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The Distinct Effect of Musical Improvisation on Human Health and Well-being

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Abstract

To ‘improvise’ music is to create music, to perform individual’s own music creations in a real time. Musical improvisation is different from making music from memory or from the written notation. Musical improvisation is the activity of playing music, creatively make a live of novel musical compositions at a specific moment, which combine the results of musical performance, emotional, communication, techniques of playing musical instruments. The process during musicians improvising their music, requires a specific process that creates new ideas spontaneously without any preparation in advance. Improvisation is creativity, it links conscious with unconscious process in brain networks, improvisers experience non-verbal creative social interaction, and be able to express emotion and feeling. The creative process during generating improvisation, involves individuals to always think creatively, and that process affects the networks within human brain and contributes many positive impacts to health and wellbeing. During the process of design, produce and generating creativity of art, the improvisation activates wide range of brain area, give impacts to brain and its connectivity, its transfer effects to improve cognition, eliciting good emotion and positive feelings, and influence many elements of human’s health and well-being. Overall the activities of improvisation, especially the musical improvisation promotes creativity as a resources to enhance distinct effects to human health and well-being and it is suggested that improvisation activities should be developed further in order to obtain its optimal benefits.

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Preface

This thesis contents about the distinct effects deals with musical improvisation on human health and well-being. The process that occurs during musicians improvising music is associated with the creation of creativity. Musical improvisation requires a specific process to innovate new ideas spontaneously without being planned or without any preparation in advance. The series of actions within the artists' mind during improvising their music, innovate the creative process.

The link and interconnection between the creative process during musical improvisation and various responses in brain networks and activities in brain connectivity explain the reason why musical improvisation affects various parts of the brain organization, and influences human health and well-being.

Musical improvisation stimulates many regions in brain organisations. It improves cognitive performance, enhances the function of multiple systems in brain regions, and promotes creativity as a resources to combat many health problems.

I express my gratitude for all experts, researchers and writers who conduct studies and write about their excellent researches on creativity process within improvisation and to prove the facts that improvisation is creativity and musical improvisation as creative art elicits good emotion and positive feelings which play an important role as a resource to give positive contributions to cognitive performance and provides various essential benefits to human health and well-being.

I hope this thesis, could add insight and knowledge to many people, educators, parents, music therapists and professional health-cares about the essential benefits of improvisation and to continue their supports in implementing improvisation in various fields especially the musical improvisation as a music creativity to improve human health and well-being .

Index of abbreviations

ABC	Autism Behaviour Checklist
ABC2	Aberrant Behaviour Checklist
ACC	Anterior Cingulate Cortex
ACTH	Andrenocorticotropic Hormone
ADHD	Attention Deficit Hyperactive Disorder
ADOS	Autism Diagnostic Observation Schedule
ANEW	Affective Norms of English Words
ASD	Autism Spectrum Disorder
ASSCM	Assessment of Social Skills for Children with Autism
ATEC	Autism Treatment Evaluation Checklist
AUT	Alternative Uses Task
BCA	Broca's Area
BDI	Beck Depression Inventory
BVP-A	Amplitude of Peripheral Blood Volume
CARS	Childhood Autism Rating Scale
Cb	Cerebellum
CDT	Clock Drawing Test
CGI	Clinical Global Impression
CMA	Centro Medial
CPM	Component Process Modal
CRASS	Communicative Responses Acts Score Sheet
CRS	Coma Rating Scale
CRS-R:L	Conners' Rating Scale (Revised- Long Version)
DERS	Difficulties in Emotion Regulation Scale
DLPFC	Dorsolateral Prefrontal cortex
DMN	Default Mode Network
dPMC	dorsal Premotor Cortex
DRS	Disability Rating Scale
ECN	Executive Control Network
EEG	Electroencephalogram
EIMT	Emotional – regulating Improvisation Music Therapy

EQ	Empathy Quotient
ER	Emotional Regulation
ERQ	Emotion Regulation Questionnaire
ERT	Emotional Response Task
ESCS	Early Social Communication Scale
FEAS	Functional Emotional Assessment Scale
FDT	Five Digit Test
fMRI	Functional Magnetic Resonance Imaging
FSS	Flow State Scale
FTT	Finger Tapping Test
GAF	Global Assessment of Functioning
GDS	Geriatric Depression Scale
GOS	Glasgow Outcome Scale
HADS-A	Hospital Anxiety and Depression Scale-Anxiety
HCG	High Creative Group
HD	Huntington's Disease
HRSD	Hamilton Rating Scale for Depression
HRV	Heart Rate Variability
IFG	Inferior Frontal Gyrus
IPA	Interpretative Phenomenological Analysis
IPL	Inferior Parietal Lobule
IPMC	Lateral Premotor Cortex
ITG	Inferior Temporal Gyrus
LAS	Likert Anxiety Scale
LCG	Low Creative Group
LEiDA	Leading Eigenvector Dynamics Analysis
MACT	Music Attention Control Training
MBSR	Mindfulness Base Stress Reduction
MADRS	Montgomery Asberg Depression Rating Scale
MCIMT	Music Centred Improvisational Music Therapy
MFG	Middle Frontal Gyrus
MIR(S)	Music Interaction Rating for Schizophrenia
MMSE	Mini Mental State Examination
MPA	Music Performance Anxiety

MTIDP	Music Therapy Improvisation and Desensitization Protocol
MTG	Middle Temporal Gyrus
PANAS	Positive and Negative Affect Scale
PARQ	Performance Anxiety Response Questionnaire
PCS	Post Coma Scale
PDDBI	Pervasive Developmental Disorder Behaviour Inventory
PET	Positron Emission Tomography
PFC	Prefrontal Cortex
PMd	dorsal Premotor Cortex
PMv	ventral Premotor Cortex
POc	Probability Of Occurrence
Pre-SMA	pre Supplementary Motor Area
RBMT3	Rivermead Behavioural Memory Test
RAVLT	Rey Auditory Verbal Learning Test
RCPM	Raven's Coloured Progressive Matrices
RCb	Right Cerebellum
RCZ	Rostral Cingulate Zone
RMAS	Rush Modified Anxiety Scale
RMT	Relational Music Therapy
tDCS	Transcranial Direct Current Stimulation
SAM	Self - Assessment Manikin
SAPS	Scale for Assessment of Positive and Negative Symptoms
SFG	Superior Frontal Gyrus
SMA	Supplementary Motor Area
SMG	Supra Marginal Gyrus
SPL	Superior Parietal Lobule
SPSS	Statistic Package for Social Sciences
STAI	State Trait Anxiety Inventory
STEPS	Summer Training in Environmental and Pharmacological Health Science
STG	Superior Temporal Gyrus
STT	Synchronised Tapping Task
VAS	Visual Analog Scale
vPFC	Ventrolateral Prefrontal Cortex
vPMC	ventral Premotor Cortex

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1 Introduction

The topic of this research is the distinct effect of musical improvisation on human health and wellbeing. I am interested to research this topic, in order to continue my previous study about the importance role of music in human life. Music is widely appreciated as important to human health, and the activity of musical improvisation is distinct from other music activities. Within its distinctive characteristics, it relates to social interaction which everyone could participate in it and while performing in a group it needs contribution of two or more people who response to each other, each performance is a spontaneous creation of novel music, therefore it demands creative thoughts, everyone involved in this activity obtain the experiences to express their own emotions and feelings. Considering the accessibility of musical improvisation, many experts believe it has the potential for a wide range applications as an medium to improve human health and well-being.

In recent years, musical improvisation and its impacts have caught many experts' attention, and the expanding field of researches have attracted my interest to learn more about all of the information and knowledges which are related to this topic. This study analyses the existing records from reliable resources, such as; theories, literatures and science research materials, and other relevant data and information which related to the capacity of musical improvisation. Through the investigation of all relevant resources, I realized that musical improvisation as a creative art may offer beneficial impacts to human health and well-being.. It is an essential field that must be explored further, in order to extract its fullest advantages.

Improvisation is generally seen as an act of inventing and performing a creation of art, which is carried out at the same moment simultaneously and as a spontaneous performance. The action of improvisation content a freedom to create and to perform, so that the created art work is in different form of creativity and it is a unique work which is different from one another.

Improvisation and creativity are combined into one idea and inseparable from one another. Experts consider improvisation is the process of creativity (Johnson-Laird, 2002; Sawyer, 1999; Thompson, 2014). According to Oxford dictionary, creativity is the using of skill and imagination to generate something novel that similar to the producing of art" (Oxford English Dictionay), and creativity contents two things which are flexibility and exploration which incorporated with inspiration (Nous9, 2008). In general condition, researchers often equalize the final result of an act of creativity in the form of product, idea or behaviour (Richards, 2007). Musical improvisation is one of the improvisational

performance. The creative process when it occurred during performance, is the product and the audiences enjoy the product of creative process (Sawyer, 2000). Creativity can be harnessed in various human activities to improve the quality of life. In our daily language, creativity is a process that guide us to an output that evokes positive affect (e.g. pleasure) and is primely (not extremely) novel" (Schiavio et al., 2022).

Ruth Richards had conducted a study to prove that in creative accomplishment, positive affect is involved (Runco & Pritzker, 2020). Being a creative person experiences the creative process that include mental abilities and practical behaviour to innovate and discover new ideas or new outcomes, and during the journey of experiencing the creative process, it boosts and eliciting good emotion and positive feelings, thereby creativity promotes health and well-being.

Musical improvisation has its essential potential to link conscious (guided by logic/reality) with unconscious process (not governed by logic/reality) in human mind, it absorbs the creative process, through musical improvisation individuals experience the non-verbal social and creative interrelation, and also the capacity to express difficulties or represses emotions without spoken/oral articulation (MacDonald & Wilson, 2014). Thus as a creative art, musical improvisation promotes the creativity to improve human health and well-being. It stimulates many regions in brain organisations and activates wide range of brain areas, It effects cognitive performance, such as cognitive flexibility and memory, enhances creativities and divergent thinking. eliciting positive feelings and emotion, effects blood system and neurochemistry, enhances interpersonal coordination, provides opportunity to express oneself and to increase social bonding, and many other benefits to combat many health problems. Overall, most of the improvisation activities including the musical improvisation facilitate the distinct effects on human health and well-being.

2 The concept of improvisation

What do we understand about improvisation? An improvisation is a deed or an action in individual practice that develops something instantly, and while people perform the improvisation they also develop it. The practices of improvisation are unequal with the practices of something which only different form how things are normally done (Bertinetto & Ruta, 2021). A practice could be called improvisation if it "can be specified through the concept of the unexpected" (Bertinetto & Ruta, 2021). In terms of improvisation practices there are something unexpected, that trigger / prompt a reaction which change the way of the ongoing practice. In order to make clear explanation about the concept of improvisation, in

their writing Bertinetto and Ruta give an example about cooking a meal. If the person who cook the meal only omit the salt for his purpose to obtain mere curiosity or fun, the action is not considered as an improvisation in cooking, because the person who cooks only doing something differently and nothing unexpected could happened, which means that we could guess how the meal would taste without salt, but the improvisation in the sense of cooking is to develop a dish through series of actions without any guidance of fixed recipe, since in the concept of an improvisation, it generates a different form of the unexpected conditions. And using the same example about the dish without salt, if the person who cooks has a hope that he/she will produce an interesting taste, but then in their practice they don't, he/she is triggered/ forced to react towards the unexpected taste by modifying the dish, and this is the typical of an improvisation as explained above that "something unforeseen/ sudden drives a response and alter the way the practice is ongoing" (Bertinetto & Ruta, 2021).

There are various types of improvisational practices, such as dance improvisation, improvisational theatre, improvisation in painting, improvisational poetic, improvisation in sculpture, improvisation in design process, urban improvisation, improvisation in cooking and tasting, improvisation in musical practices and many others fields. Most of those various types of improvisation, are characterized with many features within its process such as originality, value, unexpected surprise, and which are all associated with creativity. To many experts, improvisation is creativity. According to Sawyer (2000) improvisation performance has been in the state of being uncared, since most people have been focused on product creativity that result in real/ tangible products such as paintings, sculptures, music scores, in which the final product/ real results are remained after the creative process is completed, and the production period usually involved a long duration of creative work. To Sawyer, improvisation performance is creativity, since the creative process during improvisation performance is the product, it is created in the moment onstage, and improvisational performance is interrelated to the empirical study of all creative genres (Sawyer, 2000). Other experts also wrote that they presume that improvisation has a significant mark as a creativity, they found many elements within the improvisational practice confessional as components in creativity, and they also mentioned that spontaneity in improvisation as a unique aspect of improvisation, as well as a common feature in creative process (Bertinetto & Ruta, 2021).

Improvisation is essential and play an important role, through learning and developing the skills of improvisation, whether through acting like in the improvisational

theatre, improvisational design process, musical improvisation or other fields of improvisation could leads to better outcomes of health and well-being (Gillam, 2018).

2.1 Musical improvisation and creativity

In every genre of performing art, there is an element called improvisation and it is not prescriptively notated (Sawyer, 1999). Improvisation is originated from the Latin word "improvisus" which means unforeseen or unexpected (Sawyer, 1999).

Improvisation is generally seen as an inventiveness, a potential of being inventive and performing a creation/ creativity, which is carried out at the same moment simultaneously and as a spontaneous performance. The action of improvisation content a freedom to create and to perform, so that the created art works are different creativity and unique from one another.

In terms of musical improvisation, it refers to the ability to invent and to perform new music by modifying or enhancing individual touches. We hear and enjoy novel and origin music which is in the form of different creation in each musical performance both in tone colour, phrasing, timing, tempo and dynamic and also its character of music. Each musician and artist has his/her unique artful expression to perform their unthinkable form of music to their audiences which are created from their creative and spontaneous thoughts at the moment of their performances. To improvise, an individual needs skill, extensive practice and creative thoughts. Each musical improvisation from each musicians is a new creation of new music/ a novel music composition, which representing performer's individuality with their own characteristic and uniqueness. Thus the activity of musical improvisation is considered as musical creativity because it involves the invention and production of new music (Deliège & Wiggins, 2006).

In order to obtain a fullest understanding about the wide range of capacity from the activity of musical improvisation, it is necessary to look from different prospective. It isn't only ties with creative activity that demand attention and concentration of creative thoughts to explore productivity and inventiveness, but also it has a potential to express emotions and feelings from individuals who involved in it. As written in the book of *"Philosophy of Improvisation"* by Gary Peters (2009) , "improvisation becoming increasingly submerged in a collective language of care and enabling of dialogue and participation, a pure, aesthetically cleansed language of communal love" (Landgraf, 2011, p.12) (Peters, 2009, p. 24), it is explained that it implies the participation, dialogue and communication in the practice of musical improvisation. To many musicians who had experienced in performing musical

improvisation, it is like language, when they improvise, they're talking, speaking and responding and like having a conversation. Music improvisation is also closely related to social phenomena. "It is noteworthy that improvisation seemingly can accommodate both delectations, an increased focus on differences, singularity, and originality as much as celebration of sameness, universality and community" (Landgraf, 2011, p.12).

By realizing the wide range of capacity and the characteristic of musical improvisations many experts and researchers suggesting that improvisation may offer many intrinsic benefits and distinct effects on human health and well-being, and there are several characteristics of musical improvisation which are identified as underlying these effects during individuals engage in improvisation; its potential to link conscious with unconscious process, focus in absorption of a creative process, creative and social interaction non-verbally, capacity of communication for expressing feelings and hold down emotions without verbal articulation (MacDonald & Wilson, 2014). Therefore Nowadays, in various therapeutic implementation, it is widely develop to use musical improvisation as well as other fields of improvisation to enhance the creativity, boosting the good emotion and feelings, and as a transformation facility to promote healing, support positive effects on health and well-being.

2.2 A brief history of musical improvisation

Musical improvisation had been applied in musical activities long time ago since the early music era. So it has its roots since late medieval (around Anno Domini 1250-1500), renaissance (around 1400-1600), and early baroque (around sixteenth to seventeenth century) (Wegman et al., 2014). "Instrumental musicians of the Middle Ages and early Renaissance rarely worked from scores, but improvised or memorized most of their pieces" (Gould & Keaton, 2000, p.143). A long with the gradual innovation of music instruments and widening of music performance, the popularity of musical improvisation during this era is decorated and showed in basso continuo and the use of figured bass was rising prominently (Vigran, 2020).

After the music notation was invented and standardized, musical improvisation still passing through to each music generation; classical era, romantic era, modern era, and to date we still sense that musical improvisation as highly valued in many genres of music. According to Ben Bechtel a professor of musicology in Cincinnati, the most prominent characteristic of music performance during renaissance and baroque eras was improvisation and spontaneity, since there wasn't any authentic interpretation existed, means that

composers infrequently specified interpretation criteria, thus many considerations must be improvised (Bechtel, 1980). In Baroque era, music improvisation was an important part, performers in that period, were demanded with high responsible freedom. Both Bach and Handel held a great reputation as improvisers (Renwick & Renwick, 1995). Musical improvisation grew to such importance in this era due to the emphasis on personal expression which was highly valued. Music performers in earlier eras were expected to be able to improvise, "the improvisation of a fugue has been considered by many as the definitive test of musical accomplishment" (Renwick & Renwick, 1995, p.17), performers often improvised based on figure bass pattern (Heble & Laver, 2016).

In the Classical Period (seventeenth to eighteenth century), musical improvisation was still tightly bounded. The word "fantasien" which means something was performed fanciful or over imaginative. It was used since the word improvisation didn't exist until the end of eighteenth century. Therefore the "fantasias" which have become a part of the standard repertoire, were originally improvisations, which were later written down on paper (Vigran, 2020). It is very often, during the period, cadences/ cadenzas and ornamentations were improvised. During the most intense moment of Western classical music, between the seventeenth and eighteenth centuries, musical improvisation was prevalent and played an important role (Heble & Laver, 2016). Musical improvisation is represented oftentimes as a centre of attention in most performances both in public events or in personal lives of many composers. Beethoven is one of the prominent composer with supreme skilled of musical improvisation, and he improvised during his public concerts. Other composer during classical era such as Mozart is also very often performed musical improvisation with his interpretation of their own written pieces in public (Borio & Carone, 2017).

During romantic era (eighteenth to nineteenth century), it was frequently included musical improvisation in musician's/ composer's performances, which was very often based on member of audience's requests (Gould & Keaton, 2000), as an examples Liszt enjoyed improvisation pieces based on themes which suggested by the audience, which was written on scraps of paper before his performances. A great composer Chopin is also extensively known for his brilliant improvisation skill.

In the late nineteenth to early twentieth century, musical improvisation for Western classical music performance has played a smaller role and become almost disappeared, but the opposite condition for some modern/ contemporary composers which increasingly focus adding the musical improvisation in their performances. Several prominent musicians in this

era with brilliant skill in improvising are Josef Hoffmann (1876-1957) and György Cziffra (1921-1994) (Vigran, 2020).

Present day, we still could enjoy musical improvisation performances from many talented artists with their brilliant improvising skills, among them are Robert Lavin, a prominent pianist and musicologist of Harvard who frequently performs and improvises classical era compositions and Gabriela Montero a Venezuelan pianist who also improvising in her classical concerts, she often asks for a melody from the audiences at random and improvising upon the melody as an encore, or performs a unique concert like improvising Bach composition using Jazz harmonies (Vigran, 2020).

Throughout historical study, we could reassure that the ability to generate new music or novel composition of music spontaneously during the performance of musical improvisation is indeed and considered as very important activity and as fundamental aspect of music performance in each musical period. To date, many experts have discovered its significant advantages to human life, thereby guide us to a deeper understanding of musical improvisation as a creative art, that contain its specific beneficial function to generate creativity, evokes good feelings and emotions, thus brings good impact to health and well-being.

2.3 Creativity and its importance

It isn't an easy way to define the meaning of creativity, but it is simple to understand it. Basically, every individual has been biologically inherited with the ability and capacity to be creative, for example in our daily life how we generate our own sentences in expressing our thoughts, choose outfits on what to wear, how to combine our clothes and shoes, what to cook for our breakfast, lunch and dinner and what drinks should we combine with our selected meals, how to train our pets, how to solve our daily problems, the way we organize our leisure time or vacation and how to involve in many other activities.

It is important to understand and considered widely accepted that creativity is an element of giftedness (Young, 2013), some people has more creative abilities exceed the abilities of others, and conversely there are also those whose levels of creative abilities are lower compare to others. This can be triggered by different types of occupation which carried out by each individual. For those who involve in arts such as musicians, interior designers, architects, painters might have higher ability & opportunity to develop their creativity.

The ability to be creative could be developed and the way of teaching creativity is by encouraging the use of imagination, learn autonomously, have and apply ideas, or generate

novelty even at the risk of being wrong (Cropley, 2018). The ability to be creative, is needed in every aspect of life both at work and in leisure time.

The meaning of creativity according to Oxford dictionary is using our skills and imagination to produce something novel similar to produce arts. The word "creativity" originally derives from Latin "creare*"* which means to make and the Greek "Krainein" means to fulfil. Creativity, according to Young, it involves three components : skills, newness and value (Young, 2013). In our daily creativity, we could see it as a fundamental survival capability (Richards, 2007). According to Csikszentmihalyi through creativity we could also see a process by which a symbolic domain in the culture is altered, for instance new songs, new ideas, new invention in machinery and others new discovery are what creativity is about (Csikszentmihalyi, 2009).

The outcome of creativity is created through creative process, and in this process, skills are important, because it takes skills to generate something new and valuable. The creative process which had been researched and described by Graham Wallas in his timeless 1926 model, consists of four sequential stages of creativity process (Wallas, 2018) , mentioned as "Preparation" The stage when the problem was investigated, and our brain collects information, learns as much as we could to prepare, focus on the problem to begin the journey to create a new creation; "Incubation", *w*hen we were not consciously thinking about the problem, our brain stop all activities which were related to the creation which we had initially set on our mind ; "Illumination" when our brain was out from the incubation stage and the happy idea is appeared together with the psychological events which immediately preceded and accompanied that appearance, in this stage we find the insight to proceed with our creation to make it visible; "Verification" when we perform action to improve our creation and the validity of the idea and the outcome is tested.

