between humor events and well-being through positive affect.

gelotophobia has been defined as a subclinical form of social anxiety, as the fear of being laughed at and implies differences in humor reception [19]. Although initially introduced as a clinical phenomenon related to social phobia, there is evidence that gelotophobia may be conceptualized as an individual variable that also applies to normal, non-clinical samples [20]. Experiencing humor, either positive or negative, influence individual's feelings, thoughts, and behaviors [20]. Recently, some studies have demonstrated that there is indeed an enduring fear of being laughed at [21]. This fear embraces a paranoid sensitivity to the humor of others, may raise exaggerated responses to humor events, or going along with social withdrawal. This may also be accompanied by the belief that one is indeed ridiculous [22].

Gelotophobia has been conceptualized as a continuum, ranging from no fear to feeling a strong fear of being laughed at [20]. Individuals who are positioned at the highest end of this continuum fear or anticipate being shamed by the ridicule of others. Therefore, they may react fearfully even to positive humor events. These reactions function as self-protection and coping strategies.

Every day, employees face diverse (positive and negative) humor events. The fear of being laughed at may impair feelings and cognitions to humor events, once gelotophobes believe that they actually are ridiculous objects and, therefore, the laughter of others who constantly screen them for ridiculous cues may appear as justified. In addition, gelotophobes misattribute even innocent humor events (not directed at or not meant to hurt them) as demeaning assaults. Based on these assumptions, we hypothesized that:

H3: Gelotophobia moderates the relationship between humor daily-events and positive affect, such that, gelotophobia weakens this relationship.

2.4 The moderating role of psychological work climate

Several studies have shown associations between psychological work climate and individual work outcomes. For example, it was demonstrated that psychological climate was associated with job satisfaction [23]. It was also showed that psychological work climate was positively related to employee satisfaction, engagement, and other work-related attitudes [24].

In recent years, diverse studies have shown that the psychological work climate can influence employee well-being [25]. Psychological work climate may provide social and psychological resources, such as, support from colleagues or supervisors, for individuals at work.

Based on these findings, it is likely that psychological work climate moderates the affective reactions of individuals to humor events and, consequently, their well-being. Thus, we hypothesized that:

H4: Psychological work climate moderates the relationship between positive affect and well-being, such that, positive climate strengthens the relationship.

3. Method

3.1 Participants

Ninety-three individuals (64 women, 29 men; mean age = 24.76 years, SD = 9.05 years) participated in this study. 52% of the participants recalled a pleasant humor event and 48% an unpleasant one.

3.2 Procedures

In this study, we gathered data in two different phases with an interval of one month between them. We measured the level of gelotophobia and we asked participants to recall a humor event. Participants filled out a survey on both phases.

At the start of the first phase, participants were informed about the purpose and objectives of the study. At this stage, participants responded to demographic questions and to the scale of gelotophobia. On the second phase, we randomly assigned the participants into one of the two conditions: recalling a humor event occurred in organizational context which had provoked pleasant affect or recalling a humor event occurred in organizational context which had provoked unpleasant affect. They also answered to a measure of well-being and work climate.

3.3 Measures

Humor events recall. We randomly assigned the participants into one of the two conditions: (1) pleasant condition: recalling and reconstruct a humor event which had provoked pleasant affect; (2) unpleasant condition: recalling and reconstruct a humor event which had provoked unpleasant emotions. Participants were instructed to recall a recent humor event in organizational settings. They were also asked to describe the episode in a detailed way.

Well-being. Individuals responded to the satisfaction with life scale (SWLS [26]). This is a 5-item scale that measures global life satisfaction. Answers to each item are given on a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). An example item is "the conditions of my life are excellent". In this study, the internal consistency reliability was .78.

Affect. We used the multi-affect indicator [27]. The scale includes 16 items, in which eight measure positive affect (e.g., enthusiastic, joyful), and the other eight items measure negative affect (e.g., nervous, tense). Participants were asked to assess the degree to which they experienced those feelings after the described humor event, using a 7-point Likert scale (1 -not at all; 7 – extremely). The Cronbach's α for the negative affect subscale was .90, and for the positive affect subscale was .85.

Gelotophobia. Participants answered to the GELOPH<15> [28]. It is a 15-item measure for the subjective assessment of gelotophobia. All the items are positively worded. Individuals answer to each item on a 4-point Likert scale (1 – strongly disagree; 4 – strongly agree). An item example is "When others laugh in my presence, I get suspicious". In this study, the scale presented a good internal consistency ($\alpha = .89$).

Work psychological climate. We used two items from the scale of psychological climate of cooperation and warmth [29]. Participants answered on a 7-point Likert scale to the items "At work, there is a nice atmosphere", and "I have a nice time with my colleagues". Inter item correlation was .65.

3.4 Data analysis

We started our analysis by verifying whether the manipulation was effective. Then, we explored the descriptive statistics and correlations with the variables under study. After that we tested our hypothesis. To test the first and the second hypotheses, regarding the direct effect of humor affective events on well-being, and the mediating role of positive affect in this relationship we used bootstrap

analysis (based on 5.000 bootstrapped samples using bias corrected and accelerated 95% confidence intervals (CIs) [30]. This analysis calculated the direct paths between the variables, in the form of regression weights, and the significance of the indirect path, which is the reduction of the relation between humor affective events and well-being, when positive affect is included in the model. The indirect effect is significant when the 95% CI does not include 0. We z-transformed the variables to compare the variable effect sizes. To test the moderated mediation model (hypotheses 3 and 4), we used PROCESS macro [31]. This macro is relevant as it allows evaluating whether a specific mediation effect is contingent upon the level of a moderating variable by providing coefficients for both the mediator, and the dependent variable models. It also allows to probe whether the mediation exists at specified levels of the moderator.

4. Results

An unpleasant humor event was reported by 48% of the participants and a pleasant one was reported by 52%. After describing the humor event, participants identified how good/bad they had felt in the recalled experience. The answers were given on 7-point Likert scale, ranging from 1 – "very bad" to 7 – "very good". Results from a between-subjects one-way analysis of variance (ANOVA) showed significant differences between the conditions: $F_{(1, 90)} = 211.65$; $p = .000$; $\eta 2 = .70$. Participants, in the pleasant condition, reported feeling significantly better ($M = 5.64$; $SD = 1.19$) than did those in the unpleasant condition ($M = 2.36$; $SD = 0.94$). Means, standard deviations, and correlations between the variables are showed in **Table 1**.

4.1 Hypothesis testing

4.1.1 Hypothesis 1

As expected, humor events, gelotophobia, positive affect, psychological work climate and well-being presented moderate to strong correlations with each other. Only, psychological work climate presented a non-significant association with humor events. Therefore, our first hypothesis was supported, as humor events presented a positive and significant correlation with well-being ($r = .19$, $p < .05$).

4.1.2 Hypothesis 2: the mediating effect of positive affect between humor affective events and well-being

To test the second hypothesis, regarding the mediating role of positive affect in the relationship between humor events and well-being, we tested the indirect effect, via bootstrap analysis. We found evidence for the indirect effect of humor events on well-being via positive affect (.26, 95% CI [.04, .57]). The overall model was significant ($F_{(2, 87)} = 10.46$, $p < .01$) and explained 25% of the variance in well-being.

4.1.3 Hypothesis 3: the moderating effect of gelotophobia

To test the third hypothesis, regarding the moderating effect of gelotophobia on the relationship between humor events and positive affect, we used the PROCESS macro, model 7 [31]. Results are presented in **Table 2**. The interaction term was not significant ($\beta = -.04$, $p > .05$). However, when analyzing its direct effect on positive affect, results showed a significant direct path ($\beta = -.95$, $p < .01$), suggesting that gelotophobia does not interact with humor events, but it influences positive affect

Variables	*M*	*SD*	1	2	3	4	5
1. Humor Events	—	—	1				
2.Gelotophobia	2.14	.60	−.15*	1			
3. Positive affect	3.99	1.17	.32**	−.54**	1		
4. Psychological work climate	5.80	1.16	*Ns*	−.38**	.41**	1	
5. Well-being	4.75	1.14	.19*	−.40**	.50**	.51**	1

*$^{*}p < .05$; $^{**}p < .01$.

Table 1.
Means, standard deviations, and correlations between the variables.

Predictor	Hypothesis 3					
	β	*SE*	*T*	*p*	LLCI	ULCI
Humor events	.58**	.21	2.75	.00	.16	1.00
Gelotophobia	−.95**	.22	−4.23	.00	−1.37	−.74
Humor events x Gelotophobia	−.04	.31	−.13	.89	−.67	.59
R^2	.35			.000		
Gelotophobia	**Conditional effects at gelotophobia + − 1 SD**					
	$(a_1 + a_3W)\ b_1$	*SE*	*z*	*p*	LLCI	ULCI
- 1.00	.61	.23	2.58	.01	.14	1.07
0	.58	.21	2.75	.00	.16	1.00
+ 1.00	.55	.33	1.69	.09	−.09	1.21

Notes. The conditional indirect effect is calculated $(a_1 + a_3W)\ b_1$ where a1 is the path from humor events to positive affect, a3 is the path from the interaction of humor events and gelotophobia to positive affect, W is gelotophobia, and b1 is the path from positive affect to well-being. SD standard deviation, SE standard error.

Table 2.
Moderated mediation analysis for hypothesis 3.

directly. Specifically, individuals with low levels gelotophobia reported more positive affect (M = 4.57; SD = .95), than individuals with high levels of gelotophobia (M = 3.60; SD = 1.15), regardless of the condition in which they have been assigned (pleasant or unpleasant). Plus, these differences were significant ($t_{(1, 88)}$ = 4.27, $p < .01$). Thus, the third hypothesis was not supported.

4.1.4 Hypothesis 4: the moderating effect of psychological work climate

Table 3 shows the output for the moderating role of psychological work climate. The interaction term for the model testing the moderating effect of psychological work climate on the relationship between positive affect and well-being, was significant (β = −.13, $p < .05$). The negative sign implies that the indirect effect is larger for those who reported lower levels of positive affect, than for those who reported higher levels. This significant interaction supports the indirect effect of positive affect at different levels of the moderator (psychological work climate). [31] suggest verifying the results with bootstrapped standard errors, used to create 95% CIs. Thus, results showed the existence of conditional indirect effects at the mean, and one SD below the mean, using 95% bias accelerated and corrected CIs with 5.000 bootstrapped resamples. The indirect effect at one *SD* below the mean (.50, 95% CI [.28, .72]),

Predictor	Hypothesis 4					
	B	*SE*	*T*	*p*	LLCI	ULCI
Positive affect	.33	.11	3.03	.00	.13	.55
Work climate	.28	.09	2.91	.00	.07	.45
Positive affect x Climate	−.13	.06	−2.08	.03	−.26	−.01
R^2	.38			.00		
Psychological work climate score	**Conditional effects at psychological work climate + − 1 SD**					
	$(a_1 + a_3W)\ b_1$	*SE*	*z*	*p*	LLCI	ULCI
- 1.00	0.50	.11	4.57	.00	.28	.72
0	0.36	.10	3.31	.00	.13	.55
+ 1.00	0.18	.14	1.30	.19	−.09	.46

Notes. The conditional indirect effect is calculated $(a_1 + a_3W)\ b_1$ *where a1 is the path from humor events to positive affect, a3 is the path from the interaction of positive affect and work climate to well-being, W is work climate, and b1 is the path from positive affect to well-being. SD standard deviation. SE standard error.*

Table 3.
Moderated mediation analysis for psychological work climate moderating positive affect mediation of humor events and well-being.

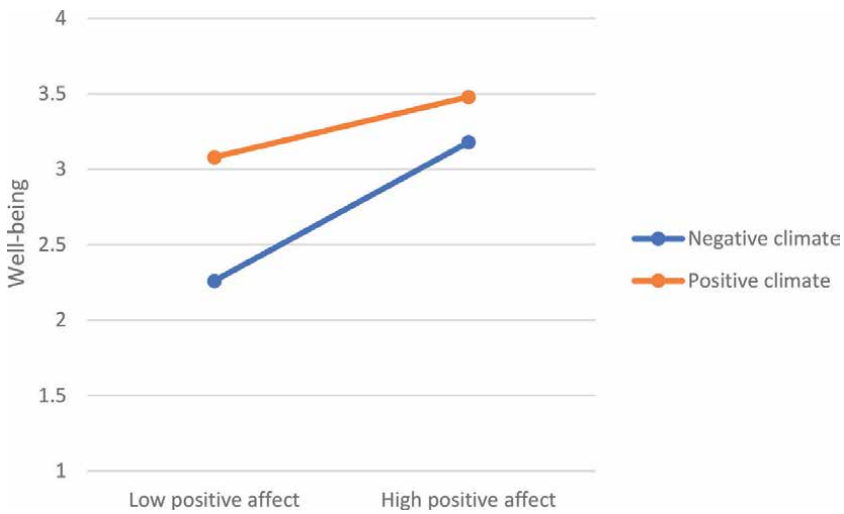

Figure 2.
The interaction of positive affect and psychological work climate on well-being.

and the mean (.36, 95% CI [.13, .55]) were significant, but the indirect effect a tone *SD* above the mean (.18, 95% CI [−.09, .46]) was not (**Figure 2**). The model explained 38% of the variance on well-being.

5. Discussion

The present study had four goals: (1) to test an established link relating humor events to well-being, and (2) to examine positive affect as a mediator in the relation between humor events and well-being. We also investigated (3) the degree to which gelotophobia moderates the relation between humor events and positive affect, and; (4) whether psychological work climate serves as a moderator of the link between positive affect and well-being.

There is considerable evidence of the benefits of humor for well-being. However, most of these studies have been focused on humor as an individual characteristic. There are few studies considering the role of humor events on individual's well-being.

Regarding our first hypothesis, humor events were positively related to higher levels of well-being. This is consistent with the humor-health hypothesis, which states that humor has beneficial effects for individual's optimal functioning [6]. Humor is globally recognized to be an indicator of positive mental health [7] and has been found to be related to both physical and psychological well-being [3]. However, this study goes further and specifies some conditions that may affect that relation.

Our results support our second hypothesis, regarding the mediated relationship between humor events and well-being through positive affect. These findings are in line with affective events theory [14], as the theory suggests that affective events at work stimulate affective reactions which, in turn, will influence employee's attitudes and behaviors [15]. Thus, humor events, as affective experiences, will arouse affect and, at the same time, will influence individual's well-being. Our results also demonstrated that positive affect fully mediated the link between humor events and well-being. A potential reason for the full mediation found is that positive humor events facilitate the emergence of relaxation feelings, which contributes to increased levels of positive affect and, in turn, results in higher levels of well-being. Moreover, these results also emphasize the well-established concept that positive affect is a strong predictor of individual's well-being [7]. Thus, the more positive humor events, the higher the frequency of positive affect, which may be translated in higher levels of well-being.

The findings regarding the moderating role of gelotophobia, between humor events and positive affect, were not supported. Gelotophobia did not moderate the relationship between humor events and positive affect. This was not expected, as gelotophobia emerges as an individual characteristic defined as the fear of being laughed at and appearing ridiculous to peers [20]. However, gelotophobia presented a negative direct path to positive affect. That is, individuals high in gelotophobia experienced less positive affect than individuals low in gelotophobia ($F_{(1, 89)} = 19.01$, $\eta 2 = .18$, $p < .000$). This difference was statistically significant and occurred either in individuals reporting a pleasant humor event or an unpleasant one. Therefore, regardless of the condition, gelotophobes tend to experience less positive affect, even after positive experiences. This is consistent with the notion that gelotophobes experience disproportionate negative responses to being laughed at, and have a paranoid sensitivity to anticipated ridicule [21]. It is likely that this paranoid sensitivity to ridiculous impairs gelotphobes to discriminate between unpleasant humor affective events and pleasant ones. Therefore, this paranoid sensitivity will stimulate negative affect, even after pleasant humor events [21].

In support of the fourth hypothesis, psychological work climate moderated the relationship of humor events and well-being via positive affect. This result was significant only for individuals who reported low to moderate levels of good psychological work climate. That is, individuals in poorer psychological work climates benefit more from experiencing humor events that trigger positive affect, which in turn, will translate into higher levels of well-being. A possible explanation is that those working in positive psychological work climates tend to pay less attention to positive humor events, and therefore, are less likely to experience emotional gains from the presence of positive affect. But for those in poorer work climates, positive affect aroused by humor events will have a larger impact in their well-being. People working in supportive psychological work climates already tend to feel good while working with their work colleagues/supervisors, so the effect of increased

positive affect after humor events may be negligible. From an organizational perspective, positive climates have singular characteristics. That is, it is possible that humor experiences are part of the daily routine in these working climates, making it expected events to employees, and for that reason, it will not stimulate their well-being. However, for individuals working in poorer and non-supportive work climates, experiencing positive affect, after humor events, as well as increased perceptions of work climate, may increase, substantially, their well-being. Some studies have already demonstrated that a good work climate can have a significant effect on employees' well-being [25]. It is likely that a good psychological work climate protects against the translation of the inexistence or low frequency of positive affective experiences into lesser well-being.

In sum, the findings of this study are in line with the humor-health hypothesis and suggest that humor events influence individuals' well-being. In addition, this relation is mediated by positive affect, that is humor events trigger positive affect, which will enhance individual's well-being. Moreover, this relationship between positive affect and well-being is shaped by low and moderate levels of psychological work climate. Gelotophobia did not interact significantly with humor events, however it did influence positive affect directly, such that, individuals low in gelotophobia experienced more positive affect than did those high in gelotophobia.

5.1 Limitations and future research

Despite the positive features of this study, it has some limitations. First, the small sample size means that these results should be generalized with some caution. Second, the use of self-reported measures may also have biased the data, because individuals may not always provide accurate reports. Third, we asked participants to report a pleasant/unpleasant humor event occurred in organizational context. Despite we have asked them to recall a recent event (less than one month ago), it is likely that their reports may have been influenced by memory bias. Efforts should be made to further studies, by conducting, for instance, a diary study, in order to obtain more accurate data. Moreover, because we do not have longitudinal data, we cannot assume a model of causality between the variables. Thus, future studies should gather data longitudinally.

The results of the current study open several avenues of potential research. First, we tested the affective events theory, by assuming humor events as an affective event. We also tested the model under analysis with the negative affect, however, as this part of the model was not significant, we opted by do not including it the study. This might have happened because in the study the prevalence of gelotophobes was low. Therefore, it may have biased the data. Moreover, because gelotophobia did not interact significantly with humor events, it is likely that there are other variables that may also account for these relations, and interact with gelotophobia, for instance, social anxiety, or other personality characteristics.

Future studies should also test the model with other designs, for instance, longitudinal or daily studies. By examining these relations with other designs, it will be possible to confirm the results of the present study and acknowledged it more consistently.

5.2 Practical implications

This study has several practical implications for organizational actors. First, it is important to acknowledge the relevance of humor events at work, as well as the prevalence of gelotophobes. With regard to this, managers may analyze whether their employees are high or low in gelotophobia, for instance through the measure

GELOPH<15>, and take measures accordingly. Once gelotophobes display less positive affect, it is likely that they experience more anxiety or discomfort while working, which in turn, will reduce their well-being. Thus, identifying whether individuals are gelotophobes may help to design interventions among them. For instance, modifying their perception of being ridiculous could have significant results for their sense of well-being. There are training programs and interventions aimed to promote and enhance individual's perceptions of themselves and to reduce the fear of being ridiculous at the eyes of their social peers. These training programs offer tools aimed at encouraging the maintenance of good perception of themselves in the face of humor experiences.

