CHAPTER THREE

THEORY AND METHODOLOGY

3.1 INTRODUCTION

The chapter three deals with the methodology of questionnaire survey and Electro-encephalography (EEG) experiment. The methodology offers a procedure to rationalizes the subjective quantitative survey and it rationalizes scientifically the objective quantitative Electro-encephalography (EEG) with the spiritual characteristics of Swami Tyagaya’s devotional Sangeetham in association with neuro-psychology.

The study has made extensive preparation for the Questionnaire survey and Electro-encephalograms (EEG). This chapter offers a descriptive and explicable methodology to perform the survey and the (EEG) investigation. The methodology for both the procedures deals with nine basic responsibilities.

1. It deals with the thorough description about the EEG experiment and the Questionnaire survey.

2. It deals with the procedure, criteria, safety and the outcome of the experiment.

3. It deals with the needs to review the questions and the variables.

4. It deals with collecting the necessary data.

5. It deals with reasonable assurance that the findings are accurate and credible.

6. It deals with the justification for selecting the various methods for data collection and the problems to face.
7. It deals with the accuracy of studies of other research articles and review literature.

8. It deals with the detailed description of steps taken to collect the survey data and the EEG data.

9. It deals with tools used for the statistical analysis and inferences for both the survey and the EEG.

The methodology shows the development of a questionnaire survey with a grand total of Eighty two questions to measure five different types of subjects extending from Swami Tyagaya, Sangeetham, devotional music, neuro-psychology and spirituality. The compilation of questionnaire is distributed to the Indian community in Malaysia. The intention is to assess the Psychological measurement with Psychometric properties of Tyagaya’s Sangeetham and spirituality which addresses the society’s abilities, attitudes, traits, knowledge and educational progress. One part of the field is concerned with the subjective measurement of knowledge, abilities, attitudes, personality, wisdom, and education with the validation of assessment instruments such as questionnaires and personality tests. The other part of the field is concerned with statistical measurement theory like item response theory, correlation theory and hypothetical nullifying theory. The Statistical Package for the Social Sciences, (SPSS 22), is used for statistical analysis. In this methodology, significant effects are demonstrated in both descriptive statistics and anova results based on gender, age, academic specialty, economic status, musical skills, and research productivity. The survey methodology approach is robust and replicable and is beneficial for this study. This method is realistic and the individual data is an
exemplar for other alternate level of studies. This rich array of survey model can integrate more realism into many other macro-level models.

The methodology illustrates the development of an EEG experiment with a background assessment questions. The formulated EEG experiments are conducted on three groups of Indian volunteers with and without Sangeetham knowledge. The intention is to assess the scientific dimension of the electrical signals from the brain of selected volunteers who are exposed to Swami Tyagaya’s devotional Sangeetham against two control groups of volunteers who are not. The purpose of the EEG is to determine the effects of Swami Tyagaya’s Sangeetham in the brain and to study the influence of devotional songs in the brain and correlate the electrical signals. The results are compared with the EEG results of the control groups. The correlation is to measure the effect of Swami Tyagaya’s Sangeetham, devotional music, in the brain for spirituality and neuro-psychological results. The study will investigate the origin and emergence of both the structure and behavior of the brain towards Swami Tyagaya’s Sangeetham. The study will understand how inherited and environmental factors play important interactive processes in the development of the brain system towards visualizing God. The study will recognize the spiritual experience and its dynamics with Swami Tyagaya’s devotional Sangeetham. The outcome is to demonstrate a God module in the brain.

Both the quantitative methodologies show the key to understand the psychological characteristics of the local Indian society and the neurological aspects of the brain in the influence of devotional meditative Sangeetham. The purpose is to go to the grass roots of the society to obtain valuable insights about Sangeetham,
Swami Tyagaya, devotion, brain, and spirituality. The study formulates a close link between long term devotional *Sangeetham* singing, the brain changes and spirituality. It may be suggested that Swami Tyagaya’s *Sangeetham* and devotional singing can bring about a sacred spiritual dynamics in the brain.

### 3.2 THE RESEARCH DESIGN

The design of the current study offers a methodology that can enable better understanding of Swami Tyagaya’s devotional *Sangeetham* and neuro-psychological properties. The study uses both qualitative and quantitative methods to collect primary data. The reason for doing so is to get in-depth understanding of the responses of *Sangeetham* and the brain. The qualitative analysis is endorsed through the review of the various literatures on *Sangeetham*, Swami Tyagaya, Vedanta and neuro-psychology. The quantitative empirical methodology is formulated by a laboratory Electro-encephalogram investigation on selected candidates. The quantitative subjective methodology is devised by the Questionnaire survey method. The survey investigates the responses of the society on *Sangeetham*, Swami Tyagaya, brain and spirituality as a random probe. “Random probes provide a check on the validity of questions and yield a representative sample of accurate comments which can be used as illustrative quotations when writing-up the research” (Gilbert, 1993:42).

The qualitative analysis of literature and the quantitative analysis can acquire detailed explanations of responses that emerged from the the questionnaire survey and the EEG. Therefore the researcher, prefers to combine both methods (qualitative and quantitative) in order to compensate for the inadequacies and benefits from the investigations. As Philip (1998) argues, ‘employing a range of methodological
strategies means that the researcher does not necessarily privilege a particular way of looking at the social world. I would suggest that such diversity encompasses methodological plurality as well as postmodernism encouraging different voices to be heard and facilitating the exploration of different truths’ (Seale, 2004:296). According to Bryman they each have distinctive characteristics that make the possibility of combining them especially attractive (1992:231). The study provides illustrative material about what underlies the respondent's views of Sangeetham, Swami Tyagaya, Brain and spirituality. Additionally, the main intention of the study is essentially in substantiating Swami Tyagaya’s devotional Sangeetham brings neuro-spiritual changes in the brain. The study is in fact a combination of Theo-philosophy and Neuropsychology. The complex study necessitates the combination of various methodologies to avoid possible misinterpretation of responses and barriers.

