
**DESIGNING, DEVELOPING AND IMPLEMENTING
A WHOLISTIC SCIENCE EDUCATION PROGRAM
AT SECONDARY SCHOOL LEVEL**

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**CENTRE OF ADVANCED STUDY IN EDUCATION
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CERTIFICATE

This is to certify that **Ms. Shilpa D. Parekh** has completed her doctoral study titled ***“Designing, Developing and Implementing a Wholistic Science Education Program at Secondary School Level ”*** under my guidance. This is her original work submitted to The Maharaja Sayajirao University of Baroda, Vadodara for the degree of Doctor of Philosophy in Education. It is a record of her bonafide research work. The results embodied in the same have not been submitted elsewhere for the award of any degree or diploma. It is further stated that the doctoral research was carried fulfilling the requisite attendance criteria as per O. Ph.D.:3(i) of The Maharaja Sayajirao University of Baroda, Vadodara.

Date : 25th January, 2012

(Prof. D. R. Goel)

Place : Vadodara

Guide

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Chapter 1

Introduction

1.1 INTRODUCTION

Education refers to the wholistic development of the human being. Education is a discipline which aims at developing the knowledge, moral values and required understanding in all walks of life. The Education Commission (1964-66) began its report with the expression “The destiny of India is being shaped in her classrooms.” This is not a rhetoric. In a world based on Science and Technology, it is the Education which determines the level of prosperity, welfare and security of the people. On the quality and number of people coming out of our schools and colleges will depend our success in the great enterprise of national reconstruction, whose principle objective is to raise the standard of living of people. Education is a potent instrument in the development process. The education system must be powerful in itself, so that, it is helpful in solving the problems of the country by developing knowledge, skills and attitudes.

The strength of modern economy depends on the strength of its industry and industrial development in turn depends upon Science and Technology. All progress grows out of man’s creative capabilities. Hence it has become essential to train and equip men of every level, such as, researchers, manual workers, engineers, executives, technicians, office workers. The wholeness of teaching the subject is an essential feature. As it has been said that science cannot be taught in isolation. All the branches of science are interdependent on each other and also on society and environment. There are number of facts and principles which are common to various science subjects. The Education Commission in UK put a strong emphasis on the social value of science, by referring not only to knowledge and understanding the scientific approach to inquiry, but also to science as a ‘social enterprise’ i.e. the social practice of community. Science also is a powerful subject to develop the environmental concern among the students.

All the development and training starts from the school level itself. Therefore the education at school level should be up to the mark. At school level the secondary education stage is holding the key position because here the science subject becomes more complicated and comprehensive. This stage is the basis for further learning. Also hands on activities, i.e., experiments are introduced at this level. So dealing with the subject here, demands dedication.

The scenario of secondary school system as the base of higher education is not satisfactory, which demands change in current practices. The subject should be taught lively with different methods, techniques and approaches, which gives proper understanding of science subject to the students and hence brings the overall development – the prime aim of education. Education is meant for all round development and by virtue of its nature wholistic. Wholistic Education in its core challenges the fragmentation of present education. It lays due emphasis to the development of all the domains, i.e., cognitive, affective, psychomotor and spiritual. Here one needs to remember Swami Vivekananda’s view that Education is not that amount of information that is put into your brain and runs riot there undigested, all your life. We must have life building, man making, character making, assimilation of ideas. If you have assimilated ideas and made them your life and character, you have more education than any man who has got by heart a whole library. Education, said Albert Einstein, is that which remains when everything that is learnt in school is forgotten. If modern education system is evaluated in this regard, its chief outcomes can easily be identified as aggressive competition, pride and envy. At its best, the modern educational system imparts some professional knowledge and skills, but it lacks cultivation of affect attributes. Because the present education system is more of head oriented, the heart and hands are neglected. So, this is the high time to lay proper emphasis on the implementation of the wholistic education program. To foster a whole and healthy world, we must strive to be whole and healthy individuals, through our education programs and practices.

1.2 CONCEPT OF WHOLISTIC EDUCATION

Throughout the history a group of experts all over the world have pointed out that the education of young human beings should involve much more than simply molding them into future workers or citizens. The important aim of ancient Indian education was to make the students fit to become a useful and pious member of society (Rangachar, S. 1994). Inculcating the civic and social duties among the students was also a part of ancient Indian educational system. The Swiss humanitarian John Pestolozzi, the American transcendentalists, Upanishadic thinkers of India and many stalwarts of the progressive educational movement insisted that education should be understood as the art of cultivating the moral, emotional, physical, psychological,

artistic and spiritual, as well as, intellectual dimension of the developing child (Forbes Scott H and Robin Ann Martin, 2004). An emerging body of science, philosophy and cultural history provides an overarching concept to describe the wholistic education. Wholistic education facilitates the students to identify, meaning and purpose in life through connection to the community, to the natural world and to spiritual values such as compassion and peace. Besides, wholistic education also aims to call forth from students an intrinsic reverence for life and a passionate love of learning.

The ancient Indian thinkers felt that a healthy society was not possible without educated individuals. They framed educational set up carefully and wisely aiming at the harmonious development of the multiple dimension of the human personality. This is essentially a universally applicable educational framework highlighting the purpose of human life and interconnectedness at all levels of existence as a basis of human values. According to them without a deep understanding of one's relationship with nature, with ideas, with fellow human beings, society and a deep respect for all life, one is not really educated (Ramchandra Rao SK, 1992). Another unique feature of this educational system is that it aims at creating a mind that is both scientific and spiritual at the same time. One that is enquiring, precise, rational and skeptical but at the same time has sense of beauty, wonder, aesthetic, sensitivity and an awareness of the limitations of the intellect (James Moffett, 1994). It also aims at developing a mind, which is rational, flexible and not dogmatic, open to change and not irrationally attached to an opinion or belief.

Wholistic is a phrase being coined by many people or schools, as well as, being used in curriculum descriptions. It can also be found in medicine, business, ecology and many other fields. *Spiral Dynamics* (Beck and Cowan 1996) uses wholistic to describe a particular (*Holistic* is Turquoise, second tier), as well as, to describe an integrated experience that a person might have of a particular. In education it refers to education of integration, integrated curriculum and consideration of whole systems. Jack Miller's notion of Wholistic Education is that it has three key themes: balance, inclusiveness and connectedness. He recommends pedagogies which assist students in connecting self with body, nature, others and inner self. The concept of wholism refers to the idea that not all the properties of a given system in any field of study can be determined by the sum of its parts. Instead, the system as a 'whole' determines how its parts behave. Wholistic education is concerned with the totality of life. The

four different but inter-related aspects of human life can generally be recognized, viz., the physical, emotional, intellectual and spiritual. Wholistic education should cultivate all these aspects in full measure. For example, physical education should include not only the performance of physical exercises to keep body fit but, also the training to use the senses and physical framework wisely. Similarly, emotional education should emphasize the type of training of mind that develops the positive human emotions of universal love, compassion, humanity, equanimity and eradicates the basic instincts such as, greed, envy, pride and aggressiveness. In this way one can establish a healthy relationship with society. Intellectual education should require not only the development of ability to think, but also the ability to act independently, rationally and logically on the basis of a deep understanding of the various phenomena of nature. Finally, spiritual education should cultivate a refinement of mind, understanding of the very purpose of our existence and a clarity of what ought to be done to achieve it. The wholistic education includes identity of own self, inter disciplinary approach, subject specific cognition, development of affect attributes and relation with real life like situations, co-existence and completeness. Some of the features of wholistic education are as follows;

1. Wholism is complex, it need not be fragmented, the curriculum must emphasize on interconnectedness and the focus should be on understanding of relationship rather than the study of parts. The coordination of all the domains should be well emphasized in a wholistic curriculum. There ought to be coordination between intellect, allies, skill and personal life. The wholeness will be described by an outcome of a person characterized by – Fully human, Creative expression, Growth and Responsibility.
2. The wholistic action should be examined in the context of four ‘E’s – Efficiency, Effectiveness, Ethics and Environment.
3. Philosophers, namely, Vivekananda, Aurobindo and Gandhiji have talked of wholistic education. Indian culture is denoted by wholism. Our education should sustain sensitivities to our basic culture and values.
4. Whole must be based on our own heritage, our own value system. Before thinking of wholistic concept, we must be convinced with our own value system. Wholistic education needs a vision of past, present and future.

5. There is a need to realize globalization but at the same time one needs to keep sight of our local perspective.

6. There is a need of spiritualization of organizations. We need to think of moksa, salvation at early age not old age. This will lead to wholistic education.

7. There could be two possibilities of organizing curriculum, one is subject based approach and the other one is problem based approach. The wholistic education makes an effort to follow Problem based approach. The problem must be real. The PPT (Problem, Practice, Theory) should be practiced more than TPP (Theory, Practice, Problem).

In order to achieve the goal of wholistic education, the psychology of learning encompasses different domains on the part of a learner. The affective domain plays a crucial role in integrating all aspects of teaching-learning process. Robin Ann Martin (2004) describes this further by stating, at its most general level, what distinguishes wholistic education from other forms of education are its goals, its attention to experiential learning and the significance that it places on the relationship of primary human values within the learning environment. The wholistic education reflects and responds more fully than conventional education to a new and increasingly accepted view of what it means to be human. This was also visualized by Mahatma Gandhi. He believed that mere academic knowledge is not enough for Wholistic development of child and so wrote: “I am a firm believer in the principle of free and compulsory Primary Education for India. I also hold that we shall realize this only by teaching the children a useful vocation and utilizing it as a means for cultivating their mental, physical and spiritual faculties. It will check the progressive decay of our villages and lay the foundation of a joustier social order in which there is no unnatural division between the ‘haves’ and ‘have – notes’ and everybody is assured of a living wage and the rights to freedom” (Harijan, 11.9.1937).

1.3 AIMS AND IMPORTANCE OF SCIENCE EDUCATION

Science can be defined as “the process by which we increase and refine understanding of our selves and of universe through continuous observation, experimentation, applications and verification.” Science is increasingly being viewed as a subject of life-long utility to all students, whether or not they enter science related careers. In many nations, science and technology education are becoming increasingly identified as the background for economic stability and growth. In the past, only the brighter students have been encouraged to pursue science knowledge. Science has been viewed as knowledge accessible to only the few elite. Now, however, many countries are subscribing to the goal of ‘science for all’.