Employers could also offer interventions specifically focused on gelotophobes, in order to help them deal with their fear of being laughed at and, at the same time, promote positive perceptions of themselves. Moreover, psychological work climate appears to be a mechanism that may protect employees' well-being, from displaying less positive affect. Therefore, it is crucial that managers promote a good and supportive psychological work climate among their employees. For example, managers may organize social events or teambuilding activities, that may improve social and psychological bonds between workers. We believe that the emotional and social bonds that may be created among employees go a long way improving their quality of life at work. Other interventions or programs could be aimed at creating a more supportive and warmth work environment, that addresses the special needs of employees high in gelotophobia, possibly by providing access to psychological health and wellness services.

6. Conclusions

These results add to the existing literature on humor events and its impact on well-being; to date this is the first quasi-experimental study exploring the role of positive affect as mediator between humor events and well-being and analyzing the moderating role of gelotophobia and psychological work climate among these relationships. It was found that humor daily events affect well-being via affect, and that this relationship is conditional upon the levels of positive work climate, such that it is stronger when the scores of positive work climate are higher. Despite the significant direct effect of gelotophobia on well-being, it did not moderate the relationship between humor daily-events and well-being.

The present study addresses a major gap in the current positive psychology literature; whereas the correlational link between humor and well-being has been well-established, this is one of the first studies to examine some of the intricacies of this relation.

Author details

Ana Junça Silva[1*], António Caetano[2] and Rita Rueff Lopes[3]

1 ISCTE – Instituto Universitário de Lisboa, Instituto Politécnico de Tomar, Lisbon, Portugal

2 ISCTE – Instituto Universitário de Lisboa, ISPA, Lisbon, Portugal

3 ESADE – Business School, Barcelona, Spain

*Address all correspondence to: analjsilva@gmail.com

References

[1] Maiolino, N., & Kuiper, N. Examining the impact of a brief humor exercise on psychological well-being. *Translational Issues in Psychological Science*. 2016; *2*(1), 4. https://doi.org/10.1037/tps0000065#

[2] Zillmann, D. Disparagement humor. In *Handbook of humor research* (pp. 85-107). 1983. Springer New York. https://doi.org/10.1007/978-1-4612-5572-7_5

[3] Ruch, W. Fearing humor? Gelotophobia: The fear of being laughed at Introduction and overview. *Humor-International Journal of Humor Research*. 2009; *22*(1-2), 1-25. https://doi.org/10.1515/HUMR.2009.001

[4] Schaufeli, W. B., & Taris, T. W. A critical review of the Job Demands-Resources Model: Implications for improving work and health. In *Bridging occupational, organizational and public health* (pp. 43-68) 2014. Springer Netherlands. https://doi.org/10.1007/978-94-007-5640-3_4

[5] Cooper, C. L., & Marshall, J. Occupational sources of stress: A review of the literature relating to coronary heart disease and mental ill health. In *From Stress to Wellbeing Volume 1* (pp. 3-23) 2013. Palgrave Macmillan UK.

[6] Martin, R. A., Puhlik-Doris, P., Larsen, G., Gray, J., & Weir, K. Individual differences in uses of humor and their relation to psychological well-being: Development of the Humor Styles Questionnaire. *Journal of research in personality*. 2003; *37*(1), 48-75. https://doi.org/10.1016/S0092-6566(02)00534-2

[7] Junça-Silva, A., & Rueff Lopes, R. Unfriendly customer behaviors and employees' psychological capital: the role of health symptoms and positive humor events. *Curr Psychol* (2020). https://doi.org/10.1007/s12144-020-01163-8

[8] Junça-Silva, A., Caetano, A., & Lopes, M. A working day in the life of employees: Development and validation of the scale for daily hassles and uplifts at work. TPM: Testing, Psychometrics, Methodology in Applied Psychology. 2020; *27*(2), 221-250. 10.4473/TPM27.2.5

[9] Cooper, C. L. The future of work: careers, stress and well-being. *Career Development International*. 2005; *10*(5), 396-399. https://doi.org/10.1108/13620430510615319

[10] Romero, E. J., & Cruthirds, K. W. The use of humor in the workplace. *The Academy of Management Perspectives*. 2006; *20*(2), 58-69. https://doi.org/10.5465/amp.2006.20591005

[11] Hobfoll, S. E. The influence of culture, community, and the nested-self in the stress process: advancing conservation of resources theory. *Applied psychology*. 2001; *50*(3), 337-421. https://doi.org/10.1111/1464-0597.00062

[12] Hobfoll, S. E., Johnson, R. J., Ennis, N., & Jackson, A. P. Resource loss, resource gain, and emotional outcomes among inner city women. *Journal of personality and social psychology*. 2003; *84*(3), 632. 10.1037/0022-3514.84.3.632

[13] Xanthopoulou, D., Bakker, A. B., Demerouti, E., & Schaufeli, W. B. The role of personal resources in the job demands-resources model. *International journal of stress management*. 2007; *14*(2), 121. https://doi.org/10.1037/1072-5245.14.2.121

[14] Weiss, H. M., & Cropanzano, R. *Affective Events Theory: A theoretical discussion of the structure, causes and consequences of affective experiences at*

work. In B. M. Staw & L. L. Cummings (Eds.), *Research in organizational behavior: An annual series of analytical essays and critical reviews.* 1996; *Vol. 18* (p. 1-74). Elsevier Science/JAI Press.

[15] Junça-Silva, A., Caetano, A., & Lopes, R. R. Daily uplifts, well-being and performance in organizational settings: The differential mediating roles of affect and work engagement. *Journal of Happiness Studies*. 2017; *18*(2), 591-606. 10.1007/s10902-016-9740-2

[16] Fredrickson, B. L. The role of positive emotions in positive psychology: the broaden-and-build theory of positive emoticons. *American Psychologist.* 2001; *56*, 218-226. https://doi.org/10.1037/0003-066X.56.3.218

[17] Kong, D. T., Cooper, C. D., & Sosik, J. J. The state of research on leader humor. *Organizational psychology review*. 2019; *9*(1), 3-40. https://doi.org/10.1177/2041386619846948

[18] Titze, M. Gelotophobia: the fear of being laughed at. *Humor: International Journal of Humor Research*. 2009; *22*(1-2), 27-48. https://doi.org/10.1515/HUMR.2009.002

[19] Ruch, W., Hofmann, J., Platt, T., & Proyer, R. The state-of-the art in gelotophobia research: A review and some theoretical extensions. *Humor*. 2014; *27*(1), 23-45. 10.1515/humor-2013-0046

[20] Ruch, W., & Proyer, R. T. Extending the study of gelotophobia: On gelotophiles and katagelasticists. *Humor-International Journal of Humor Research*. 2009; *22*(1-2), 183-212. http://dx.doi.org/10.5167/uzh-14037

[21] Hofmann, J., Ruch, W., Proyer, R. T., Platt, T., & Gander, F. Assessing Dispositions Toward Ridicule and Laughter in the Workplace: Adapting and Validating the PhoPhiKat-9 Questionnaire. *Frontiers in Psychology*. 2017; *8*. https://doi.org/10.3389/fpsyg.2017.00714

[22] Proyer, R. T., & Ruch, W. Enjoying and fearing laughter: Personality characteristics of gelotophobes, gelotophiles, and katagelasticists. *Psychological Test and Assessment Modeling*. 2010; *52*(2), 148-160.

[23] Koys D. J. The effects of employee satisfaction, organizational citizenship behaviour and turnover on organizational effectiveness: A unit-level, longitudinal study. *Personnel Psychology. 2001; 54,* 101-114. https://doi.org/10.1111/j.1744-6570.2001.tb00087.x

[24] Harter J. K., Schmidt F. L., & Hayes T. L. Business-unit-level relationship between employee satisfaction, employee engagement, and business outcomes: A meta-analysis. *Journal of Applied Psychology. 2002; 87*, 268-279. 10.1037/0021-9010.87.2.268

[25] Tims, M., Bakker, A. B., & Derks, D. The impact of job crafting on job demands, job resources, and well-being. *Journal of occupational health psychology*. 2013; *18*(2), 230. https://doi.org/10.1037/a0032141

[26] Diener, E. D., Emmons, R. A., Larsen, R. J., & Griffin, S. The satisfaction with life scale. *Journal of personality assessment*. 1985; *49*(1), 71-75. https://doi.org/10.1207/s15327752jpa4901_13

[27] Warr P., Bindl U. K., Parker S. K., Inceoglu I. Four-quadrant investigation of job-related affects and behaviours. *European Journal of Work and Organizational Psychology.* 2013; *23*: 342-363. https://doi.org/10.1080/1359432X.2012.744449

[28] Ruch, W., & Proyer, R. T. The fear of being laughed at: Individual and group differences in gelotophobia. *Humor*. 2008; *21*(1), 47. https://doi.org/10.1515/HUMOR.2008.002

[29] Kattenbach, R., Demerouti, E., & Nachreiner, F. Flexible working times: effects on employees' exhaustion, work-nonwork conflict and job performance. *Career Development International*. 2010; https://doi.org/10.1108/13620431011053749

[30] Hayes, A. F. Partial, conditional, and moderated moderated mediation: Quantification, inference, and interpretation. *Communication monographs*. 2018; *85*(1), 4-40. https://doi.org/10.1080/03637751.2017.1352100

[31] Preacher, K. J., Rucker, D. D., & Hayes, A. F. Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate behavioral research*. 2007; *42*(1), 185-227. https://doi.org/10.1080/00273170701341316

Chapter 12

Emotional Intelligence as a Haruspex of Societal Aftermath in Adults with Asperger Syndrome

Anjali Daisy

Abstract

Asperger's syndrome is not a learning disability and it has features of autism spectrum disorder, nonverbal learning disabilities and ADHD. Asperger syndrome in the context of the domains within which some of those characteristics occur. To begin with social interaction and then move to language and then move to other "in the social interaction domain. Individuals with Asperger's syndrome tend to have limited and sometime inappropriate kinds of behaviours in the social interaction domain. They have difficulties with nonverbal communication For example they have hard time reading gestures or facial expressions and sometimes their gesture and facial expressions, don't communicate what it is that they're thinking and feeling they often have difficulties understanding emotional cues so they miscue when listening to someone or watching somebody they may then say something inappropriate or they may repeat something that isn't appropriate to the situation. Because they're miss reading the social aspect of the situation or the emotional aspect of the situation. Individuals with Asperger's are often seen to have low eye contact either not making good eye contact or sustaining good eye contact and in this social interaction domain. Those with Asperger's tend also to be at risk for not having many friends, they tend to be socially isolated in the language area. Those with Asperger's often are extremely verbal, highly verbal and their language can be very sophisticated at times what they do, when they're talking is that they tend to discuss themselves and their interests and not focus on the interests of others. It can be a one-sided conversation and some of that prosody the flow the reciprocal flow between one person another can be awkward they tend to be literal in the ways that they understand language".

Keywords: emotional intelligence, Asperger syndrome, learning disability

1. Introduction

The ways that they use their voice both the tone of their voice, the pitch of their voice when they're speaking and the way that they modulate the volume of their voice can be problematic but as mentioned before those with Asperger's tend to be very sophisticated in terms of the language that they use the vocabulary and language when we think about Asperger's syndrome [1]. I listed other but can almost think of them as quirky kinds of behaviours "in the same way that individuals on the autism spectrum disorder are fascinated and focused on pieces or things

in an expanded kind of a way. Those with Asperger's tend to focus on or many have particular interests in unusual objects or topics so they may memorize the map of a subway system or they may be fascinated by the specifics of what constitutes the decorative ironwork on bridges they focus on those kinds of peculiarities and they run with them and they become quite expert at them. They exhibit often awkward body language, their posture and their movement They don't often know what they do with their hands. They stand in a funny kind of a way they may posture difficulties they may have posture difficulties or present differently in social situations that are individuals with Asperger's are also at times bothered by noise or by lights or by certain textures or intense kinds of tastes. They tend to have difficulties often in areas of motor coordination so sports can be an area of difficulty. Many individuals with autism do really well in individual sports and not so well in team sports and they tend sometimes to have difficulties not just with the coordination or the rules or the following of the interactive nature of sports but also with balance and muscle control. Individuals with Asperger's syndrome will struggle often with routines or changes in routines. They have pitfalls in transition periods moving from one activity to another and they are known often to have difficulties with the physical act of writing, the handwriting process, the motor control needed to do written expression. Those with Asperger's syndrome are almost always of at least average intelligence and they can certainly demonstrate characteristics of giftedness as I mentioned earlier Asperger's often manifests itself in features of attention deficit hyperactivity disorder Anxiety becomes an issue at certain points with individuals with Asperger's as does depression and that needs to be looked at carefully and monitored carefully. They may have some several like qualities as might those in the autism spectrum disorder category and as mentioned earlier they may also be referred to at times as high functioning autistics".

2. Social: emotional deficits in Asperger syndrome

Youngsters and youthful grown-ups with Asperger's are the same—aside from they might be more powerless against enraptured considering. These passionate direction troubles come from contrasts profound inside their brains, alongside other phenomenal blessings [2], for example, solid consideration abilities or elevated visual and sound-related detail. The cost of this blessing may show up as restrictions in the capacity to see the ten thousand-foot view and the social subtlety (or hazy areas) of a circumstance [3]. This implies numerous Asperger's are vulnerable to surveying every day knocks out and about of life as settled, as opposed to adaptable. Those with Asperger's face challenges that would undermine anybody's capacity to remain sincerely managed and adaptively issue fathom notwithstanding a harsh circumstance.

The ability to think outside about the crate, identify with the mental states and expectations of others around them (emotional Theory of Mind) viably verbalise his or her own particular passionate encounters [4]. Moreover, in light of the fact that this kid or youthful grown-up has authentic difficulties in emoting and verbally communicating their own particular passionate experience, their parent or guardian's capacity to help in co-directing them from early stages and toddlerhood ahead may likewise have been weakened [5].

3. Asperger disorder and non-verbal learning disability

Asperger's syndrome and nonverbal learning disabilities and do a bit of a comparison since those two terms and these two conditions are very often confused

and in fact share many characteristics in common so let us begin with a little bit of a refresher about Asperger's syndrome and nonverbal learning disabilities and for a deeper dive a closer look at each of these [6], when we think about Asperger's syndrome we think about individuals who have very strong visual spatial thinking and learning abilities these are individuals who often are very attentive to detail these strong vocabularies they have speech language development that's somewhat robust. They often exhibit very intense and narrow focus on particular types of objects or subjects topics and we do see in Asperger's syndrome individuals some repetitive behaviours different from Asperger syndrome. Those individuals different from the visual thinking strengths that those with Asperger's have [1]. These are individuals who have very strong auditory skills They're good auditory listeners good auditory thinkers and learners a little bit confusing because the title says nonverbal learning disabilities when in fact that's their area of strength. The verbal areas in fact where they often have some of their strongest skills these are individuals who in the auditory domain in the listening domain have very good attention skills they are able to concentrate for long periods of time they have good receptive [7] or listening vocabularies and they have very good auditory memory skills listening skills often these individuals with nonverbal learning [8] disabilities are very strong and reading and often in spelling as well it's in the areas of written expression and often in the handwriting the actual act of writing and also in the areas of math where they struggle individuals with nonverbal learning disabilities like those with [9] Asperger's often pay attention to detail but not so much as a fascination or a preoccupation and these individuals with nonverbal LD rarely exhibit the kinds of rituals that we associate with other kinds of disorders they have some functional routines things that they do to help them along to do things but they often do not exhibit [10] what we refer to as non-functional routines so here are some of the differences between Asperger's and nonverbal learning disabilities as two different types of disorder but what are some of the shared characteristics [11] and here's where this here's why there's often confusion about these two disorders and they are sometimes thought about interchangeably both individuals with Asperger's [12, 13] and nonverbal learning disabilities often struggle in the area of eye contact there sometimes and often literal thinkers they do not read between the lines they miss innuendo in the ways [14] that things are communicated to them. They struggle with social reciprocity the give-and-take in social situations that makes for conversation and a relaxed social rapport they are at risk for anxiety and depression more so than many other kinds of individuals [15] who have learning and behavioural issues. There is a motor skill delay and even if there's ketchup very often individuals with Asperger's and nonverbal learning disabilities will maintain a sense of motor awkwardness about them both of these types of individuals often have difficulty understanding social cues [16, 17] and reading body language they may and often do struggle with changes in routine and have difficulties during periods of transition they often struggle with spatial relationships sort of figuring out where they are supposed to go to the left to the right how far is it, how long does it take their empathy and their social judgement [18] can be areas of concern because of some of these language and social kinds of issues some of these eye contact issues some of these social reciprocity issues it's often hard for them to establish and maintain productive peer relationships and another aspect of that peer interaction is impacted by difficulties that they have in shared enjoyment or interest in others often [19] what they'll talk about is something that they are very much focused on but it's hard for them to read whether the person who they are talking to is similarly interested in what they are interested at the same time when we think about Asperger's syndrome and nonverbal learning disabilities.

4. EI: a promising approach

The social shortfalls in AS cannot be sufficiently clarified by existing speculations, for example, ToM and EF. Therefore, it will be useful to investigate substitute builds that hold guarantee to upgrade comprehension of the social association issues of people with AS. Passionate knowledge (EI) is a developing build which has as of late been shown to foresee fruitful social interactions, informal community measure [20], and life fulfilment. These results are of enthusiasm for people with AS. "While EI has for quite some time been in people in general eye, two models win in the exploration writing and have been exhibited to be unmistakable in conceptualization and shape. The capacity EI approach conceptualises EI as the subjective reaction to enthusiastic data. In this approach, EI is measured utilising execution tests. Interestingly, the quality EI approach portrays EI as a progression of related skills in feeling related ranges that may incorporate attributes, for example, good faith, mindfulness, confidence, and self-completions. This conceptualization of EI ordinarily utilises self-report in the estimation of the develop Capacity EI is conceptualised as a between related arrangement of psychological capacities, abilities, or limits that include: perceiving the implications of feeling; perceiving the mind boggling connections amongst feelings; and, thinking and critical thinking on the premise of this data. Capacity EI has been appeared to be unmistakable from identity and IQ and is prescient of social aberrance Self-report capacity EI anticipated life fulfilment and showed incremental legitimacy over identity This preparatory proof recommends that capacity EI predicts critical results, well beyond that which is anticipated by identity measures Assist, Ability EI emphatically associates with self-announced compassion, life fulfilment, and self-revealed relationship quality Once more, it shows up there is adequate confirmation to demonstrate that this type of EI gives data well beyond conventional identity or IQ [21, 22] and that it can represent numerous vital results that conceivable identify with effective social associations Quality EI is thought to be a dispositional propensity like identity which can be evaluated without anyone else's input report poll While a typical feedback of the characteristic EI approach is that it is too firmly identified with identity to give any novel data, late reviews have demonstrated that attribute EI shows incremental legitimacy over identity in the forecast of life fulfilment, informal community quality, dejection, and melancholy inclination Assist, relationship between quality EI and alexithymia, mental misery, and depression have been illustrated Finally, factor examination of quality EI has uncovered that the Eysenck Personality Scales and the Five Factor Model of Personality uncover an unmistakable EI calculate [23] Thus, it shows up there is adequate proof to demonstrate that attribute EI tests measure some part of mental prosperity past that of identity measures.