3.3 DATA COLLECTION

The questionnaires are in English language. The questionnaires are distributed by email and as well as hand delivery depending on which method is convenient for the respondents. In either case, the researcher explained the purpose and use of the study and sought their consent in a letter. A four pages structured self-completion questionnaires with open ended questions were sent electronically and by hand to the general public of Indian society of Malaysia and University students of Malaysia. (Indian society is important because they may be familiar with the context of the questionnaire like Sangeetham, Swami Tyagaya and Vedanta). The primary data are collected using the questionnaire guidance. This is to allow for triangulation of results. The Secondary data of previous researches as well as
theoretical articles and other discourses relating to the subject are also used to gain in-depth knowledge and therefore understanding of the subject and its previous findings.

3.4 DATA ANALYSIS

Lofland and Lofland, Glaser and Strauss, argue for the importance of combining data collection and analysis as much as possible (Thomas, 2000:113). This approach has worked well mainly due to the combination of data collection methods. The answered questionnaires were received slowly in full numbers which gave sufficient time for checking them thoroughly. However, it was impossible to do full data analysis at this stage. According to de Vaus (2002:203), there are four broad factors that influence data analysis. They are: 1. The number of variables being examined 2. The level of measurement of variables. 3. Whether to use the data for descriptive or inferential purposes and 4. The ethical responsibilities. Subsequently, the study included these four above factors and incorporated the Six Null Hypothesis statements of Inferential Tests.

The questionnaire had both open-ended questions. However, additional and different responses came up during the survey which necessitated implicit coding. Data from self-completion questionnaires were analyzed by using SPSS 22 method. This was in order to generate frequencies of responses as well as relationships between them. Two methods of analyzing meaning were used thus; meaning condensation which is an abridgement of the meanings expressed by the respondents into shorter formulations and narrative restructuring for the temporal and social organisation of a text to bring out its meaning. (Kvale, 1996:192).
3.5 VALIDITY, PRE-TEST STUDY RELIABILITY AND GENERALITY

Validity is the truthfulness or correctness of the measurement as planned or intended. Seale gives seven threats to (internal) validity thus: history, maturation, instability and regression, testing, instrumentation, selection and experimental mortality (Seale, 2004:74). Bearing the importance of validity, the study was designed and conducted from 1st December to 31st March (Four months), which was adequate for the respondents to answer the questions diligently.

The questionnaire was pre-tested to both professionals (specialists in the field, supervisors etc) as well as some respondents. This was to guard against the threat of instrumentation as well as testing. Experimental mortality would have little effect since the study was not ‘experimental’ but a survey. Reliability concerns the consistency with which research procedures deliver their results (Seale 2004:72). It also relates to the repeatability of the findings under similar conditions. Apart from statistical variations, it is doubtful whether a similar study would yield very different findings. Additionally, the same questions were asked to all respondents and the questionnaire can be used elsewhere, hence the study is repeatable. The research has also applied Pearson correlation method to determine generality of findings. It would be inaccurate to claim hundred percent reliability and validity due to the limitations of understanding and knowledge of the subjects.

3.6 ETHICAL CONSIDERATIONS AND LETTER OF CONSENT

According to Finnis (1983), ethics is a branch of philosophy, said to have been initiated by Aristotle, which takes human action as its subject matter (Seale, 2004:116). A central issue in ethics, Ali and Kelly argue, is the relationship between
the individual and the social world (Seale, 2004: 117). They further argue that, in research, we need to consider how the imposition of the research on individuals (with their consent or otherwise) can be balanced with the benefit of making the world a better place to live in. Indeed a number of ethical considerations were taken into account throughout this study. Therefore, a letter of consent was printed on the Questionnaire form and also sent through email to the respondents. The consent for EEG was also acquired. However, before the EEG procedure, the purpose of the study and the research subject was explained to the volunteers. They were as well as assured of their confidentiality and while at the same time their consent was solicited. The EEG brain experiment was completed after their confirmation of willingness to participate in writing. Therefore, the researcher has tried as much as possible to respect the volunteer’s privacy.

3.7 LIMITATIONS AND ADVANTAGE OF THE STUDY OF QUESTIONNAIRE AND EEG

There were some limitations in Questionnaire survey and the EEG experiment. The key limitation remained in the complexity of the topics such as Swami Tyagaya, devotional Sangeetham, brain, neuro-psychology and spirituality which are philosophic, cultural and scientific subjects. The questions are numerous and voluminous for simple comprehension and the topics are not specific to one type of decision making. The complex nature of the questionnaire appeared little confusing for some respondents which was unavoidable. The specific background particulars and the questionnaire form had to be distributed to all candidates and the reply collected in the specific period of time which was difficult. Some volunteers were less conversant with the English language. Some candidates were ignorant of Swami
Tyagaya and Sangeetham. The characteristic advantage was that the volunteers were willing to answer the questions. Some vague questions were purposely placed for intelligent answers. Structured surveys normally use closed ended questions which makes opinions clear.