Science education is now major concern in almost all the developing countries. High priority has been accorded to its quantitative expansion as well as qualitative improvement. The general aim of science education is to help to develop well-defined abilities in cognitive and affective domains, besides enhancing psychomotor skills. It helps to foster an uninhibited spirit of inquiry, characterized by creative, innovative and objective approaches. Therefore, science subject has its own importance and significance through out the curriculum.

Science plays a vital role in the development of many qualities in the individual’s life. It helps him to be a good citizen in the society, a useful, productive and progressive member of the society intellectually enlightened, vocationally fit, morally sound and thus contributing to quality life. Realizing the importance of science education, the education commission in its report of education and national development denotes, “Science education must become an integral part of the school education and ultimately some study of science should become a part of all courses in the humanities and social sciences at the university level, even as the teaching of science can be enriched by the inclusion of some elements of humanity and social sciences.”

School education comes closes with the secondary stage. The aim of teaching science at this stage is primarily directed towards the learning of key concepts that span all disciplines of science. At the secondary stage, the pupil should be enabled to develop a more profound understanding of the basic nature, structure, principles, processes and methodology of science, with special reference to its relationship with agriculture,

industry, environment and contemporary technology. The teaching of science at this stage should help pupils to develop insights in health and environment. Greater emphasis needs to be placed on precision and accuracy while handling laboratory equipments and while engaged in procedures. It is aimed at developing scientific and technological skills and attitude among children. The following are some of the important aims of teaching science at secondary level:

- The learner understands the nature of science and technology.
- The learner develops problem solving and decision making skills.
- The learner inculcates the values of science and technology.
- The learner develops manipulative skills which are required in day-to-day life situations.
- To familiarize the pupils to the world in which they live and to make them understand the impact of science on society so as to enable them to adjust themselves to their environment.

To realize all these aims of teaching science, the science education must be in the form of whole and not separate one. Looking at whole began to be seen as necessary for understanding even traditional disciplines. Scientists namely, David Bhom, David Peat, Karl Pribam and Ilya Prigogine were even insisting that seeing things as a whole was better way to understand their traditionally reductionist disciplines, as well as, most other things. They said that for the sake of convenience we can look at parts, but separate parts do not actually exist. So the subject should be understood in totality i.e. wholeness for students to have the feel of it.

Thus, whether science is taught to the future scientist or to future citizens, there is a pressing need to ensure that the purpose of science education is changing, the content and its delivery are evolving and the expectations for students' achievement are rising. Today's students will be the tomorrow's citizens. They will enter a workforce that needs the talents of better educated students, capable of life-long self-directed learning and of contributing to sound decision-making for their community and their country.

1.4 PRESENT SCENARIO OF SCIENCE EDUCATION

Science is a subject which cannot be taught in separation. As it has interrelated branches, has relation with life, environment and society as well. The present day traditional or conventional methods of teaching are dominated by memorization, dictation, and verbalism and give insufficient scope for practical and productive work. These methods are devoid of correlating and integrating various subjects and experiences. The science courses should be so structured and taught so that the nature of science pervades curriculum. Science teaching should stress the different aspects, such as, science as a body of knowledge, as a method and as a way of thinking.

But unfortunately the present education is more of teacher centered and rigid. The teaching learning process does not have any link with daily life of the students. It is more of mechanical and memorization of content and reproducing it in the examination. Science, which is more of a practical subject, is mostly being taught as theory based subject in the classrooms. It is quoted that in the prevailing system the content from the teacher's note is being transferred to the students' notes without any understanding, which really needs change in the prevailing system. Umashree (1999) in her study revealed that lecture method was found in 70% of cases, lecture cum demonstration method in 10% and lecture cum activity teaching strategy only in 6% of the cases. Malhotra (2006) also found that teachers often provide lectures and students mostly observe the teacher and their participation in classroom is very less. Most of the teachers are of view that the courses of science subject are vast and so to finish the course in time, the lecture method is the better option. But the fact is that it does not provide the proper understanding of the subject to students. The theory and practical work are not properly co-related. If the theory portion is not properly clear to the students, then the basic objective behind the practical also is not clear to them. When teachers are not able to clear the theoretical concepts, the students are not aware about their practical implications. The proper grasp of the subject is not acquired and so students find the subject difficult.

One of the objectives of teaching science at secondary level is to cultivate scientific temper, scientific attitude, social, moral, ethical and aesthetic values. But in present system there is lack in satisfactory attainment of this objective. Umashree (1999) in her study founded the reason for that is, the development of all these qualities is less

feasible as specific guidelines how to achieve or develop these are not available to the teachers. She also stated the other reasons that science at secondary level is just ones among other subjects and many students may discontinue with science. Hence, there is a need to improve the status of science subject at secondary level.

1.5 NEED TO INTRODUCE WHOLISTIC APPROACH

Present practices reveal that science teaching is more of head oriented and the higher objectives are neglected. Science, the dynamic subject is taught as a static one. So it requires an immediate change in current practices. The nature of the subject demands the dynamic and progressive methods of teaching which provide suitable opportunities for learning by doing, observation, experimentation, co-operation and dignity of labour to the students. Such good methods can result from the constant observation of certain broad principles. These include orderly procedure in teaching, an arrangement of subject matter, which will avoid waste of time and energy and secure the greatest co-operation from the pupils and maintain their active interest. The wholistic approach of teaching science is appropriate to cater to the demands of present time and provides a comprehensive way of teaching the subject matter relating them with life like situations. The classroom teaching may lead to wholistic development of the child, if the following aspects can broadly be taken care of.

- Cognition of the convention, terms, examples, concepts, principles and theories

This is an era of the modernization and globalization. To cope up with such competitive world an individual must be having thorough understanding of the subject. Therefore, students must cognize the conventions, examples, concepts, principles and theories. If students are not having this cognition, they will not be in a position to apply their knowledge into the practical world.

- Establishing relation with other disciplines

The child is interested to learn the things which are related to his experience. They cannot learn the various subjects in isolation. The interrelationship makes study easier, more interesting and natural. It develops knowledge by dove-tailing with each other the bits of similarities existing in the diversity of subjects and compounds them into such a complex whole which the mind of the child is willingly ready to accept.

The principle of correlation demands that various subjects contribute to the child's education in the manner and to the extent that they help him to understand his environment better and carry out activities that have meaning for him. This relationship should be made clear to the students for their clear understanding. Hence, it becomes necessary to establish the relationship of one subject with the other subject. By doing so students are in a position to understand the relative importance of each subject.

- Development of feeling faculty through inculcation of values

For all round development of an individual, all the domains have equal importance. While imparting knowledge to the students most of the teachers emphasize on the development of cognitive domain. Even the examination patterns also support the same. Though students are getting knowledge, the development of affective domain is lacking somewhere which is indeed necessary for an individual to be a good human being. It is an important aim of education. Values play an important role to realize this aim of education. This drawback can be overcome to a large extent by introducing wholistic education, because, with the help of values only the individuals respect themselves, society and environment. Also the harmonious development of the human being can be visualized and realize.

- Development of Psychomotor Skills

This is an age of science and technology. Technology has taken an important place in man's life, because technology has entered in all walks of life. Handling technology is a challenging task which requires proper training on the part of students. Science Policy Resolution, Government of India (1958), visualized training of men in scientific and technical skills, so that; they will solve the national problems of hunger, disease, scarcity and underdevelopment. Therefore, students must be having these skills of handling the technology for their own survival. To develop such skills, development of psychomotor domain is needed. In the present education system it is not observed fully.

- Establishing Relationship with the Environment

Environmental concern is the major issue throughout the world among all the scientists, researchers, industrialists and even for a common man. With the help of science and technology, man overcomes the natural barriers. He can travel from one

part of world to other part, in a matter of a few hours, undertake journey to outer space and planets, dive down to the bottom of seas and explore the wonders there. But at the same time, the environment became more and more polluted and degraded. As a result of manmade activities – deforestation, urbanization, industrialization, hazardous waste and pollution - the quality of environment suffered which has threatened the survival of man himself, as well as, other organisms on the earth. Scientists are in search of environment friendly systems to overcome these problems. Thus, there is a need to educate the children about ecology and environmental problems, as well as, protection. One of the ways to protect the environment is to generate the environmental awareness among the children.

The Stockholm conference (UN) on human environment (1972) initiated efforts to develop program of environmental education at all levels - primary, secondary and tertiary and also to motivate general public in rural and urban areas about environmental awareness. This was followed by Belgrade (1975) and Tbilisi (1977) conference of environmental education. These laid stress on developing basic concepts of quality of life plus environmental knowledge, awareness, attitude, skills and participation. To develop this concern among students teaching of subjects should be in such a way which serves the purpose. For transaction of environmental education science is one of the powerful subjects. This subject can also be helpful to establish ecological equilibrium, to learn the proper use and conservation of natural resources and also the control of environmental pollution. Therefore, teaching the content matter of science in wholistic manner is of great help to create environmental awareness, understand, interpret and put into practice the knowledge gained by students from school life itself.

- Development of Life Skills

One of the important aims of education is the harmonious progress of nation. To achieve this aim school should produce the good and responsible citizens. For that students should be equipped with proper skills which help them to develop the healthy attitude towards their lives and nation at large. Curriculum transaction may be a suitable option to develop this attitude. Life skills enable to translate knowledge and attitude which one believes and feels into action. According to WHO (1997), “Life skills are living skills or abilities for adoptive and proper behavior that enable

individuals to deal effectively with demands and challenges of everyday life.” Life skill based education empowers the students to increase their capabilities. These skills are required for individual to navigate everyday situations and help them to live a healthy and productive life. The wholistic education gives place for a teacher to develop the life skills, namely, Self-awareness, Coping with emotions, Coping with stress, Empathy, Interpersonal relationship skills, Effective communication, Creative thinking, Critical thinking, Decision-making and Problem solving into the students while teaching a particular subject.

- Development of Spiritual Domain

Spirit is the ultimate power resident within organism which controls and regulates various actions and functions of the organism. Spiritual faculty is essentially intuitive, creative, constructive and wholistic in nature as against cognitive intelligence, which by its very nature is analytical and atomistic. The spiritual abilities synthesize the experiential data, whereas, the experimental data are analyzed by the cognitive processes. Now, the question is whether the spiritual abilities and their development are measurable? The measurement of spiritual abilities is beyond the domain of psychometrics, but their estimation is possible qualitatively. The atoms constituting the organisms have their scientific configuration though having no manifest real intelligence of their own. The intelligence creating the atoms which are the embodiments of various entities – animate and inanimate is metaphysical. Similarly, the centre of location of the spirit is still unknown which controls all our actions, functions and constellations. While thinking and initiating any action we obey and disobey the inner power fully or partly. The development of spirit is a function of adherence to this inner power. The spiritual quotient (SQ) thus, may be expressed as,

$$SQ = \frac{\text{Multi – dimensional self awareness of a person}}{\text{Self awareness in totality}}$$

The awareness / consciousness is power and therefore, in situations of life this can be translated as the degree by which we are masters of ourselves, commanding knowledge and overcoming limitations.