5. Conclusion

While Asperger himself noticed a "discord of perception and influence" for the people he considered, and numerous others have noted issues in passionate preparing for this gathering, little exertion has been made to archive a connection between emotional handling and challenges in social association for those with AS. Contemplate 1 showed that attribute EI was altogether impeded while capacity EI was in place in the AS gathering. Examination of branch results for capacity EI uncovered data about territories of quality that have suggestions for mediation design. Specifically, the AS gathering showed in place psychological abilities in connection to passionate data. In any case, a similar gathering likewise revealed weakened execution [24] in passionate collaborations, all things considered,

settings. At last, the consequences of the previously mentioned review uncovered that EI anticipated vital social results for the AS gathering. In this manner, utilising capacity and characteristic EI approaches together gives a multidimensional way to deal with evaluation, which thusly has suggestions for mediation. While the examination of EI uncovered vital data for mediations, an investigation of ToM and EF together with EI may enhance the forecast of social results and educate appraisal hones for those with AS.

Author details

Anjali Daisy
SASTRA Deemed University, Thanjavur, Tamil Nadu, India

*Address all correspondence to: anjalidaisy@sastra.ac.in

References

[1] Attwood, T. (2000). Strategies for improving the social integration of children with Asperger syndrome. Autism, 4, 85-100.

[2] Bowler, D. M. (1992). "Theory of mind" in Asperger's syndrome. Journal of Child Psychology and Psychiatry and Allied Disciplines, 33, 877– 893.

[3] Berthoz, S., & Hill, E. L. (2005). The validity of using self-reports to assess emotional regulation abilities in adults with autism spectrum disorders. European Psychiatry, 20, 291-298.

[4] Brackett, M.A., Rivers, S. E., Shiffman, S., Lerner, N., & Salovey, P. (2006). Relating emotional abilities to social functioning: A comparison of selfreport and performance measures of emotional intelligence. Journal of Personality and Social Psychology, 91, 780 –795.

[5] Brackett, M. A., Mayer, J. D., & Warner, R. M. (2004). Emotional intelligence and its relation to everyday behaviour. Personality & Individual Differences, 36, 1387-1402.

[6] Ganon, N., & Ranzijn, R. (2005). Does emotional intelligence predict unique variance in life satisfaction beyond IQ and personality? Personality & Individual Differences, 38, 1353-1364.

[7] Austin, E. J., Saklofske, D. H., & Egan, V. (2005). Personality, well-being, and health correlates of trait emotional intelligence. Personality & Individual Differences, 38, 547-558.

[8] Barnhill, P. (2001). Social attributions and depression in adolescents with Asperger syndrome. Focus on Autism and other Developmental Disabilities, 16, 46 –53.

[9] Aydemir, O. (2000). Rating depression in patients with alexithymia: Self-report scale versus observer rated scale. Turkish Psikiyatri Dergisi, 11, 127-130.

[10] Bellini, S. (2006). The Development of social anxiety in adolescents with autism spectrum disorders. Focus on Autism and Other Developmental Disabilities, 21, 138 –145.

[11] Baron-Cohen, S., O'Riordan, M., Stone, V., Jones, R., & Plaisted, K. (1999). Recognition of faux pas by normally developing children and children with Asperger syndrome or high-functioning autism. Journal of Autism and Developmental Disorders, 29, 407– 418.

[12] Brackett, M. A., & Mayer, J. D. (2003). Convergent, discriminant, and incremental validity of competing measures of emotional intelligence. Personality and Social Psychology Bulletin, 29, 1147-1158.

[13] Campbell, D. T., & Fiske, D. (1959). Convergent and discriminant validation by the multi-traitmultimethod matrix. Psychological Bulletin, 56, 81– 105. 34, 1327-1350.

[14] Bar-On, R. (2003). How important is it to educate people to be emotionally and socially intelligent, 578 / Education and Training in Autism and Developmental Disabilities-December 2010 and can it be done? Perspectives in Education, 21(4)

[15] Campbell, J. M. (2005). Diagnostic assessment of Asperger's Disorder: A review of five third-party rating scales. Journal of Autism and Developmental Disorders, 35, 25-35.

[16] Bar-On, R. (2002). BarOn Emotional Quotient Inventory Short Form (EQ-i:S), Technical Manual. Toronto: ON: Multi-health Systems.

[17] Bar-On, R. (1997). Bar-On Emotional Quotient Inventory (EQ-i): Technical Manual. Toronto, ON: MultiHealth Systems.

[18] Forgas, J. (2008). Affect and Cognition. Perspectives on Psychological Science, 3, 94 –101. Frith, U. (Ed.). (1991). Autism and Asperger Syndrome. New York: Cambridge University Press.

[19] Ehlers, S., Nyden, A., Gillberg, C. L., Sandberg, A. D., Dahlgren, S. O., Hjelmquist, E., et al. (1997). Asperger syndrome, autism and attention disorders: A Comparative study of the cognitive profiles of 120 children. Journal of Child Psychology and Psychiatry and Allied Disciplines, 38, 207-217.

[20] Austin, E. J., & Saklofske, D. H. (2005). Far too many intelligences? On the commonalities and differences between social, practical, and emotional intelligence. In R. Schultz & R. D. Roberts (Eds.), The International Handbook of Emotional Intelligence. Gottingen, Germany: Hogrefe.

[21] Baron-Cohen, S. (2003). The essential difference: The truth about the male and female brain. New York: Basic Books. Baron-Cohen, S. (1995). Mindblindness: An essay on autism and theory of mind. Cambridge, MA: MIT Press.

[22] Baron-Cohen, S., & Wheelwright, S. (2004). The Empathy Quotient: An investigation of adults with asperger syndrome or high functioning autism, and normal sex differences. Journal of Autism and Developmental Disorders, 34, 163-175.

[23] Baron-Cohen, S., Jolliffe, T., Mortimore, C., & Robertson, M. (1997). Another advanced test of theory of mind: Evidence from very high functioning adults with autism or Asperger syndrome. Journal of Child Psychology and Psychiatry, 38, 813– 822.

[24] vidya bhagat, joash jayaraj, mainul haque(2015) parent's self-efficacy, emotionality, and intellectual ability impacting the intervention of autism spectrum disorders: a review proposed model for appraisal of intervention, International Journal of Pharmacy and Pharmaceutical Sciences Vol 7, Issue 11, 2015 Page: 7-12

Chapter 13

Critical Dimensions of EQ among Malay Women Entrepreneur in Malaysia

Nazatul Shima Abdul Rani, K. Sarojani Devi Krishnan, Zurinah Suradi and Nurita Juhdi

Abstract

This paper highlights the dimensions of emotional quotients (EQ) of Malay women entrepreneurs who own either micro enterprises or small and medium size enterprises in Klang Valley, Malaysia. EQ comprise of five dimensions which are social skills, self-awareness, self-regulation, self-motivation, and empathy. About 1000 questionnaires were distributed around Klang Valley, Malaysia, with a 20% response rate. Out of 200, only 169 questionnaires were able to be used for the analysis of this study. The findings show that the most important dimension of EQ during economic crisis was self-regulation followed by self-motivation, empathy, social skills, and self-awareness. After the economic crisis, the most important dimension was self-awareness followed by social skills, self-motivation, self-regulation, and empathy. Hence, emotional quotients are important for Malay women entrepreneurs during the economic crisis to remain positive and endure business challenges in managing their business operations for business sustainability. The findings also highlighted that after the economic crisis, the focus was more towards facing business challenges from employees, customers, and other stakeholders due to increasing demand in products/services and business activities. To conclude, all the elements of each dimension were considered important for Malay women entrepreneurs during and after the economic crisis.

Keywords: Malay, women, entrepreneurs, EQ, Malaysia

1. Introduction

According to the former Malaysian Prime Minister, Tun Dr. Mahathir Mohamad, he stated that with the implementation of National Entrepreneurship Policy, Malaysia is expected to be a true entrepreneurial nation by 2030 [1]. Entrepreneurship is an ongoing process for business continuity and development that contributes to the economic development process of a country. In Malaysia, entrepreneurship is an area that can enhance the quality of life of women, in particular single mother [2].

According to the Department of Statistics Malaysia, the Malaysian population in 2020 is estimated to be 32.7 million as compared to 32.5 million in 2019. Overall, there are more males than females. Based on the report released on July 2020, the male population which is about16.8 million outnumbered females which is only

15.9million in 2020. The Malay is the majority of Bumiputera (native people) population, was the highest with 69.3 percent in 2019 and it is estimated that there would be an increase by 0.03 percent in 2020 [3]. However, in the economic sector, the Malays, being the majority did not perform in parallel with the total population [4].

The Chinese community has been monopolizing more than 50 percent of the economic activity in Malaysia [4]. Thus, the Malaysian government has made many initiatives to encourage more Malay or Bumiputra (native people) to become entrepreneurs [5]. Past literatures highlighted that the Malaysian government has been very concerned about developing and promoting entrepreneurship especially for women entrepreneurs [6, 7].

Hence, it is about time to further explore the emotional quotients of Malay women entrepreneurs who face business challenges in Malaysia. Thus, the purpose of this study is to investigate the important elements and dimensions of Emotional Quotients among Malay women entrepreneurs during the economic crisis and after the crisis which contribute towards business sustainability.

2. Literature review

This section discusses Malay women entrepreneurs, and emotional quotients.

2.1 Malay women entrepreneurs

The inherent attitude of a patriarchal society which claims that men are superior to women and that women are best suited to play the reproductive roles pose significant challenges for Malay Muslim women entrepreneurs [7]. Malay women entrepreneurs also must face many challenges in the business and economic sector as this field is monopolized by males and other ethnics in Malaysia [4].

In support of the inclusion of women in economic activities, the 2021 budget highlights several initiatives to provide for women entrepreneurs. Among the allocations given are RM 95 million for special micro financing through Tekun, Mara and Agrobank for women entrepreneurs [8].

However, with the advancement of technology nowadays, there are many opportunities and platforms to encourage women participation in entrepreneurship activities. For example, recent studies point out that a large portion of new entrepreneurs on the Shopee platform are women and they are a strong force in driving rural entrepreneurs [9]. Thus, with the presence of social media and e-commerce platform today, Malay women entrepreneurs will be able to grow in this field along with males and other ethnics in Malaysia.

2.2 Emotional quotients

Emotional Quotient (EQ) can be defined as the competence of a person to understand one's own emotions with respect to other people emotions and it can be learnt or nurtured [10, 11]. Emotional quotients consist of five major dimensions which are self-awareness, self-regulation, self-motivation, empathy, and social skills [12]. The first dimension, self-awareness can be defined as the skills to evaluate, judge, and comprehend emotions, and internal issues. The second dimension is self-regulation that can be defined as the skills to manage and regulate one's own impulses and emotions. The third dimension is self-motivation which are skills related to goals attainment, that includes passion and enjoyment with work-related challenges. The fourth dimension is empathy while the fifth dimension is social

awareness which are skills related to understanding other people's emotions and reacting to the emotions. The last dimension is social skills that can be defined as the skills in communication that are able to inspire and influence others to get a favorable response from them [13, 14].

Hence, an entrepreneur must have high EQ due to the nature of the business that requires them to deal with employees, customers, suppliers etc. on a daily basis. Those high in EQ able to work effectively in teams and can build strong social capital in the company that improve business performance. Moreover, EQ has a direct relationship with job efficiency, operational success, and leadership [15–17].

Thus, it is highly critical to identify whether these dimensions of EQ are important or critical for Malay women entrepreneurs during and after economic crises.

3. Methodology

This section focuses on a brief discussion on sampling and data collection, questionnaires development, ethical considerations, and reliability analysis.

3.1 Sampling and data collection

About 1,000 questionnaires were distributed in Klang Valley to micro and small medium enterprises business owners consisting of Malay women entrepreneurs. The questionnaires were collected after seven days. About 200 Malay women entrepreneurs participated in the survey at 20% response rate, However, only 169 questionnaires were deemed complete and usable for analysis. The remaining 31 questionnaires could not be used due to incomplete information in Section B.

3.2 Questionnaire development

The questionnaires comprised of two sections which are Section A and Section B. Section A uses nominal scale to identify information related to respondent personal information and business information. Meanwhile, Section B is on items for each emotional quotient (EQ) dimensions which are self-awareness (5 items), self- regulation (5 items), self-motivation (5 items), empathy (5 items), and social skills (7 items). Five-point Likert scale was used to measure the respondents' agreement with the statements for each item, with 1 for Strongly Disagree, 2 for Disagree, 3 for Neutral, 4 for Agree, and 5 for Strongly Agree.

3.3 Ethical consideration

The challenges faced during the data collection were due to the hectic schedule and availability of Malay women entrepreneurs to respond to the survey. Nevertheless, they were given freedom to respond to the survey at their convenience. They were not forced to participate or respond to the study.

3.4 Reliability analysis

The reliability analysis were performed using SPSS Software on each dimension of emotional quotients was noted to be within the acceptable range of between 0.7 and 0.8 (refer to **Table 1**). The Cronbach Alpha value for self-awareness $\alpha = 0.707$ during crisis and $\alpha = 0.734$ after crisis (5 items). The scale statistics for self-awareness during crisis is a mean of 20.57 with variance of 5.09, and standard

	During Crisis		After Crisis	
	Total Items	Cronbach's Alpha	Total Items	Cronbach's Alpha
Self-Awareness	5	0.71	5	0.73
Self-Regulation	5	0.80	5	0.76
Self-Motivation	5	0.72	5	0.71
Empathy	5	0.71	5	0.75
Social Skills	7	0.71	7	0.73

Table 1.
Reliability analysis results.

deviation of 2.26. Meanwhile, after crisis the mean is 20.89 with variance of 4.42 and standard deviation of 2.11.

Self-regulation α = 0.80 during crisis and α = 0.76 after crisis (for 5 items). The scale statistics for self-regulation during crisis is the mean of 21.62 with a variance of 5.713 and standard deviation is 2.39. After crisis, the mean for self-regulation after crisis is 20.25 with a variance of 5.21 and standard deviation 2.28.

Self-motivation α = 0.717 during crisis and α = 0.714 after crisis (5 items). The scale statistics during crisis for motivation skills shows a mean of 21.06 with variance of 4.33 and standard deviation of 2.08, and after crisis with a mean of 20.79, variance 4.213 and standard deviation 2.05.

As for the empathy dimension the mean is 20.80 with variance 4.37, and standard deviation of 2.09, whereas after the crisis the mean is 20.24 with variance 3.97 and standard deviation of 1.99.

Social Skills α = 0.716 during crisis and α = 0.73 after crisis (7 items). For social skills dimension, during the crisis the mean is 29.10 with variance 6.97 and standard deviation of 2.64, and for after crisis the mean is 29.14 with variance 5.80 and standard deviation of 2.41.

Hence, since all items have high internal consistency, none of the items were deleted, and all items are considered reliable.

4. Analysis and findings

This section is a brief discussion on the respondent profiles, descriptive analysis of the items in each dimension, and correlation analysis between the dimensions, and correlation of EQ with business sustainability and profitability.

4.1 Respondent profiles

In **Table 2**, 169 Malay women entrepreneurs responded to the survey with about 10.1% aged from 20 to 30 years old, 35.5% between 31 to 40 years old, 33.7% between age 41 and 50 years old, and 20.7% aged more than 50. In terms of education of the respondents, about 29% of Malay women entrepreneurs had a qualification of PMR, 31.4% with SPM, 24.9% with Diploma, 5.9% with Bachelor's degree, and 8.9% with either a Master or PhD.

The business have been in operation around 11 to 15 years for 39.1% of the entrepreneurs, 6 to 10 years for 22.5%, 16 to 20 years for 17.8%, 3 to 5 years for 15.4%, and more than 20 years for about 5.3%. In terms of types of business ownership, about 87% were classified as sole proprietorship, 8.9% partnership, and 4.1% private limited.

Age	**N**	**%**	**Education Background**	**N**	**%**
20–30 years old	17	10.1	PMR	49	29.0
31–40 years old	60	35.5	SPM	53	31.4
41–50 years old	57	33.7	Diploma	42	24.9
More than 50 years old	35	20.7	Bachelor's Degree	10	5.9
			Master and above	15	8.9
Total	**169**	**100**	**Total**	**169**	**100**
Years in Business	**N**	**%**	**Types of Ownership**	**N**	**%**
3–5 years	26	15.4	Sole proprietorship	147	87.0
6–10 years	38	22.5	Partnership	15	8.9
11–15 years	66	39.1	Private Limited	7	4.1
16–20 years	30	17.8			
More than 20 years	9	5.3			
Total	**169**	**100**	**Total**	**169**	**100**
Number of Employees	**N**	**%**	**Financial Loan**	**N**	**%**
1–5 employees	7	4.1	No	28	16.6
6–10 employees	132	78.1	Yes	141	83.4
11–15 employees	30	17.8			
Total	**169**	**100**	**Total**	**169**	**100**
Sustainable for next 20 years	**N**	**%**	**Business will sustain forever**	**N**	**%**
No	0	0	No	27	16.0
Yes	169	100	Yes	142	84.0
Total	**169**	**100**	**Total**	**169**	**100**
Profit Last Year	**N**	**%**	**Profit Next Year**	**N**	**%**
No	128	75.7 24.3	No	146 23	86.4
Yes	41		Yes		13.6
Total	**169**	**100**	**Total**	**169**	**100**

Table 2.
Respondents' profiles.

The number of employees who worked for the women entrepreneurs were about 4.1% with 1 to 5 employees, 78.1% with 6 to 10 employees, and 17.8% with 11 to 15 employees. About 83.4% had loans, and 100% believed their business will sustain for next 20 years, 84% will sustain forever, while about 75.7% did not earn profit last year, and 86.4% also were expecting not to earn profit the following year.

4.2 Descriptive analysis on items for EQ dimensions

This section briefly discusses the descriptive analysis of each item in self-awareness, self-regulation, self-motivation, empathy, and social skills.

4.2.1 Self: Awareness: During and after crisis

All items for self-awareness are important during and after economic crisis (refer **Table 3**). However, the top three most critical elements are self-control and tasks control (mean = 4.20; s.d. = 0.62), confident in managing business (mean = 4.14; s.d. = 0.70), and confident and have pride with the business (mean = 4.11; s.d. = 0.64) during economic crisis. After economic crisis are confident and have pride with the business (mean = 4.21; s.d. = 0.64), confident and

Items Self- Awareness	During Crisis		After Crisis		N
	Mean	Std. Deviation	Mean	Std. Deviation	
Confident with own decision.	4.07	0.67	***4.17***	0.56	169
Self-control and tasks control.	***4.20***	0.62	4.16	0.57	169
Confident in managing the business.	***4.14***	0.70	4.14	0.62	169
Confident and work hard for the business.	4.05	0.69	***4.21***	0.63	169
Confident and have pride with the business.	***4.11***	0.64	***4.21***	0.64	169

Table 3.
Descriptive analysis – Self-awareness.