Bryman (2001) has argued that research methods are rooted in epistemological and ontological commitments.... The epistemological positions in which the two methods (quantitative and qualitative) are grounded constitute irreconcilable views about how social reality should be studied (Seale, 2004:294). Philip (1998) echoes this distinction and notes, ‘recognizing this destabilizes the distinction between the two approaches and therefore their apparent incompatibility’ (Seale, 2004:295). The study tries to reconcile this dichotomy by conforming to the institutional setting in which the research was carried out. The study investigates the complex subject of Swami Tyagaya’s Sangeetham and the brain factor which cannot be a pure qualitative research through review of literature books. The nature of the topic in the form of brain dynamics deemed necessary to resort to quantitative investigatory method such as EEG experimentation. The limitation of the EEG instrumentation is that the volunteers were initial anxious about the procedures. The influence of the EEG is not absolute but it has certain limitation in the activity of the brain.

The advantages of the EEG experiments are that it is a relatively cheap, fast, and simple. It is a safe way to check functioning of different areas of the brain. It is a non invasive procedure that does not cause pain and it is effective in displaying the electrical activity of the brain. The advantage of the questionnaire survey is that it can
be inexpensive especially if they are self administrated and they can be sent to different locations by using mail, email or by hand. The questionnaire needs no guidance and they can be completed easily and quickly. It is an effective way to get opinions of a large number of people.

3.8 SIGNIFICANCE OF THE SURVEY AND THE EEG STUDIES

The questionnaire survey is significant from a subjective point of view. The survey is cheap and can be distributed widely. They do not require much effort. The answers are simple to compile. The questions are vivid and the respondents can read the questions and reply to them. Some time for some researchers the demographic survey by questionnaire may not be concrete. Some statisticians say a result is “highly significant” which may mean that it is “probably true”. They do not essentially mean that it is highly significant. Generally Statistical surveys are undertaken with a view towards making statistical inferences about the population being studied. The response depends strongly on the survey questions. Surveys provide important information for all kinds of public information and assist in research fields. The field of survey in this study is on Sangeetham, Swami Tyagaya, brain and spirituality.

The EEG experiments are true and important from an objective methodology point of view and it remains scientific for the study. The Electroencephalography is a non-invasive method to record electrical activity of the brain along the scalp. EEG measures voltage fluctuations resulting from ionic current flows within the neurons of the cortex of the brain. In this research, EEG is used for the recording of the brain's electrical activity over a period of time when exposed to devotional Carnatic Sangeetham and other devotional music. The multiple electrodes placed
on the surface of the scalp produce the different electrical activities which are recorded as a graphic form. Along with fMRI and CT scans, EEG continues to be a valuable tool for research. The EEG experimentation used in this research establishes the physiological activities of the brain under the influence of devotional meditational Sangeetham.

Therefore, the purpose of the questionnaire survey study is expected to indicate the aspiration of the society towards Devotional Sangeetham, Swami Tyagaya, brain and spirituality. The purpose of the Electro-encephalogram will show the evidence of the electrical activities in the brain in the influence of Swami Tyagaya’s devotional Sangeetham. The study attempts to show evidences for the following points subjectively and scientifically.

1. Swami Tyagaya’s visualization of God Rama can be real.
2. Spiritual life and God realization signifies tolerance, righteousness, compassion, humility, and love.
3. Spirituality is one’s journey towards moksha, awareness of self, the discovery of higher truths, true nature of reality, and consciousness.
4. Devotional Sangeetham can enhance specific neural activity for God sensation.
5. There are spiritual perception centres in the neocortex where the neurons can comprehend God, (God module).
6. Modern neuroscience explains through brain imaging methods, the neuroplasticity in the emotional centres and increase neuro-vascular activities in the multiple brain parts. The EEG elucidates electrical activities in the brain.
7. The brain can create a visual imagery of God.
8. Swami Tyagaya’s Sangeetham leads to spirituality and the perception of God is possible in selected mind.

Therefore the significance of the study is that devotional Sangeetham as a contemplative practices may have a substantive impact on the biological processes which may be critical for the wellness of the physical and spiritual health. Research on meditation and theo-psychology may provide new insights into the methods of mental and spiritual training that have potentials to enhance human health, compassion and love.

3.9. THEORY AND METHODOLOGY

The theory is based on 1. Swami Tyagaya’s vision of Lord Rama and the contribution of Sangeetham. 2. The association of the devotional Sangeetham in the development of ‘God Module’ in the brain and 3. How neuropsychology views the perception.

The technique employed are both qualitative and quantitative research methods for data collection on subjective and empirical investigations respectively. Thus, through the qualitative and quantitative methods the researcher finds it appropriate to identify, analysis, justify, interpret and conclude the subject and the object of the study.

The methodology adopted in this current study is both conceptual and scientific. The line of investigation is by Qualitative analysis of literature and Quantitative
analysis of Laboratory and Survey examination. This study is researched with three guidelines.

1. By means of theoretical assimilation of literature
2. Exploratory social Questionnaire survey method and
3. Electro-Encephalogram (EEG) procedure conducted in a Laboratory.

These three guideline methods endorse to understand the relationship between devotional *Sangeetham* of Swami Tyagaya and the psychological aspect of the brain. The guideline also supports the society and spiritual experiences. An important contribution that exploratory research can make to our understanding is helping us to identify patterns and enabling us to give names to social phenomena (Thomas, 2000:170).

The research tools employed were:

i. As a Subjective analysis a Questionnaire survey on Devotional *Sangeetham*, Swami Tyagaya, God, brain and spirituality.

ii. As an Objective analysis, the EEG laboratory investigation is conducted on the brain to assess the electrical signals emitted in the cortical area of the brain as a result of the effects of Swami Tyagaya’s devotional singing and its spiritual philosophy. This EEG study is demonstrating that the contemplative practices may have a substantive impact on biological processes which is critical for physical and spiritual health. The EEG research on devotional songs, meditation and Theo-psychology provides new insights into the methods of mental and
spiritual training that has potentials to enhance human health and religious tolerance.