Being a creative people, it requires imaginative thought, knowledges and skills and the creative process is regarded as a process of discovery which evokes positive feelings and emotions thereby creativity promotes health and well-being (Schmid, 2006).

Dr. Csikszentmihalyi, M. a psychologist described his brilliant thought in his writing on a chapter explained about the flow of creativity, that the result of creativity enrich the culture and improve our quality of life. We learn a great deal of value of being a person with creativity. Individual who actively engage in creativity could drive one's life more interesting, more fulfilling, more flourishing which is elicited by the expression of one's inner self. Creative persons devoted to what they do, they feel good when something is

discovered, and to them the great deal of enjoyment was the quality of experience they felt when they involved in creativity (Csikszentmihalyi, 2009).

Many researchers had conducted their studies to find out the great impacts of everyday creativity both to emotion, personality, health and well-being. One of the great researches is from Conner and her colleagues, they had conducted recent experiment sampling of 658 young adults based on models of creativity as a tool for promoting well-being, the result showed that everyday creativity cultivating positive psychological functioning. DR. Conner and her team believe when people think they are creative, they certainly experience more positive emotion and they suggested that people should engage more in creativity in daily life (Conner et al., 2016).

It has been scientifically proven and widely accepted that creativity plays an essential role in our everyday activity and critically important to individual's health both physically and psychologically in optimizing human functioning (Villarreal et al., 2013).
People have both the indigenous/ original capacity to be creative and the biological need to reveal it and at the moment that the creativity is sufficiently expressed through daily activities, it has a primary impact on health and well-being" (Schmid, 2006).

2.3.1 Musical improvisation as a therapeutic in music therapy

Musical improvisation is a performing art like theatre and dance, it could be understood as an artistic creativity. The value of creative achievement is involved in the actions to create something with genuineness, originality, and it needs skills, abilities or flairs, thoughts, and imagination to produce creativity outcomes in the form of products, ideas or behaviours.

Many people are trying to obtain improvisational skills in order to prepare themselves as a professional musical therapist, then using musical improvisation as a therapeutic in helping people who need treatments. They start to acquire skills and knowledges from a series of simple musical techniques then continue move on to combining those techniques to form therapeutic methods. So musical improvisation as a therapeutic could be interpreted as using the combination of musical techniques as well as differing musical parameter which can modify and influence the style and quality of music then to form a series of musical creation, also developing a conscious awareness of the potential in each variability of musical creation (action in developing the integration and elaboration of musical improvisation skill) then implement them as therapeutic methods (use them as interventions in each musical therapy) (Wigram, 2004).

Sawyer wrote, that the creative process which occurred during improvisational performance, is a product and the audiences enjoy the product of creative process. Improvisation is creativity (Sawyer, 1999). In terms of musical improvisation, its product is unique, and it is original, we hear something new and it is performed unpredictable. What we hear in every musical improvisation performance is beyond our ability to foresee, thereby it is widely accepted that musical improvisation is an artistic creativity, and the creative process in improvisational activities have robust potential to give a great impact to health and well-being.

In musical improvisation, the musicians' intense degree of sensitivity and responsiveness to one another, both in rhythmic, melodic, and harmonic nuances and the ability to express themselves communicatively with one another, is closely correspond aspects of music therapy improvisation. According to Pavlicevic, in his journal *"Improvisation in music therapy: human communication in sound"*, the musical proceeding seems to have an intimate interpersonal base (Pavlicevic, 2000), and it would seem to be a sufficient grounds for interchanging the musical improvisation and music therapy improvisation due to the resemblances (Pavlicevic, 2000), but in music therapy, improvisation is a direct communicating and experiencing of oneself through music elements such as tempo, rhythm, contour, shape, motion and texture of music, speech vocalization, gestures and facial expressions, therefore it is not only musical experience, but also as personal and relational (Pavlicevic, 2000).

The significance of improvisation in the therapeutic process has been understood by many therapists. "Jazz music has promoted improvisational abilities of musicians and created a tool which music therapists use in active music therapy for their work with client" (Aldridge, 2005, p. 231). Musical improvisation has been used in therapeutic methods, and the ability in using the improvisational technique is depends on the knowledge of specific musical skills and the integration of those skills and according to Bruscia (1987), in his book "*Improvisational Models of Music Therapy"*, there are about 64 improvisational techniques which are applicable in therapy (Wigram, 2004, p.34)

It is important to identify the potential of creative arts as a therapeutic tool and transformational tool for healing and to give protective effect in health and mental well-being. A literature studies conducted on several researchers had suggested that creative art used as a therapeutic tool, could effects and enhances relaxation, develops self-expression, reduces blood pressure, reduces stress and boosts immune system (Leckey, 2011). There is

also an example of scientific study which was conducted by Gene D. Cohen, M. D., Ph. D. with a project's title of *"The Creativity and Aging Study",* which took place in Washington DC, had showed a positive result in 50 participants of intervention group (approximately 80 years of age),who participated in art program, had reported a better health condition, fewer doctor visits and less medication usage, more positive responses on mental health measures and more involvement in overall activities (Cohen, 2006).

Armed with the extensive knowledges about the essential potential of musical improvisation, many therapists have utilised the musical improvisation in their clinical improvisation to help people who are in needs. There are many models of musical improvisational therapy and the application of each model is depend on the specific objectives (Bruscia, 1989). Musical improvisation as a creative art plays a central role in many approached to music therapy. According to Kenneth E. Bruscia, PhD a professor of music therapy, improvisation is the most essence of therapy (Wigram, 2004). Although the improvisational skill which is performed in musical therapy for many purposes of treatments distinct from the improvisation in other context, actually its processes is identical, thus suggesting that through the activity of improvisation may offer primary and real benefits to human health and well-being to wide range of populations (MacDonald & Wilson, 2014).

3 Musical improvisation and brain networks.

Improvisation is generally seen as an inventiveness, a potential of being inventive and performing a creation/ creativity, which is carried out at the same moment simultaneously and as a spontaneous performance. The action of improvisation content a freedom to create and to perform, so each of the final creation is a different creativity from one another and a unique work. And in terms of musical improvisation, it refers to spontaneous performance of music to generate new, novel music composition.

Many neurologists have studied the neural correlation of musical improvisation, and they use many sophisticated brain imaging and electrophysiologic method of studies such as fMRI, PET, EEG , as well as tDCS. Through these researches we learn a broad network of brain organization detected are recruited and affected during the performance of musical improvisation (Erkkinen & Berkowitz, 2018). During improviser's brain generating the spontaneous process in creating the novel music, it involves cooperation between large-scale brain networks both the dynamic interaction of the default mode network (DMN – an automatic bottom-up process) and the executive control network (ECN – a top down control process), these different brain's networks associated with different tasks. DMN is linked to

spontaneous thoughts, memory or abstract thoughts, self-generated thought, such as mind-wandering, mental simulation, social cognition, autobiographical retrieval, episodic future thinking, but ECN is linked to cognitive control or cognitive processes which require external directed attention, including working memory, reasoning, problem solving, planning, relational integration and task-set switching (Beaty, 2015)

Many experts had tried to establish many facts and to reach new conclusions about the essential capacity of musical improvisation. The researches' records shows the activation of brain networks during improvisation activity implicates the prefrontal cortex such as medial PFC, ACC, DLPFC, a region which is very important to several cognitive, behaviour and affective functions; motor regions such as primary motor cortex, PMd, PMv, SMA, pre-SMA, CMA, cerebellum, which control body's movement; Limbic/ affective processing (emotional nature), and also reduce activity in hypothalamus, amygdala, hippocampus, parahippocampal gyrus, temporopolar cortex and ventral striatum which associate with positive emotional valence; activates languages areas such as the IFG which is critical for expressive language and generative verbal fluency; sensory processing in both primary sensory area and secondary sensory cortex, such as auditory sensory, somatosensory, and visual; heteromodal sensory processing and the pariental lobes. (Erkkinen & Berkowitz, 2018), and many others.

3.1 What happened to the brain during generating novel improvisation task?

Many experts had conducted researches to figure out what had happened to human brain during musicians generating the novel improvisation task. They investigated which part of the brain is involved specifically when musicians creating the novel musical composition spontaneously. Presented below are several examples of the related studies:

Charles Limb and Allen Braun (2008), neurologists who used fMRI to detect changes in blood oxygenation and flow, they observed the brain's activation of six jazz improvisers, and during their study they found evidences which showed the changes in over 40 regions of their brain areas. The evidence showed that during improvising, there were distributed processing of motor tasks, they found a distinctive feature of improvising brain image which showed a pattern of dissociation in brain area of the prefrontal cortex, most blood activation in medial prefrontal cortex (medial PFC), the increased activity in this part of brain, is associated with self-expression, higher-level goals and intentions (Solstad, 2020),

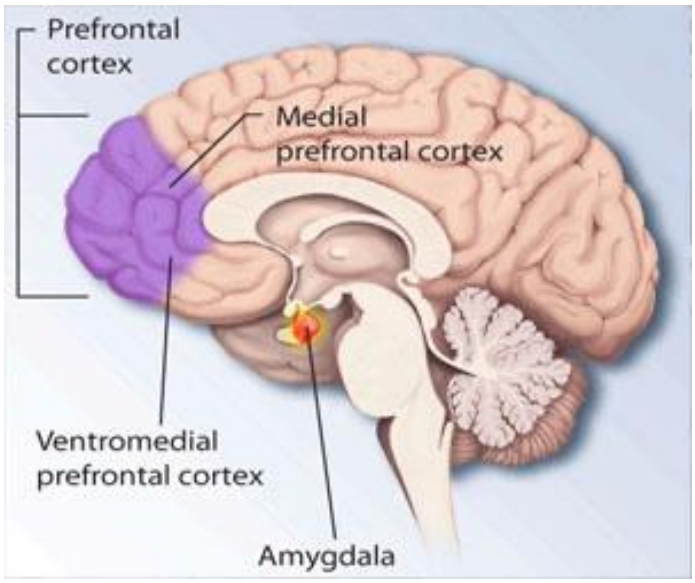

Figure 3–1 *"Medial Prefrontal Cortex*[1]*"*

It has been suggested that the prefrontal cortex is a region of brain organization that has critical importance for number of cognitive behavioural, affective function, and to enables the creative process (Limb & Braun, 2008) and decreased activation in lateral orbital prefrontal cortex and dorsolateral prefrontal cortex (DLPFC). And during conducting their research, they also found several facts which showed activations in visual areas, ITG, MTG and auditory sensory area, posterior superior temporal area and somatosensory (Limb & Braun, 2008). They also saw reduction of activities in some areas including the hypothalamus, amygdala, hippocampus, parahippocampal gyrus, temporopolar cortex and ventral striatum which indicated the positive emotional valence associated with improvising (Limb & Braun, 2008). The entire DLPFC region was attenuated during improvisation, it was shown by the decreased blood flow in these areas, and this part of brain is associated with self-monitoring, planned action and correction. The deactivation of DLPFC area might suggest suspension of conscious control, therefore enabling freer, more spontaneous thoughts and actions, more creative performance, since this area is considered as an inner critic region, and associated with self-criticism, or self-critical thinking area (Jiang et al., 2018), as voice in our thought like “don’t eat that”, “don’t say that, or “what will happen when you do that”.

[1] URL**:** https://theinfomonkey.com/2015/03/05/what-goes-on-in-your-head-during-creative-musical-improvisation-part-2/ [02.08.2022].

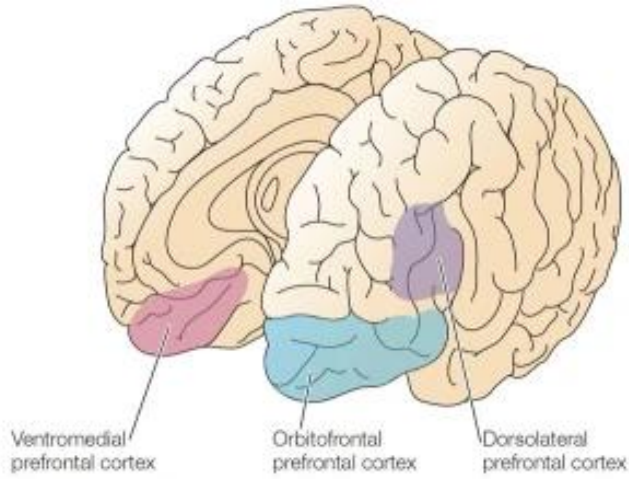

Figure 3–2 *"Dorsolateral Prefrontal Cortex (DLPFC)*[2].

There are numerous studies on self-critical thinking which recruited the DLPFC, for example a study which was conducted by Ke Jiang and his colleagues, showed that individual with low self-esteem would be more self-critical and have greater dlPFC activation during agentic self-evaluation" (Jiang et al., 2018). They concluded their research:

> *conscious control processes are less active during improvisation and theorized that the medial prefrontal regions could generate the improvised output without conscious involvement. In this case, the DMN may have been able to guide improvisational choices due to the high level of improvisational training of the participants*(Dhakal et al., 2019, p.2).

Another scientific research conducted by neurologists Aaron Berkowitz and Daniel Ansari (2008) was to find out which part of the brain were activated on 13 classical trained improvisers during improvisation and they concluded that the finding of novel motor sequences in musical improvisation recruits a network of brain regions coordinated to generates possible sequences (Berkowitz & Ansari, 2008). In their study they used samples of classical trained improvisers. The participants played either novel or pre-learned rhythmic and melodic sequences. They found out there was main effects of melodic improvisation to brain organization, many brain regions were activated, such as RCZ - rostral cingulate zone, ACC - anterior cingulate cortex, left vPMC - ventral premotor cortex, left dPMC - dorsal premotor cortex, IFG - inferior frontal gyrus, right dPMC - dorsal premotor cortex and the left cerebellum.

[2] URL**:** https://theinfomonkey.com/2015/03/05/what-goes-on-in-your-head-during-creative-musical-improvisation-part-2/ [02.08.2022]

Additionally there was a networks of regions deactivated which relative to rest in all conditions in terms of increasing melodic freedom, those regions were the right medial frontal gyrus, right SFG - superior frontal gyrus, right angular gyrus, left supra marginal gyrus and bilateral posterior cingulate cortex. Furthermore, they also found out, there was main effects of rhythmic improvisation to brain organization, it activated a network of regions of RCZ, ACC, left IFG which is critical for expressive language and related to the production of verbal fluency, left sensorimotor cortex, left superior parietal gyrus, and left inferior parietal lobule (Erkkinen & Berkowitz, 2018) (Berkowitz & Ansari, 2008). Here, we could see partially different activation finding compare to Limb and Braun (2008). It occurred due to the different level of improvisational skill owned by the participants, which caused the ECN was greatly engaged during this research as participants were struggling with the novel improvisational task (Dhakal et al., 2019).

Another interesting study which was conducted by Dhakal and his team, with the participants of twenty-four male advanced jazz improvisers. The participants were asked to do four tasks, to sing/ VP - vocalize pre-learned, VI - vocalize improvised, IP - imagine pre-learned and II - imagine improvised, the performance of pre-learned melodies from memory require little to zero creativity. During the pre-learned conditions, participants were asked to sing/ vocalize or to imagine singing without any overt vocalization of one of the four melodies from “Au Privave, Now’s the Time, Blues for Alice, and Billies Bounce”, and during the improvisation condition, participants were asked to vocalize or to imagine a spontaneously improvised melodies over the blues chord progression. Results from both pre-learned conditions were contrasted with the two improvised conditions, VI versus VP, II versus IP, and overall improvisation (VI+II) versus overall pre-learned (VP+IP). They found out that during each of the improvisation task, there was significantly higher brain activation compared with the pre-learned condition. Significant changes were found in frontal activity, during the improvisation compared to the pre-learned condition, they observed widespread activations in “left IFG which is critical for expressive language and generative verbal fluency” (Erkkinen & Berkowitz, 2018), included the BCA, dlPFC, motor areas, IPMC in MFG, and left SMA plus RCb. They also conducted a connectivity analysis among the six nodes IFG, dlPFC, MFG, SMA, RCb and STG, which is a key in selection , initiation, timing and monitoring of motor movements (Erkkinen & Berkowitz, 2018), and this expanding study was to observe whether these regions were functionally connected, and the result showed that the brain networks connectivity or functional connectivity during the

improvisation conditions was less compared to the pre-learned conditions. They concluded that higher brain activation/ higher node activity during improvisation appeared to verify the central role of BCA in the creation of novel musical output, and the attenuation of connectivity/ less brain networks connectivity during musical improvisation supports the idea of limited top down control (ECN) (Dhakal et al., 2019).

Ana Luisa Pinho and her colleagues also conducted a research in 2014. Thirty nine participants of pianists with a wide range of experience in both classical piano experience and jazz improvisation piano playing joined the study, all of the subjects were measured with fMRI during six sessions of experiment. Participants were asked to fill out questioners about the duration they had spent in playing piano throughout their lifetime, and from the data, they calculated the total number of hours spent in improvising ("imphours") and total hours experience in classical (non- improvisatory) or the total hour spent in piano playing ("classhours = the total hours – imphours"*)*. Participants were instructed to play musical improvisation, they were allowed to improvise freely as long as they followed the constraints condition and the specific pitch sets were unique for each trial of tonal and atonal. In the "tonal" condition, they were improvised using six different pitches (from Western music scale - major or minor), in "atonal" condition, they were improvised using six different pitches randomly, the pitches were not all parts of the same major or minor scale and at least one interval greater than a third ("to avoid chromatic sequence") They were also instructed to produce improvisation with the corresponding emotional character for the two other conditions (happy and fearful). In the character of "happy", they were asked to improvise a happy melody without pitch constraints, and in the character of "fearful", they were asked to improvised a fearful melody without pitch constraints. Each condition (tonal, atonal, happy and fearful) occurred two times in each session, they should keep playing throughout a certain duration, and they were scanned during their performance. The results showed that the total hours of improvisation experience ("imphour") had negative correlation with activity in frontoparietal executive cortical areas (the DLPFC, IFG, anterior insula, angular gyrus), but improvisation training was positively associated with functional connectivity of bilateral dorsolateral prefrontal cortices, dorsal premotor cortices and presupplementary area. (Pinho et al., 2014). Through this result, they explained that more skilled improvisers (more experienced - more "imphours"), characterized by lower demands on ECN (executive control). They also found that improvisation with emotional intent is associated with bilateral insular activation, which is important in representing subjective emotional and

motivations states. Moreover, the result also showed that the experienced improvisers, have greater functional connectivity, which reflect more efficiency of informational exchange within important associative networks. (Pinho et al., 2014). In contrast, this study did not show any significant relation between brain activity during improvisation and the "classhours" (experienced in classical music), and there were no association between "classhours" and functional connectivity (Pinho et al., 2014).

Donnay and his colleagues also conducted a research on musical improvisation to find out whether musical discourse engages the language areas of brain. Both language and music are complex system, combinatorial system from smaller units like notes in music and morphemes in language combined to create more complex formation. They had confidence that the generative capacity of music and language that allows each to serve as a means of communication between individuals, in aesthetic and emotional or pragmatic and semantic, and this identical character between music and language raise the probability to share the same brain regions, brain networks and structures to carry out process in both language and music (Donnay et al., 2014). The study examined eleven male musicians who were professional in jazz piano performance. The research of musical improvisation was conducted as it occurs with an interlocutor like "trading fours" in jazz, interacted musically with an interlocutor by four-bar phrases with each other. In control task (scale-control), both musicians A and B alternated playing a D Dorian scale in quarter notes by their right hand. In interactive task (scale-Improv) each musician A and B took turn improvising four measure phrase (trading fours), and the improvisation was limited to continuous quarter notes in D Dorian, one octave (Donnay et al., 2014). In Jazz control task (jazz-control) both musician A and B alternated, performed four-measures segments of memorized novel jazz composition. In interactive task (jazz-improv) both musician A and B performed traded fours, and improvisation was limited melodically and rhythmically, but subjects were instructed to play monophonically and to listen and respond musically to each other's playing (Donnay et al., 2014).The study's result of the improvisation intervention versus the control conditions both "scale" and "jazz", had showed that many brain regions were increased in activation such as language area included bilateral IFG, posterior STG, prefrontal area – bilateral DLPFC (was felt to represent increase in conscious self-monitoring due to increased working demands related to trading fours) , motor area – bilateral SMA, parietal areas – bilateral IPL, bilateral SPL, bilateral SMG and bilateral middle occipital gyrus. There were also areas that showed deactivation such as prefrontal areas- bilateral dorsal prefrontal cortex, default mode areas –

bilateral angular gyrus, bilateral precuneus, motor areas- bilateral precentral gyrus. They concluded that there was a link between linguistic and music discourse, many similarities in hierarchical structures and purposes and both utilize a common neural network for syntactic operations, the social paired of musical improvisation utilized inferior frontal systems which is important for hierarchical structuring of language and musical discourse.

The investigation about the neural functional link between the spontaneous improvisational aspect of music and language was also done by Brown and his colleagues in 2006. They had identified a wide range of brain network which associated with the activity of generating the new melodies and sentential phrases. The found out that the brain's regions which shared identical activation between the task in music and language, were included the bilateral SMA, left primary motor, bilateral premotor, left IFG, left primary auditory, bilateral secondary auditory, anterior insular, left anterior cingulate cortices, the subcortical areas (Brown et al., 2006.).

A comparison study to compare the brain functional connectivity between a conventional group and an improvised group was done by Liu and his team in 2012. The conventional group consisted of freestyle rap artists conducted the task to rap a memorized lyric while the improvise group were asked to improvised lyrics. During the research, the functional connectivity in the improvise group showed increase of connectivity in PFC, increased of connection in left IFG, CMA, ACC, pre-SMA, PMd and reduced connectivity in the right DLPFC. Lyrical improvisation is associated with appearance of a network that integrates motivation, language, emotion and motor function (Liu et al., 2012). This similar result as what had been found in the study of Limb and Braun (2008), suggested the deactivation of the right DLPFC showed that during improvising, the top-down attentional process mediated by network was reduced, so enable the creation of novel that underlie creative and spontaneous activity. Also, during the improvised condition, the left amygdala is itself connected to a wide array of regions in both hemispheres, included the insula, this fact showed that the limbic system which represent emotion, motivation, and memory is involved (Erkkinen & Berkowitz, 2018). "The medial prefrontal cortices may guide behaviour in the absence of conscious attention and effect motor control through alternate cingulate pathways- is one feature of a large network, linking intention, affect, language and action" (Liu et al., 2012, p..6).