Items Self-Regulation	During Crisis		After Crisis		N
	Mean	Std. Deviation	Mean	Std. Deviation	
Ethical in managing the business.	***4.40***	0.65	3.93	0.62	169
Patient in facing business challenges.	4.24	0.61	***4.17***	0.65	169
Fair in managing the business.	***4.41***	0.63	***4.09***	0.65	169
Multitasking and good in time management.	4.22	0.65	3.97	0.64	169
Objective in managing the business.	***4.35***	0.66	***4.09***	0.64	169

Table 4.
Descriptive analysis – Self-regulation.

work hard for the business (mean = 4.21; s.d. = 0.63), and confident with own decision (mean = 4.17; s.d. = 0.56).

4.2.2 Self-regulation – During and after crisis

All elements for self-regulation are critical during and after economic crisis (refer **Table 4**). However, the top three most critical elements during economic crisis are fair (mean = 4.41; s.d. = 0.63), ethical (mean = 4.40; s.d. = 0.65), and objective (mean = 4.35; s.d. = 0.66) in managing business. Whereas, after economic crisis are patient (mean = 4.17; s.d. = 0.65), fair (mean = 4.09; s.d. = 0.65), and objective (mean = 4.09; s.d. = 0.64) in managing business.

4.2.3 Self-motivation – During and after crisis

All elements for self-motivation are important during and after economic crisis (refer to **Table 5**). The findings shows that the top three most important elements during crisis are controlling operation cost (mean = 4.25; s.d. = 0.65), enduring all challenges to keep positive business culture (mean = 4.25; s.d. = 0.62), and positive in facing business challenges (mean = 4.21; s.d. = 0.60). Meanwhile, after crisis the top three most important elements are keeping employee interest in any circumstances (mean = 4.21; s.d. = 0.65), controlling operation costs (mean = 4.18; s.d. = 0.60), and ensuring business operation run smoothly (mean = 4.17; s.d. = 0.60).

4.2.4 Empathy – During and after crisis

All elements for empathy are important as seen in **Table 6** that shows all the mean scores are above 4.00 out of 5-point Likert scales. The top three most important elements during business crisis are understanding problem faced by employees

Items – Self-Motivation	During Crisis		After Crisis		N
	Mean	Std. Deviation	Mean	Std. Deviation	
Positive in facing business challenges.	**4.21**	0.60	4.14	0.57	169
Ensure my business operation run smoothly.	4.19	0.55	**4.17**	0.60	169
Endure all challenges to keep positive business culture.	**4.25**	0.61	4.10	0.60	169
Control operation cost in enduring business challenges.	**4.25**	0.65	**4.18**	0.60	169
Keep employee interest in any circumstances.	4.15	0.63	**4.21**	0.65	169

Table 5.
Descriptive analysis – Self-motivation.

Items Empathy	During Crisis		After Crisis		N
	Mean	Std. Deviation	Mean	Std. Deviation	
Cautious on ethical business issues and know how to face it.	**4.14**	0.60	4.02	0.57	169
Empathize on others and fully understand their situation.	4.11	0.62	**4.12**	0.58	169
Ensure family matters given priority and allow employee to settle their family matters.	**4.21**	0.59	**4.05**	0.60	169
Understand the problem faced by employees and give them time to solve it.	**4.25**	0.63	**4.05**	0.50	169
Put initiatives to help employees.	4.09	0.64	4.01	0.58	169

Table 6.
Descriptive analysis – Empathy.

and give them time to solve it (mean = 4.25; s.d. = 0.63), ensuring family matters given priority (mean = 4.21; s.d. = 0.59), and being cautious on ethical business issues and know how to face it (mean = 4.14; s.d. = 0.60). However, after business crisis, it is critical to empathize on others and fully understand their situation (mean = 4.12; s.d. = 0.58), ensure family matters given priority (mean = 4.05; s.d. = 0.60), and understanding the problem faced by employees (mean = 4.05; s.d. = 0.50).

Items – Social Skills	During Crisis		After Crisis		N
	Mean	Std. Deviation	Mean	Std. Deviation	
Use negotiation techniques to get cooperation.	**4.20**	0.63	4.10	0.53	169
Give full attention when communicating.	4.12	0.64	**4.18**	0.55	169
Give full attention in giving inspiration.	4.08	0.66	**4.18**	0.56	169
Evaluate abilities in communication.	4.15	0.57	4.17	0.56	169
Evaluate abilities to inspire others.	4.15	0.65	**4.20**	0.57	169
Special unit to manage communication.	**4.21**	0.62	4.16	0.55	169
Special unit to inspire others.	**4.20**	0.61	4.14	0.58	169

Table 7.
Descriptive analysis – Social skills.

4.2.5 Social skills – During and after crisis

All elements for social skills are important during and after crisis (refer to **Table 7**). However, the top three most important elements during crisis are special unit to manage communication (mean = 4.21; s.d. = 0.62), negotiation techniques to get cooperation (mean = 4.20; s.d. = 0.63), and special unit to inspire others (mean = 4.20; s.d. = 0.61) as critical during business crisis. However, after crisis the top three most important elements are evaluation on abilities to inspire others (mean = 4.20; s.d. = 0.57), give full attention in giving inspiration (mean = 4.18; s.d. = 0.56), and give full attention when communication (mean = 4.18; s.d. = 0.55).

4.3 Correlation analysis

This section is a brief discussion on the dimensions for EQ during and after economic crisis.

4.3.1 Correlation for the five dimensions of EQ during economic crisis

The most important dimension for EQ during economic crisis is Self-regulation (mean = 4.32; s.d. =0.48), followed by Self-Motivation (mean = 4.21; s.d. = 0.42), Empathy (mean = 4.16; s.d. = 0.42), Social skills (mean = 4.16; s.d. = 0.37), and Self-Awareness (mean = 4.11; s.d. = 0.45) (refer **Table 8**).

From the Pearson Correlation (refer to **Table 9**), none of the dimensions have any relationship, hence, during economic crisis, all dimensions for EQ on its own and not related to each other.

	Mean	Std. Deviation	N
DEQSA	4.11	0.45	169
DEQSR	4.32	0.48	169
DEQSM	4.21	0.42	169
DEQE	4.16	0.42	169
DEQSS	4.16	0.37	169

Table 8.
Descriptive analysis result for DEQ.

		DEQSA	DEQSR	DEQSM	DEQE	DEQSS
DEQSA	Pearson Correlation	1	0.133	−0.071	0.058	0.055
	Sig. (2-tailed)		0.084	0.361	0.454	0.476
	N	169	169	169	169	169
DEQSR	Pearson Correlation	0.133	1	0.036	0.067	−0.123
	Sig. (2-tailed)	0.084		0.645	0.385	0.111
	N	169	169	169	169	169
DEQSM	Pearson Correlation	−0.071	0.036	1	0.101	−0.068
	Sig. (2-tailed)	0.361	0.645		0.191	0.378
	N	169	169	169	169	169

		DEQSA	DEQSR	DEQSM	DEQE	DEQSS
DEQE	Pearson Correlation	0.058	0.067	0.101	1	−0.008
	Sig. (2-tailed)	0.454	0.385	0.191		0.915
	N	169	169	169	169	169
DEQSS	Pearson Correlation	0.055	−0.123	−0.068	−0.008	1
	Sig. (2-tailed)	0.476	0.111	0.378	0.915	
	N	169	169	169	169	169

Table 9.
Correlations analysis result for DEQ elements.

4.3.2 Correlation for the five dimensions of EQ after economic crisis

The most important dimensions for EQ are Self-Awareness (mean = 4.18; s.d. = 0.42), Social Skills (mean = 4.16; s.d. = 0.34), Self-Motivation (mean = 4.16;

	Mean	Std. Deviation	N
AEQSA	4.18	0.42	169
AEQSR	4.05	0.45	169
AEQSM	4.16	0.41	169
AEQE	4.05	0.39	169
AEQSS	4.16	0.34	169

Table 10.
Descriptive analysis result for AEQ.

		AEQSA	AEQSR	AEQSM	AEQE	AEQSS
AEQSA	Pearson Correlation	1	0.046	***0.196****	−0.134	−0.135
	Sig. (2-tailed)		0.557	***0.011***	.082	0.081
	N	169	169	***169***	169	169
AEQSR	Pearson Correlation	0.046	1	0.021	0.102	−0.145
	Sig. (2-tailed)	0.557		0.784	0.188	0.060
	N	169	169	169	169	169
AEQSM	Pearson Correlation	***0.196****	0.021	1	0.068	−0.042
	Sig. (2-tailed)	***0.011***	0.784		0.382	0.584
	N	***169***	169	169	169	169
AEQE	Pearson Correlation	−0.134	0.102	0.068	1	0.032
	Sig. (2-tailed)	0.082	0.188	0.382		0.684
	N	169	169	169	169	169
AEQSS	Pearson Correlation	−0.135	−0.145	−0.042	0.032	1
	Sig. (2-tailed)	0.081	0.060	0.584	0.684	
	N	169	169	169	169	169

**Correlation is significant at the 0.05 level (2-tailed).*

Table 11.
Correlations analysis result for AEQ elements.

s.d. = 0.41), Self-regulation (mean = 4.05; s.d. = 0.45), and empathy (mean = 4.05; s.d. =0.39) (refer **Table 10**).

The Pearson correlation analysis shows that there is only one significant relationship between self-awareness and self-motivation (*r = 0.196*; p = 0.011*) (refer to **Table 11**). Hence, those who have high self-motivation also have high self-awareness and vice-versa.

5. Discussion

Figure 1 summarizes and discusses the findings in Section 5.1 and Section 5.2.

5.1 The importance dimensions and elements for EQ during economic crisis

During the economic crisis, all dimensions of EQ are important for Malay women entrepreneurs. Firstly, most of the Malay women entrepreneurs agreed they should self-regulate by being more ethical, fair, and objective in managing their businesses when facing the economic crisis.

Secondly, most of the Malay women entrepreneurs agreed that self-motivation was highly needed in facing economic challenges to keep positive business cultures, controlling operational costs, and be positive in facing business challenges during the economic crisis.

Thirdly, empathy as the third dimension of EQ was considered to be important, whereby they need to understand problems faced by employees, prioritize family matters, and be cautious of ethical business issues.

Fourthly, for social skills, the Malay women entrepreneurs agreed that they should use special unit to communicate with employees, inspire employees,

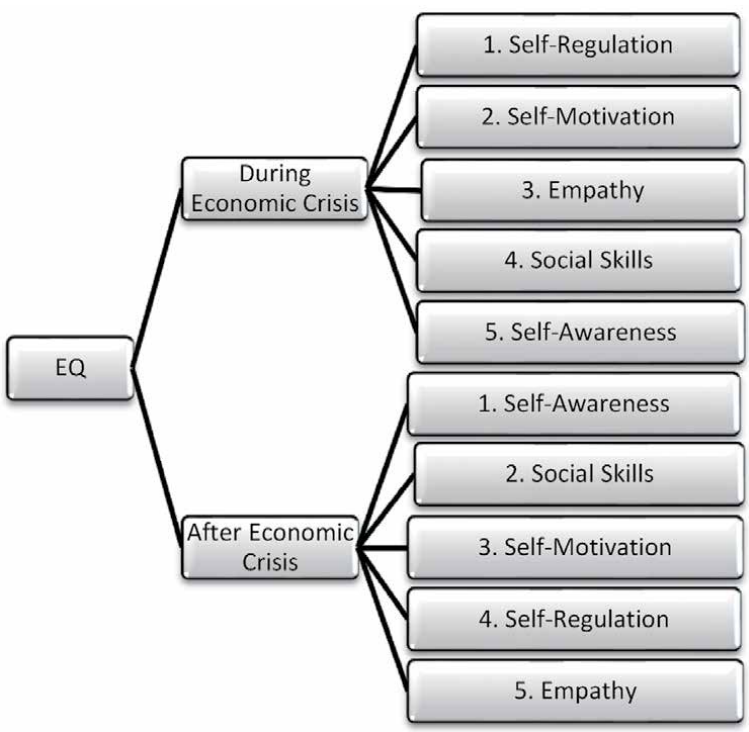

Figure 1.
Findings on important EQ dimensions during and after the economic crisis.

and use negotiation techniques to get cooperation from others (employees, customers, etc.).

Finally, self-awareness as the last dimension was also important during the economic crisis. Most of the Malay women entrepreneurs agreed that during the economic crisis they should be able to perform self-control and tasks control, be confident in managing the business, and have pride with their business to ensure business sustainability.

The top two dimensions of EQ which are Self-regulation and Self-motivation are similar with findings from previous study on women entrepreneur EQ during economic crisis [12, 15].

5.2 The importance dimensions and elements for EQ after the economic crisis

Figure 1 shows that after the economic crisis the most important dimensions in terms of the sequence also changed significantly, whereby the first dimension was self-awareness followed by social skills, self-motivation, self-regulation, and empathy. Hence, the focus of the Malay women entrepreneurs after the economic crisis was to focus more on expanding and earning more profits as compared to during the economic crisis. In short, most of the most important dimensions and elements are more focused on business sustainability.

The first dimension is self-awareness that focuses on being confident and working hard for the business followed by having confidence and pride with their business venture, and confident with the ability to make decisions as the top three elements important after the economic crisis.

The second important dimension is social skills, as agreed by most Malay women entrepreneurs where they must evaluate their abilities to inspire others, followed by the ability to give full attention when giving inspiration, and communicating with others.

The third dimension is self-motivation whereby the Malay women entrepreneurs agreed that must keep the employees' interest in any circumstances, should keep on controlling operational costs, and must ensure that the business operation runs smoothly. Thus, at this stage the focus is more on efficient business operations to serve increasing demands after the economic crisis.

The fourth dimension is self-regulation that includes having patience, being fair and objective in running the business after the economic crisis. In other words, most women entrepreneurs agreed that they must be prepared when facing stiff competition and increasing demand after the economic crisis.

The fifth or the last dimension is empathy. After the economic s crisis, it is critical to empathize on others and fully understand their situation (employees, customers, etc.), ensure family matters are given priority, and understand the problems faced by employees. In short, after the economic crisis, most Malay women entrepreneurs agreed that they must remain empathizing with employees for smooth business operations, customers for income or profit generation, and other stakeholders to sustain their business operations.

The findings of this study, quite similar with previous study in terms of the top three important dimensions of EQ and bottom two dimensions of EQ after economic crisis [12, 15].

6. Conclusion

As an entrepreneur whether male or female, they are human beings, hence they have emotions. Thus, it is pertinent for them to understand the emotional quotients or emotional intelligence in sustaining and growing their business venture [16].

Thus, this paper has highlighted the findings on emotional quotients or emotional intelligence among Malay women entrepreneurs while facing economic crisis, and after the economic crisis. These findings can be used not only for Malay women entrepreneurs but for women entrepreneurs in general. As can be seen, women entrepreneurs is more caring in terms of the top three elements for empathy has indicated women are motherly and concern of other people situation, problems, and etc. The highlight of the findings are the important dimensions during the economic crisis as agreed by most Malay women entrepreneurs who participated in this study which are self-regulation, self-motivation, empathy, social skills, and self-awareness. Whereas, after the economic crisis the most important dimensions identified are self-awareness, social skills, self-motivation, self-regulation, and empathy. In fact, after the economic crisis, the findings show those Malay women entrepreneurs with high self-awareness also have high self-motivation, and vice versa.

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Author details

Nazatul Shima Abdul Rani[1]*, K. Sarojani Devi Krishnan[1], Zurinah Suradi[2] and Nurita Juhdi[3]

1 UniKL Business School, Universiti Kuala Lumpur, Malaysia

2 Management Information Systems Department, Dhofar University, Oman

3 Kulliyyah of Economics and Management Sciences, International Islamic University, Malaysia

*Address all correspondence to: shima.rani@unikl.edu.my

References

[1] The Sun Daily (11th July 2019). Malaysia a true entrepreneurial nation by 2030. (https://www.thesundaily.my/local/malaysia-a-true-entrepreneurial-nation-by-2030-YK1095032).

[2] Yusoff SZ, Yasin YF. The Roles of Social Media in Promoting Health Products among Women Entrepreneurs in Malaysia. International Journal of Asian Social Science. 2019;9(12): 618-625.

[3] Current Population Estimates, Malaysia 2020. Department of Statistic Malaysia Website. Released : 15 July 2020. (https://www.dosm.gov.my/v1/index.php?r=column/cthemeByCat&cat=155&bul_id=OVByWjg5YkQ3MWFZRTN5bDJiaEVhZz09&menu_id=L0pheU43NWJwRWVSZklWdzQ4TlhUUT09).

[4] Mohamad M, Bakar MS. Malay Women entrepreneurial success: Challenges and barriers. International Journal of Accounting, Finance and Business. 2017; Sep;2(5):76-84.

[5] Hossain J, Jahangir N, Nur-Al-Ahad M. A Study on Female Entrepreneurs in Malaysia. Business Ethics and Leadership. 2018; 2(3): 67-73. DOI: 10.21272/bel.2(3).67-73.2018

[6] Rashid KM, Ngah HC, Mohamed Z, Mansor N. Success factors among women entrepreneur in Malaysia. International Academic Research Journal of Business and Technology. 2015;1(2):28-36.

[7] Selamat NH, Endut N. " Bargaining with Patriachy" and Entrepreneurship: Narratives of Malay Muslim Women Entrepreneurs in Malaysia. Kajian Malaysia: Journal of Malaysian Studies. 2020 Jan 2;38.

[8] The Star Online. (17 Dec 2020). Encouraging Entrepreneurship for Growth. (https://www.thestar.com.my/news/nation/2020/12/17/encouraging-entrepreneurship).

[9] The Malay Mail (8 November 2020). Shopee: Budget 2021 to facilitate the success of women entrepreneurs. (https://www.malaymail.com/news/malaysia/2020/11/08/shopee-budget-2021-to-facilitate-the-success-of-women-entrepreneurs/1920624).

[10] Surbhi S. Difference between IQ and EQ. 2016. URL address: https://keydifferences.com/differencebetween-iq-and-eq.html, Access date: 19/11/2018.

[11] Subramanian KR. Key to organizational effectiveness: Social and emotional intelligence. International Research Journal of Advanced Engineering and Science. 2016;1(4): 127-131.

[12] Rani NS, Krishnan KS, Suradi Z. Emotional Quotients During and After Economic Crises. Asia Proceedings of Social Sciences. 2018 Dec 2;2(3):19-23.

[13] FakhrEldin H. The relationship between the emotional intelligence of entrepreneurs and the new venture creation: The role of age, gender and motive. Arab Economic and Business Journal. 2017 Dec 1;12(2):99-108.

[14] Mortan RA, Ripoll P, Carvalho C, Bernal MC. Effects of emotional intelligence on entrepreneurial intention and self-efficacy. Revista de Psicología del Trabajo y de las Organizaciones. 2014;30(3):97-104.

[15] Rani NS, Krishnan KS, Suradi Z. Critical Elements of Emotional Quotients (EQ) During and After Crisis among Malay Women Food Operators in Klang Valley. International Journal of Psychosocial Rehabilitation. 2020 Feb; 24(2): 1638-1648. DOI: 10.37200/IJPR/V24I2/PR200466.

[16] Rani NS, Ahmad H. Saidun, Z. The Relationship of Emotional Quotients of UNIKL TEKNOPUTRA Alumni Entrepreneur on Business Performance. Test Engineering & Management. 2020 Jan-Feb; 82: 5622-5627.