1.6 REVIEW OF RELATED LITERATURE

Forbes & Robin, (2004) conducted a study on ‘What Holistic Education Claims About Itself: An Analysis of Holistic Schools’ Literature’ and concluded that Holistic Education is the interest in the larger field of education and found that;

- Many common phrases, such as, freedom, experiential learning, love, and community were being used in a variety of ways and contexts, often pointing toward somewhat different phenomena.
- Similar notions about the purpose of education, the nature of children and the state of childhood and the nature of teaching and learning were expressed in a wide variety of ways while often pointing to similar understandings and perspectives.
- There seems to be a core set of values and perspectives which reveal family resemblances for the field of Holistic Education, that appears to deserve a distinction from other schools that might be better grouped as performance-based, progressive, self-directed or back-to-basics.
- Rather than trying to claim that some schools in our sample were completely holistic while others were not, it seems more justified to claim the existence of a continuum of holistic qualities along which schools fall.

Morris & Windhan, (2005) conducted a study on ‘The Whole School Initiative: An investigation of Casey Elementary School.’ The longitudinal study focused on the impact of the whole school initiative (WSI) on one arts-infused school in Mississippi. The WSI, a comprehensive school reform program established by the Mississippi Art Commission (MAC) in 1992. 26 Mississippi elementary and middle schools are currently involved in the project. WSI’s major purpose is to promote chronological all-inclusive art education program that serves the non-artistically talented students. Mixed methods were used to collect and analyze the data. The investigation results were overwhelming positive impact of WSI in the education of children. As a result of art integration and art celebration, the traditional educational experience has been enhanced achievement and student’s behaviour has improved and on-going quality professional development has encouraged better teaching and student engagement in learning.

Robbins & Min, (2005) conducted a study on ‘Wholistic Work Place Ministry: An Onsite Employee Benefit of Care/Coaching, Connection/Inspiration and Enrichment.’ Wholistic Work Ministry (WWM) is a new frontier for religiously pluralistic agency who wants to serve in community. It is an innovative application of ministry in the form of an onsite employee benefit. It is implemented through the “Wholeness At Work” model which is designed to facilitate the well-being of employee and the corporate culture. The wholistic value and behaviour list, grounds the model in ethical principles which foster wholeness, “a way of being which is life-enhancing for oneself, for others and for the world.”

Yuejin, (2005) conducted a study on ‘Levels of Wholetheme Instruction and Student’s Outcomes; A Mixed-Method Study.’ It distinguishes three different levels of constructivist teaching varying in the degree of integrated wholethemeness: direct, eclectic and integrative. The sample consists of three instructors and 96 students. Qualitative results from interview and videotaped lessons revealed three distinguishable approaches, varying over all in direct, eclectic and integrative levels of wholetheme instructions. Quantitative results from the analysis of ratings on an essay test suggested that students in integrative level wrote significantly better than those in direct level. Moreover, students in the integrative level also demonstrated significant gain from pre-test to post-test in an ethical decision making measure. The study shows that employment of wholetheme instructions enhances the student’s outcomes. This study has special significance in the field of education and psychology.

Jung Hyun, (2006) conducted a study on ‘Effect of Part-task and Whole-task instructional approaches and learners levels of expertise on learner performance of cognitive task.’ The study investigated the effect of two instructional approaches and levels of learner expertise on learner’s acquisition and transfer of complex cognitive skills. In addition, the study also examined the effects of these variables on learner’s cognitive load, instructional effectiveness, time on task and their attitude towards the instructions. 51 undergraduate students in four sessions of an instruction to educational technology course participated in study. Two sections were assigned to each of the two instructional approaches and two lessons were presented to each group. The results indicate that there were statistically significant difference between two treatment groups (whole-task > part-task). It also shows the a) higher efficiency

on whole task test, b) higher efficiency and higher scores on far-transfer task test and c) more confidence towards the instructions.

Kelly & Lynn, (2006) conducted a study on ‘The arts as catalyst, catharsis and crucible: Towards a personal philosophy of art.’ this qualitative research explores the role of the arts in human development from a holistic educational perspective. The guiding question of this inquiry is: How does the artistic process facilitate holistic learning and personal transformation? With specific focus on visual art it examines the three levels of experience within the artistic process: the role of artistic medium; the role of artistic representation and the imagination and the role of creative act.

This study uses narrative portraiture as inquiry and examines the live experiences and personal practical knowledge of three visual artist educators. It examines their ongoing narratives within the arts, key experiences of holistic learning in visual arts and their experiences of how the artistic process facilitates personal transformation. The key experiences in the arts for each participant are varied in their biographical details however, there are three commonalities: through encountering a holistic approach to the visual arts their relationship to the artistic process changed; they valued and cultivate a profound connection to the nature and spirituality and each indicated the important connection between the spirit of play and creativity.

Key emergent themes include: the development of heightened awareness; learning to perceive and discern in new ways; becoming literate with the various artistic languages; developing greater soul-spiritual capacities and the arts as crucial catalyst for personal transformation.

This study concluded that within the visual arts the artistic process acts on the senses like a central catalyst for change. The imagination acts as a powerful and critical agent for catharsis and enables the creative acts of the artist to create a crucial crucible for becoming of artist. This study makes significant contributions to the fields of holistic education, arts education, transformative learning, teacher development and arts-based methodology.

Kim, (2006) conducted a study on ‘An ethnographic study of the culture of a third-grade ESL class: ESL education for whole child development.’ The central goal of this ethnographic study is to construct an integrated description and interpretation of

the culture of an ESL (English as Second Language) class at an American public school. This study examined the nature of classroom processes and interaction and interpreted classroom life in terms of its relation to the children's overall development and school life. Methods of data collection included five-months of classroom observation, audio-video recordings of classroom lessons, field notes, photograph, document collection and interview with teachers, children, parents and a state official. The researcher's observations are;

- One salient theme highlighted is the variety of ways the ESL class under investigation addressed the children's linguistic, academic/cognitive and emotional needs in a balanced way. The class served not as an isolated language laboratory but as a site addressing the children's diverse changing needs.
- Classroom practices used to promote linguistic development also supported integration of the children's sociocultural, individual resources, quality teacher-student interaction and co-operative learning.
- To foster academic / cognitive development, academic content was incorporated into ESL instruction. To encourage emotional development, the class functioned as a care-provider when needs arose.
- This study has practical implications for ESL and mainstream teachers, teacher educators, policy makers and classroom researchers.

Larimer, (2008) conducted a study on 'Authentic education and the innate health model: An approach to optimizing the education of the whole person.' The researcher examined outcomes of instruction using an approach called Innate Health which claims that awareness of the dynamics of thought will stimulate healthy, productive behaviour. While much has been written about socio-moral education; little research has addressed the role of thought, innate qualities or attention to the whole person as mediators of learning and development.

Two self report scales (Understanding of Experience Scale and Lifestyle Assessment Scale) were constructed to measure outcomes of instruction among participants in Innate Health seminars. Data were evaluated using Analysis of Variance. Results of the analyses provided substantial support for the hypotheses that participants would

report increased well being following the Innate Health seminars and that improvement in mean scores would remain relatively stable over time. The concept of Authentic education was suggested as an appropriate theoretical frame work for incorporating models such as Innate Health as a part of a comprehensive approach to educating the whole person.

Osment, & Min, (2008) conducted a study on ‘Spirituality and wholeness: Essential components of congregational revitalization in the digital age.’ The discussion of the study is presented below;

What are we missing in our lives and congregations today is wholeness. Our disconnection lies not on the outside but in the inside. This in turn leads to a lack of balance and the development of both psychological and spiritual problems. Our principle failure in this day and age is to acknowledge the special nature of our relationship with God. The blessings we have receive in terms of knowledge, technology and materials have created a type of blindness in us. Through the wonders of all we have, we have difficulty seeing God. Each and every day we are exposed to numerous evidences of God’s activity. Yet we pass over these events as if they are childish fairy tales.

We must, therefore, step out and proclaim through the good news that an alternative way of life exists. This is a way which can be balanced and whole. It is a way which can be enriching and fulfilling. It is a way which can be healing and helpful.

Benson, (2009) conducted a study on ‘Wholistic development: A survey of the core affective dimensions of the whole person as defined by collage educators and business professionals in the southeastern region of United States of America.’ The purpose of this work was to identify the core affective dimensions of the whole person that should be goals or learning outcomes at four year colleges and universities as perceived by those who conceptualize whole person goal and learning outcomes in colleges and universities and the end users of the graduates of America’s colleges and universities.

Qualitative and quantitative data were collected through the use of a mailed survey questionnaire sent to a purposeful sample of college educators and business professionals. The findings identified character, judgment and moral reasoning as the

core affective dimensions of the whole person that should be considered imperatives as goals or learning outcomes at four year colleges and universities. In addition to the conclusion, this study includes recommendations for implementation and future research. These recommendations encourage educational planners to seek deliberate and purposeful opportunities to include the core whole person dimensions and other important whole person dimensions, as time and resources permit, in curricular and co curricular baccalaureate degree seeking programs.

Gay, (2009) conducted a study on ‘The effect of handwriting, spelling, and T-units on holistic scoring with implications for dysgraphia.’ This study examine the relationship of holistic scoring with handwriting legibility, spelling accuracy and number of T-units within compositions written by children in grade three through six using path analysis. A sample of two-three compositions was rated for handwriting legibility and composition quality, coded for number of T-units and percentage of accurately spelled words. Number of T-units was consistently the strongest predictor of holistic scoring across the four grade levels. Handwriting legibility and spelling accuracy yielded varying results in different grade levels.

Denice, (2009) conducted a study on ‘Reframing human development in public education: Equity, Achievement, Accountability (and Human actualization) through whole person teaching and learning.’ The investigative concerns represented in two broad areas of educational research: (1) the human conscious and human learning motivation as this concepts related to the development of humanistic, emancipator, and transformative education system; and (2) the role of experiential knowing, indigenous wisdom and dialogic instructions in generating sustainable and multicultural education and educational leadership. Reflecting both the areas of concern, the focus of investigation was concentrated on the role of human development in realizing the social, economic, and human actualizing goals in public education. A primary goal for this investigation was to promote the promise of holistic, cognitive, social and moral human development of all persons through public education.