Another interesting research was designed by Villarreal and her team (2013) to examine the brain's activities in rhythmic improvisation. Their purpose in this study was to

observe the effect of the level of creativity on the recruit networks. They compared the different impact on the brain's activity in high creativity ability participants and low creativity ability participants through the rhythmic creative capacities in twenty-four music students of a therapy college. The participants were asked to perform different tasks, either they did a repetition on the rhythm they had heard on the instrument's synthetic sound with a timbre that similar to cymbal or they generated creation of a new rhythm based on the presented rhythmic pattern. They were divided into two groups, LCG - less creative group and HCG - high creative group and during the research, their performances were measured, both the number of variations (fluidity) and the type of variations they used (flexibility). The salient findings of the study had showed that individuals with high fluidity and flexibility generated their own genuine creation of modification to the original rhythm, and the brain activity in creation task was increased compare to the repetition task, both in HCG and LCG. In the HCG they found the frontal lobe activation in both hemispheres (left dlPFC, right insula, and a small cluster in vPFC), but in LCG they found activation only in precentral and SMA regions. The novel suggestions to their finding was the individuals with higher levels of creativity implement different brain mechanisms compare to the individuals with lower levels of creativity. HCG had showed greater focus of attention, greater reliance on working memory in generation of their unique and novel combination of products (Villarreal et al., 2013).

Lopata and his team used EEG to evaluate and to compare the neural responses between skilled musicians with FITI - formal institutional training in musical improvisation and those who had no improvisation training (non-FITI). They conducted their research on 22 participants who were shown music charts for three – 16 bars music progressions and also were told the diatomic structures native to each progression (e.g., C-blues scale, G major scale, D-modal) (Lopata et al., 2017). Participants had to perform each piece of the experimental tasks, each time in the same order through the six conditions: listened to the melody (listen), actively learn to play the melody on keyboard (learn), imagined playing the prior melody as closely as what they had heard (imagine playback), performed the learned melody as closely as what they had heard during the listen condition (actual playback), imagined improvising melodies over the chord changes (imagine improvisation), and improvised over the chords changes (actual improvisation) (Lopata et al., 2017). The results of the study showed that both FITI and non FITI groups increased in the frontal alpha synchronization of the right hemisphere during the tasks of "listen", playback", and

"improvisation", but the FITI group showed increased activity in right hemisphere alpha power compared to the non-FITI group. The FITI group also showed, the alpha synchronization during "improvisation" task was higher compare to "listen" and "playback" tasks. The FITI group also showed the positive correlations between the left and the right hemisphere frontal alpha synchrony in all tasks. In non-FITI group showed a strong negative correlation of right hemisphere alpha synchrony in both musical and improvisational experience during the improvisation task. In the FITI group showed that there were positive correlations of left hemisphere alpha synchrony and age, musical experience and improvisational experience during all tasks. These findings suggested that the frontal alpha synchronization is associated with musical improvisation, individuals showed increased in the frontal upper alpha-band activity during generating the creative tasks of improvisation, and the effect was greatest for musicians with formal musical improvisation training (Lopata et al., 2017)

Masaru Sasaki and his colleagues in 2019 also conducted a research on the neural activity which underlying the creative process, and they investigated through musical improvisation. The participants who joined in this study were 14 guitars players with a high level of improvisation skill. The tasks during the experiments were differentiated into two categories, playing 32-s alternating blocks of improvisation or play the scales on guitar instruments (the experimental contrast was improv vs. scale). The result of this study showed that greater activity for improvisational group over the scale group, in many frequency bands such as theta, alpha, and beta, which located primarily in the MFC - Medial Prefrontal Cortex, MFG - Middle frontal gyrus, anterior cingulate, MPFC - Polar medial prefrontal cortex, PMC - Premotor cortex, Pre-CG and Post-CG - pre and postcentral gyrus, STG - Superior Temporal Gyrus, IPL - Inferior Parietal Lobule and temporal parietal junction (Sasaki et al., 2019).

From the above mentioned studies, we understand that the musical improvisation as a musical creativity/ creative art has its essential capability to link the conscious processes with the unconscious processes in human mind (MacDonald & Wilson, 2014), and according to Freud the conscious processes in human mind are guided by logic/reality while the unconscious processes are not governed by logic/reality (Kandel, 2018). And during the process of musical improvisation, it shows the interaction between the DMN - default network and the ECN - executive control network. In real time while the improviser's brain generating the spontaneous process in creating the novel music, it involves cooperation

between large-scale brain networks both the dynamic interaction of the default mode network (DMN – an automatic bottom-up process) and the executive control network (ECN – a top down control process), these different brain's networks associated with different tasks (Beaty, 2015).The neural effects of musical training are depend on the type of training in which musicians engage in, furthermore the different level of improvisational skills and different level of creativity also implement different brain mechanisms. Most of the studies showed that during the process in generating the improvisational tasks, there were significantly higher brain regions' activation and brain regions' connectivity compared with pre-learned condition or non-improvisational condition.

Musical improvisation is one of the most complex forms of creative behaviour (Beaty, 2015), thus during generating spontaneous and creative works of art, the activity of musical improvisation is associated with the widespread functioning of brain regions which involved in attention, higher- order motor processing, limbic processing, unimodal and multimodal sensory processing, and linguistic processing, as what occurs in verbal language, in which auditory-motor representations are recovered from memory storage, chosen and combined based in stylistic rule-based constraints and then executed through the motor system based on real-time sensorimotor and emotional evaluations" (Erkkinen & Berkowitz, 2018).

By having its essential and robust capability to link the conscious and unconscious process in human mind, influence the dynamic interaction between ECN and DMN process (Beaty, 2015), musical improvisation activates many functioning of brain regions. Musical improvisation has the essential characteristic that demands on attention of absorption creative process, and also most musical improvisation is social, which anyone could engage in, each interpreting and musical responding to each other (performing in two – more people), thereby the activity of musical improvisation as a spontaneity, social nonverbal creativity which unfolding in real time, is a kind of unique psychological phenomenon, and it is distinct from other fields of musical activity, and this accessibility of musical improvisation confirms it has the potential for wide ranging application as an intervention in health and well-being, and therefore could suggest further researches to establish accurate measurements and parameters of improvisation in order to claim for its positive effects (MacDonald & Wilson, 2014). All of these distinctive characteristics of musical improvisation could explain that our brain networks and many brain regions respond to the stimuli of musical improvisation's process and that is why, we may suggest that the musical improvisation has distinct effect to influence human health and wellbeing.

4 The distinct power of musical improvisation

To become a healthy individual, it is not just being absence of illness, but it is a complex combination, a merging of different components/ aspects which related to the formation of well-being such as having a great cognitive performance, good physical and mental condition, good emotional and also social health factors. As provided by the World Health Organization (1984), healthy is condition of complete physical, mental and social well-being and not simply the absence of illness (Hozhabri et al., 2022).

Musical improvisation is a complex form of creative behavior (Beaty, 2015) which proven by facts has its robust capability, essential and unique characters in optimizing the function of human body and mind, support actions that individuals perform, enhance the social life activities. Thereby musical improvisation has its unique abilities and wide range application and capabilities to influence human health and well-being. Presented below are several positive influences of musical improvisation.

4.1 Musical improvisation effects emotion regulation and eliciting positive feelings.

One of the factor that influence health and wellbeing is happiness, good emotional regulation which include the ability to repress and control emotion, and also having the positive feelings such as enjoyable and fulfilling.

Musical improvisation as a creative art is a useful and effective tool in cultivating and boosting individual's creativity. It is more than generating spontaneity but the nature of creativity within it, creativity has many great characteristics such as flexibility, sense of intellectual curiosity, passionate, fearlessness, playfulness, enjoy experimenting (Jesson, 2012, as citited in Csikszentmihalyi 1996a, Spendlove 2005 and Craft 2001) which may allow individual to trigger, modify or inhibit higher behaviour goals thus suggest favouring in eliciting good feelings and expressing difficulties or represses emotion.

Positive findings throughout the researches also shows the process during musical improvisation in generating novel composition, is associated with the activity of many brain regions which might eliciting and boosting the good emotion and positive feelings. The activity of musical improvisation could reduce activities in some brain's areas including the hypothalamus, amygdala, hippocampus, parahippocampal gyrus, temporopolar cortex and ventral striatum which may be the indicative of the positive emotional valence associated with improvising (Limb & Braun, 2008). During the study of freestyle rap (improvised condition), the "left amygdala is itself connected to a wide array of regions in both

hemispheres, included the insula", this showed that limbic system which represent emotion, motivation, and memory is involved (Liu et al., 2012, p.4) (Erkkinen & Berkowitz, 2018). The process during improvisation and emotional intent is associated with activation in bilateral insular (Pinho et al., 2014).

In terms of the role of emotion in musical improvisation, there is a high number of musical variety within each emotional category (McPherson et al., 2014), and musicians could combine disparate features, heterogeneous musical elements together in order to convey emotions during improvisation and in generating the spontaneous improvisation, the improvisers can use high degree of structural diversity/ variation as an essential feature of the ability of music to express wide range of emotion in comparison to other forms of musical expression. (McPherson et al., 2014**).**

A great study by McPherson and her colleagues (2014) with an objective to explore the range of musical features that jazz pianists use to express emotions through the process of musical improvisation. In the study they conducted experiment on twelve professional jazz pianists who were asked to improvise melodies in response to emotional cues. They were shown photographs which represented one of the three emotional states, like positive, negative and ambiguous. The result of the study showed that positive improvisations were associated with decreased signal within left hippocampus and more extensive or robust deactivation in the DLPFC which in association with a lack of increased activity in the SMA (which is active during tasks requiring continuous monitoring of motor output), angular gyrus, precuneus compared with the negative/ambiguous, so the positive improvisation induces a deeper state of flow than negative or ambiguous improvisation (Erkkinen & Berkowitz, 2018). In their study they found out "that the emotional cue and subsequent emotional intent of the performers greatly influenced all measured musical elements of their performance". (McPherson et al., 2014, p.,4). The researchers believe that the high degree of structural variation in music, straight related to the wide capacity of music to provide mesmerizing. vivid and fluid emotional experiences that are often hard to describe".(McPherson et al., 2014).

Another interesting research conducted by Mark C. Gridley from the psychology department of Cleveland State University, Ohio, USA, on fifteen studies using questionnaire sampling method to evaluate whether wordless jazz improvisation evokes emotion and whether musical improvisation conveys emotion and weather the emotion felt by the improviser is the same as the emotion felt by the listeners (Gridley, 2010).

> The instigation for the studies was that, during the early part of Coltrane's recording career, one journalist had written that Coltrane was an "angry young tenor," and another journalist had referred to "the rage in his playing," both of which were the opposite of the performer's stated intentions (p.163)

Among the samples, twenty three different professional jazz musicians (aged 20 to 63 years) were contacted at the performance sites during their attendance for the concert in 2004 -2005, and they were asked to describe a single adjective word, about hearing the improvisations of tenor saxophonist John Coltrane, none used the word “angry” or any word that has the same meaning as angry. Another ten jazz critics (aged 76 to 80 years), they were contacted over the phone call and were interviewed about what emotion did they perceive in Coltrane’s playing. None of the participants feel that Coltrane’s music was angry. Three hundred fifty five participants of students from assortment of different classes of four different colleges, they were asked to circle the number on a perception of affect-survey which was designed on one line constituted a 7-point continuum in which position 1 represent friendly and position 7 represent angry (friendly 1 2 3 4 5 6 7 angry) (Gridley, 2010) which best represent their perception of emotion in the saxophone solo they heard on recording (recording from Coltrane’s works). All of them were not told whom they were hearing nor did their teachers know the identity of the improviser. From total 355 students , 61 percent perceived the music as friendly (endorsed on number 1,2,3), 21 percent rated as neither friendly nor angry (endorsed on number 4 – middle number), and 18 percent perceived the music they heard as angry (endorsed on number 5,6 or 7). The result of the study showed variation emotion among listeners, different emotion or different feelings felt by jazz journalists, jazz critics, jazz musicians, and the considerable diversity was obvious in the responses of the student listener (Gridley, 2010), which diverged from the testimony of Coltrane himself. An interview with John Coltrane was held to reveal his feeling and his intention while generating his jazz improvisation work. The author (Gridley, 2010) wrote :

> Coltrane: I hope to play not necessarily a more beautiful sound, though I would like to, just say tone-wise, I would like to be able to produce a more beautiful sound. But now I'm primarily interested in trying to work what I have, what I know, down into a more lyrical line, you know. That's what I mean by beautiful—more lyrical, so it’ll be, you know, easily understood (p.174).

The implication of this study confirm that the wordless jazz improvisation certainly could evoke emotion and the emotion that felt by the listeners were different or not always the same from what was felt by the improviser.

The capacity of musical improvisation to affect individual’s feeling and emotion is consider as one of the major aspect that make possible musical improvisation generates positive effects to health and well-being.

4.2 Transfer effects of musical improvisation on cognition

Good health and well-being has been shown strongly and closely related to good cognitive performance. Creativity is well accepted as a high level cognition process characterized by contextually significant generation of new ideas (Diaz Abrahan et al., 2020), and participated in receptive and creative activities is significantly associated to good health (Clift & Camic, 2016). Musical improvisation as a creative art/ musical creativity which has its potential for wide ranging application as an intervention in health and well-being, which had been proven over many studies which effect on cognition in many fields of cognitive performance. Presented below are several researches about the positive effects of musical improvisation on cognitive performance.

4.2.1 *Musical improvisation improves memory*

Memory is a part of cognitive performance, which is very important to learn, store and retrieve the whole types of information. We know many subsystems of memory. Emotional memory is considered as a part of episodic memory which defined as "a better storage and recall of the events associated with emotional factors" (Hurtado-Parrado et al., 2020, p. 208). Musical improvisation involved musical creative behaviour, and therefore implemented in many researches in order to investigate its intervention in the field of neurologic musical therapy. There are several studies which focused on the effects of musical improvisation on memory.

One of the research was conducted by Veronika Diaz Abrahan and her colleagues. They studied on one hundred thirty seven volunteers between 18 and 40 years of age, to prove that musical improvisation improves memory. Seventy five of the participants were musicians (M) with more than 5 years of musical training, while sixty two participants were non-musicians (NM). The material for the memory task consisted of 36 pictures from the "International Affective Picture System". Among the pictures, 24 pictures were emotional arousing which consisted of 12 with positive valence and 12 with negative valence, while the other 12 pictures were non-arousing, neutral pictures. And for instrumental setting, the participants could choose percussion instruments such as drums, maracas, bells wood blocks, shakers and tambourine or melodic/ harmonic instruments such as guitar, melodica, xylophone or flutes. The treatment conditions were divided into 3 conditions: silence condition (SIL) in which the participants remained silent in 3 minutes, imitation condition (IMI) in which the first author-music therapist performed a rhythmic pattern repeatedly for 3

minutes and to be imitated by the participants using instruments, voice or body. In music improvisation condition (IMP), the same therapist performed the same rhythmic pattern repeatedly for 3 minutes and then the participant used it as a base for their improvised performance in playing the instruments, voice or body spontaneously. All of the participants were divided into 6 groups or 6 groups of experimental design; (1) M/SIL musician who remained in silence (33 individuals); (2) M/IMI musicians who imitated (16 individuals); (3) M/IMP musicians who improvised (26 individuals); (4) NM/SIL non musicians who remained silent (31 individuals); (5) NM/IMI non musicians who imitated (16 individuals) and (6) NM/IMP non musicians who improvised (15 individuals). The research was held in two sessions with one week intersession interval. For the first session there were 4 phases, firstly the participants were signed the informed consent and complete questionnaires about personal information such as age, gender and music expertise. The second phrase run about 5 minutes, all of the participants watched the 36 selected pictures in 7 seconds of each. Pictures were showed in random order except the 2 neutral pictures were presented as a first and last image in the series. Simultaneously they had to give rating from 0 to10 scale of how they felt on each images (0= nothing to 10= highly arousing) in order to measure how emotional they felt. The third phrase (treatment phrase), participants were generating the treatment conditions as mentioned above (silent, imitation or music improvisation). The fourth phrase was a two-weeks test phrase – Immediate Free Recall task (Diaz Abrahan et al., 2018). The participants had to describe in a word or a short phrase about the maximal number of pictures that they remembered (they observed the previous 36 original pictures plus 36 new pictures in random order), and they had to make marks on paper mentioned whether they had ever seen the images before – Immediate Recognition task (Diaz_Abrahan et al., 2018). Then after a one week of intersession interval, the second session was conducted, in which the two test - tasks were run again (Deferred Free Recall task and Deferred Recognition task). The result of Veronika Diaz Abrahan's study (2018) showed :

> A post-hoc test showed that participants in the Improvisation condition recalled more images than participants in the Imitation and Silence conditions, $p < .05$. Between these last two groups there were no significant differences, $p > .05$, and that participants in the Improvisation condition had better recognition than Silence, $p < .001$, and participants in the Silence groups had better recognition than those in the Imitation groups, $p < .05$ (p.8).

They concluded that musicians were more emotional than non-musicians when they had to rate the pictures, and musical improvisation was more effective at modulating memory compare to the other conditions.

These findings strengthen a great opinion that during generating the musical improvisation task, individuals felt the "enjoyment which loaded with emotion, that could play an important role in modulating memory, since it is well documented that emotion moderates this cognitive function" (Diaz Abrahan et al., 2018, p.13, as citied in McGaugh & Roozendaal, 2009).

Abrahan and her team also conducted a research in two studies on the impact of musical improvisation on verbal memory. They evaluated two types of verbal memory: a neutral one using the RAVLT - Rey Auditory Verbal Learning Test in study 1. (neutral verbal memory) and an emotional one, using the Spanish version of ANEW - Affective Norms for English Words in study 2 (Diaz Abrahan et al., 2020). The participants were volunteers of 60-90 year of ages, twenty-four were musicians (M) with musical experience more than 5 years of both formal and informal musical training, and sixty-four were non-musicians (NM). The experimental interventions were consisted of 3 conditions: Musical Improvisation (MI), Rhythmic Imitation (RI) and Rest (R). In MI intervention, all of the participants combined and produced musical patterns with instruments or voices or bodies spontaneously fitting the provided base pattern and they were allowed to choose their instruments, either percussion instruments such as drums, maracas, bells, woodblocks, shakers or tambourine or melodic/ harmonic instruments such as guitars, melodica, xylophone, and flutes. The active control condition was the RI intervention in which the participants were instructed to repeat a rhythmic pattern which was provided by researcher, and participant imitated using their instruments, voices or bodies. The passive control condition was rest condition, the participants were remained seated and silent for about 3 minutes. The study was divided into two-session with one week intersession interval.

In the first session, there were consisted of four phrases, the first phrase is an information phrase, the participants signed and completed the musical background questionnaire then followed with the MMSE test – Mini Mental State Examination test and GDS tests – Geriatric Depression Scale test (Diaz Abrahan et al., 2020) for each individual. In the second phrase, all of the participants listened to the 15 words of RAVLT once, and they were asked to rate 0-10 scale about how they felt about each of the word. The third phrase was an interventions phrase (MI, RI and R), in which participants were randomly assigned into the different groups (4 – 10 persons in each group) and were exposed to the interventions tasks (MI,RI and R), as mentioned before the subjects were given free choices to choose the musical instruments as they wished, The fourth phrase was the two-task

memory test, the participants were asked to write down as many words as they could remember from the RAVLT (Immediate Free Recall task) then after that the previous 15 words of the RAVLT were mixed with 15 new words and they were asked to indicate whether they had listened to the items before or not (Immediate Recognition Task) and after a week-interval , the second session was held again (Deferred Free Recall Recognition task) (Diaz Abrahan et al., 2020). The result of the study 1 showed that the musicians remembered more words than non-musician and the musical improvisation groups (MI) remembered more words than the other two interventions (RI and R).

The study 2 (emotional verbal memory) was conducted on volunteer participants with 60 – 90 years of age, twenty-four were musicians (M) and fifty seven were non-musicians (NM). They used the measurement of ANEW-Affective Norms for English Words, using twenty-four words with emotional awakening (12 with positive valency and 12 with negative valency), and 12 words non-awakening (neutral words) (Diaz Abrahan et al., 2020). The intervention used in study 2 were the same as in study 1, and was consisted of two sessions with a week interval period. The first session consisted of four consecutive phrases. The first phrase was similar to study 1, but in the second phrase the subjects were asked to listened to the 36 selected words, which was presented in random order except for the first and the last location in the series were the neutral words, and the subjects were asked to rate on a 0-10 scale of their feeling about each word. The third phrase was the intervention phrase which was conducted in the same way as the study1. In the fourth phrase a two-task test was held. All participants were asked to write the words they remember (Immediate Free-Recall task), then they were asked to listen from the 36 original words mixed with other 36 new words in random order, next they were instructed to mark on a sheet of paper if they had listened to the words before or not (Immediate Recognition task). The findings showed that the musicians remembered and recognized more words than the non-musicians. They had concluded that musical improvisation altered/ modified neural verbal memory and also had the potential for a wide application as an intervention for cognitive stimulation and rehabilitation of older adults (Diaz Abrahan et al., 2020).

4.2.2 Musical improvisation facilitates divergent thinking and enhances creativity

Divergent thinking and creative thinking has long been of interest to many scientific researchers and consider as essential aspect and one of the main skill in order to survive in today's highly competitive life. As written by Mark A Runco (1991, 2010) that creativity plays a role in each of our lives, it is distinct and independent, and divergent thinking is an

important component of the creative process. Divergent thinking remains the most frequently used indicator of creativity in both creativity studies and educational practice, and divergent thinking theory has a strong hold on everyday conceptions of what it means to be creative (Baer, 2014). Divergent thinking involved a broad search for decision options with respect to a problem for which there is no unique answers, thus in divergent thinking process it generates many alternatives which involve in finding many combination of elements to provide more than one possible solution (Proctor, 2005). It has been suggested that improvisation facilitates the chance to think in a divergent manner (Lewis & Lovatt, 2013 as citied in Medonca & Wallace,2005).