Chapter 14

Emotional Competence of Women Administrators

Mary Grace B. Lubguban

Abstract

Leadership is a social mechanism where action toward a common goal is affected by any person or community. The organization is in trouble without effective leadership, it has been said. Any educational institution's success hinges greatly on how competent the leaders are. The research's main objective is to assess the emotional competencies of women school administrators at public and private schools in Siquijor, Central Visayas, Philippines. The study focuses on the five (5) dimensions of emotional competence which are self-awareness, self-regulation, motivation, empathy and social skills. The study was conducted to fifty-seven (57) school heads or administrators during School Year 2016–2017. The study revealed that the women administrators are all experienced and possess a high degree of emotional competence relative to their performance as leaders and administrators.

Keywords: leadership, emotional competence, women, administration, education

1. Introduction

Leadership study is often seen as a broad and generic discipline that transcends multiple fields, including the academic, political, military, industry, and corporate world, and has become a common subject among both researchers and scientists [1]. Leadership is a process that influences action toward a shared goal by any person or a community. The leaders are the ones in charge of setting the direction, and establishing policies and procedures for the institution to accomplish its objectives [2–4]. Therefore, school leaders and administrators must be proficient and competent in order to be effective and efficient leaders in their organizations. History teaches that in the past, women were treated as inferior beings and second-class people. They were taught to be docile and were taught to work only within the confines of the home. They were marginalized and considered smaller-cost commodities [5].

The teaching profession is known to be the most noble and one of the most challenging and demanding profession compared to other professions in the world. Teachers are more exposed to stress and are involved in multiple responsibilities. The school is a social institution. It is a community of mutual relationship between teachers, students and school administrators. The teachers, students as well as administrators interact as organizational members. In this sense, schools direct their efforts toward the attainment of goals and objectives and contribute to a major function of a more comprehensive system, the society [6].

The successful operation of a school depends on the good leadership and management of its administrators. Principals and school heads provide day-to-day

instructions, manage school programs and activities, provide good academic environment and promote positive growth and development for both teachers and students [7, 8].

1.2 Emotional intelligence or emotional competence: Brief background and literature review

Competence comes in various forms. Leadership in organizations requires competence and skills required in the office and position one has been placed into. Leadership studies conducted for the past decades reveal how significant and vital emotional competence is not only among leaders and administrators but all employees as well in both public and private entities for that matter. Emotional intelligence is perceived as the individual's ability to recognize and understand one's emotions and skills that one utilizes in order to manage his/her relationships with one's self and others. Academic skills and technical proficiency is not enough to achieve success in one's job duties, but it is imperative for a person to exercise self-management, self-control and effective interpersonal relationships that would contribute in achieving the desired goals and objectives. Well-developed emotional intelligence also enables managers and leaders to implement effective leadership skills on their subordinates to encourage them to give their best performance. More so, success in the workplace takes a lot more than education, book knowledge or experience [9, 10].

The concept of emotional intelligence was first introduced almost thirty years ago. Salovey and Mayer asserted that emotional intelligence is the ability to monitor one's own and other's feelings and emotions, to discriminate among them and to use this information to guide one's thinking and action [11]. The term was then popularized by Goleman in his book *Emotional Intelligence- Why is it more important than IQ?* Goleman stated that emotional intelligence entails "the ability to recognize our feelings and those of others, to motivate ourselves and to manage our inner emotions as well as those regarding others". Goleman's book argues that effective business leaders are distinguished not by their education, native intelligence or subject knowledge, but by emotional intelligence, which in the context of the workplace includes characteristics like self-awareness and self-control; the ability to communicate and influence others; and facility at building bonds and creating group synergies [12].

In 1997, Mayer and Salovey revisited the former definition of emotional intelligence and offered a more comprehensive one by stating that "emotional intelligence involves the ability to perceive accurately, appraise and express emotion, the ability to access and/or facilitate emotion, the ability to understand emotion and the ability to regulate emotions to emotional and intellectual growth [13].

Furthermore, emotional intelligence directly is a collection of competencies which allow an individual to: identify one's own emotions and those of others; accurately express one's own emotions and help others express theirs, understand one's own emotions and those of others, manage one's own emotions and adapt to those of others, use one's own emotions and kills peculiar to emotional intelligence in various areas of one's life to be able to better communicate, make good decisions, maintain good interpersonal relations and others [13].

In recent years, emotional intelligence has become a major topic of interest in scientific and academic circles. While education and experience are of great importance to success, emotional intelligence is also of great importance. Leaders ought to be able to apply abstract ideas, and bring them into action or action. Studying emotional intelligence provides leaders with the understanding to meet staff needs, maintaining a focus on high achievement for all students, and building

environments of confidence and appreciation for schools in order to develop a community that challenges the status quo and foster excellence [14].

Experts say that emotional intelligence is a very critical skill for leaders as it lets them get a better picture of their strengths and limitations without obstructing them. As a result, they are able to effectively deal with and fix issues [15, 16].

Other experts consider emotional intelligence as socio-emotional competence in the sense that the concept deals with relationship of one's self with other people, thereby calling it socio-emotional competence. It includes the capacity of a person to convey, obtain and control emotions [17, 18] as well as their success in establishing relationships and sustaining them. This also requires the knowledge and skills a person possess to make good decisions and deal critically with problems [19, 20].

In a study conducted by Hourani, Litz & Parkman (2017) results suggested that school leaders need to build and cultivate their skilled emotional intelligence despite the many job constraints and challenges in the field. They emphasized that professional learning opportunities must be recognized and built to improve schools [21]. Furthermore, a recent study was conducted to Harvard graduates of business, law, medicine, and education by Michael Akers and Grove Porter which revealed that one's EQ is more important than one's IQ in achieving success. Akers reiterated that, "As individuals, our profession's success today depends on the ability to interpret and respond appropriately to other people's signals." Both Akers and Porter have argued that EQ is more a predictor of achievement than IQ. Therefore, the study advised that one needs to develop mature EQ skills to better understand, empathize, and compromise with other people as the world becomes global [22].

Results of a study conducted to women school administrators in Siquijor, Central Visayas, Philippines share similar findings and results with the cited literature above. Lubguban (2020) explained in her study that Siquijodnon women school administrators possess high level of emotional competence in the discharge of their duties and functions as leaders. In this study, emotional competence was tested through the five (5) dimensions which are: self-awareness, self-regulation, motivation, empathy, and social skills. Peter Salovey and John D. Mayer identified these four as: perceiving emotions, reasoning with emotions, understanding emotions and managing emotions [11].

2. Results/findings

2.1 On leadership proficiency and emotional competence

The research shows that there is no significant relationship between the leadership proficiency and the emotional competence of the women school administrators. The women administrators possess a "High" level of proficiency in terms of administration, supervision, flexibility, continual learning and communication and community relations. They are "Advanced" and very proficient and most often apply the competency in considerably difficult situations and require little or no guidance. Likewise, the results suggest that the women administrators are compassionate, democratic and accommodating in their approach in treating problems and conflicts in the organization. These women leaders perform very well in their administrative duties and responsibilities. The data however, contradicts some ideas presented in other researches which prove that holding leadership roles and occupying executive Nevertheless, results of the study affirms the idea that without emotional skills, it would be very difficult for leaders to lead, inspire, and manage the complexities of being executives and administrators [23]. In addition, emotionally intelligent leaders realize and therefore build an open contact atmosphere

to participate and engage in the organization's ideal state of the future [24–26]. Likewise, school administrators who create good, trustworthy relationships with teachers and show compassion and motivation, foster positive school environments and academic results for students, and meet the emotional needs of teachers [27].

2.2 On emotional competence of women administrators

There are various problems and challenges that the women executives encounter in the workplace and in the performance of their duties and functions. Among these are family issues and concerns, lack of mentoring, low level of aspiration, negative leadership behavior exhibited by supervisors, organizational discrimination, office politics, and lack of training and development opportunities. The findings explain the significant connection between the emotional maturity of the women leaders and the degree of the severity of the problems experienced by the women administrators. Findings show that women managers have "high" ability levels in terms of self-awareness, self-regulation, motivation, empathy, and social skills. It means the managers are very motivated and guided in their work, empathetic, rational, and self-regulated individuals, mindful of their own feelings and emotions. This validates on the belief that emotional and social maturity of leaders is a crucial factor in establishing a compassionate and productive atmosphere for teachers and students alike. School heads have important impacts on many facets of their schools, including the school environment and community, the well-being and retention of staff, and the school success of the students. Leaders predominate in the organization's emotional condition. This can lead to low employee participation and low morale if they are unsuccessful. Indeed, even higher educational institutions such as colleges and universities are conscious that academic leaders require emotional intelligence [28, 29].

Leadership is a method of social contact with the capacity of the leader to control followers' behaviors. Leaders increase the unity and morale of the community by building mutual emotional interactions and affect the organization's performance. Instructional leadership and emotional ability are essential resources that help leaders create relations among followers to effectively and efficiently lead the schools [25]. School leaders and managers need to improve and cultivate their professional emotional intelligence, as many job-related constraints and challenges require the demonstration of critical emotional intelligence skills and traits, and hence the need for professional learning opportunities to encourage, enhance and promote school performance [21].

In a study conducted [30], they explained that emotional intelligence is always correlated with social competence because both are antecedents to school administrator's success. Knowing that these variables are interrelated, school administrators should be aware and highly informed to their total leadership qualities. They likewise emphasized that emotionally intelligent leaders can better understand and motivate others through the use of their feelings, impulses, and sentiments. In their study, they found out that characteristics such as compassion, feedback, commitment, empowerment, communication, inspiration were the leadership qualities that leaders must possess to be able to motivate, inspire and persuade teachers to be good followers in order to create valuable and positive change in the organization [30].

Results of a study conducted to women school administrators in Siquijor, Central Visayas, Philippines share similar findings and results with the cited literature above. In a study conducted [21] explained in her study that Siquijodnon women school administrators possess high level of emotional competence in the discharge of their duties and functions as leaders. In this study, emotional competence was

tested through the five (5) dimensions which are: self-awareness, self-regulation, motivation, empathy, and social skills. Peter Salovey and John D. Mayer identified these four as: perceiving emotions, reasoning with emotions, understanding emotions and managing emotions [11].

Self-awareness means understanding oneself – knowing one's weaknesses and limitations, strengths, drivers, and values. A self-aware and emotionally intelligent leader would plan properly and get the work done well in advance of any deadlines. It is the ability to control impulsive feelings and behaviors and manage emotions in healthy ways. A self-aware leader pays attention to nonverbal communication and focus on listening to what others have to say and look for ways to solve problems and minimize tensions [27, 31]. The women administrators possess a high level of self-awareness.

Emotionally intelligent people are also good at stepping into another person's shoes and understanding how they feel. The teachers of the public and private schools who were the subordinates of the school administrators attested that their leaders exhibited a caring and uplifting environment in spite of the many challenges and pressures in the teaching profession.

Empathy in the workplace can be done by seeing things from the other person's point of view and paying attention on how to respond to others. Being emphatic means being a good listener, open and sensitive to school and community concerns. The principals and school heads being studied are leaders of learning, open and sensitive to their subordinate's feelings and concerns.

Meanwhile, motivation is another component of emotional competence. In addition, an emotionally competent leader who possesses social skills is somebody who is able to build rapport with colleagues and communicate his/her ideas effectively. The leader shows attention, asks questions and provides feedback, and is a good team player [11].

Leaders with good social skills are able to build rapport with colleagues and are passionate and committed to their work. They have trust and respect not only to their co-equal but to everybody as well. The women executives or administrators being studied have good social skills, friendly and compassionate to their colleagues in the workplace [32, 33].

3. Conclusion

Research has shown that school leaders frequently deal with highly stressful circumstances in ways that jeopardize their ability to establish and maintain healthy relationships with stakeholders, effectively lead, create positive community relationships and support school programs. This research has shown the role and importance of emotional competence for leaders especially school administrators. Equally important is the fact that emotional competence can be cultivated and improved through professional training programs.

Awareness and awareness of one's emotions will encourage efforts by leaders to improve self-understanding and strengthen relationships with others that contribute to growth and communication. Given the challenges facing leaders in the 21st century, educating potential leaders can go a long way toward improving emotional intelligence. The foregoing findings lead to a conclusion that leadership and administration in whatever fields require high leadership proficiency and high emotional competence. Leadership proficiency and emotional competence may not be correlated at all times but emotional competence and the problems experienced by the women administrators are. Handling problems and challenges not only

in the professional duties but also in everyday life require stable emotional well-being. Knowing that these variables are interrelated, school administrators should be aware and highly informed and trained, hence the need for an enhancement program which is the output of the study.

Author details

Mary Grace B. Lubguban
Siquijor State College, Larena, Siquijor, Philippines

*Address all correspondence to: gracelubguban@gmail.com

References

[1] Turner, T. (2019). Identifying blind spots in leadership development. Handbook of Research on Strategic Communication, Leadership and Conflict Management in Modern Organizations. https://doi.org/10.4018/9781-5225-8516-9.ch010

[2] Harrison, C. (2018). Leadership theory and research: a critical approach to new and existing paradigms. Basingstoke: Palgrave, Macmillan

[3] Mason, Tanzy L. (2018). Emotionally connected: the role of emotional intelligence in the workplace. digitalcommons@georgiasouthern.edu.

[4] Abdullah, S.; Kosnin, A. & Jiar, Y. (2019). Emotional intelligence among women: a systematic review. International Journal of Engineering & Advanced Technology ISSN: 2249-8958 Vol. 8, Issue 5C, May 2019.

[5] Streibich, B. & Desjardins, C. (2019). Gender, self-image and leadership: a gender-specific comparison of the selfimage of female and male leaders. Journal of Applied Leadership and Management Vol. 7, 95-109.

[6] Zebral, L. (2017). The influence of leadership and payment for performance on individual performance. Journal of Applied Leadership and Management, Vol. 5, 76-89.

[7] Rodl, J. etal. (2018). A survey of school administrators' training and support related to evaluating special education teachers. Journal of School Administration, Research and Development, Vol. 3, No. 1.

[8] Hill, D., Woodruff, D., Meyers, C. &Zhu, G. (2018). Principal competencies that make a difference: identifying a model for leaders of school turnaround. Journal of School Leadership, Vol.28 Issue 1, 56-81

[9] Page, Michael (2020). The importance of emotional intelligence in the workplace.

[10] Landoy, L. (2019). Why emotional intelligence is important in leadership. Harvard Business School Online. April 3, 2019.

[11] Shantz, G. (2015). Improving emotional competencies of principals and vice-principals in an educational organizations: an exploratory study. eprints.usq.edu.au

[12] Akduman, G., Hatipoglu, Z. & Yuksekbilgili, Z. (2015). A research about emotional intelligence on generations. International Journal of Advanced Mulktidisciplinary Research and Review, ISSN: 2330-1201 Vol. 3, No.4, 2015

[13] Cherry, Kendra (2020). Utilizing emotional intelligence in the workplace. https://www.verywellmind.com/utilizing-emotional-intelligence-in-the-workplace-4164713

[14] Winkler, K. & Wagner, B. (2017). The relevance of knowledge management in the context of leadership. Journal of Applied Leadership and Management, (5), 104-110

[15] Mayer, J., Caruso, D., & Salovey, P. (2016). The ability model of emotional intelligence. Emotion Review. https://doi.org/10.1177/1754073916639667

[16] Hoy, W., & Miskel, C. (2013). Educational Administration, 9th ed. New York, USA: McGraw-Hill Companies

[17] Berkovich, I. & Eyal, O. (2018). The effects of principals' on teachers' emotional distress. Educational Management Administration & Leadership, 46 (2), 642-658

[18] Njoroge, C. N. & Yazdanifard, R. (2014). The impact of social and emotional intelligence on employee motivation in a multigenerational workplace. Globasl Journal of Management and Business Research: Administration and Management, 14 (13), 31-36.

[19] Yin, H. (2015). The effect of teachers' emotional labour on teaching satisfaction: moderation of emotional intelligence. Teachers and Teaching, 21 (7), 789-810.

[20] Segal, J. & Smith, M. (2020). Improving emotional intelligence (EQ). https://www.help.guide.org

[21] Hourani, R., Litz, D., & Parkman, S. (2020). Emotional intelligence and school leaders: evidence from Abu Dhabi. Educational Management Administration and Leadership. https://doi.org/10.1177/1741143220913552

[22] Korotaj, B. & Mrnjaus, K. (2019). Emotional competence: a pre-requisite for effective teaching. Economic Research- Ekonomska Istrazivanja. https://doi.org/10.1080/1331677x.2020.1751673

[23] Connor, P., Hill, A., Kaya, M., & Martin, B. (2019). The measurement of emotional intelligence.: a critical review of the literature and recommendations for researches and practitioners. Frontiers in Psychology, Vol.10. doi: 10.3389/fpsyg.2109.01116

[24] Wells, C.M. & Klocko, B.A. (2018). Principal well-being and resilience: mindfulness as a means to that end. NASSP Bulletin, 102 (2), 161-173.

[25] Issah & Zimmerman, (2016). School leaders' instructional leadership and their social and emotional competence. https://doi:10.13140/RG 2.2.20710.52801 Research Gate April 2016

[26] Issah, M. (2018). Change leadership: the role of emotional intelligence. SAGE Open. https://doi.org/10.1177/2158244018800910

[27] Mahfouz, J., Greenberg, M. & Rodriguez, A. (2019). Principals' social and emotional competence: a key factor for creating caring schools. The Pennsylvania State University, October 2019

[28] Parish, D. (2015). The relevance of emotional intelligence for leadership in a higher education context. Studies in Higher Education 40(5). https://doi.10.1080/03075079.2013.842225

[29] Kebede, A. & Demeke, G. (2017). The influence of leadership styles on employee's job satisfaction in ethiopian public universities. Contemporary Management Research, Vol. 13, No. 3, 165-176 https://doi:10.7903/cmr.17668

[30] Cerado, E. & Abdullah, S. (2015). Emotional intelligence and social competence: antecedents of school administrators' leadership qualities. Journal of US-China Publication Administration, March 2015, Vol.12, no.3, 180-184. https://doi:10.17265/2015.03.002

[31] Boyland, L. & Geesa, R. (2019). Emotional intelligence for school administrators: a priority for school reform. https://researchgate.net.publication/234628221

[32] Leonard, E. (2019). Leadership and leadership intelligence. Journal of School Leadership. https://doi.org/10.1177/1052684619845697

[33] Madanchian, M. et. al. (2017). Leadership effectiveness measurement and its effect on organization outcomes. Procedia Engineering, 181, 1043-1048 https://doi.org/10.1016/j.proeng.2017.02.505

Chapter 15

The Effect of Emotional Intelligent on Team Performance: A Case Study of a Government Hospital

Lukman Setiawan

Abstract

Organizational development requires human resources. Professional organizations manage systems and the organizational mechanisms of existing resources to support flexible responses of change. Hospitals are a part of the service industry and have extraordinarily complex business processes, and a large potential for optimization and efficiency improvements. The aim of this study is to explore the relationship between emotional intelligence and team performance during the inter-institutionalized collaboration work process. This study was conducted in the South Sulawesi and Central Sulawesi Province's hospitals. The study lasted for six months in 2017. The sampling was done by using the cluster method and stratified random sampling, which was based on hospital type and the level of health officers. The data analysis approach used in this study was the partial least square (PLS), using WarpPLS software. The results show that emotional intelligence significantly and positively affected team performance with a path coefficient value of 0.138 and a p-value of 0.050. Based on the results of the data analysis, it can be concluded that there is a significant direct influence of emotional intelligence on team performance.