3.9.1 Qualitative Methodology

In the qualitative method the review of the literature is based on Hindu Theological culture, Indian devotional Sangeetham, Brain science, psychology and Spiritual science. Therefore, this study will be supported by the primary sources of Hindu Vedanta books, Indian Sangeetham manuscripts, Neuro-psychoplogy text books and Indian classical literature books on Swami Tyagaya.

The Qualitative methodology adopted in this research is conceptual and theoretical. The study is basically an assimilation literature review involving;

- Tyagaya’s Musical compositions (C. Ramanuchari)
- Books on Carnatic Sangeetham (Prof. P. Sambamurthy)
- Books on Vedantic Philosophy (Swami Yatiswarananda)
- Research books on Neuropsychology (Dr. A. Newberg)
- Journals and Medical Text Books on the Brain (Scientific American)
- Journals on Carnatic Sangeetham (Indian editions)
- CDs / Internet, U tubes (Downloads)
- Devotional lectures by Swamis and Search in Libraries (Attendance)

3.9.1.1 INTERPRETATIVE PHENOMENOLOGICAL ANALYSIS (IPA)

The Qualitative methodology applied for the analysis, comprehension and conclusion is Interpretative Phenomenological Analysis (IPA). It has its theoretical
origins in phenomenology and hermeneutics. Phenomenological methods are particularly effective at bringing to the fore the experiences and perceptions of individuals from their own perspectives, and therefore the approach challenges the structural hypothesis. The adding of an interpretive dimension to phenomenological research will enabling it to be used as the basis for practical theory and will allow it to inform, support or challenge policy and action. (Stan Lester, 1999:1). The hermeneutic phenomenological research emphasizes on the metaphysical stance, methodological grounds, quality concerns and ethical issues that contribute to its paradigmatic assumptions. Finlay (2009:45) further states that applied to research, phenomenology is the study of phenomena: their nature and meanings. The focus is on the way things appear to us through experience or in our consciousness where the phenomenological researcher aims to provide a rich textured description of lived experience (Narayan Prasad Kafle, Katmandu University, 2011:181)

Through the IPA methods the researcher aims to gather an in-depth understanding of Devotional music of Swami Tyagaya, his behavior towards God, his Spirituality, the Brain science and the reasons that govern such behavior. IPA has a good balance of phenomenological description with insightful interpretation. It has a degree of transparency (contextual detail about the sample, a clear account of process, adequate commentary on the data, key points illustrated by verbatim quotes). Phenomenology of Swami Tyagaya is concerned with the study of experience from the perspective of the individual and it emphasizes the importance of personal perspective and interpretation. Phenomenological approaches are based in a paradigm of personal knowledge and subjectivity. The Hermeneutics deals with the
interpretation of Swami Tyagaya’s vision of God and the devotional wisdom and the Vedantic, philosophical or religious texts.

The IPA encourages an open-ended dialogue. It offers insight to see things in a new light because of its combination of psychological, interpretative, phenomenological, hermeneutics and ideographic components. It is an approach to psychological qualitative research with an ideographic focus, which means that it aims to offer insights into how a given person, in a given context, makes sense of a given phenomenon. Usually these phenomena relate to experiences of some personal significance; such as a major life event, or the development of an important relationship. IPA usually requires personally-salient accounts of some richness and depth, and it requires that these accounts be captured in a way which permits the researcher to work with a detailed literal transcript.

This IPA approach emphasizes four main levels which are as follows.
1. Identification and documentation
2. Investigation and compartmentalization
3. Interpretation and analysis
4. Integration and conclusion

The Identification and Documentation is the first stage. The study will obtain the principal data for identification and documentation from the reliable text books like Shastria Carnatic Sangeetham, Swami Tyagaya’s life and works, Neuropsychology, Vedantic and Spiritual Books as primary source. The secondary source will obtain the relevant materials from research papers on Neuropsychology,
Journals, CDs / Videos – interviews of musicians, devotional lectures by commentators, Swamis and Gurus, related books, academic exercises, seminar papers, reference books and magazines. The primary and secondary source informations will be identified, scrutinized and documented. All these materials are useful to substantiate the study.

The Investigation and Compartmentalization is the second stage. The documented data will be investigated and co-related for detailed comprehension, evaluation and assimilation. Then, the material will be scheduled for compartmentalization in chapters. The subject matter and the data which are compartmentalized are analyzed carefully for correlation of meaning in the correct chapters. The main divisions of analysis are, introduction, rationale, statement of study, objective, literature review, methodology, theories, Implication and conclusion. Care will be taken not to repeat ideas

The Interpretation and Analysis is the third stage. The study will facilitate the significance of the current research objective. The analyzed data will be treated accordingly and appropriately to fulfill the objective that Tyagaya’s devotional music findings corroborates with the evidences of the neuro-science.

The Integration and Conclusion is the last stage. The study will scientifically rationalise and substantiate the findings and discuss and integrate the evidences gathered from the data. The conclusion is drawn based on the Sangeetham, Tyagopanishad, Neuropsychology and Spiritual philosophy.
3.9.2 JUSTIFICATION OF INTERPRETATIVE PHENOMENOLOGICAL ANALYSIS

The study finds it appropriate to choose “Interpretative Phenomenological Analysis” (IPA) because, it is an psychological qualitative research with an ideological focus, which means that it aims to offer insights into how a given person, in a given context, makes sense of a given phenomenon. This phenomenon can be scientifically rationalized and there are sufficient evidences to prove it right. These phenomena is relate to experiences of some personal significance, such as a major life events, or the development of an important relationship or a major experience or an emotional perception.