Many scientists have conducted many researches about the relationship between the musical improvisation and divergent thinking. Presented here are several studies about the impact of musical improvisation on divergent thinking:

Carine Lewis and Peter J. Lovatt from the University of Hertfordshire, United Kingdom, conducted a study on total 36 musicians, 24 musicians who were participated in improvisation (12 classical musicians and 12 jazz musicians), and 12 musicians in control condition. The measurement material and instruction used was the AUT - Alternative Uses Task (Lewis & Lovatt, 2013), which required the participants to list down as many as different uses for a common object within 3 minutes. Improvisation condition consisted of two tasks. The first task which was questions and answers, consisted of 18 short musical phrases (each lasted about 10 – 15 seconds) and the 18 phrases were varied in terms of key signatures, tempo, pitch and technical difficulties and each phrase was played in order of complexity and each musician had to provide an answering phrase to what they had just heard. The second task was the ERT - Emotional Response Task (Lewis & Lovatt, 2013), in which each musician was shown visual representations of anger, disgust, fear, joy, sadness and surprise for 15 seconds, and they had to respond musically to one of the six emotional stimuli. Each emotion was displayed six times with 15 seconds interval and participants were told to improvised differently in response to each emotional repetition. In contrast, participants in the control condition were asked to practise a known piece of music. All of the participants were tested individually and they had to complete the AUT pre and pro treatment. The result of this study showed that the score of AUT indicated that the post improvisation's scores were significantly higher compare to the control condition, and from this research the authors concluded that musicians who improvised showed an increased in the scores of divergent thinking compare to the control condition (Lewis & Lovatt, 2013).

Theano Koutsoupidou and David J. Hargreaves conducted an experimental study of the effects of musical improvisation on the children creative thinking in music. The participants were primary school student and were divided into two groups, the experimental group were experienced with variety of improvisation, they were able to explore musical instruments and to improvise freely or under their teacher's guidance, they were also allowed to explore music expression through movement and dance, using their bodies to produce different sounds, so they were well supported to be able to explore both rhythmic and melodic elements of music, also they could made music in a small groups, in pairs, or individually depend on their free choices. There were many improvisatory activities developed in this group, children had to improvise sounds to describe pictures, or to express themselves creatively as part of a story, discussion about many sound qualities, children improvised their movement based on the musical rhythm, and asked to extend musical ideas of familiar musical pieces (made their own musical improvisation), and many other types of musical improvisation (Koutsoupidou & Hargreaves, 2009).

In contrast, the children in comparison group (control group) were not using improvisation at any stage of their lessons. They were introduced a new musical concept or aspects of music theory, the same musical examples were used for music listening and other materials such as stories, pictures which were served as the basic of various activities. In this group, they were given certain rhythmical patterns, simple melodic contours and they were instructed to reproduce, with no opportunities to add any individual aspect during performance. Many repetition of teacher-led exercises were done in this group, and most of the activities were involved all the class together while working in small groups was not allowed, in order to avoid the creative performance (Koutsoupidou & Hargreaves, 2009).

Participants were experienced the pre-test, post-test, and the measurement used to measure the creative thinking in music, was the Webster's MCTM-II - Measure of Creative Thinking in Music II (Koutsoupidou & Hargreaves, 2009). At the beginning of the experiment, the two groups demonstrated similar level of creative thinking, which were shown by their pre-test scores, but at the final of the experiment, there was a statistically significant change in the scores (Koutsoupidou & Hargreaves, 2009), The experimental group improved significantly in their ability of creative thinking, both in music flexibility, originality and syntax, while the control group showed only a small change (Koutsoupidou & Hargreaves, 2009).

Laura Navarro Ramón and Helena Chacón-Lopez also conducted a study to evaluate the impact of musical improvisation on the development of creative thinking skills in terms of four musical factors; extensiveness, flexibility, originality and syntax. Also to analyse the evolution of the creative thinking skill through the comparison between the experimental groups. They researched on 17 participants, and subjects were divided into two groups, a group of younger ages (8 – 11 years of age) and another group of older ages (10 – 11 years of age). They also used the measurement of MCTM-II, and all of the participants experienced the pre-test (before the experimental session) and the pro-test (after the experimental session), the experimental session was conducted approximately within three months. During the experimental session, the education programme was consisted of improvisation workshops with piano as the main instrument and also other musical instruments were introduced, such as percussion instruments, a digital keyboard, microphones with a speaker, a saxophone and a horn. The improvisational activities were designed carefully by researcher in order to engage all of the participants in artistic experience in different context and with contemporary art and music. The result of their study showed after the intervention, the scores of the four factors ME = musical extension, MF = musical flexibility, MO = musical originality and MS = musical syntax) were increased significantly, therefore the study revealed that musical improvisation had a significant impact on children's development in creative thinking in music (Navarro & Chacón-López, 2021). The comparison between two groups showed MS's score in pre-test of younger group (ages 8-9) was much higher compared to the older group (ages 10-11), but pro-test showed the MS was the factor that most improved in the older group (ages 10-11) which proved the intervention had an impact in improving musical aspect that this factor of creativity entails (skills related to the development of form and musical sense) Besides that, they also found the evolution of MO - musical originality in the younger group, which increased from being the lowest score in pre-test to the highest score in pro-test, which could signify that an unusual way to explore musical materials, instrument and performance has actually been developed through the improvisation workshop and interestingly the finding showed that the worst score from each group, MO in group 1 and MS in group 2 were those scores that had improved the most (Navarro & Chacón-López, 2021).

Another study of musical creativity using musical improvisation was done by Patricia Alves Da Mota and her colleagues. They used fMRI to measure the dynamic neural substrates of musical creativity in 16 jazz pianists, during the participants performed the four

different tasks: (1) to play by memory the melody of a song – Memory task, (2) to play from a score sheet another alternative melody – Read task, (3) to improvise on the melody – iMelody task, (4) to improvise freely on the chord – iFreely task, and also during the resting-state. They wanted to estimate how different modes of improvisation (musical creativity) developed over time and which cognitive mechanisms involved in it and compared the changes in the dynamic fingerprint, i.e. POc = probability of occurrence of each functional brain networks involved. The measurement used in this research was LEiDA - the Leading Eigenvector Dynamics Analysis (Mota et al., 2020). During their investigation in the dynamic nature of jazz improviser's brain, they found out that a substrate comprising auditory, sensorimotor and posterior salience networks had a significantly higher POc in both modes of improvisation iMelody and iFreely compare to resting state and plying by memory while another substrate comprising the default mode (DMN), executive control (ECN) and language networks were significantly lower POc in iFreely than in resting-state, while iMelody had a higher POc compared to iFreely condition. In the condition of iMelody and iFreely characterized with the most repeated pattern of the whole- brain functional connectivity (Mota et al., 2020). The authors had concluded that musical improvisation depends strongly on the use of multiple brain regions (each represent by a network combining multiple fundamental brain mechanism), musical improvisation is facilitated by interplay between convergent and divergent thinking, where musicians need to explore multiple prospects, but with a goal of arriving at musical output which is novel and aesthetically pleasant (Mota et al., 2020).

4.2.3 Musical improvisation improves communication skills

The communication skills are very important skills in cognitive performance, that is related to the ability to communicate, to transmit information, thoughts or feelings from an individual to another or within groups. It is a learned skill, but many people are unable to communicate well due to many reasons, such as due to the diseases or other physical and mental disabilities. The communication skills are essential, and by developing the good communication skills can develop all aspects of human life and improve our quality of life (Rajshri, 2011).

Researchers and clinicians have studied the musical improvisation intensively, to find out the facts and to prove that musical improvisation could improve the communication skills. Experts such as psychologists also turn to be more fascinated in using concepts from music therapy and music especially jazz improvisation to describe or draw concern, to

features of non-verbal communication (Pavlicevic, 2000). The valuable skills that improvising jazz musicians engage to communicate and to coordinate their music idea offers a special concept of human interaction and has been employed for many years by many music therapists as a successful intervention/medium in their therapeutic practices (Benjaman, 1998). In musical improvisation, musicians express themselves and communicate with one another, their sensitivity and responsiveness to one another both in rhythmic, melodic and harmonic nuance, is very similar communication in improvisation music therapy between therapist and their clients, since the act within generating music has proven that musical act seems to have an intimate interpersonal base (Pavlicevic, 2000), thereby the musical improvisation process applied in musical therapy suggests to improve the communication skills. One of the interesting studies was conducted by Cindy Lu Edgerton, the participants involved were eleven autistic children (6-9 years of age) who deficits in communication skills, and they were experienced the improvisational music therapy sessions for ten weeks period, using piano, drum and cymbal (Edgerton, 1994). The experimental design in the study consisted three phrases: (1) the intervention session, (2) followed with one session withdrawal of intervention after a level of consistency was achieved, and (3) continue with the intervention for the remaining sessions. During the study there were two observers recorded the communicative behaviors of each participants using the CRASS-Communicative Responses Acts Score Sheet, which contained a total of 107 items (sixty-nine items were categorized as communicative responses and thirty-eight items were categorized as communicative acts), and there were 91 items under the musical category and 16 items of non-musical category. The check was given for each of the behavior and maximum of one check for each behavior, then the checks were totaled in one total communicative responses/ acts score per participant per session (Edgerton, 1994). The result of the study showed an overall increase in the group mean Communication Response/Acts for each session in total 10 sessions (Edgerton, 1994), as well as the individual CRASS scores in 10 sessions showed the increasing scores after the musical improvisation therapy sessions, thereby the result of the study suggests that improvisational music therapy is effectively give essential impact in increasing the sum of the communicative behavior in autistic children (Edgerton, 1994).

Anna Ping- An Wang a music therapist who conducted an observation to analyze the impact of clinical improvisation on an adolescent with communication difficulties. Wang examined four improvisation activities which were taken from four phrases of clinical improvisational music therapy. Improvisation is an essential and effectual tool in musical

therapy, and during her clinical experiences, musical improvisation had been value for its ability to adapt in many different function/ activities and also its spontaneous behavior in providing solution to achieve the therapeutic changes (Wang, 2010). After the improvisational music therapy, she witnessed a progression of the therapeutic changes and communicative improvement in her client, through the growing realization, expansion of interaction ability, and the improvement in the level of pre-verbal expressiveness and verbal skills (Wang, 2010).

Kimberly McCord from Illinois State University, shared her observation on three students with disabilities, by using both traditional and electronic musical instruments as a mean for communicating musical ideas through musical improvisation. The teaching approach used in the musical improvisation therapy was the Orff Music Therapy (McCord, 2009). The participants in the study were three subjects of disability students: John (eleven-year old) with mild autism spectrum disorder, Heather and Linda were fourth-grade disability students - non-verbal students with cerebral palsy and used motorized wheelchair. After engaged in call and response improvisation in the jazz style, focused on building skills in playing and improvising on the instruments, worked on call and response with a recorded jazz rhythm section and took turns playing improvised solos and using call and response (the children listen to their partner's call and respond by playing something that related to their partner's solo), Mc Cord observed that John started to express himself through improvisation, he had proceeded and carried on to work on developing solos and responded to his partner solos. (McCord, 2009). The same improvement experienced by Linda and Heather, they had shown improvement to communicate themselves. Through the study, the author concluded that musical improvisation as communication is one of the most sophisticated form of musical expressiveness (McCord, 2009).

4.2.4 Musical improvisation contributes to the prevention of cognitive decline

Everyone concerns about the cognitive decline which mostly affects many older people. At present moment, it is known that the cognitive impairment or cognitive decline could be prevented and the onset of the condition could be delayed (Leshner et al., 2017). Music therapy has been found to improve the severity of cognitive impairment such as dementia and cognitive decline, and through musical improvisation it could facilitate and contribute in influencing the executive functioning and motor skills and thereby suggesting that musical improvisation contributes to the prevention of cognitive decline.

An interesting study conducted by Marcelo Rabello dos Santos and his team in 2020, with 37 volunteers of elderly people (minimum age 60 years of age), and the participants were divided into 2 groups , the experimental group which experienced the improvisation task and the control group which carried out the choir/ singing task. Before the intervention session, all of the participants experienced the pre-intervention data collection stage (pre-test), in which the psychological and motor tasks were carried out, within two-weeks period which was performed by researchers and was guided by the psychology course of "Universidade Federal de Ciências da Saúde de Porto Alegre. The psychological and motor tests employed in this study were TMT - Trail Making Test, VFL - Verbal Fluence Test, CDT - Clock Drawing Test, FDT - Five Digits Test, RBNT-3 Rivermead Behavioural Memory Test, TUG - Timer Up and Go and FTT - Finger Tapping Test (Santos et al., 2021). Then, the participants in the experimental group were instructed engaged in the free music improvisation task which was lasted in eight weeks with one hour of meeting per week while the subjects of the control group engaged in non-improvisatory - choir activity for the same period of weekly rehearsals of one hour during eight weeks. After the two weeks from the end of intervention period, the post-intervention collection tests was performed (post-test), using the same tests method as in the pre-intervention test. The result of the study showed a significant difference between the experimental group and the control group in the performance of CDT that assesses the visuospatial and planning ability, and the TMT that focused on sustained attention, while there were no significant difference in VFT and RBMT-3 (Santos et al., 2021). They also found a significant difference in FDT score (the reduction of errors in the counting task), which assesses the aspects of executive functioning such as flexibility and inhibition but there were no significant difference both in the TUG and the FTT (Santos et al., 2021). They had concluded that the findings in this study gave partial support to their hypothesis that musical improvisation activity performed by elderly had impact on the executive functioning through transfers between training, planning and inhibition functions, thus their finding strengthen the idea that musical improvisation can contribute to the avoidance of the cognitive declination/ weaken cognitive condition (Santos et al., 2021).

4.2.5 Musical improvisation enhances social skills

According to Ruud from the Musicology Department - Oslo University, if we study musical improvisation we may be able learn that music provides social bonding through listening and making music (Ruud, 2008). Musical improvisation facilitates from being able

"to synchronize oneself with one another, and this may be the first step from social isolation to living in a relationship here and now" (Ruud, 2008, as citied in Ruud 1998, p. 148).

The creative process during the activity of musical improvisation had been researched by many neurologists and scientific experts to provide the communication and interactive process (Diaz Abrahan et al., 2022, as citied in MacDonald & Wilson, 2005, Wilson & Mac Donald, 2012,2016), and musical improvisation in generating the novel music composition is considered a social act in itself, and it involved the individual contribution of two or more people which acting and responding musically to one another (Diaz Abrahan et al., 2022 as citied in MacDonald & Wilson, 2014).

Abrahan and her colleagues conducted a research to investigate the social interaction features that emerge during the musical improvisational process (Diaz Abrahan et al., 2022). They compared the effects of the communicative and social interactive processes which emerged during the activity of musical improvisation with the other musical activity. The participants participated in this study were one hundred thirty one of younger adults and one hundred and ten of older adults. The subjects were involved in two type of music activities , the musical improvisational task and the rhythmic imitation task. They were grouped and compared between eight groups of music musical improvisation groups and eight groups of rhythmic imitation groups. The researchers conducted six types of analysis to evaluate different aspects of the social interaction and non-verbal communication: visual contact, body movement, type of production, music interaction, vocal aspect and leadership (Diaz Abrahan et al., 2022). In the improvisational group, the participants were instructed to listen to a rhythmic pattern played by a music therapist, then participants created and combined musical pattern using instruments, voices and bodies, in a spontaneous way in generating the music according to rhythmic base pattern, while in the group of imitation the participants were also instructed to listen to a rhythmic pattern and after that they started to imitate the pattern precisely without any variations or new musical ideas (Diaz Abrahan et al., 2022). The result of their study showed that the improvisational groups which was performed by two different population – young adults and older adults, they exhibited greater social involvement while creating their music as a group compared to the imitation groups.

4.2.6 Musical improvisation enhances focused attention

Focused attention is a brain's capability to concentrate or keep its attention on every target stimulus in certain period of time. Focused attention plays an important role in mental and physical health (Fehmi & Robbins, 2008). Several studies have reported that through

musical intervention, it may give a positive impact on focused attention, since many elements in music provide multidimensional stimuli that could drive focused attention, such as rhythmic, melody and harmony (Kasuya-Ueba et al., 2020, as citied in Gardiner, 2005; Thaut and Gardiner, 2014).

Yuka Kasuya-Ueba and her colleagues observed the effect of music intervention on the attention in children. The participants who participated in the study were 35 children (6-9 years of age), they were divided into two groups the music intervention group and the video game intervention group and all of the subjects experienced a test of TEA - Ch – Test of Everyday Attention for children prior to and after participating in an experimental task, and also, they were administered to the RCPM - Raven's Coloured Progressive Matrices to make sure that all participants had no intellectual disabilities and ADHD Rating Scale-IV to measure the ADHD – Attention Deficit Hyperactive Disorder symptoms (Kasuya-Ueba et al., 2020). Participants in experimental group experienced the MACT - Music Attention Control Training, involved in structured active or receptive musical exercises and involved pre-composed performance or improvisation in which musical elements cue different musical response to practice attention function (Kasuya-Ueba et al., 2020, as citied in Thaut and Gardiner, 2014). Free improvisation musical intervention were designed according to the participant's ages by using instruments of percussions, a keyboard, hand drums, cymbal. An example of the task were participants were asked to perform percussion instruments matching the experimenter's singing or keyboard playing, and during conducting this task, participants should switch their attention auditorily and also visually in order to match the tempo, rhythm, and melody, and throughout the experiment period participants must rapidly shift their attention back and forth due to the musical cues that designed in multi-layered and changed randomly (Kasuya-Ueba et al., 2020). Participants in the video game group (control group) experienced the video game from 'Nintendo Wii Sports' without music. All of the subjects were reported enjoyed the activities and both video games and musical instruments grabbed the children's attentions. Each participant's data of the mean TEA-Ch scores under each condition were analysed statistically, but due to some reasons, six participants were excluded from statistical analysis, so in total n=29 were analysed. The statistical analysis result showed that the intervention effects were modulated by participants' IQ traits which was facilitated by the music intervention but not by the video game intervention during the attention control, and in musical intervention the author found an enhanced effect on the response speed of attention control/ switching when subjects' IQ - Intelligence quotient traits were controlled,

compared to the video game intervention (Kasuya-Ueba et al., 2020), thereby the study result showed that the musical intervention significantly improved children's attention compared to the video game intervention, and thus the author suggested that musical interventions may be more effective than video game intervention to improve attention control in children (Kasuya-Ueba et al., 2020).

4.3 Musical improvisation potentially lessen the condition of labile hypertension

Labile hypertension is a term of high blood pressure which repeatedly change or changes suddenly from the normal level to the up-normal high level, and could have caused by many problems. One of the main cause of the labile hypertension according to many experts and physicians is that feeling discomfort, anxiety and stressful conditions could have caused the labile hypertension, for instance some people might experience a spike in their blood pressure just because of feeling stress, they are anxious about their visit to dentist or other doctors. Also according to Vögele and Steptoe, the inhibited expression of negative emotions and anxious emotional inhibition could play a role in the level of hypertension or interacted with hypertensive risk (Vögele & Steptoe, 1992). Many researchers suggests that the neural process linked to the creative process during the musical improvisation might particularly appropriate to lessen the condition of labile hypertension, since researchers found in the neural substrates during musical improvisation, give positive affect on the central nervous system areas which involved with euphoria or pleasant emotion, such as shown by the decreasing activity in the hippocampus and amygdala can increase the pleasure or positive emotion response, and many other brain networks which reduce the self-monitoring or self- critical (Limb & Braun, 2008) (Jiang et al., 2018) (Berkowitz & Ansari, 2008) (Pinho et al., 2014) (Azzara et al., 2009).

A great explanation which was written by Christopher D. Azzara, PhD; Mark W. Nickels, MD, and John D. Bisognano., MD, PhD, who hypothesized that developing the mindset of musical improvisation could help individuals with labile hypertension by controlling the blood pressure spikes more effectively. They concluded that learning the musical improvisation skills might give rise to a pleasure response, which then help their patients better handle the negative events or situation thereby could suspend the harsh self-judgement and help them lessen the condition of labile hypertension (Azzara et al., 2009).

Corbett and his colleagues surveyed on twenty individuals (above 18 years) with labile hypertension. During the evaluation, the participants were engaging in approximately one hour- duration of musical improvisation simulation which was delivered via electronic

media. All of the individuals were checked on their blood pressure before and after the observation in a control setting, and they also completed the pre and post evaluation survey in which they should answered questions about how they felt about musical improvisation could help them in their efforts to combat their labile hypertension (Corbett et al., 2021). During the observation, participants were engaged in mindfulness/ breathing session, physical movement/ clapping sessions, and series of improvisational activities which included following tasks: listened to and sang melodies and bass lines based on chord roots; listened to and sang tonal patterns based on the harmonic function of the songs / tonal vocabulary; listened to and chanted rhythm patterns based on the rhythm functions for songs / rhythm vocabulary; listened to and improvised by singing rhythm patterns of the chord roots of the bass line with accompaniment; listened to and improvised melodic phrases with an accompaniment; listened to vocal improvisation performance following specific tonal and rhythmic guidance; listened to vocal and instrumental improvisation performance as exemplars of improvisation skills- included vocal, trombone, trumpet and tenor saxophone performance; solo improvisation by singing with accompaniment. The participants were promoted to create their own music from their inner voice (Corbett et al., 2021). The result of their observation showed that sixty percent of all participants felt that the intervention tasks made them feel less self-critical and self-conscious, thereby the authors concluded that musical improvisation had the potential to both decrease the emotional distress i.e. through mindfulness and also lessen the impact of negative thoughts and emotions so help reduce the labile hypertension and lessen the impact of labile hypertension as well (Corbett et al., 2021).