Keywords: Emotional Intelligence, Team Performance, Government Hospital

1. Introduction

Hospitals are a part of the service industry and have overly complex business processes, and a large potential for optimisation and efficiency improvements [1]. The public demands for better health services indirectly requires the hospital to continuously develop [2]. To improve the quality of health services for the customer, the work should be done effectively and efficiently, and it requires continuous improvement with the least amount of resistance that is possible [3]. In the last decade hospitals and technical services for health care in Indonesia rapidly expanded; in 2012, the number of public hospitals was 1.608 and by 2013, the number of hospitals was 1.725.

The progressive development of health care services correlates with a decrease in the readiness of health personnel resources which can affect the quality of health services [4]. It is generally known that the level of knowledge and skills of health service providers can affect the performance of officers in the hospital sector and can directly affect the quality of service to customers, including patients and their families [5]. For this reason, hospital managers must integrate various potential

existing resources to achieve maximum employee performance. Hospital management should implement a series of operational policies and standards that require the cooperation of all departments and divisions [6]. The tools that are arranged and implemented will benefit hospitals that have limited resources if all departments and divisions work together [7].

The quality of collaboration and interdepartmental team performance is expensive for the knowledge sharing function of a collaborative team [8]. Collaboration ability, competence and culture are the backgrounds of team performance in every organization, including hospitals [9]. In addition, variations in knowledge and motives among work team members will also have the potential to cause conflict as a necessity in every organization [10]. Internal conflict within the team at a hospital will have a detrimental effect on the harmonization of interaction and communication [11]. To reduce unwanted conflicts in work teams in government hospitals, the emotional intelligence of each team member is a dominant factor that must be cultivated [12].

2. Materials and methods

This study applies an explanatory approach which is oriented to describe the position of each variable involved in the study [13]. At a further level, the study aims to analyze the relationship between variables using the appropriate unit analysis. Data collection was carried out for six months from May to September in 2017 at two government hospitals located in the provinces of South Sulawesi and Central Sulawesi. Information was obtained through interviews using a structured questionnaire on selected respondents according to the criteria set by the researcher [14]. In addition, additional information is obtained through observing the work atmosphere to obtain the real conditions of the work team at the hospital. Literature studies from various sources were also carried out to obtain secondary data to complement the research analysis [15]. Determination of respondents as the study sample was carried out by applying the cluster method and stratified random sampling [16], which was based on the type of hospital and the level of occupation of a health worker. The decision to use two sampling methods was based on the

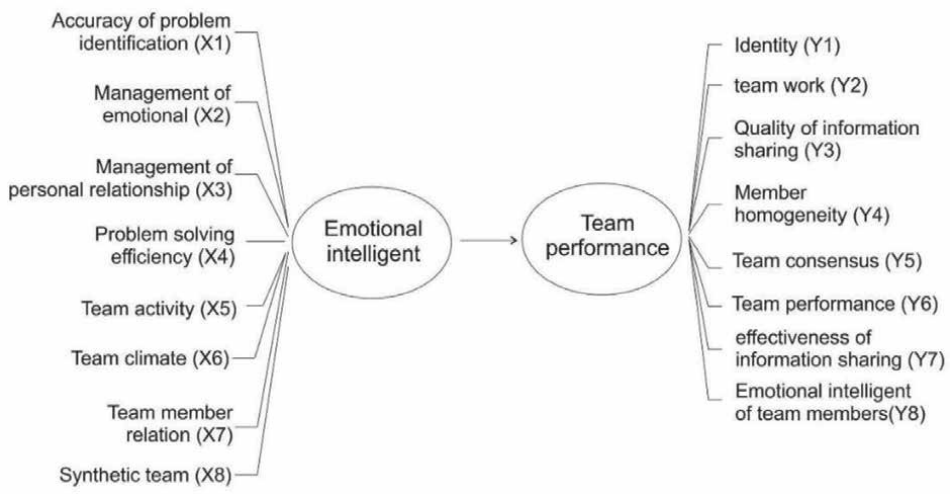

Figure 1.
Data analysis design.

objective of obtaining a very heterogeneous representation of the information [17] through interviews with representatives of health workers. Methods of processing and data analysis using the WarpPLS software with the partial least square (PLS) method [18]. The data analysis design is illustrated in **Figure 1**.

3. Results

3.1 Validity and reliability testing

Data collection uses a questionnaire that has been tested to guarantee its reliability and validity [19]. The perception score was determined using the Likert scale. The Likert scale is a scale applied to assess behavior, attitudes and opinions [20]. This scale is particularly useful for application in survey research because it helps researchers to operationalize personality traits or perceptions. Likert scales usually use 5 or 7 answer items. The answer choices used most often ranged from Strongly Agree to Strongly Disagree. The Likert scale allows survey researchers to obtain a holistic picture of their opinion and level of agreement. Person Correlation Value is used to test the validity of the research instrument [21]. Person Correlation Value (r) is greater than 0.30, indicating that the item is valid and meets the requirements for use at a later stage in the field. Conversely, if the value of Pearson (r) is less than 0.30, it indicates that the item is not valid for use. The reliability test of the data collection instrument used Cronbach's alpha analysis [22]. The Cronbach alpha coefficient value is above 0.60, indicating that the research instrument meets reliability principles; Conversely, if the Cronbach alpha coefficient value is below 0.60, it indicates that the data to be obtained will be biased because the instrument is not reliable. The validity and reliability test scheme is provided in **Table 1** below.

Variables	Indicators	Validity		Reliability	
Emotional Intelligence (X1)	X11	0.421	Valid	0.702	Reliable
	X12	0.423	Valid		
	X13	0.472	Valid		
	X14	0.446	Valid		
	X15	0.422	Valid		
	X16	0.373	Valid		
	X17	0.509	Valid		
	X18	0.375	Valid		
Team Performance (Y3)	Y31	0.626	Valid	0.774	Reliable
	Y32	0.702	Valid		
	Y33	0.664	Valid		
	Y34	0.612	Valid		
	Y35	0.620	Valid		
	Y36	0.597	Valid		
	Y37	0.479	Valid		
	Y38	0.612	Valid		

Table 1.
Validity and Realibility of Indicators.

The results of the analysis show that all indicators for each variable have a value greater than 0.30 which indicates that the research instrument is valid. Likewise, the Cronbach's alpha value is greater than 0.60 on all variables which indicates that the research instrument is declared reliable.

3.2 Goodness of fit test

The goodness-of-fit test uses the predictive-relevance (Q2) value in statistical hypothesis testing to analyze how well the sample data fits a distribution from a normally distributed population [23]. In addition, the difference between the observed value and the expected value of the normal distribution can be done by applying the Goodness-of-fit test [24]. The analysis showed that the predictive-relevance value reached 0.787 (78.7%); which indicates that the research model or design has a relevant predictive value. The level of prediction relevance at the value of 78.7% indicates that the level of diversity of research data that can be explained by the model is 78.7. Statistical interpretation explains that the information contained in the data can be explained by 78.7% through the model and the remaining 21.3% is interpreted by other variables not explained by the model) and error. The value of Q2> 75% indicates that the research model used is in an exceptionally good category and can be interpreted for further hypothesis testing [25].

3.3 Partial least square analysis results

Partial least squares (PLS) is a statistical method used to build a predictive model when various factors interact and collide [26]. PLS focuses on predicting responses and should not try to understand the underlying relationships between variables [27]. Another terminology of PLS is the inner model testing (structural model) [28] to test the research hypothesis using the t-test (TStatistic) on each of the partial direct influence pathways. The results of statistical analysis (WarpPLS) on the detailed data model are presented in **Table 1**. The **Table 2** presents the results of hypothesis testing.

The results of testing the indirect effect of the emotional intelligence variable on team performance (health workers in the hospital) show that the path coefficient value reaches 0.138 with a p-value of 0.050. The p-value level of 0.05 indicates a significant direct effect of emotional intelligence on team performance (see **Table 2**). In addition, the path coefficient value which is positive indicates that there is a positive relationship between emotional intelligence and the level of performance of health workers. Statistical interpretation states that the higher the emotional intelligence of health workers in the hospital, the more optimal their performance will be.

Relationship	Path Coefficient	p-value	Information
Emotional Intelligence (X1) → Team Performance (Y3)	0.138	0.050	Significant

Table 2.
Inner model result in WarpPLS: Direct effect.

4. Discussion

The results of data analysis indicate that the intelligence variable has an empirically significant effect on team performance in government hospitals in two

provinces. The path coefficient value of 0.138 with a p-value of 0.050 in direct testing indicates a significant direct effect between emotional intelligence and team performance in government hospitals [28]. Given that the path coefficient is positive, this indicates that the relationship is positive. The results of the study found that the emotional intelligence of a leader in a work team in the hospital had an impact on the performance of the staff, the effect of which was to mediate the emotional level and creativity of the team members. The results determined that health care quality correlated positively with emotional regulation. Emotional regulation was also positively correlated with group cohesion. It is surprising that emotional assessment was negatively correlated with the quality of health care provided by the team. This result indicates that EI and, more specifically, the emotional regulation can provide a new, interesting way to improve team cohesion [29].

Transactional leadership models basically work from the idea that managers give employees what they want in return for getting what they want [30]. In the case of the hospital, the staff providing health services are not independently motivated and thus require structure, instruction, and monitoring to complete tasks correctly and on time. The transformative leadership style that has emerged in government hospitals [31], generally displays a managerial leadership style, focusing on the role of supervisory, organization, and group performance [32, 33]. Leaders who adopt this style focus on a specific task and use rewards and punishments to motivate followers [34]. In addition, transactional and transformational leadership styles sending messages have a symbiotic relationship with emotional intelligence in the leadership style domain [35, 36].

The results of research which recommends that transactional/transformational leadership styles act as strong predictors of leadership strength [37] and abilities [38]. Several study have investigated the relationship between emotional intelligence and team performance and found that only emotional understanding and emotional management were positively correlated with multiple measures of team performance [39–41]. However, another fact stated by Hansenne (2008) indicated that emotional intelligence (EI) is assessed using a modified version of the Schutte Emotional Intelligence Scale and the cohesiveness with the Group Cohesiveness Scale [42]. Finally, the performance of the nurse team was measured at four different levels: job satisfaction.

5. Conclusions

Emotional Intelligence Plays an Important Role in Improving Team Performance in an organization including hospitals. Based on the results of data analysis, it can be concluded that there is a direct and significant effect of emotional intelligence on team performance. It is important for leaders to understand, analyzed the emotions of themselves and the team members who work at a hospital. Emotionally intelligent team leaders will have useful insights into how to focus the interests and needs of team members. Including how to use and regulate emotions effectively to achieve maximum team performance. This study found that continuous and comprehensive handling of emotional intelligence for all teams within the hospital area is needed. Knowledge factors, team conflict and structural mechanisms strengthen the influence of Emotional Intelligence on team performance. Application of new ideas and processes, continuous innovation, application of skills, cognition, roles, key ideas, interpersonal relationships, division of labor, hierarchies of authority, rules of rights and obligations, and interpersonal relationships will drive the optimization of team performance. This research contributes to the development of theories of emotional intelligence and team performance. As a recommendation, the organization should

ensure that the indicators are applied in the resource development planning system. The work team must be able to manage their negative emotions through emotional intelligence to reduce conflict, which in turn encourages creativity, facilitates effective communication, exchanges knowledge and is able to solve complex problems.

5.1 Significant statement

This study found that the emotional intelligence of team leaders had an impact on team performance. Emotional intelligence can be a mediating factor between the emotional level of team members and work team creativity. That can be beneficial for the head of the hospital and the ministry of health of the Republic of Indonesia to formulate a strategic policy related to increasing human resources in the Government Hospital. This study will help the researcher to cover the critical areas of the relationship between emotional intelligence on team performance during the inter-institutionalized collaboration work process. Thus, a new theory on the effect of emotional intelligence on team performance is arrived at.

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Conflict of interest

The authors whose names are listed in this article state that they have no affiliation or involvement in any organization or entity with any financial. The author declares that the article is the Authors' original work and has not received prior publication and is not under consideration for publication elsewhere. This research has not been submitted for publication nor has it been published in whole or in other parts.

Author details

Lukman Setiawan
Bosowa University, Makassar, Indonesia

*Address all correspondence to: lukman94setia@gmail.com

References

[1] Gray, B.; Boshoff, C. The relationships between service quality, customer satisfaction and buying intentions in the private hospital industry.

[2] Rhyne, D.M. The Impact of Demand Management on Service System Performance. *Serv. Ind. J.* **1988**, *8*, 446-458.

[3] Ghosh, S.; Sallam, S. Patient satisfaction and postoperative demands on hospital and community services after day surgery. *Br. J. Surg.* **1994**, *81*, 1635-1638.

[4] Ruiz-Aranda, D.; Extremera, N.; Pineda-Galán, C. Emotional intelligence, life satisfaction and subjective happiness in female student health professionals: the mediating effect of perceived stress. *J. Psychiatr. Ment. Health Nurs.* **2014**, *21*, 106-113.

[5] Gunkel, M.; Schlaegel, C.; Taras, V. Cultural values, emotional intelligence, and conflict handling styles: A global study. *J. World Bus.* **2016**, *51*, 568-585.

[6] Eriksen, B.O.; Kristiansen, I.S.; Nord, E.; Pape, J.F.; Almdahl, S.M.; Hensrud, A.; Jaeger, S. The cost of inappropriate admissions: a study of health benefits and resource utilization in a department of internal medicine. *J. Intern. Med.* **1999**, *246*, 379-387.

[7] Salovey, P.; Grewal, D. The science of emotional intelligence. *Curr. Dir. Psychol. Sci.* **2005**, *14*, 281-285.

[8] De Luca, L.M.; Atuahene-Gima, K. Market Knowledge Dimensions and Cross-Functional Collaboration: Examining the Different Routes to Product Innovation Performance. *J. Mark.* **2007**, *71*, 95-112.

[9] Chrisman, N.J. Extending cultural competence through systems change: Academic, hospital, and community partnerships. *J. Transcult. Nurs.* 2007, *18*.

[10] Mohammed, S.; Dumville, B.C. Team mental models in a team knowledge framework: Expanding theory and measurement across disciplinary boundaries. *J. Organ. Behav.* **2001**, *22*, 89-106.

[11] Bresman, H.; Zellmer-Bruhn, M. The structural context of team learning: Effects of organizational and team structure on internal and external learning. *Organ. Sci.* **2013**, *24*, 1120-1139.

[12] Stanton, J.M.; Julian, A.L. The impact of electronic monitoring on quality and quantity of performance. *Comput. Human Behav.* **2002**, *18*, 85-101.

[13] Rose, R.; Pilkington, A. *Mixed Methods-Theory and Practice: Sequential, Explanatory Approach*; 2017;

[14] Rylance, G. Privacy, dignity, and confidentiality: Interview study with structured questionnaire. *Br. Med. J.* **1999**, *318*, 301.

[15] Snyder, H. Literature review as a research methodology: An overview and guidelines. *J. Bus. Res.* **2019**, *104*, 333-339.

[16] Aoyama, H. Stratified random sampling with optimum allocation for multivariate population. *Ann. Inst. Stat. Math.* **1962**, *14*, 251-258.

[17] Holm-Nielsen, J.B.; Dahl, C.K.; Esbensen, K.H. Representative sampling for process analytical characterization of heterogeneous bioslurry systems-a reference study of sampling issues in PAT. *Chemom. Intell. Lab. Syst.* **2006**, *83*, 114-126.

[18] Abdi, H. *Partial Least Square Regression PLS-Regression*;

[19] Raczkowski, D.; Kalat, J.W.; Nebes, R. Reliability and validity of some handedness questionnaire items. *Neuropsychologia* **1974**, *12*, 43-47.

[20] Hussain, Z.; Barua, A. *Methods for Decision-Making In Survey Questionnaires Based on Likert Scale*; 2013; Vol. 3;.

[21] Rosner, B.; Willett, W.C. Interval estimates for correlation coefficients corrected for within-person variation: Implications for study design and hypothesis testing. *Am. J. Epidemiol.* **1988**, *127*, 377-386.

[22] Gliem, J.A.; Gliem, R.R. Calculating, Interpreting, And Reporting Cronbach's Alpha Reliability Coefficient For Likert-Type Scales Available online: https://scholarworks.iupui.edu/handle/1805/344 (accessed on May 19, 2021).

[23] Hosmer, D.W.; Lemeshow, S. Goodness of fit tests for the multiple logistic regression model. *Commun. Stat. - Theory Methods* **1980**, *9*, 1043-1069.

[24] Fisher, R.A. The Goodness of Fit of Regression Formulae, and the Distribution of Regression Coefficients. *J. R. Stat. Soc.* **1922**, *85*, 597.

[25] Andersen, P.K. Testing Goodness of Fit of Cox's Regression and Life Model. *Biometrics* **1982**, *38*, 67.

[26] Tobias, R.D. *An Introduction to Partial Least Squares Regression*;

[27] Akter, S.; Ambra, J.D.'; Ray, P. *An evaluation of PLS based complex models: the roles of power analysis, An evaluation of PLS based complex models: the roles of power analysis, predictive relevance and GoF index predictive relevance and GoF index*;

[28] Lee, L.; Petter, S.; Fayard, D.; Robinson, S. On the use of partial least squares path modeling in accounting research. *Int. J. Account. Inf. Syst.* **2011**, *12*, 305-328.

[29] Islami, X.; Mulolli, E.; Mustafa, N. Using Management by Objectives as a performance appraisal tool for employee satisfaction. *Futur. Bus. J.* **2018**, *4*, 94-108.

[30] Melita Prati, L.; Douglas, C.; Ferris, G.R.; Ammeter, A.P.; Buckley, M.R. Emotional Intelligence, Leadership Effectiveness, and Team Outcomes. *Int. J. Organ. Anal.* **2003**, *11*, 21-40.

[31] ALFadhalah, T.; Elamir, H. Exploring leadership styles in government hospitals in Kuwait. *Leadersh. Heal. Serv.* **2019**, *32*, 458-476.

[32] Waqas, H. Impact of Leadership Style (Transformation Transactional Leadership) On Employee Performance & Mediating Role of Job Satisfaction" Study of Private School (Educator) In Pakistan. *Glob. J. Manag. Bus. Res.* **2012**, *12*.

[33] N, N.; A, D. Relationship between leadership styles of Nurese managers and nurses' job satisfaction in Jimma University Specialized Hospital. *Ethiop. J. Health Sci.* **2013**.

[34] Voon, M.L.; Lo, M.C.; Ngui, K.S.; Ayob, N.B. The influence of leadership styles on employees' job satisfaction in public sector organizations in Malaysia. *Int. J. Business, Manag. Soc. Sci.* **2011**, *2*, 24-32.

[35] Spano-Szekely, L.; Griffin, M.T.Q.; Clavelle, J.; Fitzpatrick, J.J. Emotional intelligence and transformational leadership in nurse managers. *J. Nurs. Adm.* **2016**, *46*, 101-108.