The IPA method is distinct from other approaches because of its combination of psychological, interpretative science and ideographic components. It appears most appropriate for qualitative phenomenological psychology. It elicit an in-depth understanding of meanings of human practices, culture, works of art and science texts. Phenomenological analysis is based on discussions and reflections of direct sense perception and experiences of the researched phenomenon. The Conclusion of the research will be based on deductive method and scientific corelation method. The understanding is produced through systematic interpretation of the scientific and survey processes. Therefore the selection of “Interpretative Phenomenological Analysis” (IPA) will be effective and useful for literature review.

The study with IPA attempts to understand the rationale by demonstrating that Swami Tyagaya’s spiritual Sangeetham plays a prominent role in the brain and the brain creates the visual imagery of God. It also studies how modern
neuro-psychology approves this “God - Image” in the brain? It endeavors to attain the spiritual phenomenon and explains the benefit of spirituality to the society.

3.9.3 QUANTITATIVE METHODOLOGY

The Quantitative methodology adopted in this research is in the form of a field survey and a laboratory Electroencephalogram (EEG) experiment. The two studies are basically an investigative, assimilative, and inference related review. The survey is subjective and the EEG is objective.

3.9.3.1 Questionnaire Survey (Subjective Analysis)

Swami Tyagaya attributed Lord Rama as God. Different religious traditions assign differing attributes and characteristics to God. God is great for the believer’s mental, physical, and spiritual health. The study attempts to comprehend the precise implications of Swami Tyagaya’s Sangeetham and God’s attributes. The study also comprehends wide-reaching views of people’s religious, devotional, musical, neuro-psychological and spiritual experiences. The survey is conducted in a national level. Eventually, the researcher conducts a statistical analyses, inference and conclusion with the collected data.

3.9.3.2 Pilot study & Questionnaire Validity and Rules

i. The purpose of a pilot study is to test the effectiveness of a questionnaire on a limited number of people before the main survey is conducted. The flaws like unclear instructions, repetitions, ambiguity, excessive length, bias statements are corrected. The Pilot study is based on quantitative and qualitative methods. A self administered pilot questionnaire is conducted for a selected experts and members of community.
ii. The questionnaire probes the design, the development, the reliability and the validity of *Sangeetham*, Swami Tyagaya, brain and spirituality by formulating basic rules and using statements which are interpreted easily by members of the society. It uses positive statements and avoids negatives or double negatives. It uses clear and comprehensible wording, easily understandable for all educational levels. It uses correct spelling, grammar and punctuation. The questions are not prejudicial but inadvertently, a few questions are leading the candidates towards an answer in order to elicit a clear view.

iii. The survey is a most commonly used tool in a research. This survey produces valid and reliable demographic variable measures and yields valid and reliable individual disparities that self-report scales generate. The first part of the survey simplifies the concept for statistical significance as much as possible so that non-technical readers can use the concept to help make decisions based on their data. The second part provides more technical importance so that a fuller discussion of the subject is necessary for statistical significance. The Questions investigates on *Sangeetham*, Swami Tyagaya, Brain, God and theology. The study also surveys the frequency of the participants’ devotional attendance, society work, religiousness and spirituality. The survey assesses the participant’s spiritual experiences measured by statistical indices. It measure the statistical interpretation on *Sangeetham*, Swami Tyagaya, Brain, religion and spirituality. The Survey is compared with the report of other researchers in order to acquire the perception of God, spirituality and devotional music between the Malaysian Indian society and the European society.
3.9.3.3 Study Time period, Areas, Ethics, and Purpose

The Survey was distributed on the 1st December 2013 and collected on the 30th March 2014. The majority of the participants are those who are from an Indian cultural background. The Questionnaire is focused to get the views of the Malaysian Indian population. The survey addresses respondents’ views on devotional sangeetham, Swami Tyagaya, consciousness, brain, social, and religious issues. Questionnaire sheets were printed and distributed by hand to the candidates and also electronically sent. The representatives were requested to be responsible for the distribution and receiving the questionnaire. The anticipated time to complete the questionnaire was approximately thirty minutes. However they were welcome to take as much time as they needed. Ethics approval was obtained from the representatives. An introduction letter and candidate consent letter was given for the candidates to put their signature.

The purpose the survey is to obtain information about spiritual experiences and how candidates relate to various belief systems. Candidates were asked to provide information regarding their spiritual experiences and their understanding of devotional music, Swami Tyagaya, brain activity and spirituality. The candidates were asked to relate about their existential experiences and beliefs.

3.9.3.4 Confidentiality, Address, Distribution, Number of Respondents

3.9.3.4.1 Confidentiality

Every attempt is made to maintain strict confidentiality for all information collected in this project. If in due course of any publications or presentations of the
result, the participant will not be identified by name. However, excerpts of their comments may be used as examples.

### 3.9.3.4.2 Distribution

The questionnaire was distributed randomly through interested friends and their family members. The respondents replies are accessed through the same sampling based on willingness to participate in the study. The respondents are mostly adults, family personal, professionals, educated members, musicians, religious teachers and students. All are accessed through the same sampling process. However, their willingness to take part in the study takes precedence. This survey is conducted via two important questionnaire methods: i. the printed and electronic method. Most of the printed Questionnaires are distributed to the general community such as professionals, theologians, musicians, students, families, colleagues, strangers and friends and some questionnaire are electronically sent to doctors, professionals, associates, strangers, acquaintances, friends and their friends.