Using a quantitative two-stage survey designs, college professors, legislator, superintendent, principal, and teacher perspectives were collected from first stage in-depth interviews and second stage free response questionnaires. Content / thematic,

inductive / constructive, and logical / cross classification analyses yielded an understanding about the participant perspectives in terms of the purpose for public education; core elements of human development; pedagogical methods linked to human development; the perceived importance of human development in relation to students achievement and the purpose for public education, educational policy and practice linked to human development; and the potential of human development as an accountability measure. Data analysis also revealed participant understandings about the external socio-cultural motivators and internal consciousness motivators that impact human development. A whole person education model developed from these findings is introduced and implications are discussed in terms of socio and structural change, teacher education and instructional change, and educational leadership change.

Karmer, (2010) conducted a study on ‘Closer to the heart: An exploration of caring and creative visual art classrooms.’ Four questions initiated the study

1. What are the intentions of visual art teacher who state that they believe creative and caring environment is essential for art instructions and students’ holistic development?
2. How are these intensions realized in their practice?
3. How does the enacted curriculum affect students’ willingness to take creative risk?
4. How do the intentions and practices of the teacher impact students self concepts?

Sample: Six teachers in three Colorado and three Western Australian schools and 25 students participated in this study.

Tools: Semi-structured interview, Observation and Photo essay.

Findings:

- It facilitated the development of interpretations, thematic and evaluation that inform understanding and enhance ability to help students within visual art and other content area.

- The addition of photo essay was based on recent support for having participants utilized metaphor through photographic images to more effectively express their feelings, beliefs, and interpretations.

Gandhi, (2011) published a paper ‘Sevenfold sustainability for ensuring a holistic life in contemporary India: Role of higher education.’ The author has suggested the sevenfold for sustainability in the modern age of competition and knowledge. The sevenfold are 1. Environ sustainability 2. Biological sustainability 3. Social sustainability 4. Cultural sustainability 5. Economic sustainability 6. Political sustainability and 7. Moral-spiritual sustainability. To realize these seven folds the auther has suggested changes in higher education system

- Higher education has immense man making potential in itself. Therefore, the existent system of higher education needs to be reshaped step by step and build up new nurseries of terming out highly sensitized, conscientious young men and women who will be the torch bearer of sevenfold sustainability to make life the holistic phenomenon.
- The present crucial step could be – changing the present mono track, status quoits and insipid system into a cross disciplinary, vibrant adventure.
- The same need is also highlighted by UN that the higher education should be Trans disciplinary. UN has given 40 knowledge areas for cross disciplinary. On the basis of that the gradual changes in curriculum is needed.
 - Phase – I Infusion of sustainability elements in the subject of present syllabus of the curriculum in vogue keeping everything else untouched.
 - Phase – II Implementation of a multi disciplinary approach based on the subject areas suggested by the UN agency with a provision for selected inter disciplinary applications.
 - Phase – III Evolution of a full-fledged cross disciplinary curriculum and the strategy for its transactions.
- The basic structure of three degree program of cross disciplinary type may have the following components.
 - Component – 1 : Knowledge including its generation, dissemination, deployment, storage, retrieval and reform.

- Component – 2 : Values including those of sustainability and of all the diverse departments of life and work.
- Component – 3 : Skills and Competences that should contribute to the formation of the life of a ‘Whole man.’
- The measures will need to be undertaken are;
 1. Developing an articulate and comprehensive design of the objective of teaching academic subjects in context of social goals, including that of the sevenfold sustainability.
 2. Identifying cross disciplinary and cross sustainable areas of study and critical points of interpretation among them.
 3. Designing capacity building program for different participants in the system of higher education.
 4. Developing a program of teaching – learning task to be carried out in classrooms in the world work.
 5. Preparing plans of acquiring teaching – learning materials, preserving them and using them for specific task.
 6. Evolving projects for the institutions – society collaboration to implement the cross disciplinary curriculum.
 7. Putting in place well designed mechanism of appraisal and audit of the programs and the personal involvement.
 8. Preparing schemes for resources generation management so as to make the enterprise of higher education economically productive.
 9. Suggesting a comprehensive and overarching management system of the entire enterprise, a policy of inclusive in house research ability, its reporting, follow up and related public relation initiatives.

Implications for the study

The studies reviewed above on wholistic education focusing on wholistic schools (Forbes & Robin, 2004), whole task instructional approach (Jung Hyun, 2006), whole school initiative (Morris & Windhan, 2005), wholistic work (Robbins & Min, 2005), levels of wholetheme instructions (Yuejin, 2005), development of spirituality and wholeness (Osment, & Min, 2008), development of soul-spiritual capacities and

personal transformation (Kelly, 2006), identification of affect attributes for whole person development (Benson, 2009), relationship between holistic scoring and written language abilities (Gay, 2009), awareness of dynamics of thought through Innate Health approach (Larimer, 2008) and Gandhi, 2011 suggested introduction of Sevenfold Sustainability in Higher Education system reveal that various wholistic approaches have their own contribution in bringing out the desirable changes. Similarly, there is a need to design, develop and implement wholistic science education program for the all round development of students.

1.7 RATIONALE

‘Why does this magnificent applied science which saves work and makes life easier bring us so little happiness. The simple answer runs: Because we have not learnt to make sensible use of it.’

- **Albert Einstein**

Science is a dynamic, expanding body of knowledge covering every new domain of experiences, which helps in preparing pupils to think and sharpen their intellect making them more careful and systematic in reasoning, as well as, providing a unique training in truth, inculcating a spirit of inquiry, developing the capacity to know the unknown. The students need to know that science is established through science courses that emphasize the connection between science, technology and society. The important thing in learning science is the capacity to analyze and classify data, to gather evidence about solution, to solve problems and to test theories. The knowledge base in science is expanding too fast to ensure that students cover all aspects of knowledge of science within the duration of school education. The alternative is to offer students the learning experiences that allow for conceptual exploration and acquisition of skills needed for their future learning.

The general aim of science education is to help students to develop well-defined abilities in cognitive and affective domains, besides enhancing psychomotor skills. In addition, in many countries there seems to be a growing recognition that science education is important not just for scientists, but all the students who are not going to become scientists. Many problems that humanity faces today will be solved through the active involvement of a scientifically and technologically knowledgeable

citizenry. Therefore, it is necessary that the students should have thorough and proper understanding of the subject. As the world has witnessed a huge scientific and technological explosion in recent decades, the students should have the ability to master and apply the science and technology into the process of modernization and development of economies. Well aware of this fact as early as the 1960's, developing countries embarked on programs to support the development of science education at secondary and higher secondary stage.

At the secondary stage the objective is to develop an understanding of the nature of scientific knowledge and its relationship to its manifestation in nature and in daily life. Also the students should be able to develop the capacity to use science to solve the problems and arrive at right decision. Students are also expected to develop the skills required to operate equipments and to design simple experiments to seek and find explanations for natural phenomena. At this stage, science education should help the students to develop an understanding and appreciation of the joint enterprise of science and technology and the interrelationships of these with other aspects of life, society and environment. Also, this is the stage where most of the students build their interest in the subject for further learning. Therefore, dealing with the subject should be such which generates and holds the interest of students in science subject. But unfortunately in the present time this wonderful subject has lost its real feel. It has become more theoretical rather than practical. It should be transacted in such a way which in turn helps students to achieve their real goal. Hence, the subject should be taught in totality or wholistically for clear understanding and its application. All the above aspects point to the fact that there is a need to integrate wholistic approach for teaching of science.

The present learners are facing many challenges of life and living in a complex set of conditions. So the educational system of 21st century must be oriented towards creating conditions that allow learners to think critically and become creative and innovative to learn freely in productive collaboration with their teachers, peers and other members of the community. The time has come to incorporate innovative mental processes and activities into learning process. But, the traditional classes have been dominated by the spoken and printed word. In India, as reported by Kurrien (2007) it is observed from a large scale study that the students perform poorly in questions testing understanding or application of knowledge to new situation and

majority of students were unable to answer questions that appear to be different from what they typically encountered in their books, they could only be able to answer questions based on recall or standard procedure. It is clear that memorizing will not serve the purpose.

Dalene (2007) in her paper emphasizes on wholistic education as an alternative, more wholistic approach to conceptualizing learning as a process of coming to know through the imagination as a starting point for all students, rather than through what the student ‘already knows’. Wholistic education includes identification with the self, interrelation, interdependence, rhythm, co-existence and completeness. It contributes in the development of cognitive, affective, psychomotor and spiritual domains. Janet McIntyre (1997) in his paper on Consideration of categories and tools for wholistic thinking, also emphasizes on wholistic thinking. According to him ‘wholistic thinking is understood as the ability to think in terms of many cybernetically interconnected variables, instead of in terms of an independent and dependent variable linearly related as cause and effect. Wholistic thinking is useful for both, understanding the nature of the problem and working out negotiated solutions.’ The purpose of the wholistic education is to prepare students to meet the challenges of life. The teaching of science has become atomistic, isolated and mechanistic. The product approach of science could not contribute significantly to the realization of reality. The discipline based micro specialization has resulted into fragmentation. As a result we have not been in a position to address the problems wholistically. Special and deliberate inputs are required to realize wholistic education. The scientific realism should be comprehensive enough to encompass development of all the domains – cognitive, affective, psychomotor and spiritual – through intra and inter disciplinary approaches establishing relation with environment. So there is a need of developing wholistic science education program for harmonious development.

1.8 TITLE OF THE STUDY

Designing, Developing and Implementing a Wholistic Science Education Program at Secondary School Level

1.9 OBJECTIVES OF THE STUDY

1. To design and develop a wholistic science education program (WSEP).

2. To study the effectiveness of WSEP in terms of cognitive development of students.
3. To study the effectiveness of WSEP in terms of affective development of students.
4. To study the effectiveness of WSEP in terms of development of psychomotor skills.
5. To study the effectiveness of WSEP in establishing environmental sensitivity.
6. To study the effectiveness of WSEP in developing life-skills among students.
7. To study the effectiveness of WSEP in terms of spiritual development of students.

1.10 HYPOTHESES

1. There will be no significant difference between adjusted mean scores of the Experimental group and the Control group when the standard eight science comprehensive scores is considered as covariate on Content test.
2. There will be no significant difference between adjusted mean scores of the Experimental group and the Control group when the standard eight science comprehensive scores is considered as covariate on Activity based test.
3. There will be no significant difference between the demonstration ability of the Experimental group and Control group.
4. There will be no significant difference between Environmental Sensitivity of the Experimental group and Control group.
5. There will be no significant difference in the value inculcation of the Experimental group and Control group.
6. There will be no significant difference between the life skill enhancement of the Experimental and Control group.
7. There will be no significant difference in the spiritual development of the Experimental group and Control group.