[36] Brown, C. The Effects of Emotional Intelligence (EI) and Leadership Style on Sales Performance. *Econ. Insights-Trends Challenges* **2014**, *3*, 1-14.

[37] Judge, T.A.; Piccol, R.F. Transformational and transactional leadership: A meta-analytic test of their relative validity. *J. Appl. Psychol.* **2004**, *89*, 755-768.

[38] Sadeghi, A.; Akmaliah, Z.; Pihie, L. Transformational Leadership and Its Predictive Effects on Leadership Effectiveness. *Int. J. Bus. Soc. Sci.* **2011**, *3*.

[39] Shooshtarian, Z.; Ameli, F.; Amini Lari, M. The Effect of Labor's Emotional Intelligence on Their Job Satisfaction, Job Performance and Commitment. *Iran. J. Manag. Stud.* **2013**, *6*, 27-43.

[40] Quoidbach, J.; Hansenne, M. The Impact of Trait Emotional Intelligence on Nursing Team Performance and Cohesiveness. *J. Prof. Nurs.* **2009**, *25*, 23-29.

[41] Feyerherm, A.E.; Rice, C.L. EMOTIONAL INTELLIGENCE AND TEAM PERFORMANCE: THE GOOD, THE BAD AND THE UGLY. *Int. J. Organ. Anal.* **2002**, *10*, 343-362.

[42] Nelis, D.; Quoidbach, J.; Mikolajczak, M.; Hansenne, M. Increasing emotional intelligence: (How) is it possible? *Pers. Individ. Dif.* **2009**, *47*, 36-41.

Chapter 16

Facilitating Accessibility: A Study on Innovative Didactic Materials to Generate Emotional Interactions with Pictorial Art

Carmen Carpio de los Pinos and Arturo Galán González

Abstract

This research has been undertaken to establish criteria for the construction of didactic materials to be experienced through touch (using a three-dimensional model) and hearing (through the provision of an audio description of the chosen painting) to provide learning and emotions. Eleven experts examined the didactic tools in which the scene of the painting had been depicted, through the use of white plastic figures modeled using a 3D printer. The models had been positioned to accurately correspond with the reference painting, with an explanatory narration supplied as an audio recording. Each of the experts involved were asked the same open questions in interviews that were audio-recorded and later transcribed. This feedback was analyzed and eleven concerns for consideration were determined: 1. How the figures felt to touch 2. Modeling and placement of the figure, 3. Position of the character, 4. Size, 5. The accurate 3D depiction of the 2D image, 6. Perspectives or visual points of view of the scene, 7. Enough representation of the painting in the model, 8. Distribution of visual components within the scene, 9. Perceptual appraisals, 10. Size of the model, 11. Touch of the whole model. The results indicated that the size of the model and the figurines was appropriate for their function. The figurines felt pleasant to handle and adequately described the postures and placement. Suggestions for further improvements were including more figurines in the model and adding color (omitted in the test model) to belong an inclusive design.

Keywords: emotion, didactic of the art, painting, teaching material, new technologies, accesibility

1. Introduction

It is assumed that there is an inherent ability in each person who has the benefit of sight, to be able to appreciate the esthetics present in visual works of art and that it is this capability that provokes an emotional response to a picture. This being the case, visual art can be described as a tool for communication, involving a message, a transmitter and a repeater, the communication existing as a channel of perception that flows between the three, responding to esthetic influences normally related to beauty. An artist often aims to leave an impression upon the viewer, who may

respond through intelligence and emotions, the outcome being an esthetic effect that leads to the perception of the subject in a particular way. Thus, the subject of a painting may be described by the viewer to be beautiful, pleasant, surprising or interesting, for example.

Though this method of transmission, visual observation, is the same for all sighted persons, viewers frequently respond differently - to a greater or lesser degree - to an image, due to the influence of an individual's subjective responses upon the objective elements. Thus, artistic sensitivity lies at the intersection of expression involving sensorial elements (color, form, sound), and the ability to make value judgments on the beauty and meaning present in the work, reasoning about the artist's intentions and the characteristics of the artistic period, etc. On the other hand, less sensitive or informed observers experience a more superficial appreciation: the work of art communicating nothing in particular to them, nor affecting them emotionally. It is these subtle complexities and the widely recognized impact of art upon human life that determine the need for education in esthetic appreciation, through which the tools and framework for perceiving and interpreting works of art can be learned.

1.1 Pictorial art and esthetic emotion

Based on common interests concerning how art affects human life culturally, psychologically and emotionally, numerous attempts have been made to systematically measure its influence. It could be stated that the main objective of a work of art would be to provoke an artistic experience in the viewer [1], based on the fact that an esthetic experience is provoked by perceptual impressions [2]. Of course, not every work of art will provoke an esthetic experience, nor may even have been designed for such a purpose. However, the personal benefits to be gained through engaging with art, familiarity with the effects of visually-rich stimuli ought to be nurtured through educational processes designed to lead to the discrimination of stimuli and the subsequent implementation of analysis processes.

It is both helpful and convenient to differentiate concepts such as art, esthetics and beauty, since they are basically related but they are separated in their particulars. Marty [3] starts from said reflection, finding difficulty in defining these concepts, for which the establishment of ways of differentiating the esthetic from the non-esthetic is advocated. On the other hand, these researchers consider that the esthetic experience, of perceptual origin, as mentioned above, is fundamentally related to art and beauty although this relationship is not always the case. For example, historically, beauty has often been linked with the desirable and the excellent. In direct opposition to such a correlation, there are artistic currents such as "ugliness" that seek to move away from the reliance on beauty to create appeal for artistic creations. Despite this, there exists a series of universals in esthetic judgment, that is, the consideration of something as being beautiful, based on the intimate relationship between form and content [4, 5].

Bernard and Chacuiboff [6], reviewed works on esthetic sensitivity, drawing attention to the fact that the first tests carried out in the 1940's were based on the judgments of experts in artistic matters, compared with those of other non-specialist individuals. Based on the study on esthetic appreciation by Burt [7], significant correlations were found in the judgments of the subjects observing works of art, which led him to suspect certain universals in these cognitive functions. Eysenck [8] conducted a more rigorous study and again found that there was a "general factor" of esthetic appreciation. He later found (in 1972) [9] a peculiar personality in artists, compared to non-artists, regarding vocabulary, due to their formation. In contrast, there were no differences regarding perception, or what he

called "esthetic sensibility "between expert and non-expert observers of art. Further, Seifert [10] concluded that a basic knowledge of art is also evident in people with little or no formal education in art or esthetics.

1.2 Elements of esthetic appreciation in pictorial art

The present study is based on the demand for adaptive tools to help the visually-impaired to access the plastic arts, specifically painting. Graeme, McLinden, Farrell, Ware, McCall and Pavey [11], in reviewing the concept of learning accessibility in schools, describe the varying implications of teaching at various levels: whether practical sessions during classes, special educational needs methods of teaching or curricular adaptations, in addition to professional training and interprofessional coordination. They recommend that accessible materials should be used for any special educational needs student, since this will also benefit the rest of the classmates. There is evidence to show that both approaches are important, but teaching children access skills has important longer-term benefits for visually impaired children and young people. In spite of this evidence, it appears that this approach to teaching may often be neglected.

Salzhauer et al. [12] offer a series of guidelines for museum educators and art teachers to employ, in order to further develop visual descriptions for the benefit of the partially-sighted. These guidelines include giving standardized information on the author, the title of the work, the subject, shapes and colors, as well as technique and style. They advise using vocabulary suitable for the blind, (avoiding figurative words) and encourage attention to be drawn to vivid details and the work's location in the museum. This is in addition to adopting the use of other senses in order to develop analogous explanations of intangible concepts through alternative representations, together with the provision of additional information, such as the historical and social context of the work. The creative use of sound is specifically recommended, likewise, touching works of art or substitute materials, and using tactile diagrams. These same authors proposed guidelines for the creation of tactile diagrams and for the writing of oral narratives that accompany them. In this way, partially-sighted observers are provided with the perceptual information necessary to have full intellectual access to the history and culture of our world, as depicted in art.

This study follows the guidelines proposed by Salzhauer et al. [12] for the preparation of such pedagogical intervention material. Included are just a few of the examples that have been devised to better demonstrate the art works exhibited in museums, for the benefit of people with visual disabilities. Each of the didactic constructions take as their starting point the need to adapt the paintings by means of the inclusion of tactile diagrams presented with narrated descriptions, with the aim that visually-imapired people can have improved access to the original work.

Another area of approach to works of art is to introduce an explanatory narrative that moves beyond mere description of the visual work. The genre of "ekphrasis" is the written description of visual works so that they are better understood by the viewer or those unable to see them. It is a highly contested practice conceptually, since the person listening to or reading the ekphrastic work would actually be subject to the impressions of a third party, the author. These "narratives" have been extrapolated into other artistic fields, such as explaining paintings. It is very common that the paintings are explained through a description. Authors like Monegal [13] defend that literature is verbal and temporal, while painting is plastic and spatial, therefore, they belong to inherently different fields and are therefore difficult to reconcile. For this reason, Monegal [13] encourages the search for other techniques of representation of plastic art, not restricted to the narrative of a

painting. This has led the interest in searching for tactile materials that exploit new technologies.

1.3 New technologies at the service of didactics in art education

The advances brought by new technologies have been gradually introduced in the teaching of art. A good example within literature is the "Daisy book" by Ribere and Moese [14]. This innovative proposal for a multimedia book integrates text, sound, images and videos in a practical and synchronized way, with an audio narrative heard while browsing through the text. In addition, the reader can activate videos that are embedded in the programming of the book. Created using DTBook xml, (DTB = digital talking book), the format allows the author to simultaneously present audio and visual formats within one tool. While the DTBook xml format has the potential to be a valid alternative to other digital publishing formats, its viability is questionable. This is due to the excessive economic investment required per publication, at this time, and potential problems regarding the rights relating to digital reproductions.

There are general criteria to be applied when devising the production of didactic tools. These were established by Artiga [15]:

- The educational objectives must be the starting point, when considering how a particular material or construction can support the learning process.
- The contents that are going to be treated in the implementation of the material must be considered.
- Didactic tools must be suitable for the end-user. Firstly, the design must take into account the interests, abilities, prior knowledge, experience and skills of those who will be using the materials. Secondly, the materials must be be designed to promote further skills development.
- The characteristics of the application context.
- The didactic strategies to be used must be congruent with the tool.

The contents of a didactic tool, the ways in which it will be employed and any other educational resources that will be used, should be congruently arranged to ensure optimum accessibility. Based on the demand for adaptations to access the plastic arts, specifically painting, researchers such as Graeme, McLinden, Farrell, Ware, McCall and Pavey [11] have reviewed the concept of accessibility in schools and describe implications for the teaching at various levels: practical sessions in classes, specialist teaching, curricular adaptations, professional training and interprofessional coordination. It is their recommendation that accessible materials should be used for any student who has some special educational needs, since this is also likely to benefit the rest of the class.

2. Methodology

This study is based on the need to analyze the convenience of novel didactic material, consisting of models made using 3D printers, which are likely to provoke esthetic emotion as well as learning. These models provide the figurative and spatial representation in three dimensions of the scene and the characters in a 2D painting.

On the one hand, they wanted to assess the quality of materials being designed and manufactured with new technologies, to be used as a didactic instrument in the teaching of art. A series of key parameters had to be explored for proper learning to take place by students using said material.

On the other hand, we had the idea that these printed 3D models could serve as inclusive tools usable by students with disabilities. In particular, those with visual disabilities, who would normally have difficulties in the perception of the space depicted in some works of pictorial art would, through the use of such a tool, be better able to comprehend and respond to the work. We were specifically interested in the 3D representation of paintings in which the use of perspective has been employed by an artist to describe an open space, several planes and distance.

It was therefore important to consult experts so that they could give their opinion on the models, and collate their assessments, offered in conversation. A methodology of qualitative analysis of the interviews was chosen, in order to proceed in a systematic way. The experts commented on whether the material was suitable for learning the contents of the painting and could also arouse emotions. In this way, we would obtain an assessment of the quality of the models as teaching material capable of provoking esthetic emotions.

A qualitative approach was chosen for the analysis of the opinions of the experts who were to review the 3D mock-ups of the paintings. This follows the principles of McMillan and Schumacher [16], fulfilling characteristics such as: collecting perceptions and/or personal points of view, focus on understanding the models as didactic material, data collection strategies adapted to the possibilities of participation, accounting for the subjectivity of the experts, and the level of interaction between researchers and experts during the interview process, given the natural context.

For data collection, the steps recommended by Taylor et al. [17] have been followed. Firstly, various aspects of the work of art have been identified as being necessary to be understood and learned. Thus, in this respect, concepts have been established and theoretical propositions have been reviewed. Based on this, the codification of the data was established through the development of categories. All concepts were listed and classified by subject, assigning a main category that brought together statements and observations that could be included in these general categories. They were reviewed and reformulated until a definitive list of concepts that needed to be understood was obtained.

The data analysis was carried out following the requirements indicated by Rodríguez Gómez et al., [18]: data reduction, data arrangement and transformation, and the drawing and verification of conclusions. Data reduction consisted of categorizations and coding. The categories were separated by phrases that expressed exclusionary content. Following the interviews, a computer program counted the words used, in addition to indicating their position within the text of the transcription.

The analysis focused on the choice of the words used: registering nouns, adjectives, verbs, etc. An analysis of sentences and paragraphs was also considered. It was established that a phrase, fraction of a phrase, or words would be taken if communicated sufficient information and if those were different from the others, discovering the key characteristics that would allow creating a category. The results were analyzed with the technological help of the AQUAD7 program, establishing codes for content analysis.

For the arrangement and transformation of the data, an alphanumeric coding system was used, with each of the concepts listed in the definitive list of categories assigned a number. This made it possible to encode each expression made by the experts when exploring a model.

For example:

Category: Discrimination of the scene of the model.

Subcategory: Parts of the figure that are difficult to recognize.

Expression: "This, here … . mmm … not perceived well … let's see? (He touches it more carefully.) "It may be something he has taken with his hand, … I don't know."

Data categorization: 27.5.

To obtain conclusions, the choice and frequency of vocabulary used, as defined within the categories and subcategories of each table was counted. Thus, the most satisfactory aspects of the model were obtained, as well as those that needed to be modified or rethought.

2.1 Participants

The models were presented, and explanatory content were narrated to 11 experts. Five of those were teacher's specialist in primary school students with visual disabilities. A further four experts were visually impaired educators, and two experts were specialized in art education at secondary schools. The interviewers with the experts were conducted by the same person.

2.2 Process

Three didactic models were each placed on tables, with a printed copy of the painting it depicted. All the experts were provided with a questionnaire that required the same questions to be answered at each table as they examined the models. The experts were able to handle the model without vision (covering their eyes) and afterwards, they could look at the printed copy of the painting if they had visual capability (**Figure 1**). At each station, the researcher narrated information that had been provided by the museums where the artworks are on display, giving information about the main features of each of the paintings. Researchers asked questions of the experts, relating to the models, and audio recordings were made of the answers provided. These recordings were later transcribed in order to analyze the responses of the experts as they examined the didactic models.

The analysis of the experts' responses relied upon the use of phrases or expressions that were sufficiently unambiguous to make it possible to build a framework of categories in order to measure the level of response to each model. The categorization was carried out with the different comments of the experts. Some concepts were defined and some new ones were added. Ultimately, a structure of categories

Figure 1.
Expert exploring the first part of the didactic material to learn paint woks.

and sub-categories was designed, with numbering applied to create a scoring system that made it possible to analyze the experts' responses to the models.

To accurately measure responses to the models, each expression that the experts made, when responding to the models, was counted as a unit of data, identifiable within the framework of categories of expressive responses. The frequency of recurrence of data units was counted to provide a data set that recorded human response, as recommended by Bardin [19]. In this way, verbal expression could reliably be converted into measurable data. So higher frequencies of a particular data unit (expression) denoted a greater importance of that unit. (See **Table A1**).

The categories were reviewed according to the qualities described by Bardin, [19] and Olabuénaga [20], verifying that: they had mutual exclusion (an element could'cannot belong to more than one), were exhaustive (all data could be categorized), were homogeneous (they were consistent within the clear, concrete and precise framework that had been devised specifically for this purpose, divided by the principle of classification of the elements of the model), relevance (the categories were specific to the object of study of didactic material used in art teaching), objectivity and reliability (having been subject to peer-review by several teachers), clarity (understandable content), replicability (another researcher would code the stories in the same way), productivity (frequencies can be found and conclusions drawn).

3. Results

Responses to the models related to a number of considerations, with the most frequently commented upon considerations ranking highest. The data was examined to determine information about each of the three models separately.

Dalí's model (Giraffe in flames, **Figure 2**).

Categorical prominence of most the frequent responses:

1. Details of each figure (clothes, ornaments, elements) (29).

2. Details to differentiate the characters (13).

3. Adequate modeling to represent the painting (11).

4. It is necessary to clarify the meaning of the table (9).

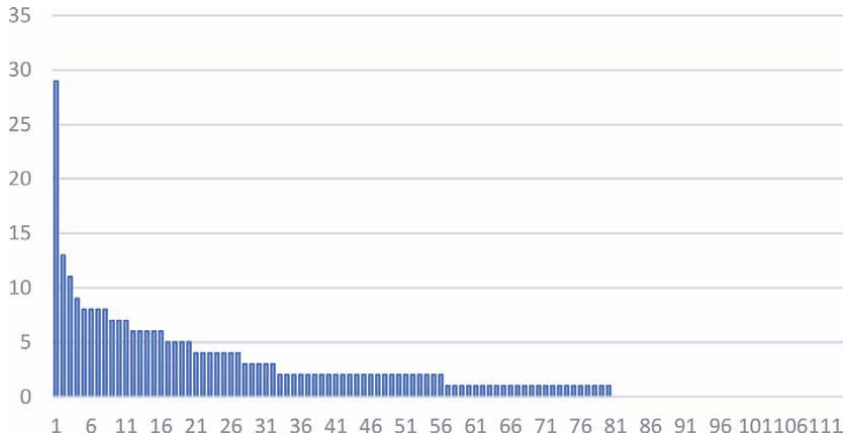


Figure 2.
Frequency of responses by range in the response categories of Dalí's model.