### 3.9.3.4.3 Number of Respondents

This quantitative questionnaire data collection method responded with 410 despondences and their replies. The response rate was quite high and this meant that the using of the quantitative questions for random probes were positive for the outcome of the study. There are no shortcomings and complaints. The language is not a barrier because all the respondents are English educated. The exercise is generally well received by the responders although the exercise required a lot of time and patience.
3.9.3.4 Sampling & Assessment Procedures

The survey procedure comprises of:

i) Questionnaire design and distribution

ii) Answers documentation

iii) Statistical analysis and Interpretation

iv) Discussion and Conclusion

The questionnaires are designed and developed to estimate the psychometric values. Psychometrics is a study concerned with the theory of psychological measurements. One part of the field is concerned with the objective measurement of skills and knowledge, abilities, attitudes, personal achievement. For example, the construction and validation of assessment instruments such as questionnaires and personality tests. Another part of the field is concerned with statistical research bearing on measurement theory for example, the validation of item response and correlation theory. The psychometric research is what has led to the development of experimental psychology and standardized testing (https://en.wikipedia.org/wiki/Psychometrics).

The survey Questionnaire is designed to estimate the psychometric values of the society’s awareness on Swami Tyagaya’s devotional kritis and other saints’ (Appar, Sundarar, Thirunavukarasar, Manikavasagar etc) devotional compositions. The questionnaire protocol is supported by a logical and systematic framework for better comprehension of the philosophy of Sangeetham (devotional music), Swami Tyagaya, neuropsychology and spirituality. The Questionnaire is designed to
demonstrate the reliability and validity of the candidates’ knowledge on Sangeetham, God, neuro-psychology and spirituality. Therefore, a non prejudicial approached is maintained for the protocol. The purpose of this questionnaire protocol is to obtain information about their spiritual experiences in association to the various belief systems. The protocol is asking participants to provide information regarding their spiritual experiences with their religion or Sangeetham or devotional music or spiritual talks or religious books. The participants are also asked about their existential experiences and the relationship to the brain and mind complex. The Questionnaire contains A and B sections. The Section A is a collection of demographic information and section B deals with questions about sangeetham, Swami Tyagaya, brain, meditation and spirituality. Absolute care is taken to create a reliable research.

The survey contains Eighty two Questions. The answers are considered based on the 5-point Likert-type scale. The answers are arranged in ordinal scales which measure levels of agreement and disagreement. The scale assumes that the strength and intensity of experience is linear, which is based on a range from strongly agree to strongly disagree. The participants are requested to scale their answer based on the Likert scale of 1-5. Example, (Strongly Disagree, Disagree, Undecided (neutral), Agree, Strongly Agree). The Questionnaire protocol also includes a validated tool survey which was previously published by Genia, V. (1991). The spiritual experience index: A measure of spiritual maturity. Journal of Religion and Health, 30, 337-347. Here, a section of the questionnaire is simplified to extract the answers with a YES; NO, Don’t know range. This scale is most widely used in survey research.
When the questionnaires are completed, the answers are further analysed. The answer data collected are entered into The Statistical Package for the Social Sciences (SPSS-22), software system which is used for statistical analysis and prediction. A consensus based assessment is created and validated on the society’s prediction on Sangeetham, Swami Tyagaya’s devotional compositions, neuro-psychology and the spiritual transformation.

The statistical null hypothesis testing is reported for the study based on the questionnaire survey statistics. The six statistical hypothesis tests are conducted for statistical inference with the assistance of the survey statistical data. The statistical data is compared with the synthetic data as an alternative null hypothesis. The comparison is regarded statistically important according to threshold probability. The Six Null Hypothesis statements of Inferential Tests are also conducted for the study. The survey results are reported with the Six Null Hypothesis statements of Inferential (Hypothesis) Tests. Inferential analysis was conducted with the methodology of Cohen, J. (1988).

3.9.4 The Six Null Hypothesis statements discussed for six alternate statements

i. Nul HO₁ : There is no significant relationship between Sangeetham (Indian Classical music) and devotional experience among Indians.

ii. Nul HO₂ : There is no significant relationship between Sangeetham and general perception on God, brain science and devotional experience among Indians.

iii. Nul HO₃ : There is no significant relationship between Sangeetham and Neuropsychology among Indians.
iv. Nul $\text{HO}_4$ : There is no significant relationship between devotional Sangeetham and holiness among Indians.

v. Nul $\text{HO}_5$ : There is no significant relationship between devotional reliance and spirituality among Indians.

vi. Nul $\text{HO}_6$ : There is no significant relationship connecting God, brain, devotional Sangeetham of Swami Tyagaya and spirituality among Indians.

The six sections of the study scrutinized are: 1. Demography of the participants; example-age, gender, town, education, believes, occupation. 2. Questions on Sangeetham and other devotional composers 3. Questions on spiritual experiences. 4. Questions about Tyagaya’s devotional songs 5. General perception of God, brain and spirituality. 6. General perception of devotional music. The questionnaires are designed and developed to estimate the psychometric values of the emotional measurements. Multiple composite indexes are created to assess the Sangeetham knowledge, Divine consciousness, spiritual faith and meditation across age, race, gender, education, income denomination, family status and spiritual health status. The above six hypothesis are anticipated to be reject by six alternate statements during discussion in chapter five.