4.4 Musical improvisation effects neurochemistry outcomes

Repetitive actions of creativity like doing the activity of musical improvisation, will flooded our brain with good hormone such as dopamine - the feeling good chemical, music has demonstrated to activate dopaminergic neuron (Roth, 2021, as citied in Blood & Zatorre, 2001; Menon & Levitin, 2005). Improvisational activities also effects the level of plasma oxytocin and vasopressin. Hormone oxytocin involved in learning and memory, sensory and motor regulations and reproductive system (Watts, 2020), oxytocin is also known to regulate social behaviour and help to regulate pressure/ stress (Roth, 2021). More than that, it also effects the level of ACTH - adrenocorticotropic hormone, and this hormone which mediates attention and distress (Keeler et al., 2015), is very important for our body, in stimulating our adrenal glands to release cortisol, and cortisol is a very essential hormone, it is most well understood as hormone related to pressure/ stress, it has many functions such as, helps our

body responds to stress, fight infections, to stimulate the release of glucose, fats and amino acids for energy production (Talbott, 2007). Oxytocin is closely related to happiness when having a positive - social relationships with others. Oxytocin is a kind of mechanism that produces a good feeling. The increase of oxytocin diminishes the experiencing of fear, thus contributes to the eagerness relaxing effect.

An interesting research was conducted by Jason Keeler and his team in 2015. In their observation on the relationship of vocal improvisation, the neurochemistry and social flow, they explored four participants of jazz vocalists (2 males and 2 females) to sing together in two separate performance; the first condition is to perform as written / pre-composed (without improvisation) and so called the SP - standard performance and the second condition is to perform the music that followed the syntactical harmonic structure (chord changes) of the composition, with improvised melodies, so called the IP - improvised performance. In their observation of each condition, the pre and post-tests were measured the plasma oxytocin and ACTH, and besides that, they also assessed the level of social flow experienced by each subjects, using the post-test survey FSS2 - Flow State Scale-2 with 36 items of questionnaire to access the individual's perceived level of social flow. The result of the study showed that the ACTH concentration decreased after sang together, in both conditions SP and IP, and singing has been shown to reduce cortisol levels (Keeler et al., 2015), this is consistent with literature which proves about the effect of music on pressure/ stress and immune (Keeler et al., 2015 as citied in Bittman et.al.,2001; Chanda and Levitin, 2013). And from the FSS-2 score ,indicated that all participants experienced the social flow in both standard and improvised conditions SP and IP, and these findings indicated that group singing reduces pressure/ stress and arousal (Keeler et al., 2015). As expected, they found the mean concentration of oxytocin increased during the improvised condition but surprisingly, they found the mean concentration of oxytocin decreased during the standard performance. they had suggested that the result should be interpreted with care due to the small sample size, since other studies with larger sample size had demonstrated the increase in oxytocin after choral singing or individual singing lessons (Keeler et al., 2015, as citied in Grape et.al, 2002; Kreutz, 2014), therefore the impact of pre-composed and improvised group singing on oxytocin were indistinct and further research with larger sample size was recommended (Keeler et al., 2015).

Another study to investigate the neurochemical changes in response to musical improvisation, was conducted by Edward A. Roth in 2021. In the study Roth recruited eight

participants of university students, they were divided into two groups, MUS - musicians (group1) and non - MUS - non musicians (group2). Each group experienced the pre-test blood draws and after the intervention tasks, they experienced another post-test blood draws, in order to analyse the changes of the hormones level of oxytocin, vasopressin, dopamine and cortisol, and these hormones are associated with stress or anxiety, depression. The intervention tasks for group 1 is musical improvisation which was designed in several types and steps of musical improvisation tasks, while the intervention task for group 2 is verbal improvisation (Roth, 2021) in-which, participants were resembled in a group discussion and were instructed to improvised a short verbal phrase while the other participants listened, gave response either by physical gestures (e.g. raise hand, point to themselves, nodding their head, etc.), or directly gave their responses by incorporating some aspects, reflecting the emotional intend of that person's improvisation in order to show empathy, then followed by introducing their own ideas (Roth, 2021). The result of this study between groups comparison showed that there were no statistically significant differences between musicians and non-musicians for either the musical improvisation and verbal improvisation in change of neurohormones volume from pre-test to post-test, but in musical improvisation group, on average the change in pre- to post- test decreased in volume of cortisol (could be a marker of reducing stress) was greater for males compare for females, and the difference was significant. Within group comparison, they found on average pre- to post- test concentration of cortisol in males decreased after the intervention task of musical improvisation, but increased after verbal improvisation and the difference was significant. Other finding showed the significant difference, on average concentration of vasopressin increased from pre-test to post-test in the non-musicians who followed verbal improvisation (Roth, 2021).

4.5 Music improvisation enhances interpersonal coordination

Humans are social beings and to be able to interact with other people is considered very important, so the interpersonal coordination is an essential aspect of all social systems, since habitual human actions often occur in a social context (Fuchs & Jirsa, 2007). Many experts related the interpersonal coordination with self-synchrony, shown that a discussant/ talker moves their various parts of their body synchronously and in the time with their own speech (Passos et al., 2016) The interpersonal coordination is an unplanned temporal synchronization of body movement and/ or linguistic expression between people when they take part in communication / in a social interaction (Cornejo et al., 2017 as citied in Bernieri et.al.,1988). Interpersonal coordination in every social interaction are associated and could

influence health outcome and excellent interpersonal coordination supports the improvement of health and well-being.

A study conducted by Juan Pablo Robledo and his team, to explore the effects of musical improvisation, using the 52 participants of undergraduate students (26 dyads) of same-sex strangers on the subsequent behavioral alignment. All of the participants had no formal music training or played an instrument and they were unknown to each other. The participants were generated and randomly assigned into 2 groups, 13 dyads in the MI - musical improvisation task group and 13 dyads in the HB - hands-busy task group. The design of study was conducted in three-stage interactions: a conversation (T1), a join activity which was either musical improvisation task (group MI) or building a tall tower task (group HB), and a second conversation (T2). First, the participants were placed opposite to each other and started with the first stage of interaction which was a first conversation (T1), the content of the conversations were free, but initially guided by an adaptation of the Fast Friends Questionnaires for inducing talks since all the students were strangers to each other and they were met for the first time (Robledo del Canto et al., 2021). After the T1, continue with the second stage interaction, group MI improvised music together using variety of instruments such as metallic and wooden xylophones, small drums, a tambourine and they were instructed to have fun together using the instruments and they tended spontaneously to organize their music behavior around a regular beat, while the group HB built a tower together using the wooden blocks. Then continue with the second conversation -T2.

Participants' motions were recorded with an optical motion-capture system - Mocap, then analyzed in terms of speed cross-correlations and participants' conversation were also recorded separately using the headset microphones and were analyzed in terms of periodicity displayed by rhythmic peaks in the turn transitions across their questions and answers (Q+A pairs) (Robledo del Canto et al., 2021). The results of their study from the motion capture data analysis showed the difference between pre- and post- activity coordination in MI condition showed peaks at 0s and at ca. 1.1 -1.2s which indicating a tight temporal connection between participants' movements while conversing after the musical interaction; and that was not tangible in the HB condition (Robledo del Canto et al., 2021). The Pearson correlation between the number of Q+A pairs and the duration of the conversation showed significant for MI in T2, while the correlation were non-significant for HB in both T1 and T2 (Robledo del Canto et al., 2021). Overall the findings showed that musical improvisation enhances interpersonal coordination, the musical interaction between non-musician

participants who were unknown to each other, encouraged greater mutual behavioral alignment of body movement in subsequent conversational interaction compared to the non-musical cooperative task (Robledo del Canto et al., 2021).

Through above mentioned observations in the scientific researches, we learned that musical improvisation affects human health in various ways, thereby we understand how musical improvisation effects health and well-being. Musical improvisation has its wide spectrum of distinct power to impact health and well-being such as; contributes good impact in emotion regulation and eliciting positive feelings; enrich the cognitive performance in many ways, improves the memory, facilitates divergent thinking; enhances communication and social skills, enhance the creative interaction; it also potentially lessens the condition of labile hypertension, gives a great effect to neuro chemistry outcomes and also enhances interpersonal coordination in every social interaction. The distinct power which could be accessed from musical improvisation provide clarity to us, about how musical improvisation activities which contents its essential capacity could contribute and support a wide range of potential intervention in health and well-being

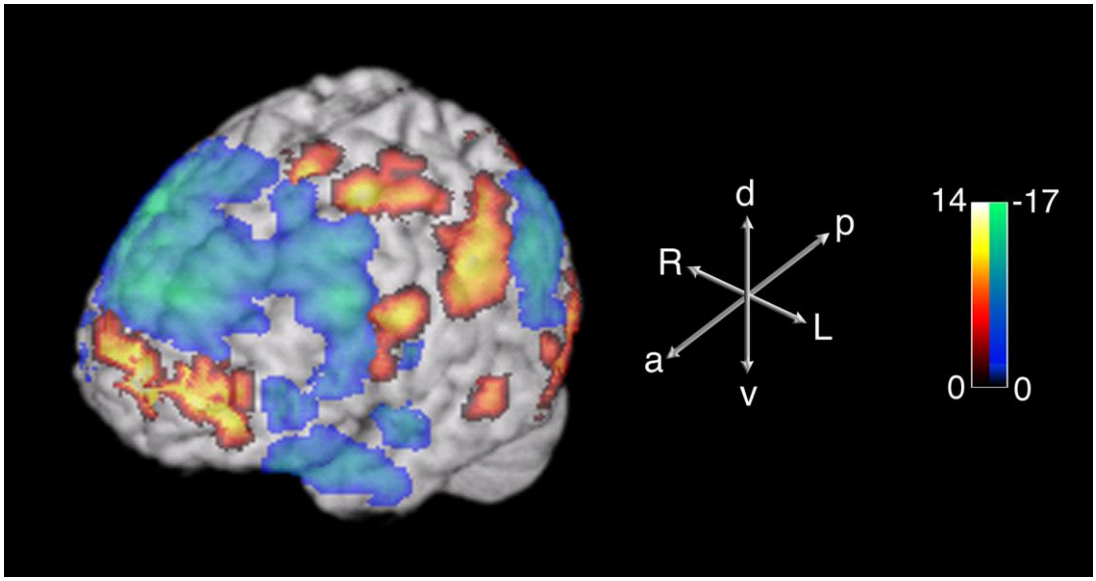

Figure 4–1 *"Three-dimensional surface projection of activations and deactivations associated with improvisation during the Jazz paradigm"*

Medial prefrontal cortex activation, dorsolateral prefrontal cortex deactivation, and sensorimotor activation can be seen. The scale bar shows the range of t-scores; the axes demonstrate anatomic orientation. Abbreviations: a, anterior; p, posterior; d, dorsal; v, ventral; R, right; L, left.(Limb CJ & Braun AR, 2008, n.p)[3]

5 The distinct effects of musical improvisation

Various types of researches in improvisation has been conducted and the study results present the facts that musical improvisation is implicated and associated in so many differential range of intervention in optimizing human functioning which related to health and wellbeing. Professional therapists implement the musical improvisation during their clinical practices and the active music making through the musical improvisation is usually flexibly adapted to the therapeutic needs. Musical improvisation as a creative art, which implemented in musical therapy contents the unique potential to offer, and as Bruscia (1988) had highlighted the importance of using non-verbal intervention in therapeutic practices in the form of sound producing instrument rather than human's voice, he proposes that dissimilar to one's voice, using the musical intervention engages the person at a deeper level through the sound vibration which produced by the instrument of sound, and thereby the person could access the invisible inner self (Cummins, 2020, as citied in Bruscia, 1988).

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The most common way in musical therapy is to use free-improvisation strategies both in individual or in group therapy, to allow each individual to freely improvise with the instrument they choose, thus may suggest a huge impact on each individual, as well as reveal valuable clinical insights about the progress of each treatment in helping people to obtain their healthy life.

People who experience the musical improvisation will engage in an experience where there is no judgement (no right or wrong) and therefore could bring forth feelings of empowerment (Pasiali et al., 2020, as citied in Heiderscheit, 2009; McFerran & Heiderscheit , 2016). Many therapists who work with persons with eating disorder describes that musical improvisation has been used in clinical technique to explore deep feelings and self-expression (Pasiali et al., 2020, as citied in Heiderscheit, 2009; McFerran 2010, McFerran & Heiderscheit, 2016, Trondalen, 2011). Through the process of musical improvisation, the therapists follow and match with the process of how the clients is playing which expressing their feelings to share their inner feelings states and the therapists relate to the emotional state of the client they are improvising with, and while the therapists recognize and emphasize their clients' emotional expression through musical improvisation, the clients will feel noticed and real (feel accepted), so that both the therapists and clients experience the non-verbal level of communication through musical improvisation and this is very important to enhance improvement in many health issues and also to increase self-confidence (Pasiali et al., 2020, p. 3). Presented below are several numbers of studies showing the distinct effects of musical improvisation:

5.1 Musical improvisation improves physical and mental health

Musical improvisation has been used in many music therapies which is a non-verbal approach to the people by using both active and passive music experiences such as free musical improvisation or discussion of music. And in general the music therapy programme use a musical intervention to obtain individual goals within the therapeutic process. Music therapy is considered as an expressive therapies, in which the therapists uses music and its elements to improve clients' condition both in physical and mental health (Pasiali et al., 2020).

5.1.1 Musical improvisation improves people with mental health condition- treatment of depression

Improvisational music as described in the previous chapter has been widely practiced in musical therapeutic centers or clinics for therapy of depression, in order to help patients by reducing their stress level. Music therapy which implements improvisational music method has been found to be effective in the treatment of depression.

Depression is a disabling ill which could cause many problems such as causing the decrease in quality of life and loss of the general functioning, and in the worst condition, depression could cause the incapability to work (Erkkilä et al., 2011).

Erkkilä Jaakko and his colleagues conducted their study on 79 adults with unipolar depression (18 to 50 years of age). All subjects were divided into two groups, the first group which was an intervention group, consisted of 33 individuals were randomized allocated to music therapy intervention and the second group which was a control group, consisted of 46 individuals were allocated to standard care only (without music therapy). Both groups continued to receive usual treatment while participating in the research. The model of therapy used in the music therapy in this study was based on an interaction between free improvisational music and discussion (anchored in psychodynamic music therapy), and during the therapeutic process about 20 bi-weekly music therapy sessions, participants were actively facilitated and supported using free improvisational music process with musical elements of rhythm, harmony, melody, dynamics, timbre and also combined with reflective discussion. The music instruments used in the therapy process were a mallet instrument (a digital mallet midi-percussion), a percussion instrument (a digital midi-percussion), and an acoustic djembe drum. All of the improvisational process were recorded in digital audio/ MIDI-data (Erkkilä et al., 2011). During the study process, there were total 15 participants dropped out mostly from control group, due to lack of motivation, health issue and unknown reasons. The improvisational music process recorded during the therapy were in total 721 improvisations (615 - duets and 106 solo - improvisation). The author used statistical calculations in the study which were the Fisher's exact test and using the standardized mean difference (Cohen's d) to facilitate the interpretation of clinical significance, and the changes in MADRS -Montgomery-Asberg Depression Rating Scale, HADS-A Hospital Anxiety and Depression Scale – Anxiety and GAF Global Assessment of Functioning scores were calculated (Erkkilä et al., 2011). The study result showed the experimental group experienced the IIMT (Integrative Improvisational Music Therapy) improved significantly compared to

the control group both in the measurement of depression, anxiety, and global functioning, and the changes conditions from baseline characteristic of patients (before the treatment) to the conditions after the treatment, in MADRS, HADS-A and GAF scores were significantly greater in music therapy group compare to the control group and the author concluded that music therapy using improvisational music added to standard care could assist people with light, moderate and advanced depressive episodes to remedy their levels of depression as well as anxiety and functioning" (Erkkilä et al., 2011).

Sonja Aalbers and her team also conducted a study to observe the feasibility of emotion-regulating by using the treatment of improvisational music therapy on young adult students with depression symptoms. The participants were eleven female students (18-40 years of age) having depressive symptoms. The music therapy program used in the study was EIMT - Emotional-regulating Improvisational Music Therapy which was based on person-centered psychotherapy by face to face individual sessions by a music therapist, and EIMT focused on the five ER - Emotional Regulation of the CPM - Component Process Model i.e. expression, feeling, bodily response, appraisal and action tendency". Each subject was planned to experience 10 weekly sessions with 60 minutes each. The purpose of the study using the EIMT was to improve ER and to reduce depressive symptoms. Each session during the treatment of EIMT, subject's attendance was registered, and therapists used musical component to synchronize, and a week after the finishing EIM, each participant was interviewed by independent and experienced interviewer (Aalbers et al., 2021). During the study, data about participants' attendance and musical components (i.e. shape, sound, harmony, dynamics, rhythm, tempo, pulse, and melody) used to synchronize is collected using the EIMT-EF (EIMT- with Evaluation Form). The treatment integrity was evaluated using the EIMT-TIM (EIMT with Treatment Integrity Measure), to measure therapist adherence and competence. The self-report questionnaire of 16 questions covering seven dimensions of EIMT: apply EIMT, synchronization, djembe, marimba, cello, reflection and ER-card for ER purpose were scored on a 0-100% scale, an example of related question was what was the purpose/ why did you apply EIMT? Was it planned? and was scored on 0 for not conducted as planned and 100 for fully conducted as planned. In order to explore the experience with EIMT, all students were interviewed after the EIMT at the end of the study in an individual face to face interview. For the data analysis, the author used numerical data on client attendance and treatment integrity with excel, the treatment integrity was analyzed, the recording of interviews about the experience with EIMT were processed in MAXQDA

2020. The results of the study showed that total participants of 11 students completed 99 sessions (each subject attended at least 8 sessions), and the group of therapists felt sufficiently competent, the music therapists reported used mostly the rhythm as a music component to synchronize with their students' musical improvisation. Most students experienced improvisation as a beneficial tool to express their emotions, they felt better, obtained more positive and free feeling and the feeling of trust that they could turn to a better condition, felt relaxation, letting perfectionism go and more accepting about what they do. Moreover, most of the students experienced fun, joy, felt that somebody was there for them, they felt the interconnection and attunement, and some students experienced verbal reflection as helpful to express verbally, they became aware of feelings obtain insight into emotion and feelings, and felt more motivated. The author concluded that EIMT seems feasible to arouse changes in ER in young adult students with depressive symptoms (Aalbers et al., 2021).

Yadira Albornoz and his team also researched on the effect of improvisational music therapy on depression in adolescents and adults. The participants were twenty-four Spanish patients (16 to 60 years of age) who received treatment at the Fundación Josė Ribas in Mérida – Venezuela. Participants were divided into two groups, the experimental group and the control group, in the improvisational music therapy group (experimental group), subjects were experienced the multi-expressive approach of improvisation combined various art form and alternated with verbal discussion. The study lasted in nine months (in three separate treatment cycles for each three months period), In each three month cycle, the subjects completed the pre-test of BDI- Beck Depression Inventory and the HRSD - Hamilton Rating Scale for Depression that indicated that they were significantly depressed, after that the experimental group joined the 12 improvisational sessions over three-month period along with the standard treatment provided at the facility, while the control group only joined the standard treatment program without improvisational music. After the three months treatment cycle, they experienced the post-test of BDI and HRSD again and the difference between the groups (both pre-test and post-test scores) were calculated using the Mann Whiney U Test. The result of the study showed that at the beginning both groups were equally matched on all pre-test measures, and after the treatment the researchers found the significant difference between the groups on the HRSD post-test scores but no significant difference between the group on post-test BDI scores (Albornoz, 2011), after the treatment the experimental group (musical improvisational group) had significant lower post-test HSRD score than the control group, the experimental group which received treatment of improvisational music therapy in

addition to the standard treatment program showed lower psychologist-rated depression scores, they obtained greater improvement in their psychologist-rated depression HRSD compared to the control group who only received the regular treatment program.

Since the results of the testing showed the changes in depression varied according to the model of tests used, the researchers conducted another examination on the result data using the "Spearmann-Rank Correlation" to examine the relationship between BDI and HRSD scores, and the result showed a significant correlation between two types of depression rating on both pre-test and post-test, and all of the post-test scores are lower than the pre-test scores both in BDI and HRSD (Albornoz, 2011). They also used the Cohen's Effect Size to calculate the effects of the two treatment conditions on depression, and the result showed there was a medium effect size of improvement on the BDI and a larger effect size of improvement on the HRSD (Albornoz, 2011).

The author concluded that improvisational music therapy had a clinically significant impact, to improve people with depression measured by HRSD and the improvisational music therapy showed the statistically significant greater improvement in psychologist-rated depression HRSD compared with the regular treatment program alone. Improvisational music therapy had a clinically significant effect in relieving symptoms of depression, musical improvisation therapy and regular treatment seemed to lead participants to feel more relaxed, obtain greater sense and motivation to explore, and experience less fear to share difficult live events. (Albornoz, 2011, p,.222).

Christian Gold and his colleagues studied on the relationship of music therapy for people with serious mental disorder with review and meta-analysis. Their aim was to examine the benefits of musical therapy for people with serious mental disorders. The type of music experiences which were used in musical therapy could include the free and structure improvisation, other types of active music-making and listening to music, but improvisational music is perhaps the most salient form of musical interaction in music therapy, and musical improvisation has been characterized central in many music therapy (Gold et al., 2009),. They studied on 166 potentially relevant cases for any mental disorder, 34 cases for schizophrenia and 16 cases for depression. The author concluded that their review had shown that musical therapy is an effective treatment for serious mental disorder and could help patients to improve global state, symptoms, and functioning. They also suggested that music therapy is an effective treatment which could help people with psychotic and non-psychotic severe mental disorders (Gold et al., 2009).

5.1.2 Musical Improvisation helps reduce music performance anxiety symptoms

Many musicians experience the feeling of anxiety during their performance, and musicians often believe that the feeling of anxiety that they felt was due to the inadequate preparation which causes their performance anxiety. Actually according to previous researches indicated that the performance anxiety could be caused by multi reasons such as technical deficiencies, emotional/ cognitive problems, career stress, or other pas traumatic experiences (Kim, 2005). In order to reduce the anxiety symptoms, there is considered a need for a variety of intervention to address the problems. Several studies have utilized musical improvisation therapy to reduce the anxiety symptoms.