5. The figure is pleasant to touch (8).

6. The texture of the material used to model the figurine is appropriate (8).

7. It is possible to discriminate one part of a figure from another (8).

The Velázquez model received different levels of feedback (**Figure 3**). Categorical prominence of most the frequent responses:

1. Details of each figure (clothes, ornaments, elements) (26).

2. The model is representative of the scene of the painting (18).

3. Explanation help enough to understand the picture (17).

4. Positive feedback received, in general terms, about the model (14).

Listed in order of prominence, the following response categories reflect an intermediate reaction to the model:

5. The figurines and scene were pleasant to handle and touch (13).

6. The figurines were of an appropriate size for this purpose (7).

7. The figures and scene were sufficiently detailed in order to reflect the period in which the painting was set (6).

8. Textural variance of the medium used to model the figurines was noted (6).

The following categories were most prominent in the responses to the Goya model (**Figure 4**):

1. Details of each figure (clothes, ornaments, elements) (21).

2. The model is a suitable representation of the painting (14).

3. Further explanation is required in order to help understand the painting (11).

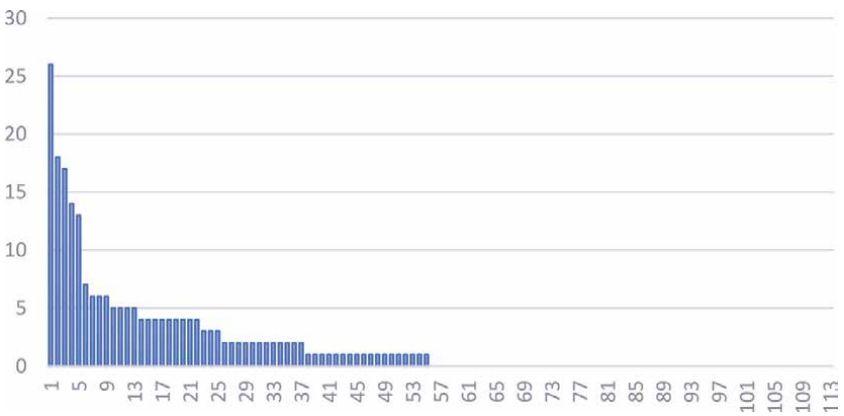


Figure 3.
Frequency of preferred responses in the categories of the Velázquez model.

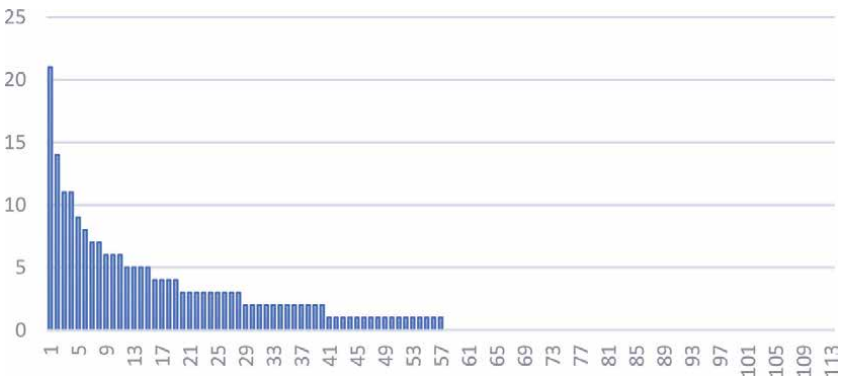


Figure 4.
Frequency of responses by range in the response categories of Goya's model.

4. Positive feedback received, in general terms, about the model (11).

5. The figurines and scene were pleasant to handle (9).

The intermediate scores were.

6. The figurines and scene were pleasant to touch.

7. Details to know the epoch (clothes, wrinkles, ties and other accessories) (8).

8. Details that provide information about gender (clothing, accessories such as hats, ties, etc.) (7).

9. The model is a helpful educational tool for people with visual disabilities (7).

10. Explanation helps to understand the picture (6).

11. Overall positive appraisals (6).

4. Conclusions

This study presents the development of observations made following an initiative to assist visually impaired persons in understanding a visual work of art. In an effort to facilitate an alternative to the visual experience, a didactic tool was created in which the chosen two-dimensional artwork was recreated as a three-dimensional model. "Viewers" were encouraged to manipulate the figures and objects within the construction and an audio description provided in order to comprehend something of the original work. Beyond facilitating an understanding of the appearance of the work, the primary objective of this initiative was to enable visually impaired persons to have the opportunity to respond to the work on esthetic and emotional levels.

The study collected in interviews with teaching experts with a speciality in the field of accessibility to the visual arts for the visually impaired has been useful, following the guidelines of Ballesteros and Mata [21] for qualitative studies in education. This work has been carried out in the field of visual impairment, in collaboration with both technical specialists in visual impairment, together with visually impaired assessors, in other to study the field in detail. However, the use of

didactic models such as these is intended to be transferable to support how other disabled individuals can derive educational and esthetic responses to art, given the inclusive use intended for the models.

Educators will all appreciate that even people who have full use of all their senses can also benefit from these models by deepening their understanding of a piece of visual art through encouraging increased engagement with senses other than the eyes.

The experts have considered the models to be an adequate representation of the pictorial works. They have emphasized that the scene depicted in each of the mock-ups is sufficiently representative of the paintings they were designed to depict, that key details can be discerned, in order to recognize the figures depicted in the paintings, and even the historical context or artistic period. They have expressed positive feedback in their assessments, for example that the didactic models are beautiful, original and practical. In addition, they have highlighted that models are pleasant to touch and are of an optimal size for the purpose of being use as an educational tool to teach an appreciation and understanding of visual art.

Likewise, the experts have highlighted that it is a useful material for the knowledge of paintings for people with visual disabilities since they can touch the main conceptual elements.

Regarding the improvements that they have indicated, they emphasize that a help of an explanation is necessary to understand the table. Appropriate narrations adapted to the educational level, in the sense of the materials proposed by Monegal [13]. They also require the use of color in the figures and the scene to be as close to the painting as possible.

At this point, it must be considered that an artistic reproduction of the pictorial work is not intended, which is far from the didactic objectives, but only an accessible 3D representation. This material aims to be inclusive, following qualitative characteristics such as those indicated by Graeme et al. [11], that is, usable for curricular adaptations of specific students, but for all others and of practical way in the classroom.

They could be used in the museum field, since they comply with the Cioppi [22] guidelines on accessibility to visual impairment, being extrapolated to other characteristics, such as intellectual disability, the elderly, attention disorder, etc. And in the educational field, they could be used, since they meet the characteristics of optimal teaching materials [15].

The narratives should be improved to make them understandable to any student. Following recommendations such as those of Salzhauer et al., [12] and D'Aveni [23] regarding visual descriptions of works of art. It would be necessary to include a tactile guide to explore the models with the hands, accompanied by a narration that refers to the main elements of the works. Thus, it would work for anyone, regardless of their characteristics and would follow the "design for all" of the Stockholm declaration. Some research about it can be found in Carpio et al. [24].

With this study a descriptive analysis of the opinions of experts on the use of models for the pictorial perception has been carried out, facilitating the learning of contents and accessibility. With this first study, the models will be prepared, and a second qualitative study will begin on the emotions that the learning of the pictorial works involved provokes.

The present study might represens a step toward improving the quality of life for the target group, allowing the visually-impaired to access visual realm of art and to respond to it on esthetic and emotional levels. Educators will all appreciate It as it helps to create a more inclusive learning environment, where the academic, physical, emotional, and social needs of learners, including those with disabilities, are addressed. It is highlighted the importance of experiencing the emotions that the

learning of the pictorial works provokes in visually impaired individuals in fostering emotional wellbeing in visual handicapped persons.

Acknowledgements

Thanks to the model makers and to the experts in visual disability and arts, who gave their opinion on the models.

A. Appendix

	TOUCH FIGURE (Question 1: Touch this figure and tell me how it feels to you)	DALI	VEL	GOYA
1	**Nice touch**	**8**	**7**	**7**
2	Unpleasant touch	1	0	0
3	Lasted	0	1	0
4	Soft touch	3	2	4
5	Rough	3	0	2
6	Different textures	6	1	1
6.1.	Same texture throughout the figure	2	0	0
6.2.	Texture makes discrimination difficult	0	0	3
6.3.	Rough	0	2	0
6.4.	Very good	8	1	1
DISCRIMINATION FIGURE (Question 2: Can you recognize or discriminate something?)		0	0	0
7	You can discriminate parts of the figure	8	0	4
7.1.	Difficult to perceive different parts in the figure	4	0	4
8	The whole figure is recognized	4	5	1
9	Associate similar figures	2	2	0
9.1.	Recognize / discriminate various shapes	2	5	2
10	Recognize something unpleasant	2	2	0
PARTS-DETAILS (Question 3: What parts and details of the figure do you perceive?)		0	0	0
11	arms	2	2	3
12	Legs	3	0	2
13	Head	2	4	3
14	Position	4	4	3
14.1.	Back, loin	1	1	0
15	Details (clothing, ornaments, items)	29	26	21
POSTURE (Question 4: What is your posture?		0	0	0
16	Crouched down	0	0	2
16.1.	Stretched legs	0	2	0
17	Bent knees	0	0	3

TOUCH FIGURE (Question 1: Touch this figure and tell me how it feels to you)		**DALI**	**VEL**	**GOYA**
1	**Nice touch**	**8**	**7**	**7**
REPRESENTATION (Question 5: what does it represent? (Person, animal, thing)		0	0	0
18	Woman	1	0	1
19	Man	0	1	2
19.1	Moving	2	0	5
19.2.	Difference Man and woman	0	0	3
19.3	Animal (suitable according to the picture)	0	3	0
19.4	Plant (suitable according to the chart)	0	0	2
19.5	Thing (suitable object, according to the picture)	6	2	1
FIGURE SIZE (Question 6: What do you think about the size of the figures?)		0	0	0
20	Big	2	0	0
21	Medium	0	0	1
22	Little	1	0	2
23	Thin	1	0	0
24	Thick	0	1	0
25	Robust	2	0	0
25.1.	High	2	0	0
25.2.	Suitable	2	6	1
25.3.	Different sizes	4	5	0
MODEL DISCRIMINATION (Question 8: Touch the model and say impressions)		0	0	0
26	Figures and parts can be discriminated	5	1	1
27	The whole figure is recognized	2	4	1
27.1.	Same material	1	0	1
27.2	Different material	2	0	0
27.3.	Different figures	0	0	1
27.4.	It is necessary to receive guidelines to follow an order	1	0	11
27.5.	Parts of the figure difficult to recognize	2	0	0
MODEL PERSPECTIVE (Question 9: Do you see different planes?)		0	0	0
28	Elements far (small)	5	3	0
29	Items close (large)	5	4	2
30	Different planes differ in space	6	5	1
30.1.	Use figures to represent / differentiate perspective	1	4	0
30.2.	Perspective is not appreciated	2	0	0
30.3.	Relies on texture to represent perspective (gentle river, rugged mountains)	1	1	0
BOX REPRESENTATION (Question 10: Give us your opinion on whether it adequately represents the content of the box)		0	0	0
31	Suitable characters	0	4	5
32	Enough characters	1	2	6

	TOUCH FIGURE (Question 1: Touch this figure and tell me how it feels to you)	DALI	VEL	GOYA
1	**Nice touch**	**8**	**7**	**7**
33	Details to know the time (clothes, wrinkles, ties)	6	6	9
3. 4	Details for character differences (dresses, accessories such as hat, ties, etc.)	eleven	2	6
35	Hairstyle	0	0	3
36	Represent the scene	2	18	3
36.1.	Approaches the context where this work was created	2	4	0
MODEL DISTRIBUTION (Question 11: Give us your opinion about the distribution of the figures in the scene)		0	0	0
37	Elongate	1	0	0
38	Narrow	1	0	0
39	Depth	1	0	0
40	More characters	0	4	0
41	Less characters	2	0	0
41.1	Suitable characters	7	4	2
41.2	Adequate (the distribution)	1	3	3
41.3	Different (distribution)	2	0	0
APPRECIATIONS IMPROVEMENT (Question 12: Give us suggestions for the use and improvement of the model)		0	0	0
42	Well ok ...	13	14	14
43	Bad, inappropriate	7	1	5
44	Regular / Confusing	1	1	0
45	Bizarre	1	0	4
45.1.	Surreal	2	0	0
45.2.	Interpretation of the subjective picture	1	0	0
46	Dramatic	5	0	0
46.1.	Difficult to understand / recognize	7	2	11
46.2.	Good box to explain perspective / proper	4	0	1
46.3.	Meaning of the box	9	0	0
46.4.	Recognize the process of making the model	3	0	0
46.5.	Knowledge of the blind	6	2	6
46.6.	Appreciations that the table does not have	4	1	1
46.7.	Type of material used	8	0	2
46.8	Details (of the model)	0	1	2
MODEL SIZE (Question 13, what do you think of the size?)		0	0	0
47	Big	0	0	1
48	Medium	2	1	1
49	Little	1	0	0
49.1.	Different sizes	2	1	0
49.2.	Appropriate size	1	0	0

TOUCH FIGURE (Question 1: Touch this figure and tell me how it feels to you)		DALI	VEL	GOYA
1	**Nice touch**	**8**	**7**	**7**
49.3.	Similar sizes	1	0	0
TOUCH MODEL (Question 14: what do you think of touch?)		0	0	0
56.	Soft	2	1	1
fifty.	Rough	0	1	0
51.	Rough	1	0	0
52.	Lasted	0	1	0
53.	Soft.	3	2	2
54.	Nice	4	1	5
55.	Unpleasant	1	0	0
55.1	Different textures are perceived	1	6	0
56.	Other uses of the box	2	0	0
57.	Explanation help to understand the picture	0	13	8
58.	Appreciations (in general or in relation to the model)	1	17	7

Table A1.
Open interview questions and categories extracted. Frequency of responses in the Dalí, Velázquez and Goya model, and the total.

Author details

Carmen Carpio de los Pinos[1*] and Arturo Galán González[2]

1 University of Castilla-La Mancha, Toledo, Spain

2 National University of Distance Education, Madrid, Spain

*Address all correspondence to: carmen.carpio@uclm.es

References

[1] Carroll, N.. Philosophy of Art. London: Routledge. 1999

[2] Collinson, D. Aesthetic Experience. En O. Hanfling (Ed.), Philosophical Aesthetics (pp. 111–178). Oxford: Blackwell. 1992.

[3] Marty, G. Formación de esquemas en el reconocimiento de estímulos estéticos. Psicothema, 13, 623–629 .2002.

[4] Lyas, C. The Evaluation of Art. En O. Hanfling (Ed.), Philosophical Aesthetics (pp. 349–380). Oxford: Blackwell. 1992.

[5] Shortess, G.K., Clarke, J.C. & Shannon, K. The shape of thinkgs: But not the golden section. Empirical Studies of Arts,1997. 15, 165–176.

[6] Eysenck, H. J.. The general factor in aesthetic judgements 1. British Journal of Psychology. General Section, 31(1), 94–102. 1940.

[7] Burt, C.. The psychology of art. En C. Burt, E. Jones y W. Moodie (Eds.), How the mind works. London: Allen & Unwin. 1933.

[8] Bernard, Y., & Chacuiboff, J. La obra de arte pictórica. En R. Francès (Ed.), Psicología del arte y de la estética (pp. 69–93). Madrid: De. Akal. 1979.

[9] Eysenck, H.L.. Personal preferences, aesthetic sensitivity and personality in trained and untrained subjects. Journal of Personality; 1972,40, 544–557.

[10] Seifert, L.S. Experimental Aesthetics: Implications for Aesthetic Education of Naive Art Observers. The Journal of Psychology, 1992. 126, 73–78.

[11] Graeme, D., Mclinden, M., Farrel, A.M., Ware, J., McCall, S., Pavey, S.. Access to print literacy for children and young people with visual impairment implications for policy and practicees. European Journal of Special Needs Education. 2011; Vol 26, Issue, 1. pp. 39–46.

[12] Salzhauer, E., Hooper, V., Kardoulias, T., Stephenson, S., Rosenberg, F. y Torunaga, K.. Art beyond sight. A resource guide to art, creativity and visual impairment. AEB. New York. 2013.

[13] Monegal, A. En los límites de la diferencia. Poesía e imagen en las vanguardias hispánicas. Ed.Tecnos. Madrid. 1998.

[14] Ribere, M., Moese, S., Daisy: un libro abierto, multimodal y accessible. El profesional de la información, 2008; vol 17, Issue, 4, pp. 403–407.

[15] Artiga, C. El material escolar: parvulario y ciclo inicial. Buenos Aires. Abril.1991.

[16] McMillan, J. H., & Schumacher, S.. Investigación educativa una introducción conceptual. Pearson educación. 2005.

[17] Taylor, S. J., Bogdan, R., & DeVault, M. Introduction to qualitative research methods: A guidebook and resource. John Wiley & Sons. 2015.

[18] Rodriguez Gómez. R., Flores, J. G., & Jiménez, E. G.. Metodología de la investigación cualitativa. Santiago de Cuba: PROGRAF. 2002.

[19] Bardin, L. Análisis de contenido (Vol. 89). Ediciones Akal. 1991.

[20] Olabuénaga, J. I. R. Metodología de la investigación cualitativa. Bilbao: Universidad de Deusto. 1999.

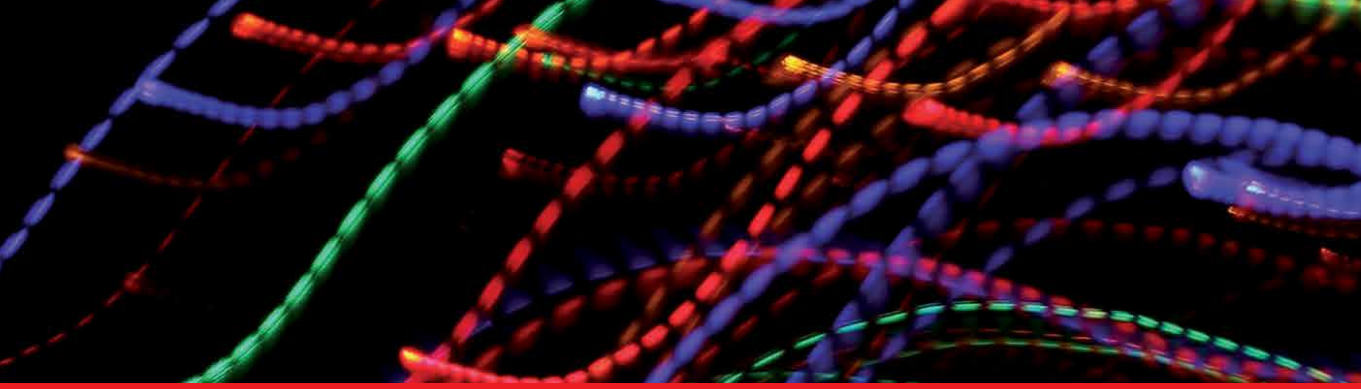
[21] Ballesteros, B. y Mata, P. Sentido y forma de la investigación cualitativa. En

B. Ballesteros (Coord.) Taller de investigación cualitativa, (pp. 12–47). Madrid: UNED.2014.

[22] Cioppi E. (a cura di) (2008). *La scienza a portata di mano. Percorsi per non vedenti e ipovedenti.* Firenze: University Press.

[23] D'Aveni, R. The time to think about the 3D-printed future is now. Havard Business Review. 2015.

[24] Carpio, C., Castillo, F., Rodriguez, D. y Carpio, A.J. Integración de la tecnología de impresión 3D en los métodos docentes. Primer Congreso Internacional de Comunicación Inteligente y Tecnologías Digitales para la Educación y la Inclusión Social. Bogotá – Colombia. 16/05/2017. Universidad Nacional Abierta y a Distancia



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Emotional intelligence (EI) is the best instrument to build stronger relationships, communicate effectively, relieve stress, overcome challenges, and achieve career and personal goals. As such, this book covers a variety of topics related to the science of EI. Chapters address the science and philosophy behind EI, using EI to cope with consequences, strategies to develop EI in early childhood education, neuromarketing, emotional responding and adversity, brain networks of emotional prosody processing, humor events and wellbeing, and much more.

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