1.11 OPERATIONALIZATION OF THE TERM

Wholistic Science Education Programme (WSEP):

In the context of present study the WSEP refers to the teaching of science using interdisciplinary approach and establishing its relationship with environment. The program aims at development of cognitive, affective, psychomotor and spiritual

domains and life skills. This program is constituted of various methods, such as, Discussion, Lecture cum Discussion, Project, Demonstration, Laboratory and Activity. Various media and modes are used as per the nature of contents.

1.12 DELIMITATION OF THE STUDY

The study is delimited to the selected topics of science subject of standard IX.

1.13 SCHEME OF CHAPTERIZATION

The first chapter describes Introduction, Concept of Wholistic Education, Aims and Importance of Science Education, Present Scenario of Science Education, Need to Introduce Wholistic Approach and Review of Related Literature available which provided the base for rationale, followed by rationale, title of the study, objectives of the study, hypotheses, operationalization of the terms and delimitation of the study. Subsequent to the first chapter the Second chapter describes the Research design, i.e., the methodology adopted for the investigation. The Third chapter is based on first objective. It describes the procedure of designing, developing and implementing the WSEP. The chapter four describes the analysis and interpretation of data objective – wise. It deals with objective, hypothesis, procedure for data collection, technique used to analyze data and data interpretation. The last chapter is the summary of the entire research work carried out, implications of the study and suggestions for further research.

Chapter 2

Research Design

2.1 INTRODUCTION

It gives the clear idea about how the present study was planned and which procedures were followed to carry out the study. Plan and procedure is regarded as the heart of the study as it provides direction at every moment to the researcher and leads to proper completion of the study.

2.2 METHODOLOGY OF THE STUDY

2.2.1 Population of the study

All the secondary school students of Baroda city (2009-2010) following Gujarat Secondary and Higher Secondary Education Board (GSHSEB) syllabus constituted the population.

2.2.2 Sample of the study

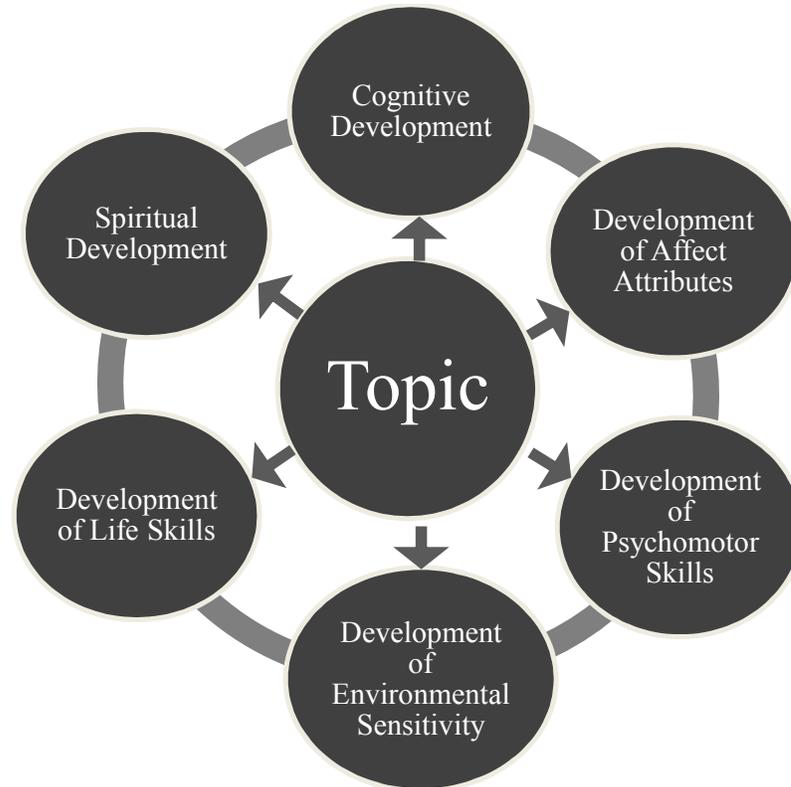
- Two of the English Medium Schools following Gujarat Secondary and Higher Secondary Education Board (GSHSEB) syllabus were selected by convenient sampling.
 - Jay Ambe School, VIP Road, Vadodara was selected as experimental group looking into the facilities (Computer lab, AV room, and Science Laboratory) and readiness of the school to give permission to conduct the required sessions.
 - Baroda High School, Bagikhana, Pologround, Vadodara was selected as control group.
- All the students of standard IX from Jay Ambe School, VIP Road, Vadodara constituted the experimental group, whereas, that of the Baroda High School, Bagikhana, Pologround, Vadodara as control group. Selection of students was done by cluster sampling.

2.3 DESIGN OF THE STUDY

The study employed both the quantitative and qualitative designs. For objectives two, three, four, five and six control group – experimental group post test design was employed, whereas, for the remaining objectives qualitative techniques, namely, content analysis was employed. It was conducted in following phases;

Phase-1 : Development of WSEP

The researcher developed the content matter for the program on the basis of the science syllabus of standard IX as follows;



Phase – 2 : Implementation of the program

The researcher implemented the WSEP over three months period.

2.4 TOOLS FOR THE STUDY

The researcher constructed the Wholistic Development Tool (WDT) (Appendix –I) to collect the data. It was inclusive of the following sections:

Section-A: Content test

Section-B: Value Inventory

Section-C: Activity based test and Demonstration Observation Scale to test the development of psychomotor skills

Section-D: Environment sensitivity test

Section-E: Life skill Inventory

Section-F: Spirituality test

2.5 DATA COLLECTION

Standard VIII comprehensive scores of both the selected schools were considered to find out the homogeneity in the science achievement by computing the significance of difference between two mean scores. The t-value was not found significant between the experimental group and control group. This means, both the groups were found to be parallel.

Table : 2.1 t – value for finding the significance of difference between the Mean scores of the Experimental and Control group with respect to standard VIII comprehensive scores, along with N, Mean, SD, SEM, df and Levels of significance.

Group	N	Mean	S.D.	SEM	t-value	df	Level of significance
Experimental Group	37	64.08	14.96	2.46	1.45	77	0.01 – 2.576 0.05 – 1.960
Control Group	42	59.26	14.45	2.23			

The researcher then implemented the WSEP. After treatment the wholistic development tool (WDT) was administered on both the groups to collect the data. Designing, Development and Implementation of WSEP is presented in Chapter – III, whereas, the data analysis is presented in Chapter – IV objective – wise.

Chapter 3

Design, Development
and Implementation of
WSEP

3.1 INTRODUCTION

The Wholistic education is a unique feature in education system. This facilitates the overall development of students, the important aim of education emphasized since Vedic era. The Wholistic development of students requires teaching - learning methodologies which are Wholistic in nature and ensure the Wholistic development. The conscious effort has to be done in this area for all round development including self. With this intention the researcher has tried to design and develop the WSEP for Science subject. This chapter describes the designing and developing of WSEP followed by its implementation.

3.2 DESIGNING OF WSEP

Design encompasses the layout of the plan of action. To design the WSEP the researcher tried to find the related site to review the literature on Wholistic education. The researcher then went through the science and technology syllabus of 9th standard. The syllabus was divided into three parts chemistry, physics and life sciences. Then the researcher went through the sub topics and exercises given in a particular chapter of each part. The researcher did excessive search on internet to collect the literature. The researcher also referred different reference books and CBSE syllabus text book to make the idea clear. The activities related to different topics of science subject were also referred. After having the concept clarity and an idea about the form of program the researcher selected the topics looking into the scope of Wholistic development. Looking into the nature of Wholistic education the researcher felt that the program should contain more than one mode and method of teaching – learning. The researcher made exhaustive efforts to access internet, specially two search engines, Google and Wikipedia to access the relationship between science and spirituality, environmental protection and ethics, science and value inculcation through the content, points related to life skills and practicum components related to selected topics and their practical implications. Same search was also done from books. The researcher also took the opinion of subject teachers to design the program.

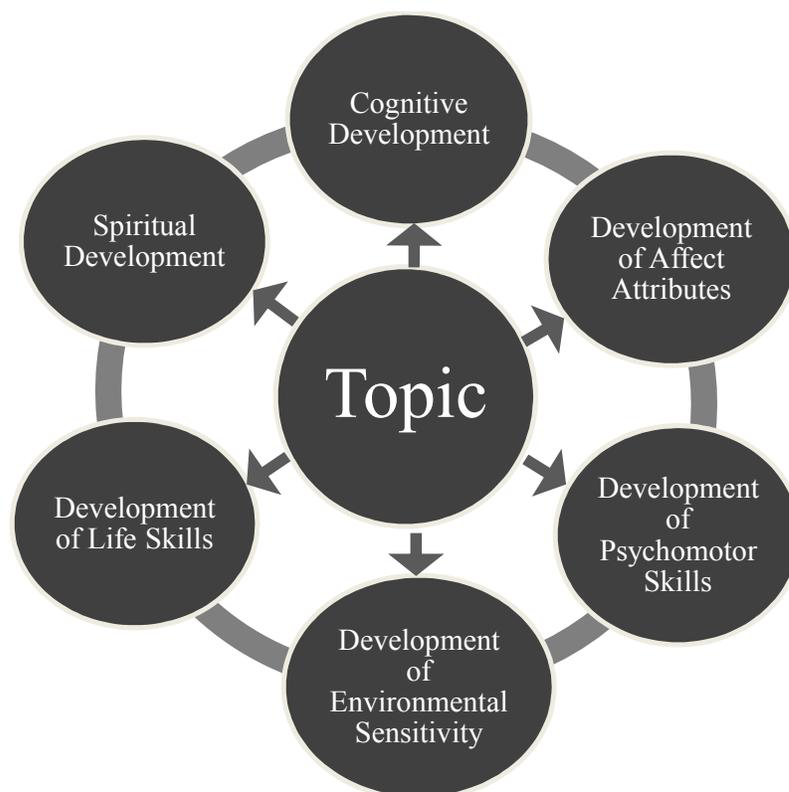
3.3 DEVELOPMENT OF WSEP

To develop the program on Wholistic science education the researcher has categorically observed the subject matter of science syllabus. After lot of brain storm

and thought researcher has selected 10 topics from each part of the syllabus. The selected topics are; (Appendix – II)

- Matter
- States of Matter
- Mixture
- Coal
- The Breath of Life – Air
- Water – A Wonder Liquid
- Work
- Energy
- Power
- Force

After the selection was over the researcher started developing the content matter of selected topics in the following syntax.