Youngshin Kim conducted her study using the combination treatment of musical improvisation and desensitization to reduce the music performance anxiety in female college pianist. There were six participants with music performance anxiety symptoms followed the treatment for the duration of six weekly sessions which involved in rhythmic breathing exercises, free improvisation and desensitization exercises. The musical improvisation therapy sessions were conducted once a week for 30 minutes each, there were total four sessions in which consisted of rhythmic breathing exercise, desensitization training, and musical improvisation activity, and also homework assignment with the same tasks (rhythmic breathing exercise, free improvisation and desensitization training). The measurement used to measure the anxiety scores were LAS - Likert Anxiety Scale, Spielberger's STAI - State-Trait Anxiety Inventory and the PARQ - Performance Anxiety Response Questionnaire, and these measurements were conducted before and after the MTIDP - Music Therapy Improvisation and Desensitization Protocol. The data was analyzed using the Wilcoxon matched-pairs signed-ranks test (Kim, 2005). The study result showed that the data were significantly different from the pre-test to the post-test in the LAS and STAI. There was no clear trends were found in the PARQ, but the mean for the PARQ is post-test (M=78.50) was lower compare to the pre-test (M=74.67) (Kim, 2005). The author concluded that the study indicated the combination treatment of improvisation and desensitization was powerful to some extent in reducing performance anxiety, and suggested the use of musical improvisation as an enhancement to performance and overall performance wellness (Kim, 2005).

Shaina Davis and Mark Montemayor conducted their observation on five sessions of improvisational music exercises with college of wind instruments to study about the effective form of music therapy in reducing the anxiety symptoms. The research was using the improvisational treatment which lasted for six weeks. The participants were student from the

university in wind instrumental music major and all of the subjects have experienced some form of MPA - Musical Performance Anxiety. The musical therapy sessions were involved deep breathing, visualization and improvisation with and without soundscapes, and the RMAS - Rush Modified Anxiety Scale was applied in measuring the anxiety symptoms during the sessions (Davis & Montemayor, 2013). The participants were experienced the pre-test which was administered during the introductory session - session 0 and also wrote their responses to questions which related to their personal musical background and their performance-related stress or anxiety experiences. In session 1, all participants followed the rhythmic breathing training for 5 minutes which was designed to assist reverse the effects of chronic sympathetic nervous system overdrive (Davis & Montemayor, 2013), then they followed the free instrumental/ improvisational music around 5-7 minutes, and verbally shared about their experience with the researchers, and received homework assignment to do daily practice of free instrumental/ improvisational music and the daily exercise of rhythmic breathing. In session 2, all participants reviewed and discussed about difficulties during doing their homework, and every discussion were recorded. After that all participants improvised a relaxing piece of music with two or three of other participants and also analyzed the music elements such as melody, harmony, dynamics, phrases, rhythms and keys. Then researchers did some journaling, which facilitates writing about participants' feeling, mood, emotions during the improvisation session, and at the end of the session 2, they had homework assignment to do daily free improvisation and daily rhythmic breathing exercise plus to prepare a short etude to be performed in the next session. In session 3, participants reviewed and discussed again about homework, did some rhythmic breathing exercise and desensitization training which consisted of developing a relaxing image, shared their relaxing scene and improvised a relaxing piece of music. After that they performed pieces which were prepared by all participants, then each subject received some homework assignment (to do some tasks: daily free improvisation, daily rhythmic breathing and desensitization training), at this session the researcher reviewed the sessions, handout the MPA questionnaires in MPA inventory sheet (Davis & Montemayor, 2013). In the session 4, was started with discussion, followed with rhythmic breathing exercises, then each participant experienced the rating of BAS - Basic Anxiety Scale to determine the level of anxiety when involved in a performance on stage, then did the desensitization training in which participants followed certain guidance from the researcher and then also did improvisational music, then in the end of the session, participants received homework assignment as before. In session 5, as usual was started with

discussion of homework, did some rhythmic breathing exercise, continued the desensitization training, performed the pieces which were prepared by participants, receiving some homework assignments, and then the researchers reviewed the session by handed out the RMAS (Davis & Montemayor, 2013). The study result showed the most of the RMAS-average anxiety scores decreased, the musicians had a positive response to visualization and experienced that the exercise helped them to obtain more control of thoughts and emotions during performance. The improvisational music therapy can help to lessen MPA, and also could be helpful in the situation not related to music (Davis & Montemayor, 2013).

5.1.3 Musical improvisation improves communication, social interaction skills and joint attention behavior in children and adolescents with autism spectrum disorder

Autism is also known as ASD (Autism Spectrum Disorders), are a diverse group of conditions which related to the development of the brain which cause the people with ASD have difficulties with social interaction and communication (World Health Organization, 2022)

Many experts suggest that music contains potential strength to engage an individual or a group in therapeutically creative and social communicative processes (Leslie, 2012). The improvisational work which involved using instruments in a freer way to encourage communication skills and expression (Rickson, 2007). Improvisational music therapy was one of the major music technique used as an intervention to facilitate social, communicative and behavioral skills especially in young children with autism (Simpson & Keen, 2011).

Payton researched on the effect of music therapy on social-communicative response of children with ASD, his purpose of study was to determine if nine- weeks of music-therapy could increase communication skills of ASD students. And the assessment of social skills for ASD students was using The ASSCM - Assessment of Social Skills for Children with Autism (Payton, 2019). Total participants were 6 students, and the tools of analysis was The ASSCM which was focused in the measurement of receptive and expressive language, each time of each student's action will be noted and responded by the therapists on total 30 items with 'never', 'sometimes' and 'always'. The responds will then transfer into scoring level of 1 to 3, such as: responses of 'never"' will receive a score of 1, responses of 'sometimes' will receive a score of 2 and responses of 'always' will receive a score of 3, the scoring indicated that higher communication skills develop by the students will receive higher scores. During the study, the musical therapy intervention applied, and musical instruments used in the research were a full-size guitar, a small children's play guitar, maracas, jingle bells, hand

drums, wood blocks and tambourines, and the intervention were consisted of variety of songs, movement activities and instrumental music activities. The comparison results of the study showed: a pre-test which was applied to value the communication score for each subject before the intervention of musical therapy, showed the score range from 30.00 to 90.00, on average the students scored a communicative score of 32.42 *(SD*=2.27*)*; on the mid-test, the communication score turned to 37.42 *(SD*=6.64); and on the post-test after the intervention, the communication score increased significantly to 50.33 *(SD*=20.02*).* The author's findings indicated that music therapy applied on students with ASD support a benefit to the communication behaviors, the musical therapy provided a unique variety of musical experiences in an intentional and developmentally appropriate manner in effecting changes in behavior and facilitated development of communication skills (Payton, 2019).

Maria Horta Freire and her team conducted a study on the effects of MCIMT - Music-Centered Improvisational Music Therapy on the treatment of preschool children with ASD. The participants in the study were 45 autistic children with 2-6 years old. All of the subjects were divided into 2 groups; the control group (*n*=19) and intervention group (*n*=26). To measure the improvement on the children's behaviors, all of the participants experienced the initial assessment (T1) in order to obtain the baseline score (both groups were paired on T1) and after 16 weeks of treatment they experienced the final assessment (T2) which were performed through the psychiatric and music therapy scales. During the research, both the control group and the intervention group received the usual care but in addition, only the intervention group received the individual weekly musical improvisation therapy. In order to obtain more follow up in evaluation upon the children's development and to evaluate the maintenance of treatment, the intervention group participated in another assessment test (T3) which is held in two months after the T2 (Freire et al., 2021).

During the 16 weeks of study, between the T1 and T2, the intervention group received the weekly individual music therapy sessions for the duration of 30 minutes each, and during the subject experience MCIMT – improvisational music therapy to develop expressiveness, creativity and musicality and also specific goals were set for each intervention's participants. All the sessions were recorded, and the instruments used in the sessions were a guitar, a four-octave keyboard, two medium drums, two sticks, two maracas, six egg-shakers, a frog-shaped reco-reco, a soprano recorder and using human voices too.

The measurements used to evaluate progress of the children's symptoms of ASD and general behavior and performance were the CARS -Childhood Autism Rating Scale, ATEC -

Autism Treatment Evaluation Checklist, ABC - Autism Behavior Checklist, ABC2 - Aberrant Behavior Checklist and CGI - Clinical Global Impression (Freire et al., 2021).
And all of the data were analyzed using statistical analyzed of Statistical Package for Social Sciences -SPSS and for the comparison's analyzed, the author used Cohen's d (Freire et al., 2021). By the end of the research, the results of the study showed that in the intervention group, for the T2, all scales proportional to the child's impairment presented smaller results, and all scales proportional to the child's development presented higher results compare to the control group, so the difference between T1 and T2 were significant for almost all scales in the intervention group, while the control group showed significant only on one communication subscale. During the improvisational music therapy period, the intervention group showed moderate to large effect size while the control group showed only a small effect size. The author concluded that the effect of MCIMT were positive for the children's improvement both in the aspect of communication, socialization and the behaviors in general, and through their study suggests the value of Music-centered Improvisational Music Therapy in promoting improvement on behaviors, communication and socialization, in the treatment for children with ASD (Freire et al., 2021).

Gustavo Gattino and his colleagues also researched the impact of relational music therapy on communication in children with autism with a randomized controlled study (Gattino et al., 2011). The research was conducted with participants of 24 male individuals from 7 to 12 years old, and the duration of the study was lasted in 20 weeks. The participants were divided into two groups, one experimental group and control group. Besides the weekly routine clinical activities, each subject in the experimental group received three music therapy assessment sessions of 30 minutes per each session. The intervention was based on RMT - Relational Music Therapy with combination activities through singing, composing, improvising and playing musical games, and the musical improvisation part in the intervention arose from the initiatives of the participants or music therapist based on the participant behaviors observed (prioritizes initiatives and observation of the subject treated) (Gattino et al., 2011). The equipment used in musical therapy were several items: a portrait audio system, a 4-octave keyboard, a pair of small metal rattles, a small rain-stick, a tambourine, a cowbell, an acoustic guitar, a small indigenous drum, a pair of large metal rattles, a pair of drum sticks, a small wooden guiro, a pair of cabasas, a pair of wood claves" (Gattino et al., 2011). The therapy treatment was 30 minutes per session for 16 weeks period, and one final music therapy assessment session for 30 minutes. In the control group, the

participants were participated only in the weekly routine clinical activities during the period of study. All of the participants experienced the pre- and post- treatment measures by CARS-BR - Childhood Autism Rating Scale in order to determine the presence and degree of autism in each subject (mild, moderate or severe), and to access special behaviors of children with ASD. The CARS-BR aspects assessed in the study were verbal, non-verbal and social communication. (Gattino et al., 2011). All data were analyzed statistically, and the study result showed that the different outcomes of CARS-BR scores in T1 and T2 between the experimental and control group did not show a statistically difference in the three measured outcomes (verbal, non-verbal and social skill), but only in the subgroup analysis showed result in favor of relational music therapy over the control group, in improving the nonverbal communication behaviors and this was possible caused by the more obvious use of alternative communication tool by autistic children who didn't have the verbal communication skill (Gattino et al., 2011). The author concluded that overall results were inconclusive, and the main reasons for these findings were the use of a non- appropriate instrument for measuring the outcomes. The CARS was considered not accurate for the assessment of the development in the children over a short period of time and it was used in the study because it was the only instrument of measure that available in the Portuguese language (Gattino et al., 2011).

John A. Carpente investigated the effectiveness of improvisational music therapy program on social communication skills for children with ASD. Participants included in the study were four children with ASD (4-8 years of age), and each child participated in twenty-four sessions of 30 minutes each and therapy sessions which based improvisational music therapy, over the course of 13 weeks. The purpose of his study was to evaluate the changes in social communication skills. The measurement used to measure each child progress of social communication development was The FEAS - Functional Emotional Assessment Scale which applied in each child both pre-test and post-test were summed to obtain subtest scores that were totaled to obtain the total score and compared to the cutoff scores to classify the child into either 'deficient, at risk, or normal' (Carpente, 2016), and FEAS measured the six developmental levels: level 1- shared attention and regulation, level 2 - attachment and engagement in relationship, level -3 two-ways purposeful communication, level - 4 behavioral organization, problem-solving and internalization, level -5 representation capacities and level - 6 representation differentiation (Carpente, 2016). The course of improvising musical experiences consisted of three phrases: 1) following the child's musical-

emotional lead, 2) two-way purposeful musical-play and 3) affect synchrony in musical play (Carpente, 2016). The detail results in each participant showed : case 1 – Participant named Kyle, he exhibited difficulty adapting the musical environment, due to his complex sensory system, so within the 6 developmental levels, he showed improvement only in level 4; case 2 – participant named Elaine, she demonstrated a significant increasing in her ability to self-regulate for extended periods during musical therapy, she showed development in each of the 6 developmental levels; case 3 – participant named Anthony, he also showed "his emerging musical-social resources appeared to be assimilated into more spontaneous musical making experience", he also showed development in each of the 6 developmental levels; case 4 – participant named Michele, she showed improvement in level 1, level 2, level 3 and level 4 from the 6 developmental levels (Carpente, 2016). The author concluded that during the treatment of improvisational music therapy, most of the participants showed the improvement in areas of self-regulation, engagement, behavioral organization and two-way purposeful communication, thus overall improvisational music therapy demonstrates improvement on social communication among children with ASD (Carpente, 2016. p. 13).

Jinah Kim, Tony Wigram and Christian Gold conducted an important research to observe the effects of improvisational music therapy on joint attention behaviors in autistic children (Kim et al., 2008). Participants in this study were thirteen boys and two girls (3-5 years of age) and each subject with autistic disorder., but due to various reasons, 5 of the participants were dropped out, and left 10 participants of boys. Participants were divided into two groups, the improvisational group consisted of 5 children and each subject of improvisational group had 12 weekly of 30 minutes treatment of improvisational music therapy sessions, and the control group consisted of 5 children, they experienced the 12 weekly of 30 minutes each of play session with toys. The participants completed 24 session programs, and the duration of study was 7-8 months due to sick leave and holidays. The measurement of The PDDBI - Pervasive Developmental Disorder Behavior Inventor (Cohen and Subhalter 1999) were used to measure responsiveness to interventions for children with ASD and the ESCS - Early Social Communication Scale - a structured toy play assessment to measure the non-verbal social communication skills, both measurements were used as pre-, in between and post-treatment measures (Kim et al., 2008). During the study, all sessions for both conditions (improvisational music therapy and play) were recorded. For the statistical data analysis, the authors applied the ANOVAs to find out the significant changes. The study result showed that in sum joint attention scores of the ESCS and session analysis exhibited

that the improvement after improvisational music therapy was significantly better compare to play condition ($p < 0.05$) (Kim et al., 2008). The participants with the improvisational music condition showed more leading improvement compare to the play condition in eye contact, alternating eye contact and joint visual attention skills (Kim et al., 2008). The result of the study indicated that improvisational music therapy was more effective in facilitating the joint attention behavior and non-verbal social communication skills in children compare to play condition. The authors concluded that the study highlighted social engagement through improvisational music making and therapeutic potential for children with ASD through improvisational music therapy (Kim et al., 2008).

Bieleninik Łucja and her team designed a randomized clinical trial which was conducted in 9 countries and which enrolled totally 364 ASD children (4 – 7 years of age). Their objective in this study was to evaluate the effects of improvisational music therapy on generalized social skill and communication skills in children with ASD. The participants were divided in a 1:1 ratio in two groups each group consisted same numbers of participants, the first group consisted of 182 participants (n=182) of the enhanced standard care group where the children experiment the usual standard care as locally available, and the second group also consisted of 182 participants (n=182) of the enhanced standard care plus the improvisational music therapy conducted by trained music therapists, and during the treatment they sang and performed music adapted to each child in order to develop sharing and joint attention (Bieleninik et al., 2017). The measurement used in this study was the ADOS - Autism Diagnostic Observation Schedule a measurement for autism symptom severity over 5 months (Bieleninik et al., 2017) and the higher scores represent the greater severity. Unfortunately, the formal training in ADOS assessment was only available in several countries but not all countries. During the research, the participants of the music therapy group received a median of 19 music therapy, 3 parent counseling, and 36 other therapy sessions, compared to the participants of the enhanced standard care who received 45 other therapy sessions and 3 parent counseling. At the end of the research, they observed that there were absence of sessions during the treatment due to holidays and sickness and some parents had hardship bringing their child to therapy 3 times a week (Bieleninik et al., 2017), the musical therapy group tended to receive fewer other therapies and not all of them were able to present the frequently therapy as planned due to some reasons especially when extra travel was needed (Bieleninik et al., 2017). The result of the study showed in the primary outcome, the means of ADOS social effect showed decrease in the musical therapy group

from 14.08 to 13.32 and in standard care group also showed decreased from 13.49 to 12.58, but the difference was not significant, so there was no significant difference in improvement. In the secondary outcomes most of the results were also insignificant, only in several SRS subscales the musical therapy group was associated with greater improvements than the standard care group in the social motivation and autistic mannerisms. In the post hoc responder analyses also indicated a higher proportion of improvement in ADOS social affect in music therapy group compared to the standard care group, and the mean changes in participant's quality of life were significantly more positive in music therapy group compared to the standard care group (Bieleninik et al., 2017). The authors concluded that, in their study of international multicenter clinical trial in comparison of improvisational music therapy added to enhanced standard care to only enhanced standard care (standard care alone), was resulted small improvement in both groups, but no significance difference in symptom severity base on the ADOS social effect measurement (Bieleninik et al., 2017).

5.1.4 Musical improvisation improves children or young people with ADHD and eating disorder

ADHD - Attention Deficit Hyperactivity Disorder is one of the most common mental disorders which affect many children, people with ADHD are having difficulties to pay their attention (inattention) or easy distractibility (shortness of attention) and not being able to keep focus or lacking the ability to concentrate, and include hyperactivity (overabundance movement which is not fitting to the setting) also reckless/hasty act which could occur in a sudden without thought, frequently they are also have sleeping and feeding problems (Wender & Tomb, 2016) (Elmaghraby & Garayalde, 2022).

People who suffer with eating disorder usually experience the severe and persistent disturbance in eating behaviour and associated with distressing thoughts and emotions. There are many types of eating disorders from the very serious conditions to mild conditions, but most of the eating disorder conditions might affect human functioning, both physical, psychological and social functioning. The types of eating disorder including anorexia nervosa, bulimia nervosa, binge eating disorder, avoidant restrictive food intake disorder and many others must be healed through proper medical care in order to obtain a healthy eating habits and recover their emotional and psychological health (Guarda, 2021).

According to Bobilin (2008), the most useful techniques implemented by many musical therapists to treat the eating disorders are through song writing intervention, instrumental musical improvisation, and other imagery interventions, since all of these

interventions are concentrated on promoting emotional expressiveness, and building self-conscious, and the self-esteem (Cummins, 2020 as citited in Bobilin, 2008). Musical improvisation requires flexibility and control, many experts believe that musical improvisation can address emotional control, rigidity and impulsivity (Shah et al., 2021 as citied in Heiderscheit, 2008; Lee, 2015). Many therapists use improvisational music therapy as an intervention for people with ADHD and eating disorder, and the treatment using musical improvisation therapy has shown significant improvement in symptoms of ADHD and eating disorders. All of the studies outlined below, were using the improvisational music therapy as the intervention to improve the condition of people with ADHD and eating disorders.

Daphne J. Rickson from Victoria University of Wellington conducted a research using instructional and improvisational models of music therapy to inspect the adolescents with ADHD. Participants in the study were 13 boys adolescents (11-16 years of age) with a formal diagnosis of ADHD, and all of the subjects had not been involved in any music program previously. The participants were divided into 3 groups, the control group A (*n=5*); group B (*n=4*) and group C (*n=4*). Group A is a control group so participants were not offered music therapy treatment until the study was completed, and they were involved in a best exercise program which integrated some of positive results from the study (Rickson, 2006), group B participated in 8 sessions of improvisational music therapy (phrase 1) and another 8 sessions of instructional approach (phrase 2), group C participated in 8 sessions of instructional approach (phrase 1) and followed with 8 sessions of improvisational music therapy (phrase 2) (Rickson, 2006).

The musical intervention for the instructional condition were based on emphasizing behaviour and developmental theory and direct teaching and modelling of specific beat and rhythm tasks (Rickson, 2006). In the improvisation sessions, participants were asked to choose a style, mood or theme fir a group improvisation the therapists relied on music itself to promote growth and development and took the stance that all participants would be able to respond to music in order to enable therapeutic changes to occur, and during the implementation of improvisation, they had anticipated that the process of making music through the improvisational music therapy, the participants would obtain increased confidence, self-esteem, self- conscious of others' need (Rickson, 2006).

The measurement used in the study was a STT - Synchronised Tapping Task to measure the impulsivity (the tendency to create an action without thinking) and only group B

and group C were tested STT test before and after the improvisational music therapy sessions. Another measurement was the CRS-R:L Conners' Rating Scales Revised: Long Version which composed of 80-item Parent Report Forms (CPRS-R:L) and 59 item Teacher Report Forms (CTRS-R:L), these scale were used to identify potential changes in impulsivity, a reduction in this scores was read as an 'improvement' in behaviour, all of the participants were administered the test before the study and at the end of each phrase. During the study there were also additional session observations using forms, daily notes, and video tape data were used to evaluate the participants' behaviours during the music therapy sessions whether the subject was restless/ anxious and fidgety (move hands and feet impatiently/ nervousness) , moving around the room, touching equipment improperly, blurting out words (say something without consideration), did not appear to be listening to others (music or speech), etc, and each behaviour was rated as Never = o, Occasionally = 1, Often = 2, Very Often = 3 (Rickson, 2006). The result of the study showed : the measurement of STT both treatment group B and C significantly reduced errors in phrase 2 compared with the baseline point, while group A made increasing errors, and the treatments group B and C continued to improve over phrase 1 and phrase 2, so when all three groups were compared the difference were significant (Rickson, 2006). The Conners' Rating Scales (CTRS-R: L & CPRS-R: L)" expressed no significant difference between the effect of instructional and improvisational music therapy approach on student's level of motor impulsivity (Rickson, 2006). The Conners' Parent and Teacher Report forms showed opposite results, parent scores generally indicated no change or deteriorating scores, while teachers reported almost consistent continuing improvement across all subscales for students in improvisational music therapy program, moreover the teacher also reported a significant decrease in cognitive problem for Group B after their improvisational treatment (Rickson, 2006). More reports were obtained from the teachers and recording analysis, they found an increase in anxious/ shy behaviour for each group during the task of instructional music therapy phrase but a decrease during the phrase of the improvisational music therapy (Rickson, 2006). The author concluded that though there were no firm conclusions could be drawn, but there were indications that further over the period of the study, both music therapy treatment groups significantly improved accuracy on STT and also the teachers reported a significant reduction of Conners' subscale scores, therefore the findings suggest that musical therapy might contribute to a reduction in range of ADHD symptoms and improvement in a range of developmental areas (Rickson, 2006).