3.9.5 CONCLUSION

This chapter introduces the theoretical techniques and the principles associated with the review of literature and the questionnaire survey. It embraces concepts and models for the qualitative and quantitative methods. It offers an understanding for the methods applied to derive at specific results. The study adopts for the review of literature the Interpretative Phenomenological Analysis (IPA) method which is a
popular approach for qualitative inquiry. IPA is phenomenological in its attitude that it explores Swami Tyagaya personal perception of Sangeetham, and spirituality. The study attempts to construct a philosophical science of consciousness in neuro-psychology. The quantitative methodology deals with the procedure-ethics-purpose and time period, Pilot Study, Confidentiality and Distribution. The study handles different statistical scales of 5 point Likert scale; Psychometric values, The Statistical Package for the Social Sciences (SPSS-22), The statistical null hypothesis testing and Six Null Hypothesis statements of Inferential Tests on the values of Sangeetham, Swami Tyagaya, the brain, devotion and spirituality.

3.10 METHODOLOGY - ELECTRO ENCEPHALOGRAM (EEG)

Over the past three decades, developmental neurobiologists have made tremendous progress in defining basic principles of brain development. Brain science has changed the dimension of brain development. The relationship between brain and behavioral development is viewed as separate entity. The key to understanding the origins and emergence of both the brain and behavior lies in understanding how inherited and environmental factors are engaged in the dynamics and interactive processes of the neurobehavioral system. Brain maturation and experience enables behavioral development. The environmental factors influence the brain development and its activity. The influence of external activity can bring neuro-plastic changes that can produce emotional expositions. The brain cell produces electrical activity which can be recorded on a graph and is called electroencephalogram. The recording on the graph can be interpreted by an expert.
3.10.1 Electroencephalography

Electroencephalography (EEG) has been used in many brain studies as a primary method for evaluating the electrical activities in the brain. Electroencephalography uses electrical leads placed on specified areas on the scalp to measure the electrical activity. The EEG measures the electric fields by frequencies and amplitudes. The EEG is able to measure the activity of a portion of the brain cells to the millisecond scale. EEG is safe and non invasive. The recorded electrical waveforms are represented as signals. The signals are Delta, Theta, Alpha and Beta.

The five main EEG signals are based on the frequency of the activity, ranging from low frequency Delta waves have less than 4 Hz, commonly found during sleep and deep meditation. The Theta waves have a frequency of 4 to 8 Hz, and is usually experienced during light sleep or extreme relaxation. With practice and experience it is possible to reach the Theta state through meditation and devotional singing.

The Alpha waves have 8 to 12 Hz, is a wakeful state but relaxed and not processing much information. The Alpha state is a very calming and enjoyable state of consciousness. The Beta waves have 13 to 30 Hz, associated with an awake and alert brain. It is the most common mental state which is the wakeful state during the day. However, many people don’t experience enough Beta activity in their brain, which can cause mental disorders such as depression, ADD and insomnia. Gamma waves function at the highest and fastest range in the brain at more than 40 Hz. It is experienced during super high levels of focus, and periods of peak cognitive functioning which is an intense state of energy, and mind alertness.
3.10.2 Application of the EEG Technology

The new generation of EEG machines are considered beneficial to assess the physiological brain activities. With the EEG, about 20 regions of the human brain are modelled and simulated. The waves are converted to signals which are processed and compared to the performance of the human brain regions. The brain creates the thoughts and the thoughts create the emotions. The amount of data gathered about the brain is increasing each year. The EEG technology has enlightened the brain activity in association with Swami Tyagaya’s devotional Sangeetham and the related psychology. There are modern brain image scanning procedures like fMRI and PET scanners which are considered beneficial. The scanners are capable of imaging individual interneuron connections and seeing them interact in real time. (This technology is done in this study). The EEG experiment in this study has turned into an excellent working model and has shown impressive results of the human brain functioning.

3.10.3 The EEG research is based on the Literature guideline


2. This study is based on the validated work done by Sundarachari R, Dhanasree Naidu, Kokiwar PR, Surendra BV. The study is called “Effect of Meditation on Electro Encephalographic graph (EEG), Blood Pressure, Heart Rate and Respiratory rate” published MRIMS, Journal of Health Sciences, Volule1, Issue 2, (July- December 2013).

3.10.4 Significance of the study with 3 Control groups

This EEG study demonstrates specific electrical wave changes in the brain of Group A vs the Control Groups B and C.

i. Group A - Swami Tyagaya Devotional *Sangeetham* (Adults - Pilot group - Long term exposed to Swami Tyagaya’s devotional singing)

ii. Group B - Non Tyagaya devotional singing (Students)

iii. Group C - Non Tyagaya devotional singing (Adults).

3.11 Ethics approval, Consent letter and location

Participants are offered a small reimbursement. Ethics approval is obtained from the representatives. An introduction letter and candidate consent letter is given for the candidates to put their signature.

3.12 The Plan for the EEG experiments

a) Guideline and Laboratory methods

b) Aim, Investigation and documentation

c) Analysis and Interpretation

d) Discussion and Conclusion
3.13 Background

The objective of this EEG experiment is to determine if there are differences in baseline brain function of experienced Devotional Singers of Swami Tyagaya’s Sangeetham (meditators) and compared to non-Tyagaya Devotional Singers (meditators). The application of Devotional singing has a fixed implication in the brain. It is the explanation of the bhakti rasa. In fact, one can use Science for spiritual exploration. The concept that is associated with Sangeetham and spiritual dimension can be examined with necessary research tools applied to the brain in order to learn the architecture and physiology of the brain. With the EEG, the psycho-neurological properties of the brain and external personality traits that characterize this meditative devotional singing state has been adequately studied in three groups of candidates.