The scope of above mentioned areas were found out from each selected topic and the learning experiences were developed. In the development of a program the researcher

has used varieties of leaching – learning modes, media and methods, like, games, puzzles, experimentation, demonstration, discussion, presentation, exercises based on spiritual inputs, informal talk, citation of incidence from the life of a person, like, Vivekananda, Gandhiji, value based stories which will help to increase concentration and sociometry to enhance collaborative and cooperative learning, sharing of articles from news paper and magazine related to various environmental issues to make the program Wholistic and interesting.

3.4 IMPLEMENTATION OF WSEP

The researcher approached five schools to implement the program. One of the approached schools gave permission to conduct the required sessions. That school has three sections of the same standard. One of them was selected as the experimental group. Then researcher approached other schools to get the permission for the control group. This school also has three sections of same standard out of which one was selected as the control group as per the convenience of the school management. The researcher then implemented the program on the experimental group for about three months. The researcher took the regular sessions of the developed program on the experimental group.

Chapter 4

Data Analysis and
Interpretation

4.1 INTRODUCTION

The present chapter is devoted to analysis and interpretation of the collected data. The data analysis and interpretation have been presented objective – wise.

4.2 COGNITIVE DEVELOPMENT

Cognitive development refers to how a person perceives, thinks, and gains understanding of his or her world through the interaction of genetic and learned factors. It focuses on a child's development in terms of information processing, conceptual resources, perceptual skill, language learning, and other aspects of brain development. This type of development needs attention from the school life itself. The present time is knowledge dominant, which requires cognition on a part of the current and future generation. Learner should be equipped with thorough knowledge and understanding of it which they can apply in required situations. The researcher has tried to develop the thorough understanding of the subject during the implementation of WSEP. It focused on deep understanding and interrelation of a science with other subject, which provides the wholistic scenario of content. The methodology used to study the effectiveness of WSEP is described below in terms of tool used, procedure of data collection and data analysis and interpretation.

4.2.1 Objective

To study the effectiveness of WSEP in terms of cognitive development of students.

4.2.2 Hypothesis

There will be no significant difference between the adjusted mean scores of the Experimental group and the Control group when the standard eight science comprehensive score is considered as covariate.

4.2.3 Data Collection

Standard VIII comprehensive scores of both the selected schools were considered to find out the homogeneity in the science achievement by computing the significance of difference between two mean scores. The t-value was not found significant between

the experimental group and control group. This means, both the groups were found to be parallel. The summary is presented in following table.

Table - 4.1 : N, Mean, SD and SEM of the Experimental group and Control group

Group	N	Mean	S.D.	SEM	t-value	df	Level of significance
Experimental Group	37	64.08	14.96	2.46	1.45	77	0.01 – 2.576 0.05 – 1.960
Control Group	42	59.26	14.45	2.23			

The researcher then implemented the WSEP. After treatment the wholistic development tool (WDT) was administered and particularly for the mentioned objective Content test was employed on both the groups to collect the data.

4.2.4 Data Analysis

To test the hypothesis ‘There will be no significant difference between the adjusted mean scores of the Experimental group and the Control group when the standard eight science comprehensive score is considered as covariate’ the collected data were analysed quantitatively using ANCOVA. To study the effectiveness of WSEP in terms of cognitive development of students, the Observed Mean, Adjusted Mean and ANCOVA were computed. The content test was prepared to collect the data. The prepared test contains questions from taught topics and it was of total 30 marks. Students of both the groups were marked accordingly on the prepared test to get the scores. After total scores of the Experimental group and the Control group were obtained, grand total was calculated by adding obtained scores of each student. Then observed mean, adjusted mean and ANCOVA were calculated accordingly. The analysed data has been presented in the following table.

Table - 4.2 : Size of the Experimental and Control group along with Observed Mean and Adjusted Mean Scores.

Dependent Variable (Content test Scores)			
Group	N	Observed Mean	Adjusted Mean
Experimental Group	37	56.11	54.93
Control Group	42	26.27	27.31
Total	79	40.24	40.25

Table – 4.3 : F value along with SS, df, MS and level of significance

Source	SS	df	MS	F	P
Adjusted Means	14655.17	1	14655.17	57.43	< 0.0001
Adjusted Error	19393.62	76	255.18		
Adjusted Total	34048.78	77			

4.2.5 Interpretation

The computed F – value of 57.43 is greater than the table F – value of 6.98 at 0.01 level against 1 and 76 degrees of freedom. So, the null hypothesis that there will be no significant difference between the adjusted mean scores of the Experimental group and the Control group when the standard eight science comprehensive score is considered as covariate is rejected. So, the adjusted mean score of the Experimental group of 54.93 has been found to be significantly greater than 27.31, the adjusted mean score of the Control group. Hence, the cognitive development of the Experimental group has been found to be significantly greater than that of the Control group.

4.3 DEVELOPMENT OF AFFECT ATTRIBUTES

Education is a methodical effort towards learning basic facts about humanity. The core idea of value education is to cultivate essential values in the students so that the civilization that teaches us to manage complexities can be sustained and further developed. It begins at home and it is continued in schools. Education of Value is important to help everyone in improving the value system that he/she holds and put them to use. Once, students understand their values in life, they can examine and control the various choices they make in their lives. It is duty of education system to uphold the various types of values in life, such as, cultural values, universal values, personal values and social values. It helps in both, regulating the self, as well as, others.

Thus, development of affect attributes is always essential to shape a student's life and to give him an opportunity of performing himself on the global stage. The need for this type of education among the parents, children, and teachers, is constantly increasing as we continue to witness increasing violent activities, behavioral disorder and lack of unity in society. The WSEP attempts to develop the balance personality. Researcher has developed value inventory which contains items from the taught content. The post implementation of the same on both the groups, i.e., Experimental and Control group and its detailed description is described below.

4.3.1 Objective

To study the effectiveness of WSEP in terms of affective development of students.

4.3.2 Hypothesis

There will be no significant difference in the value inculcation of the Experimental group and Control group.

4.3.3 Data Collection

The researcher has implemented the WSEP. After treatment the wholistic development tool (WDT) was administered and particularly for the mentioned objective Value Inventory was employed on both the groups to collect the data.

4.3.4 Data Analysis

To measure the affective development, Value Inventory was administered. The chi-square (χ^2) analysis was done. Researcher had also counted the percentage and frequencies at various points of scale with respect to both the groups. The analysis of the same is presented below;

Statement – 1

Science funfair is organized by the school. We have to help school management in to the arrangements of the function in decided groups. This type of working will be joyful for us.

Table - 4.4 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 1 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	97.30	2.70	100	15.80	1	0.01 df = 6.635
Control	100.00	00	100			0.05 df = 3.841
Total	197.30	2.70	200			

The computed value of χ^2 15.80 is higher than the table value of χ^2 6.635 at 0.01 level against 1 degrees of freedom. So null hypothesis is rejected. It reveals that both the groups differ significantly in value inculcation. Therefore, there is a significant difference observed between the value inculcation of the Experimental group and Control group.

Statement – 2

One of the boys has come in our class from the other school from this academic year. Teacher has made us to sit with him in the class to make him comfortable. We will like to do that.

Table - 4.5 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 2 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	83.78	16.22	100	0.005	1	0.01 df = 6.635
Control	83.33	16.67	100			0.05 df = 3.841
Total	167.11	32.89	200			

The computed value of χ^2 0.005 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 1 degrees of freedom. So, the null hypothesis that there will be no significant difference in the value inculcation of the Experimental group and Control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on value inventory for this particular statement, yet both the groups have been found to have high level of value inculcation.

Statement – 3

Due to the difference of opinions in classroom arguments a dispute has begun amongst two students of our class. It is very unpleasant. We will like to resolve the dispute and revive healthy classroom climate.

Table - 4.6 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 3 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	81.08	18.92	100	0.269	1	0.01 df = 6.635
Control	88.10	11.90	100			0.05 df = 3.841
Total	169.18	30.82	200			

The computed value of χ^2 0.269 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 1 degrees of freedom. So, the null hypothesis that there will be no significant difference in the value inculcation of the Experimental group and Control group is not rejected. However, the distribution of percentage scores against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on value inventory for this particular statement, yet both the groups have been found to have high level of value inculcation.

Statement – 4

A group discussion was carried out on choice based credit system in the school. The group arrangement was decided by the teacher. Being a member one has to be open to the ideas of others.

Table - 4.7 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 4 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	83.78	16.22	100	2.622	1	0.01 df = 6.635
Control	83.33	16.67	100			0.05 df = 3.841
Total	167.11	32.89	200			

The computed value of χ^2 2.622 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 1 degrees of freedom. So, the null hypothesis that there will be no significant difference in the value inculcation of the Experimental group and Control group is not rejected. However, the distribution of percentage scores against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on value inventory for this particular statement, yet both the groups have been found to have high level of value inculcation.

Statement – 5

Summer camp has been organized for children of our age group. We are participating in the camp. The selected location is very remote and the facilities there are negligible as compared to our routine life. It is difficult to bear with those facilities. In spite of all these there is meaningful learning. So we are all enthusiastic and ready to fit into that particular set up and enjoy the exposure.

Table - 4.8 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 5 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	86.49	13.51	100	0.0024	1	0.01 df = 6.635
Control	76.19	23.81	100			0.05 df = 3.841
Total	162.68	37.32	200			

The computed value of χ^2 0.0024 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 1 degrees of freedom. So, the null hypothesis that there will be no significant difference in the value inculcation of the Experimental group and Control group is not rejected. However, the distribution of percentage scores against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on value inventory for this particular statement, yet both the groups have been found to have high level of value inculcation.

Statement – 6

We are performing drama on the theme ‘United India’. For that we have to learn the culture of different types of people and we are going to meet such people in their real settings. We would like to become one amongst them to learn about their lives.

Table - 4.9 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 6 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	86.49	13.51	100	0.074	1	0.01 df = 6.635
Control	95.24	45.76	100			0.05 df = 3.841
Total	180.73	19.27	200			

The computed value of χ^2 0.00741 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 1 degrees of freedom. So, the null hypothesis that there will be no significant difference in the value inculcation of the Experimental group and Control group is not rejected. However, the distribution of percentage scores against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on value inventory for this particular statement, yet both the groups have been found to have high level of value inculcation.