Another interesting study was conducted by Priya Syah and her colleagues to observe the impact of improvisational music therapy on individuals with eating disorders. There were 21 participants (16- 58 years of age), and all of the subjects were diagnosed with eating disorders such as bulimia nervosa (BN), anorexia nervosa (AN), bingeing /purging subtypes and restricting, and most of the individuals were also diagnosed with comorbid psychiatric disorders, depressive, bipolar, post-traumatic stress, anxiety (Shah et al., 2021), and they were divided into 3 separated groups (each group consisted of individuals with different stages of treatment and recovery, also different stage of varying familiarity in music therapy). During the improvisational music therapy, all of participants experienced the therapy once per week, and the sessions contented the integration of improvisation, singing, drumming, listening back to the recorded group improvisations and responding through visual art and mindfulness-based practices (Shah et al., 2021). In total there were twelve sessions of music therapy (4 sessions for each group) and three focus-groups. The qualitative data was collected through the transcripts of participants' verbal and also musical contributions throughout the musical therapy and focus group sessions, during the focus group sessions, all of the subjects were asked a series of questions and also listened back to the recording of group improvisation combine with discussion, and in this way it allowed the researchers to keep focus observing group processes, and through the focus group, each participants had the opportunity to listen back to their group improvisations collectively and maintaining connectedness (Shah et al., 2021). The measurement used in the study to provide progress measures of emotional sated were the PANAS - Positive And Negative Affect Scale , the subscales of DERS - Difficulties in Emotion Regulation Scale, and the ERQ - Emotion Regulation Questionnaire. Before and after each of the therapy sessions, all of the participants filled out the PANAS scale, based on their feelings. The DERS was used as self-reported measure of difficulties in emotion regulation, The ERQ was consisted of 10-items self-reported scale, in the study participants received only the expressive suppression subscale. The DERS and ERQ were filled out by each participant before the first session and after the final session, and the results of these scales were analysed using the IBM SPSS statistic in order to provide insight into how group music therapy could give impact to participants, through their self-reported levels to measure the rigidity and impulsivity, affect and mood regulation (Shah et al., 2021).

The qualitative result of the study (data collected through audio recordings, transcriptions of music therapy and focus-group sessions) showed through the experience of

musical improvisation, they discovered that music could represent various aspects of themselves, music also support them to externalise, shift and stay with emotions, and they felt musical improvisation has its capacity to foster social connection. The quantitative result of the study (data collected through PANAS, DERS and ERQ) showed that there was a significant difference in expressive suppression before and after music therapy, this result explained that participants were less possible to suppress their emotions after the music therapy (increase ability to express difficulties), and also there was a significant difference in the negative affect before and after four sessions of music therapy and this results clarified that participants who experienced lower level of negative affect after four sessions of music therapy (decrease in negative affect) (Shah et al., 2021).

5.1.5 Musical improvisation improves patients with neurological disorders.

Neurological disorders is a kind of disorder caused by dysfunction in human brain and nerves, that affect human brain and nerves system, so it requires clinical care by physician or professional healthcare. There are several types of neurological disorders such as dementia, epilepsy, headache disorders, multiple sclerosis, neuro infections, Parkinson's disease, stroke or other brain injuries (WHO, 2006). Musical improvisation as a creativity art as mentioned above, has been implemented in music therapy to improve the neurological disorders/ neurological damages by many practitioners of music therapy, and it is said to allow many people to revel in spared capacity to appreciate, in order to lead to an improved quality of life (Cuddy et al., 2020). And as mentioned in chapter 3, about what Charles Limb and many other researchers had found in their studies which showed the facts of the great and valuable effects of musical improvisation on brain and network system, and those findings lead us to new understanding of why and how many patients with neurological disorders/ neurological damages do better during generating the improvisational music therapy (Tomaino, 2013). Mentioned below are some of the examples:

Rita Formisano and her colleagues observed the efficacy of improvisational music therapy in rehabilitation of psychomotor agitation after severe brain injured, with the aims to evaluate the effect of active musical improvisation therapy on the communicative, interaction abilities of patients and behavioural disorders during their coma recovery (Formisano et al., 2001). They observed 34 severe brain-injured patients (13 – 70 years of age) who suffered from traumatic brain injury, the other hypoxic, ischemic or hemorrhagic coma, and all patients with prolonged coma more than 15 days and also with lack of verbal initiative (Formisano et al., 2001). The treatment by musical improvisation therapy was performed on

3 times in a week for about 20 – 40 minutes depend on each patient's attention and during the treatments, the participants experienced the improvisational music therapy which based on musical relationship where each patient is encouraged to play variety of instruments, singing and vocalized while accompanied by a therapist. The music instruments provided in the study were percussion, keyboards and wind instruments, all of the subjects experienced playing together improvised music, and the therapist encouraged patients to create their music dialogue, stimulating the initiative and active participation (Formisano et al., 2001). Participants were examined by mean of GOS - Glasgow Outcome Scale, DRS - Disability Rating Scale, CRS - Coma Recovery Scale and PCS – Post Coma Scale in which the CRS and PCS both to examine the patients' interactive abilities with the environment (Formisano et al., 2001). The evaluation was also conducted by the music therapist who examined each video recording of each therapy session plus a blind examiner who judged the randomised examples of the video recordings for each patient, using the semi qualitative scale of clinical modification (+ for improved, = for unchanged and 0 for worsened)" (Formisano et al., 2001). The study results showed a significant betterment of the collaboration of the severe brain-injured patients and a reduction of undesired behaviours such as inertia (reduce psychomotor initiative or psychomotor agitation)(Formisano et al., 2001).

Graeme Davis and Wendy Magee wrote about their exploration of the effect of clinical improvisation on the expressive and interactive responses of a patient with Huntington's disease (Davis & Magee, 2001). HD – Huntington's disease is a kind of neuro degenerative disorder, which characterised by motor disorders, gradual cognitive weaken in selective skills such as memory skills, learning problem and verbal fluency, problem solving, and also included the emotional disorders like depression or irritability etc. (Davis & Magee, 2001 as citied in Folstein, 1989; Beaumont et.al., 1996; Harper, 1996). In their case study, they observed a case of a female patient (approximately 50 years old), suffered in the middle to late stage of HD for three years. The prior conditions of the patient before the improvisational music therapy was demonstrated no obvious choreic motion, and due to the involuntary movements had made her slightly unstable, her communication was weaken with receptive and expressive speech deficits, and her interactive experiences was centred on her shouting, she also was not be able to comprehend simple concreate information, and she was almost totally depended on the self-care supervision in order to carry out her daily activity (Davis & Magee, 2001). She was then referred to follow an assessment period within a joint music therapy, and her responses within the group had showed that musical therapy provided

an emotional and expressive outlet for her and enhanced her quality of life (Davis & Magee, 2001). Then she continued following the individual treatment sessions which occurred once a week for approximately 30 minutes, and involved in non-pitched percussion, on pitched percussion and vocalizations, and the observation on her progress during 10 months of her individual treatment, had demonstrated that she was motivated and could participate actively on musical instruments, but still her verbal was unintelligible and unresponsive during carried out her vocal tasks, and during conducted the structured improvisational tasks (followed regular pulsed, tonally based, standard Western harmonic sequences) she showed unorganized responses, but during the free unstructured improvisation task (arrhythmic, non-pulsed, no tonal centre) she showed more sustainable and more expressive responses, she could use the musical elements of rhythmic, variation, intensity and melodic in an unstable/ uncontrolled way, but her improvement showed she was able to connect her response shortly to musical stimuli through musical improvisation (Davis & Magee, 2001). The musical improvisation tasks as a music medium highlighted deficiency in her ability to interact through the lack of structure and control of her expressive responses, thus various degree of improvised musical tasks were introduced to the patient in order to encourage her to be spontaneous and self-expressive (Davis & Magee, 2001). In the therapy they also implemented the structuring though using the normal pulse, binary rhythms, simple I-IV-V harmonic sequence and rhythmically associated melodic phrasing. Using these technique in the improvisational music therapy facilitated the development of musical relationship to enhance interaction with the purposes that the inherent flexibility of musical expression could increase her expressive responses. The music instruments used were untuned percussion (drum and cymbal) which offer the chance for her to play pulse/ rhythmic structure and the metallophone which could offer her to play pulse or rhythmic and melodic structure. During the intervention, the patient's interaction, degree of structure and control showed increase in responses (Davis & Magee, 2001).

Over the therapy sessions of the next ten sessions, they developed more interactive episodes involving melody by using the diatonic metallophone, which offer the opportunity for playing the melody (with limitation on the chance for chromaticism). During the therapy, they testified the process of increasing musical interaction and relationship (Davis & Magee, 2001) Moreover, the patient exhibited carry-over of the structuring of her instrumental playing into her vocal responses, she showed betterment in relationship with the music through pitch variation and phrase length (Davis & Magee, 2001). After the ten month of

musical improvisation therapy the patient demonstrated an increased structural relationship, brought a great result in a coherent and interactive exchange of music idea (Davis & Magee, 2001).The author concluded that through the improvisational music therapy the patient demonstrated significantly an increase in the structure and coherence of the patient's expressive and communicative responses thus improve communicative contact and relationship development (Davis & Magee, 2001).

5.1.6 Musical improvisation benefits to patients in a cancer care

Cancer is defined as a disease caused by the growing/ accretion of a group of up-normal cell which is uncontrollable by passing over the normal rules of cell division (Hejmadi, 2014). Experts suggest that improvisational music therapy could support cancer care for patients during the treatment to curing process. The interactive music therapy techniques in instrumental improvisation and singing as well as the receptive musical therapy technique such as listening to live or recording music, music and imaginary could bring many essential benefits for cancer patients. The musical therapy improves the patients' mood, decrease stress, pain and anxiety level, enhance relaxation during the treatment process, so it could promote health and well-being (Stanczyk, 2011). Many studies have described through experimental researches that musical therapy intervention in cancer care could help patients on psychological and physiological needs which arising from the disease as well as dealing with the side-effects of cancer treatment (Stanczyk, 2011).

Dr. Maria Pothoulaki with her research team had conducted a study to explore the psychological processes which implicated in an improvisational music therapy program for patients with cancer (Pothoulaki et al., 2012). Participants who jointed in the study were nine individuals (44 – 83 years of age) and the intervention applied in this experimental study was improvisational music therapy program that facilitated free expression, group interaction and communication. The measurement used to analysis the interviews was the IPA - Interpretative Phenomenological Analysis (Pothoulaki et al., 2012). During the experiment, the participants experienced six weeks of music therapy program in twice a week program with duration of 60 minutes in each session, and the program was adopted from the Nordoff Robbins approach, focused in improvisational music techniques in facilitation the music making (Pothoulaki et al., 2012), and the sessions involved in free improvisational music activities, improvisational music with 'a specific context such as vocals or with eyes closed', and other structured activities like musical dialogue. The music instruments utilized in this study were slit drum, bass chime bars, metallophone, xylophone, steel pan, beaters, pan pipe,

whistle, bells, bells tree hand, gong, vibratones, bongos, ocean drum, wooden egg shakers, kalimba, rain-stick, singing bowl, tambourine, wind chimes, maracas and bodhran (Pothoulaki et al., 2012). All of the experienced from the intervention and concomitant psychological processes were explore using retrospective semi-structured interview by the principal researcher (a psychologist) in the last week of the music therapy sessions, tape recorded and then analysed using IPA (Pothoulaki et al., 2012). The results of the study showed that most of the participants felt more liberated in expressing themselves musically and they felt more comfortable to communicate musically compare to verbally. Participants also felt the connectivity (both mutual response and the feeling of closeness), and most of them felt that through the improvisational music therapy they experienced stress-relieving, positive feelings. The authors concluded that through the musical therapy, the findings of their study showed that participants experienced all positive feelings and positive experienced which derived from the musical therapy, and through the sessions they provided peer-group social supports and a feeling of freedom and creative self-expression, thus highlighting the important role of music as an innovative psychological intervention for patient with cancer (Pothoulaki et al., 2012).

Another advantageous study about the therapeutic effects of improvisational music therapy at the cancer care-centre was conducted by S.J Burns and his colleagues. The research's objection was to compare the therapeutic effects of listening to music in relaxed state and the active involvement of improvisational music therapy in playing tuned and untuned percussion instruments, in order to observe the potential influence of musical therapy on the emotion and immune system of patients with cancer (Burns et al., 2001). The participants who followed in this study were twenty-nine cancer patients (21 – 68 years of age), The intervention was in group music therapy with listening to recorded/ live music and improvisational tasks. The measurement used in the study included the quantitative pre- and post-test, with psychological measurement and qualitative focus group design. The main outcome from the measurements showed that the patients experienced the increase well-being and relaxation and also less tension during the listening music task, and during the improvisational tasks the patients experienced increase well-being and energy and also less tension. In both interventions showed increased in the level of salivary immunoglobulin A and decreased in the level of cortisol. Through these findings, they found a link between positive emotions and the immune system in the cancer patients, thereby they concluded that the link between listening to music in a relaxed state and improvisational music to

alternations in psychological and physiological parameters, provided a better understanding of the effectiveness of music therapy for patient with cancer (Burns et al., 2001).

A patient's perspective about the effect of musical improvisation therapy on cancer's treatment was explained by Maria Logis. When she was diagnosed with non-Hodgkin lymphoma, she started her treatment with improvisational music therapy, she sang and made music with the therapist, she felt the freedom every time she sang, she recorded the sessions of her musical therapy and started to share with relatives and friends. One week later she went to see the oncologist and the doctor told her that her lymph nodes were getting smaller but still insignificant so doctor advised her to start the medical treatment for her cancer. Every week she continued her musical therapy with her therapist, she continued to sing and played music, and the therapist adjusted to Logis's condition and feelings. The therapist pushed her "emotional awareness and recognition into unexplored areas" using the musical improvisation elements such as "big dissonant clusters, lifting melodies combined with jazzy blues and also a whole tone or atonal music" (Logis, 2011, p. 28). Logis felt that through her experience with improvised music, she could express her feelings in a ways that she had never done in her life. Two months later Logis visited her doctor and he described her condition as "spontaneous partial temporary remission" (Logis, 2011, p. 28). Then Logis met one music director, a teacher and vocal coach (Ms. J), then Logis told Ms. J about her condition and the great experience she had obtained through musical therapy. Ms. J told Logis that there were songs in improvisation and would like to teach Logis in order to perform with her friends. After she sang in her initial performance, Logis felt the happiest moment in her life and Ms. J supports Logis to perform in many public venues, and the intervention along with improvisational music therapy had triggered her creativity, she also created several theatre pieces from the song that they improvised together during the musical therapy sessions, she sang out her broken pieces of her life, her sadness but also enjoyed being playful and funny and through the musical therapy her sense of her life had changed, she could experience about 15 years of her cancer's remission (Logis, 2011)

5.1.7 Musical improvisation improves patients in palliative care

Palliative care is a kind of special care for patient with advanced illness and the most concern of all professional health care are to provide the effective support for those who live with cancer of other advanced illness with their high-quality palliative care with a range of services to help and provide the optimum care (Faull et al., 2012).

Improvisational music therapy as a medium to provide both a well-timed vehicle for expressing emotions beyond words, then providing an individual a valuable and intimate experience of being heard (O'Kelly, 2002), beside that improvisation also used in a group therapy and described as the very social of art forms which could provide participants with uniqueness and spontaneous way of being in expressing together in music, thereby musical improvisation has its potential implemented in the improvisational music therapy and held as an effective holistic practice for palliative care (O'Kelly, 2002).

A randomized controlled trial to observe the effect of improvisational music therapy in palliative care, with intervention of musical therapy using music instruments and vocal improvisation to evaluate its effects on relaxation, was conducted by Marco Warth and his colleagues. They researched in the palliative care unit at Vincentius Hospital, Heidelberg. All of the eligible participants (84 individuals) were divided into two groups experimental group and control group. The experimental group experience the musical improvisation therapy involving voices and musical instruments while the control group underwent the non-,musical content using the MBSR – Mindfulness Base Stress Reduction program, and the patients heard the program of body-scan mediation exercise through the headphones.

The measurement used to measure the pre- and post-test was the HRV - Heart Rate Variability measurement. The participants' self-assessments before and after each session, using the VAS - Visual Analog Scales ranging from 0-10 used to subjective measure the relaxation, general well-being and acute pain, and during the sessions the HRV in milliseconds were recorded using the photo-plethysmography (Nexus Blood Volume Pulse Sensor, 128 PS), as an indicator of nervous system function (Warth et al., 2015). "The mean Amplitude of Peripheral Blood Volume flow -BVP-A was calculated and also the medium-team effects of the intervention were explored by gathering information on quality of life using the EORTC QLQ-C15-PAL questionnaire, and all of the date were statistically analysed (Warth et al., 2015). The results of the study showed that there was a significant difference between the therapy group and control group in terms of self-rated relaxation and well-being, the scores were significantly greater increased in the improvisational music therapy group compare to the control group, but there were no significant difference in pain perception between the groups. Additional finding showed that between the beginning and ending of the study there were improvement on the overall quality of life scale in both groups, the improvisational group showed greater improvement but the difference was not significant. The authors concluded that their study is supported by the results that musical

therapy has effects on relaxation and well-being in patients receiving palliative care (Warth et al., 2015).

5.1.8 Musical improvisation improves symptoms of schizophrenic

Schizophrenic patient is a person with schizophrenia. The word schizophrenia means "of the mind", hence schizophrenia is refer to suffering from a split mind (Tsuang et al., 1997, p. 5). People with symptoms of schizophrenic might have bizarre beliefs (delusions) or they might frequently hear voices conversing with one another (hallucinations) (Tsuang et al., 1997).

Musial improvisation which applied in music therapy which makes use of spontaneous musical improvisation to establish the nonverbal interaction between therapist and person. It encourages persons to develop their interactive capacities and that is why the patients who suffer from schizophrenia and attended the sessions of individual musical improvisation therapy show improvement in the level of musical interaction, and also show improvement in their clinical status (Pavlicevic et al., 1994). Mercedes Pavlicevic and his team conducted a study to explored whether improvisational music therapy might play a significant role and could increase the attention in rehabilitation of patients with chronic schizophrenia in 10 weekly individual music therapy sessions. The participants in the study were 41 subjects and were divided in two groups, the treatment group was consisted of 21 individuals were allocated in weekly individual improvisational music therapy sessions. And the control group was consisted of 20 individuals who received only once individual music therapy session at the beginning of 10 week study period and another once at the end of study. (Pavlicevic et al., 1994). In the initial session of improvisational music therapy ,they used an untuned percussion instrument (a bongo drum) and a tune percussion instrument (a marimba), in bongo improvisation, the therapist plays on a piano together with the patient, but in the marimba improvisation the therapist and patients took turns in order to perform a musical conversation. During the improvisational session, the therapist modify / made alternations of tempo, rhythm and phrase length (Pavlicevic et al., 1994). In the initial session the subjects administered the Luria's Neuropsychological Investigations, to measure participants' musical perception of rhythmic, patterns, number of beats and the use of accents (Pavlicevic et al., 1994). In the treatment sessions (9 further weeks), the participants in the treatment group could choose instruments they prefer to play such as a chromatic xylophone, diatonic metallophone, diatonic marimba , bass drum, side drum, bongos or cymbal and every sessions were recorded on audio tape, while the control group had no music therapy

(Pavlicevic et al., 1994). The measurement used in the study were the MIR(S) - Music Interaction Rating for Schizophrenia to observe the peculiarities of chronic schizophrenic state, which consisted of 9 levels: level 1 'no music contact'; level 2'unresponsive'; level 3 'non-musical response; level 4 "self-directed musical response"; level 5 "tenuous musically directed response'; level 6 'sustained musically directed response'; level 7 'tenuous mutual contact'; level 8 'sustained mutual contact'; and level 9 'musical partnership' (Pavlicevic et al., 1994). The study suggested that the MIR(S) could be used as a highly sensitive instrument for observing and discussing the interactive capacities of chronic schizophrenia patients through the examination of their musical improvisation in music therapy sessions. The findings showed the invention group performed significantly better in the final music interaction ratings and the result strengthened that it was the communicative capacity of the subjects which elicited in the technique of improvisational music therapy (Pavlicevic et al., 1994). The patients in the treatment group confirmed their enjoyment in following the treatment sessions, and confessed the increase of confidence and improved concentration. The authors concluded that individual improvisational music therapy encourages and supports the development of an intimate, non-verbal interaction and enhance the quality of patients' communicative skills, and thereby indeed be useful in the rehabilitation of patients with chronic schizophrenia (Pavlicevic et al., 1994).