3.14 Methods

The study quantitatively analyzes the EEG changes with neuro-psychological parameters of all 34 volunteers. The Group A comprises of 12 healthy volunteers of minimum 10 years duration of devotional singing of Swami Tyagaya’s Sangeetham. The Group A, EEG signals are compared with the EEG signals of 2 control Groups B and C. The Group B comprises of 12 young University student volunteers with no knowledge of Tyagaya devotional songs and the Group C comprises of 10 adults volunteers of non Tyagaya devotional songs. The quantitative findings of the EEG changes in neuro-psychological parameters are compared between the 3 groups of A, B and C (A is the Pilot group; B and C are the control groups). The EEG experiment are recorded in 3 groups of 12
+12 +10 volunteers. The total is 34 volunteers. The EEG was done at The Bio-
Engineering Dept, University of Malaya, Kuala Lumpur, Malaysia.

### 3.15 EEG machine, EEG cap electrodes and voltage

Programmable functions include: Montage Manager and figures, filters, scales, time division, EEG process pattern, stimulator, review and recording panels, reanalysis tools, video EEG data extraction, automatic and editable report generator.

1. EEG machine etc. International 10–20 System
   - software used Profile Study Room version 2.4.444
   - amplifier model Medelec Profile

2. EEG electro cap
   - 19 channel electrode (not included reference and ground)
   - impedance set to 10 ohm
   - sampling rate used 256 Hz

3. Electro gel
   - Electro gel used for electrode conduction

(https://www.google.com/search?q=EEG+machine+etc.+International)
3.15.1 Theoretical Formula

The study is to determine if there are differences in baseline brain function of experienced Devotional Sangeetham Singers of Swami Tyagaya’s compositions (meditators) and compared to Devotional Singers (non-Tyagaya). The EEG will evaluate the effects of electrical signal (religiousness) on the human brain by the input of Swami Tyagaya’s devotional classical music verses non-Swami Tyagaya sangeetham.

This study leads to a practical system for non-invasive assessment of the emotional states in devotional singing applications. The study observes the brain electrical impulses associated with long-term devotional meditative singing and spiritual perception. This study investigates the brain activity in emotional relaxation and God realization by measuring the alpha, beta, delta and theta brain activity in the frontal (F3–F4), central (C3–C4), parietal (P3–P4), and occipital (O1–O2) electrode placements using the International 10–20 System EEG.
3.15.2 The Research Procedure

- The volunteer is seated in a comfortable chair, relax and clear mind
- Both eyes close with eye mask for 2 min
- Participants were healthy and capable of hearing well.
- Swami Tyagaya’s carnatic bhakti composition used for procedure for Group A only are from the CD (Sangeeth) - sung by Dr. M. Balamurlikrishna). The kritis were 1. Meluko dyaanidi in raga saurashtra, 2. Hecherika in raga Kambhodi, 3. Kasheerasagara in raga Anadaha bairavi, 4. Melukovaya in raga Bouli, 5. Seethakalyana in raga Shankarabharanam, 6. Nagumomu in raga Madyamavati
- EEG data recorded for 2 minutes (1st EEG)
- Both eyes close with eye mask for 15 min while listening to the music
- EEG data recorded for 2 minutes (2nd EEG)
- Both eyes close with eye mask - rest and relax for 15 min, no music
- EEG data recorded with eyes close (3rd EEG)
- 2 min latter EEG data recorded with eyes open (4th EEG)
- At the end, the electrodes are gently removed and volunteer retire

1. EEG 2 min. – 2. EEG 2 min. – 3. EEG 2 min. – 4. EEG 2 min.
3.15.3 Associated Tests

The heart rate, body temperature, hypertension before and after the EEG are assessed. A simple 10 point viva questionnaire on spirituality and devotional Sangeetham of Swami Tyagaya are conducted. The volunteers particulars and simple questions are recorded.

Portraits of Candidates at the Laboratory

3.15.4 EEG for recordings and Interpretation

The recorded EEG graphs are read by an expert neurologist for the interpretation of the electrical signals. The EEG signals are recorded and scrutinized for errors. The final corrected signals are processed further and again read for positive findings, correlations and inferences.

3.15.5 Survey and EEG Implications

The validity of the subjective quantitative and objective empirical studies identifies significant links between Swami Tyagaya’s Sangeetham, devotional music, religion, spirituality and mental health. The Questionnaire survey assesses the society’s frequency of devotional attendance, self-rated religiousness and spirituality and also the knowledge of Swami Tyagaya, devotional music, God, brain, and theology.
The EEG measures the brain signals of thirty four volunteers. The implication is to specify how or why devotional music of Tyagaya or other saints influence good physical health, excellent mental health, compassion, spirituality and the mental vision of God. The future implication for these associations, however are for the usefulness of the society.

3.16 CONCLUSION

This chapter explains the qualitative methodology of IPA and the two quantitative methodology used for the study. A quantitative subjective methodology of a questionnaire survey with The Statistical Package for the Social Sciences, (SPSS), is used for statistical analysis. The questionnaire is designed and developed to estimate the psychometric values of the psychological measurements and the reporting resulted with the Six Null Hypothesis statements of Inferential Tests. Multiple composite indexes are created to assess consciousness, spiritual faith and meditation across age, race, gender, education, income denomination, family status and spiritual health status.

The EEG experiment measures the brain electrical activity of selected volunteers who are influenced by Swami Tyagaya’s Sangeetham and devotional music. The EEG research is the key to understand the dynamics of Tyagaya’s devotional Sangeetham and the emergence of both the brain and behavior lies in understanding the interactive processes that define and guide the development of the neurobehavioral system on God.