Statement – 7

After conducting an interview of different people; we come to know different types of nature of people and different types of thoughts about each other. We know that the heterogeneity exists in people around us. We can filter out the meaningful ideas. We can differentiate good and bad, fact and opinion.

Table - 4.10 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 7 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	86.11	13.89	100	1.132	1	0.01 df = 6.635
Control	69.05	30.95	100			0.05 df = 3.841
Total	155.16	44.89	200			

The computed value of χ^2 1.132 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 1 degrees of freedom. So, the null hypothesis that there will be no significant difference in the value inculcation of the Experimental group and Control group is not rejected. However, the distribution of percentage scores against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on value inventory for this particular statement, yet both the groups have been found to have high level of value inculcation.

Statement – 8

Science Olympiad has been announced by our Principal. Our group has decided to take part in that. The competition will be held after 2 months and we have started preparation to get success. We got one free period. Some friends of our class have decided to play football during that period instead of preparing for the Olympiad. Still, we would like to prepare for the Science Olympiad during that period.

Table - 4.11 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 8 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	63.89	36.11	100	0.909	1	0.01 df = 6.635
Control	66.67	33.33	100			0.05 df = 3.841
Total	130.56	69.44	200			

The computed value of χ^2 0.909 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 1 degrees of freedom. So, the null hypothesis that there will be no significant difference in the value inculcation of the Experimental group and Control group is not rejected. However, the distribution of percentage scores against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on value inventory for this particular statement, yet both the groups have been found to have high level of value inculcation.

Statement – 9

Blood donation camp has to be organized in our school on coming Sunday. The choices have been given to us to select our group partners. Some students are unnecessarily doing the show off. We will like to work for blood donation camp.

Table - 4.12 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 9 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	71.48	28.57	100	2.908	1	0.01 df = 6.635
Control	90.48	9.52	100			0.05 df = 3.841
Total	161.91	38.09	200			

The computed value of χ^2 2.908 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 1 degrees of freedom. So, the null hypothesis that there will be no significant difference in the value inculcation of the Experimental group and Control group is not rejected. However, the distribution of percentage scores against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on value inventory for this particular statement, yet both the groups have been found to have high level of value inculcation.

Statement – 10

Within school timings our group has to complete three different tasks, namely, morning assembly, presentation on motivational theme in inaugural session of annual day function and folk dance. In spite of difficulties we will complete all the three tasks.

Table - 4.13 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 10 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	83.78	16.22	100	0.593	1	0.01 df = 6.635
Control	78.57	21.43	100			0.05 df = 3.841
Total	162.35	37.65	200			

The computed value of χ^2 0.593 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 1 degrees of freedom. So, the null hypothesis that there will be no significant difference in the value inculcation of the Experimental group and Control group is not rejected. However, the distribution of percentage scores against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on value inventory for this particular statement, yet both the groups have been found to have high level of value inculcation.

Statement – 11

Nowadays our nation is coming at par with the developed nations. Due to technological revolution the globe has become a small village. We know that directly or indirectly, we are also a part of the development. For that we have to develop the feeling of oneness amongst us.

Table - 4.14 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 11 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	97.30	2.70	100	14.95	1	0.01 df = 6.635
Control	97.62	2.38	100			0.05 df = 3.841
Total	194.92	5.08	200			

The computed value of χ^2 14.95 is higher than the table value of χ^2 6.635 at 0.01 level and table χ^2 value 3.841 at 0.05 levels against 1 degrees of freedom. So null hypothesis is rejected at both the levels. It reveals that both the groups differ significantly in value inculcation. Therefore, there is a significant difference observed between the value inculcation of the Experimental group and Control group.

Statement – 12

Personality development seminar has been organized in school. We have to undergo rigorous training. The nature of the training is quite demanding. It is left to us whether we would like to join or not. But our group has decided to join that training.

Table - 4.15 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 12 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	77.78	22.22	100	0.114	1	0.01 df = 6.635
Control	85.71	14.29	100			0.05 df = 3.841
Total	163.49	36.51	200			

The computed value of χ^2 0.114 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 1 degrees of freedom. So, the null hypothesis that there will be no significant difference in the value inculcation of the Experimental group and Control group is not rejected. However, the distribution of percentage scores against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on value inventory for this particular statement, yet both the groups have been found to have high level of value inculcation.

Statement – 13

The painting competition has been organized in a school. We have to prepare our own paintings using common materials, like, paint colors, brush, pencil and eraser. The time period is very short. Still, we love to share the things and enjoy the competition.

Table - 4.16 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 13 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	89.19	10.81	100	2.126	1	0.01 df = 6.635
Control	92.50	7.50	100			0.05 df = 3.841
Total	181.69	18.31	200			

The computed value of χ^2 2.126 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 1 degrees of freedom. So, the null hypothesis that there will be no significant difference in the value inculcation of the Experimental group and Control group is not rejected. However, the distribution of percentage scores against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on value inventory for this particular statement, yet both the groups have been found to have high level of value inculcation.

Statement – 14

We are asked to bring prepared food from home and collect it at school. In the afternoon session we have to go to nearby slum area with our teacher for distribution. The area is very dirty and unhygienic. It is very difficult to enter and deal with those people. It is a voluntary activity. But we will prefer to do that service.

Table - 4.17 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 14 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	86.49	13.51	100	0.385	1	0.01 df = 6.635
Control	72.50	27.50	100			0.05 df = 3.841
Total	158.99	41.01	200			

The computed value of χ^2 0.385 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 1 degrees of freedom. So, the null hypothesis that there will be no significant difference in the value inculcation of the Experimental group and Control group is not rejected. However, the distribution of percentage scores against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on value inventory for this particular statement, yet both the groups have been found to have high level of value inculcation.

Statement – 15

During the exam time the tension increased. One of our classmates could not prepare due to his personal problems. Still two days are there to prepare. It is a hard time now. But we are ready to make his work easier by discussing the concepts.

Table - 4.18 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 15 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	94.59	5.441	100	7.256	1	0.01 df = 6.635
Control	95.12	4.88	100			0.05 df = 3.841
Total	189.71	10.29	200			

The computed value of χ^2 7.256 is higher than the table value of χ^2 6.635 at 0.01 level against 1 degrees of freedom. So null hypothesis is rejected. It reveals that both the groups differ significantly in value inculcation. Therefore, there is a significant difference observed between the value inculcation of the Experimental group and Control group.

Statement – 16

One of our classmates met with an accident due to which he is not able to write with right hand. As he is righty he has to practice hard to write with left hand. He is not in a position to complete the assignments due to the decreased speed. He is very much disturbed. We are trying our level best to make him adjust with the present situation.

Table - 4.19 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 16 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	97.22	2.70	100	14.52	1	0.01 df = 6.635
Control	97.50	2.50	100			0.05 df = 3.841
Total	194.72	5.28	200			

The computed value of χ^2 14.52 is higher than the table value of χ^2 6.635 at 0.01 level against 1 degrees of freedom. So null hypothesis is rejected. It reveals that both the groups differ significantly in value inculcation. Therefore, there is a significant difference observed between the value inculcation of the Experimental group and Control group.

Statement – 17

We are asked to conduct a survey on use of mobile phone by school going children in our surrounding area. It has nothing to do with our academics but we know that it will be helpful to make the children aware about the disadvantage of mobile phone at certain age. We are willing to do that work.

Table - 4.20 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 17 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	83.33	16.67	100	2.061	1	0.01 df = 6.635
Control	85.00	15.00	100			0.05 df = 3.841
Total	168.33	31.67	200			

The computed value of χ^2 2.061 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 1 degrees of freedom. So, the null hypothesis that there will be no significant difference in the value inculcation of the Experimental group and Control group is not rejected. However, the distribution of percentage scores against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on value inventory for this particular statement, yet both the groups have been found to have high level of value inculcation.

Statement – 18

Now it's a time to elect the class monitors. Three boys and four girls are trying their candidature. One of the boys is from our own group but he is over proud. We have decided that we will vote for those two candidates who are capable and normal.

Table - 4.21 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 18 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	86.49	13.51	100	1.604	1	0.01 df = 6.635
Control	90.00	10.00	100			0.05 df = 3.841
Total	176.49	23.51	200			

The computed value of χ^2 1.604 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 1 degrees of freedom. So, the null hypothesis that there will be no significant difference in the value inculcation of the Experimental group and Control group is not rejected. However, the distribution of percentage scores against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on value inventory for this particular statement, yet both the groups have been found to have high level of value inculcation.

Statement – 19

We have been given two exercises.

1. Go and play on playground and
2. Clean the school garden.

We have decided to go and play.

Table - 4.22 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 19 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	37.84	62.16	100	4.656	1	0.01 df = 6.635
Control	65.00	38.00	100			0.05 df = 3.841
Total	102.84	97.16	200			

The computed value of χ^2 4.656 is higher than the table value of 3.841 at 0.05 level against 1 degrees of freedom. So, the null hypothesis that there will be no significant difference in the value inculcation of the Experimental group and Control group is rejected. It reveals that both the groups differ significantly in value inculcation. Therefore, there is a significant difference observed between the value inculcation of the Experimental group and Control group.

Statement – 20

We have been given an assignment to get the data of children who are deprived of education due to several reasons. For this principal has declared two days holiday we would like to collect data in the given time span, as much as we can.

Table - 4.23 : χ^2 value for testing the significance of difference between frequencies of the Experimental group and Control group against statement – 20 of Value Inventory.

Group	Agree	Disagree	Total	χ^2	df	Levels of significance
Experimental	94.44	5.56	100	0.450	1	0.01 df = 6.635
Control	87.50	12.50	100			0.05 df = 3.841
Total	181.94	18.06	200			

The computed value of χ^2 0.450 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 1 degrees of freedom. So, the null hypothesis that there will be no significant difference in the value inculcation of the Experimental group and Control group is not rejected. However, the distribution of percentage scores against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on value inventory for this particular statement, yet both the groups have been found to have high level of value inculcation.

Cumulative table

Table - 4.24 : Cumulative table of χ^2 value of Value Inventory.