Mohammadi and his colleagues conducted a study to observe the effect of musical improvisation therapy on negative and positive symptoms in schizophrenia patients. The participants were 96 individuals who randomly assigned into 3 groups; an experimental group 1, an experimental group 2 and a control group. The experimental group 1 consisted of 35 individuals carried out the intervention tasks of individual and group musical plying, musical improvisation singing and movement. The experimental group 2 consisted of 27 individuals experienced passive musical therapy to listen to music through recorder. The control group consisted of 34 participants did not receive any music therapy. The intervention through musical therapy was conducted in weekly sessions during 1 month duration (Mohammadi et al., 1999).All patients experienced the pre- and post-test and the scores of all patients were recorded using the Andreasen's rating Scale for the Assessment of Positive and Negative Symptoms - SAPS (Mohammadi et al., 1999), the scales were rated in six point scale ranging from 0 to 5 (0 = none, 1 = questionable, 2 = mild, 3 = moderate, 4 = marked, 5 = severe). The negative symptoms were consisted of affective flattening, alogia, avolition, anhedonia, and attention, and the positive symptoms were included hallucination, delusion,

bizarre behaviour and positive formal thought disorder. The Statistical analyses were undertaken using reliability coefficient, *ANCOVA* and also t-test (Mohammadi et al., 1999). The main findings showed that musical therapy had relatively more favourable effect on negative symptoms compare to positive symptoms, and both the active improvisational music therapy and the passive music therapy had different effects on the different schizophrenia symptoms (the effect of musical therapy varied with the type of schizophrenia), there was no significant effect in the case of paranoid type of schizophrenia (the patients commonly experience delusions and hallucinations in the form of voices) but had a lot of significant effect in the case of residual type of schizophrenia (the patients has been in remission and symptom free for up to a full year / 12 month duration) (Mohammadi et al., 1999)

5.1.9 Musical improvisation: Improvised singing and toning optimizing cardiorespiratory

In order to stay healthy and to execute healthy activity, everyone should have enough supply of oxygen to muscles throughout the whole body, and that is known with cardiorespiratory function which is a combination function of heart and lungs. It is considered important to maintain the function, capacity and health of the heart and lungs, in order to obtain the optimum cardiorespiratory benefit.

A valuable research conducted by N.F Bernardi and his colleagues to evaluate the effect of musical improvisation on cardiorespiratory physiology, with 20 participants (approximately 24 years of age). All subjects without any cardiovascular or respiratory medical condition, and all of them without any singing training experience. In the study the participants were contrasted into two different tasks and experienced two different forms of singing tasks: a) singing of familiar slow songs with rhythmic and melodic forms which were familiar to Western individuals, b) improvised vocalization of free vowel sounds (toning = a form of improvisation-based open vowel vocalization), participants utter the length of the exhalation on a freely chosen pitch using open vowel sounds, and participants could change the pitch and vowel sounds used for each exhalation (improvisation) (Bernardi et al., 2017). The measurements used in the study was a portable custom component, in order to obtain a) electrocardiogram from 3 standard thoracis leads, b) respiratory excursions from abdomen and from the chest by inductive plethysmography (Bernardi et al., 2017), and the participants were tested during resting/ baseline, singing task, improvised vocalization task (toning) and silent breathing paced. The results of the study showed that the “respiratory frequency” dropped both in singing task and improvised vocalization task, the baseline respiratory frequency was 14.1 breaths/ minute, during the toning it dropped to 6.2 breaths/ minute while

in singing task it dropped to 11.6 breaths/ minute, so during singing tasks the respiratory frequency showed significantly faster compared to during the improvised task (toning) (Bernardi et al., 2017). The "tidal volume" showed increased in all conditions compared to baseline, but during the improvised task (toning) was significantly greater compared than during singing task. The "minute ventilation" showed increased in both conditions compared to baseline, there was a trend of lower ventilation during improvised task (toning) compared to singing. The heart rate and heart rate variability showed faster in both vocal productions' condition compared to baseline with no differences between improvised (toning) task and singing task (Bernardi et al., 2017). The findings showed the improvised vocalization (toning) significantly improved the HRV heart rate variability, ventilatory efficiency, and also optimized the cardiovascular function. The singing task condition also showed a positive impact to the cardiorespiratory function but in a lesser extent. The authors concluded that both improvised vocalization (toning) and singing suggested a trigger beneficial respiratory pattern, in obtaining the cardiovascular benefits (Bernardi et al., 2017).

5.2 Comparison with the other forms of improvisation.

It is clear that improvisation has its potential benefits which related to health and well-being and each type of improvisation brings us a great range of benefit to our daily life and give a great impact to both mental and physical health.

Improvisation is all over, it's in all places, as written by George E. Lewis on a foreword of the book *"The Art of Becoming*" (MacDonald & Wilson, 2020). We understand that many fields in arts as well as in the fields of humanities, social and natural science has been enriched by improvisation (MacDonald & Wilson, 2020), thus we recognize many forms of improvisation, which principally has the similar characteristic five keys, defining elements: improvisation are creativity, social, ambiguity, spontaneity, and accessibility (MacDonald & Wilson, 2020), and improvisation is considered vital to the existence and survival of every individual and suggests to provide many great impacts to human health and well-being. Presented below are some examples of observations about the benefits of improvisation outside the realm of music:

5.2.1 Dance Improvisation and verbal improvisation: facilitate divergent thinking and creativity

An interesting research was conducted by Paul T. Sowden and his team, to observe the art-based improvisation intervention and to find out the effect of dance improvisation on

divergent thinking and creativity. The participants were consisted of 27 primary schools children (17 males and 10 females), and their ages were ranged from 8 to 10 years of age. All of the individuals were divided randomly into two groups, a control group (8 boys and 5 girls) and an improvisation dance condition (9 boys and 5 girls). In the improvisational dance condition, the children experienced a series of dance improvisation exercises for 10 minutes, and were asked to use their part of body to explore as many spontaneous ways of moving as possible which were dissimilar from their usual way of moving (Sowden et al., 2015). In the control group, children also took part 10 minutes to follow the command style dance task without any improvisation. The materials of measurement used in the study were: the personal assessment of The Adjusted NEO-Five-factor Inventory; the intelligence assessment of Raven's Coloured Progressive Matrices; the mood assessment of SAM - Self-Assessment Manikin; and the measurement of divergent thinking and creativity of the instance task and toy design task (Sowden et al., 2015). The result of the study showed that the improvisational dance group obtained higher score of instance task and toy design task which measure the divergent thinking ability, so the improvisational group obtained the higher creativity scores which were a function of the increased divergent thinking"(Sowden et al., 2015), and these benefits can develop after a quite short improvisation intervention (Sowden et al., 2015).

Sowden and team also conducted their second experiment to explore the impact of verbal improvisation and acting on divergent thinking. The participant were consisted of 34 primary school children (10-11 years of age).The children were randomly allocated into 2 groups, a control group (non-improvisation group) and an improvisation group. They administered the Incomplete Figures Task of The Torrance Tests of Creative Thinking in order to access the non-verbal divergent thinking ability, before and after taking part the participation tasks (Sowden et al., 2015). In the improvisation group, they were required to perform acting and verbally improvisational task, while the children in the non-improvisational group (control), were required to do things such as factually describe objects in the room or guess what were the things being described (Sowden et al., 2015). The results of the study showed that participants in the improvisational group obtained significantly higher scores compared to the control group (non - improvisation) in the post-games originality scores, post-games elaboration scores, but there was no significant difference in the post-games score of abstractness of titles (Sowden et al., 2015). The findings showed that children who followed the series of verbal improvisational games obtained higher scores on figural divergent thinking task in terms of originality and elaboration. Through above

mentioned two studies, the authors concluded that participating in improvisational activities has general benefit for subsequent divergent thinking and creativity, and the effect can occur in children within a short time frame, therefore the authors concluded that indeed a short exposure to improvisation activities can enhance divergent thinking and creativity (Sowden et al., 2015).

5.2.2 Theatre improvisation techniques: as a tool for improving oral communication skills

Improvisational theatre is a form of theatre where dialog, characters and story are created instantly. Experts suggest that there many key elements of effective communication can be obtained through using the techniques which engage during theatre improvisation, such as awareness, active listening, collaboration engagement, willingness to respect others' point of views, and other attributes (Phelps et al., 2021). The value of theatre improvisation has been increasingly appreciated for improving the communication skills and has been applied in various fields such as in business, healthcare, science and others.

Marianne Phelps and her colleagues conducted a study on the theatre improvisation workshop with an objective to value the intercourse/ connection between training in the theatre improvisation techniques and empathy, communication and other professional skills (Phelps et al., 2021). They observed in two separated studies, the first study was in 2018 and the second study was in 2019. In both studies, the participants who joined in the research were from a group of undergraduate participants who engaged in the Summer Training in Environmental and Pharmacological Health Science - STEPS. The subjects experienced the 3-hours workshop of a series of improvisational exercises for about 10 weeks period (Phelps et al., 2021). In the first study the authors observed the impact of improvisation workshop on empathy, the participants were administered to the pre- and post- test of self-reported questionnaire (The Empathy Quotient) which consisted of 60 items questionnaires by using the 4-point scale (rating from strongly agree to strongly disagree). In the second study, the authors observed: a) Impact of improvisation workshop on "emotional status, personal growth and professional skills and b) Understanding empathy". Participants were administered to a survey (33 - items questionnaire) by email using an online study tool (Qualtrics), and the subjects shared their opinions about the impact of improvisation workshop on their emotion, personal growth and professional skills and understanding empathy (Phelps et al., 2021).

The results of the first study (2018) showed that the comparison from pre- to post- test of the total empathy scores (EQ= Empathy Quotient) did not showed a significant difference,

so the participation in the improvisation workshop did not change the participants' in their total emotion, reactivity, cognitive empathy, or social skills, but 85,8% of respondents confirmed that the improvisation workshop enhance their self-confidence and communication skill (Phelps et al., 2021). The results of the second study (2019) showed that all participants confirmed that improvisation helped them to think creatively, 88% of the participants confirmed their confidence in their ability to recognize the emotions of others, 78% of respondents felt that they had strong communication skills, and through following the improvisation workshop increased their communication skills and become more observant and better listeners, 67% of participants indicated that by experienced the improvisation, enhanced their oral presentation skills and decrease their presentation anxiety, 56% of respondents agreed that they felt the improvement in dealing with stressful situations, 89% confirmed it helped them "in respond in the moment", and the authors concluded from the second study that participating theatre improvisation enhances self-confidence and oral communication skills as well as the ability to think creatively (Phelps et al., 2021).

6 Discussion

The purpose of this thesis is to observe the effect of musical improvisation on human health and well-being. Many advantageous results were found through this observation and the findings explain the research's questions about why musical improvisation effects human health and well-being, how musical improvisation effects human health and well-being and what are the distinct effects of musical improvisation to human health and well-being.

To improvise music is to create music, to perform individual's own music creations in a real time and the activity of musical improvisation is different from making music from memory or from the written notation, it requires creativity to invent a live of novel musical compositions at a specific moment. Each individual who wants to improvise music must equip themselves with certain skills which combine the results of musical performance, emotional, communication, techniques of playing musical instruments, and thereby improvisation is considered as a creativity.

Musical improvisation has its wide range of capacity and the characteristic which may offer many intrinsic benefits and distinct effects on human health and well-being. There are several creditable characteristics of musical improvisation which are identified as significant rationale/ causes these effects during individuals engage in the activity of improvisation; its

potential to link conscious with unconscious process, its focus in involvement of a creative process, function as non - verbal social and creative interaction, its capacity of communication for expressing feelings and emotion without verbal articulation.

During improviser' brain generating the spontaneous process in creating the novel music, it involves cooperation between large-scale brain networks both the dynamic interaction of the default mode network (DMN – an automatic bottom-up process) and the executive control network (ECN – a top down control process), these different brain's networks associated with different tasks. DMN is linked to spontaneous thoughts, memory or abstract thoughts, self-generated thought, such as mind-wandering, mental simulation, social cognition, autobiographical retrieval, episodic future thinking, but ECN is linked to cognitive control or cognitive processes which require external directed attention, including working memory, reasoning, problem solving, planning, relational integration and task-set switching. Through the fMRI, it demonstrated that during the activity of generating improvisational task, most blood activation in medial prefrontal cortex (medial PFC), a region that has critical importance for number of cognitive, behavioural, affective function, and to enables the creative process and decreased activation in lateral orbital prefrontal cortex and dorsolateral prefrontal cortex (DLPFC), an area might suggest suspension of conscious control and considered as an inner critic region, and associated with self-criticism, or self-critical thinking area, therefore enabling freer, more spontaneous thoughts and actions, more creative performance. There was a link between linguistic and music discourse, many similarities in hierarchical structures and purposes and both utilize a common neural network for syntactic operations, the social paired of musical improvisation utilized inferior frontal systems which is important for hierarchical structuring of language and musical discourse. It showed that the brain regions which shared identical activation between the task in music and language, were included the bilateral SMA, left primary motor, bilateral premotor, left IFG, left primary auditory, bilateral secondary auditory, anterior insular, left anterior cingulate cortices, the subcortical areas. All of these distinctive characteristics of improvisation activate a wide range of brain networks and connectivity, and also link the conscious and unconscious process, thereby explains that human brain networks in many brain regions respond to the stimuli of musical improvisation's process and that is why musical improvisation has distinct effect to influence human health and well-being.

Musical improvisation is a complex form of creative behavior which has been proven by facts that musical improvisation has its robust capability, essential and unique characters

in optimizing the function of human body and mind. During the process of musical improvisation, it showed reduction of activities in some areas including the hypothalamus, amygdala, hippocampus, parahippocampal gyrus, temporopolar cortex and ventral striatum and activation in bilateral insular which indicated the positive emotional valence, emotional intent and reduction of anxiety associated with improvising. Musical improvisation effects emotion regulation and eliciting positive feelings. The capacity of musical improvisation to affect individual's feeling and brings positive stimuli which evokes and improves individual's emotion, arousal, mood, and reduces anxiety is consider as one of the major aspect that make possibility of the musical improvisation to generate positive effects and bring abundance benefits to health and well-being, such as musical improvisation improves cognitive performance: improves memory, facilitates divergent thinking and creativity, improves communication skills, contributes to the prevention of cognitive decline, enhance social skills and focused attention. Musical improvisation potentially lessen the condition of labile hypertension, effects neurochemistry outcomes, and also enhances interpersonal coordination. All of these evidences illustrate how musical improvisation effects human health and well-being.

Through realizing about the robust capacity and the essential potential of musical improvisation, many therapists have utilized the musical improvisation in their clinical improvisation to conduct treatments for people who are in needs, suggesting that through the activity of improvisation may offer primary and real benefits to human health and well-being to wide range of populations. Therapists implement improvisational music as an intervention, in music therapy programme to obtain individual goals within the therapeutic process and to improve clients' condition both in physical and mental health. There are many positive findings which demonstrate the advantageous and positive benefits of improvisational music therapy which were obtained through the intervention of improvisation, such as improvisational music therapy improves people with mental health condition (treatment of depression), reduces anxiety symptoms, improves communication and social interaction skills, improves people with ADHD and eating disorder, improves people with neurological disorders, benefits to patient in a cancer care, improves people in palliative care, improves symptoms of schizophrenic and optimizing the cardiorespiratory. These findings have demonstrated that improvisational music therapy with improvisation intervention give many advantageous contribution and positive impacts to human health and well-being. Other than musical improvisation, the comparison study showed that dance improvisation, verbal

improvisation and theatre improvisation also contribute many distinctive effects to health such as facilitate divergent thinking, boosting creativity and improving oral communication skills. Thereby, in general this writing suggests that improvisation can be used as an intervention in various types of therapy for the purpose to improve human health and well-being in various aspect of health according to the special needs of each treatment.

This thesis is far from providing a complete results. In the future study, it is consider necessary to compare more evidences in order to obtain more complete and accurate outcomes. Besides that, improvisation can still be applied in many areas of therapy, in order to obtain wider benefits and to improve various kind of health's aspect, so there are still many areas which need to be observed further, such as the impact of improvisational music therapy on immune system, the influence of improvisational music therapy on digestive system, the effect of improvisational music therapy on the sleeping disorder, etc., and all of these fields of researches are deemed necessary for the future studies in order to obtain more advantages from improvisation. Due to the existence of null results or the non-significant results which were found in several empirical studies, which caused the unclear association between the improvisational music therapy on the expected treatment results, it is considered necessary to give suggestions about research implementation procedures /research methods in order to avoid the inaccuracy of study's results. There are several important aspects which must be carefully considered in carrying out an observation/ a research on the impact of improvisational music therapy, such as: the quantity of samples used and method of collecting samples, greater number of samples with a random sampling method is vital in order to obtain more accurate results in order to demonstrate the causal link between improvisational music therapy and each aspect of treatment performances. The measuring instruments (rating scales) used in each study observation also plays an important role, with a wide range availability of various measuring tools, it is fundamental and crucial in choosing the right tools of measurement for the right element of study.

This study provides many advantageous information about the benefits of improvisation for human health, therefore through its remarkable roles of improvisation, especially the musical improvisation, it is suggested that many community members such as educators and parents, therapists as well as general public could implement and apply the improvisation to improve health and for special treatment in its requiring field. A huge benefit could be obtained, if many young people want to add up their knowledge about improvisation, learn the improvisational skill from young ages in order to boost their creative

mind and maintain the flow of creativity, enabling freer, more spontaneous thought, boosting every aspect of life to its fullest by maintaining the creative performance. It is also important for musical therapists and other field of therapists to implement the element of improvisation in their therapeutic methods as a parts of the intervention of treatments in order to obtain the utmost improvement and cure for patients with various kind of illness and disorders, since improvisation produces distinct effects, if it is implemented as an intervention in each treatment, it will bring gradual improvement towards patients' recovery. For the general population or public individual, it is also consider good to learn and add knowledge about improvisation skill, it could be in the form of free musical improvisation, verbal improvisation, dance improvisation, theatre improvisation or other forms of improvisations, since during individual generating the improvisational task, it activates a huge range of brain networks and its connectivity, experiences freer spontaneous thought, elicits positive feelings, and people who engage in improvisation, could experience the non- verbal communication, thereby could improve various aspects of human health.

Through this study, it shows many positive implications. Firstly, during individual generating spontaneous novel music compositions which are unique in each performance, the neural correlation which were shown through fMRI and other brain recording devices, reveals a wide range network of human brain regions involved and activate greater connectivity within the networks, thus it provides knowledge and insight into the possibility to improve the cognitive basic of creativity, from doing/ participating in the improvised music. There may for instance to use learning improvised music be benefits to increase the IQ level of children during their development stages or in different ages, how and whether children from their young age could perceive the benefits between their practice and their sense of intelligence improvement. Secondly, similar to making music and listening to music, participating in musical improvisation that each individual fond with, could affect individual's feeling and brings positive stimuli that evoke and improve individual's emotion, arousal, mood, and reduce anxiety. It is considered useful to create a community that study and involve in improvised music which provide proficiency for people to join regularly in improvised music activity , which may for instance be benefit in terms of preventing the development of depression, stress relief, improve self-perception and overcoming negative feelings or emotions. Thirdly, it is also shown in previous researches that different styles of improvisation might involve multiple different distinct range of activity in brain networks, for instance difference brain region activation at the moment the improviser generated the jazz

improvisation and classical improvisation or between structural improvisation and free improvisation, and these findings might leads to future researches in focusing on how different improvisational practice might produce different or specific influence on health outcomes. Fourthly, it is also implied that the terms of conditions and duration during the activity of improvisation is conducted, could influence the results of study, for instance the longer intervention or larger number of treatment hours of the improvisational music therapy could give a better treatment outcomes, so the longer period of therapy is better compare to the short period of therapy. Also, the method in taking the specimen for observation must be considered carefully in order to avoid the discomfort/ anxiety effects during the process, such as when taking a blood specimen for the observation about the effect of improvisation on hormone outcomes, it is better to change it with an enzyme specimen in saliva (salivary test instead of blood draws), or other alternatives, in order to obtain the accurate result. Other aspect that must also be considered is about the selection and provision of musical instruments for the participants, the range of musical improvisation must be sufficient and in accordance with the abilities participants so that they can carry out the musical improvisation activities joyfully and according to their abilities in order to provide an optimal results. Then, it is also important to consider the burden which associated with attending the treatment condition/ therapy sessions, the settings (the location and situation of study) also could affect the observation's result, for instance if the location of study is in the hospital, it is related to suffering atmosphere/ painful situation, which could give burden to participants who attend the therapy/ treatment, they might feel that they would experience something harmful/ invasive feeling, therefore it is better to conduct the study in the school, because the school is a kind of inviting environment for children which they usually visit as part of their daily routine or to choose other comfort places. The other thing which also needs to be considered is the tightening of the supervision process during music therapy intervention period, especially those applied to children with special needs (children with autism, ADHD or other disorder), means that if improvisational music therapy is added as a support for the existing standard care (basic standard treatment), then the frequency of participants attending the standard care should not be reduced, so it is considered important for strictly supervision, especially when a study is carried out in a large scale (big number of participants/ samplings), because it can affect research's results/outcomes, therefore the inaccurate conditions and duration of intervention, method of taking specimen, selection and provision of musical

instruments, physical settings for treatment and the supervisions during the conduction of research, could collaborate for the lack of statistical significance in the outcomes.

If I have an opportunity to conduct a research in the future about the effect of musical improvisation on human health, I will do an empirical study and using random sampling method with longer period of improvisational music intervention on sampling with different ages level so expectedly it can provide more representative results to explain the impact on each age level. And also to select more accurate tools for the assessment in order to increase the accuracy and reliability of the study's outcome and to obtain more precise information of the treatment's effects.

Overall this thesis provides many positive findings in showing the great effect of musical improvisation on health and well-being and to supports many scientific books and researches about the positive impacts of improvisation on health. Likewise, this study also in line with the improvisational music therapy which has been applied as musical therapy in many healthcare which have shown many improvement in patients' health. Thereby, this thesis proves that truly spontaneous improvisation has a broadly scope to intervene human health and well-being and suggests that applying improvisational music in various kind of treatments can bring various benefits to the progress of patient's condition.

Finally, It is worth considering that musical improvisation and other forms of improvisation are important part of lessons which is good to be experienced by everyone. It is vital to reconsidered and revalue the role of improvisation especially musical improvisation within education as well as within everyday life, thus it is important be introduced to children from an early age as well as for individuals of all ages. Improvisation especially musical improvisation should have a central place and as a compulsory subject in the school curriculum, so that children from their early age could have the opportunity to improve their creativity and divergent thinking skills and to obtain many valuable benefits through generating spontaneous improvisation.

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