Statement No.	χ^2 Value	Level of Significance
1	15.80	Significant (0.01 level)
2	0.005	Not Significant
3	0.269	Not Significant
4	2.622	Not Significant
5	0.002	Not Significant
6	0.074	Not Significant
7	1.132	Not Significant
8	0.909	Not Significant
9	2.098	Not Significant
10	0.593	Not Significant
11	14.95	Significant (0.01 level)
12	0.114	Not Significant
13	2.126	Not Significant
14	0.385	Not Significant
15	7.259	Significant (0.01 level)
16	14.52	Significant (0.01 level)
17	2.061	Not Significant
18	1.604	Not Significant
19	4.656	Significant (0.05 level)
20	0.450	Not Significant

4.3.5 Interpretation

The computed value of χ^2 has been found to be significant against five statements (statement no. 1, 11, 15, 16 and 19) out of 20 statements. Out of these five statements, in one statement, i.e., statement no. – 19, the χ^2 value is found significant at 0.05 level, whereas, other four values are significant at 0.01 level. Therefore, the null

hypothesis is rejected against five statements. This reveals that there is a significant difference in the value inculcation of the Experimental group and the Control group.

However, against the remaining fifteen statements, the χ^2 value has neither been found significant at 0.05 level nor at 0.01 level. So, the null hypothesis is not rejected against fifteen statements. So, there is no significant difference between the value inculcation of the Experimental group and the Control group. Further, the percentage scores against both the Experimental group and the Control group show that the value inculcation in both the groups is higher.

4.4 DEVELOPMENT OF PSYCHOMOTOR SKILL

The psychomotor domain (Simpson, 1972) includes physical movement, coordination, and use of the motor-skill areas. Development of these skills requires practice and is measured in terms of speed, precision, distance, procedures, or techniques in execution. Psychomotor learning is the relationship between cognitive functions and physical movement. Psychomotor learning is demonstrated by physical skills such as movement, coordination, manipulation, dexterity, grace, strength, speed; actions which demonstrate the fine motor skills such as use of precision instruments or tools. Development of motor skill in an individual is very much important for Wholistic development. Even the science subject demands more of skill based performance. The researcher has tried to develop these skills in students during the implementation phase. To analyze students performance and to check the effectiveness of WSEP for the below mentioned objective Activity based test and Demonstration – Observation Scale were developed. To analyse the Activity based test ANCOVA was computed. The methodology used is described below in terms of tool used, procedure of data collection, data analysis and interpretation. Furthermore, for the analysis of Demonstration – Observation Scale the χ^2 was employed. The details of analysis are described below.

4.4.1 Objective

To study the effectiveness of WSEP in terms of development of psychomotor skills.

4.4.2 Hypothesis

There will be no significant difference between adjusted mean scores of the Experimental group and the Control group when the standard eight science comprehensive scores is considered as covariate.

4.4.3 Data Collection

The researcher has implemented the WSEP. After treatment the wholistic development tool (WDT) was administered and particularly for the mentioned objective Activity based test and Demonstration – Observation Scale were employed on both the groups to collect the data.

4.4.4 Data Analysis

4.4.4.1 Activity Based Test

To test the hypothesis ‘there will be no significant difference between adjusted mean scores of the Experimental group and the Control group when the standard eight science comprehensive scores is considered as covariate’ the collected data were analysed quantitatively using ‘ANCOVA’ for Activity based test and for Demonstration – Observation Scale the χ^2 were computed. To study the effectiveness of WSEP in terms of development of psychomotor skill, the observed means, the adjusted means and F-value were computed. The prepared Activity based test contains questions based on taught practical knowledge which students are expected to pusses and it was of total 10 marks. Students of both the groups were marked accordingly on the prepared test to get the scores. After total scores of the Experimental group and the Control group were obtained, grand total was calculated by adding obtained scores of each student. Then the observed means, adjusted means and F-value were calculated accordingly. The analysed data has been presented in the following table.

Table – 4.25 : Observed Means Scores and Adjusted Mean Scores against the Experimental group and control group.

Dependent Variable (Activity Based Test Scores)			
Group	N	Observed Mean	Adjusted Mean
Experimental Group	37	59.73	58.78
Control Group	42	19.52	20.36
Total	79	38.35	38.35

Table – 4.26 : F value to test the significance of difference between Adjusted Mean Scores of the Experimental group and Control group.

Source	SS	df	MS	F	P
Adjusted Means	28351.2	1	28351.2	82.76	< 0.0001
Adjusted Error	26034.91	76	342.56		
Adjusted Total	54386.11	77			

Interpretation

The computed F – value of 82.76 is greater than the table F – value 6.98 at 0.01 level against 1 and 76 degrees of freedom. So, the null hypothesis that there will be no significant difference between adjusted mean scores of the Experimental group and the Control group when the standard eight science comprehensive scores is considered as covariate is rejected. The adjusted mean scores of 58.78 of the Experimental group has been found to be significantly greater than 20.36 the adjusted mean score of the Control group. Hence, the psychomotor development of the Experimental group has been found to be significantly greater than the Control group.

4.4.4.2 Demonstration – Observation Scale

To analyse the above mentioned tool the χ^2 was computed. This scale was prepared to observe the students demonstration ability during their performance. The criteria were set for the performance and the responses were categorised in five intervals. The analysis of the same is described below in a tabular form.

Table – 4.27 : χ^2 value of analysis of Demonstration Observation Scale.

Group	5	4	3	2	1	χ^2	df	Levels of significance
Experimental	10	20	7	0	0	43.997	4	0.01 df = 9.210
Control	0	4	8	28	2			0.05 df = 5.991

Inference

The computed value of χ^2 43.997 is fall under the rejection region because the table value of χ^2 is 9.210 at 0.01 level against 4 degrees of freedom. Therefore, the null hypothesis is rejected. This reveals that the Experimental group was able to perform better demonstration ability than the Control group.

4.5 DEVELOPMENT OF ENVIRONMENTAL SENSITIVITY

Environmental pollution is the contamination of the air, water, and soil. Although very often it is not deliberate, human activities are the largest contributor to the alarming state of global warming. Millions of vehicles around the world emit tons of toxic fumes to the atmosphere. Various industrial plants release toxic particles to the atmosphere. The effluents released into the waterways, contaminate water and ground water resources which in turn is harmful for human life and endangers animal life. Oil spills and e-waste dumping sites are other sources of major environmental hazards that threaten the ecological balance of Earth. Ground pollution is the contamination by toxic wastes which contaminates the soil. This causes devastation of crops and land.

Environmental pollution is one of the biggest problems the world faces today. It is an issue that troubles us in all facets of life every moment. The contamination of the environment causes diseases very frequently. Yet, most people do not know about this problem. This shows that environmental pollution is becoming an increasingly worse problem that needs to be taken care of as soon as possible, not only for the good of the environment but also for the people that live in it. The interaction of many factors has made environmental pollution a large issue in the world. If the world's environmental problem escalates, it will result into catastrophic consequences. Therefore, the students who will be the future citizens need to be aware of the factors in daily life with which the environment is affected.

The environmental sensitivity in the context of the present study refers to the awareness about environmental degradation in the surroundings and to develop sensitivity towards the environment through wholistic approach amongst the students specifically through the content matter which is prescribed in the text book. The researcher tried to sensitize students about the environment through their own course of study with the help of their daily life experiences and examples, as a part of regular teaching activity. Researcher has developed environment sensitivity test which contains items from the taught content. The post implementation of the same on both the groups, i.e., Experimental and Control group and its detailed description is described below.

4.5.1 Objective

To study the effectiveness of WSEP in establishing environmental sensitivity.

4.5.2 Hypothesis

There will be no significant difference between Environmental Sensitivity of Experimental group and Control group.

4.5.3 Data Collection

The researcher has implemented the WSEP. After treatment the wholistic development tool (WDT) was administered and particularly for the mentioned objective Environment sensitivity test was employed on both the groups to collect the data.

4.5.4 Data Analysis

To measure the effectiveness the Environment sensitivity test was administrated. The chi-square (χ^2) analysis was done. Researcher had also counted the percentage scores and frequencies at various points of scale with respect to both the groups. The analysis of the same is presented below:

Statement : 1 The domestic sewage wastes are to be discharged into the water body.

Table – 4.28 : Analysis of statement – 1 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	1	1	35	0.528	2	0.01 df = 9.210
Control	1	3	38			0.05 df = 5.991

The computed value of χ^2 0.528 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 2 degrees of freedom. So, the null hypothesis that there will be no significant difference between Environmental Sensitivity of the

Experimental group and Control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on Environmental Sensitivity, yet both the groups have been found to have high level of Environmental Sensitivity.

Statement : 2 The industrial wastes are not dangerous for the growth of aquatic life.

Table – 4.29 : Analysis of statement – 2 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	1	0	36	1.518	2	0.01 df = 9.210
Control	1	3	38			0.05 df = 5.991

The computed value of χ^2 1.518 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 2 degrees of freedom. So, the null hypothesis that there will be no significant difference between Environmental Sensitivity of the Experimental group and Control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on Environmental Sensitivity, yet both the groups have been found to have high level of Environmental Sensitivity.

Statement : 3 We have to use desirable amount of soap and shampoo to keep our body clean.

Table – 4.30 : Analysis of statement – 3 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	27 (72.97%)	1 (2.70%)	9 (24.32%)	6.373	2	0.01 df = 9.210
Control	22 (57.89%)	10 (26.32%)	6 (15.79%)			0.05 df = 5.991

The computed value of χ^2 6.373 is lesser than the table value of χ^2 9.210 at 0.01 level against 2 degrees of freedom. So null hypothesis is not rejected at 0.01 level. While the χ^2 value 6.373 is higher than table χ^2 value 5.991 at 0.05 levels against 2 degrees of freedom. So the null hypothesis is rejected at 0.05 levels. It reveals that both the groups differ significantly in environmental sensitivity at 0.05 level.

Statement : 4 The excessive amount of fertilizer is useful for the growth of plants.

Table – 4.31 : Analysis of statement – 4 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	6	1	30	0.244	2	0.01 df = 9.210
Control	4	2	35			0.05 df = 5.991

The computed value of χ^2 0.244 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 2 degrees of freedom. So, the null hypothesis that there will be no significant difference between Environmental Sensitivity of the Experimental group and Control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on

Environmental Sensitivity, yet both the groups have been found to have high level of Environmental Sensitivity.

Statement : 5 Leakage of petroleum oil on the surface of water body has no relation with aquatic life.

Table – 4.32 : Analysis of statement – 5 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	0	2	35	0.017	2	0.01 df = 9.210
Control	1	3	36			0.05 df = 5.991

The computed value of χ^2 0.017 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 2 degrees of freedom. So, the null hypothesis that there will be no significant difference between Environmental Sensitivity of the Experimental group and Control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on Environmental Sensitivity, yet both the groups have been found to have high level of Environmental Sensitivity.

Statement : 6 Construction of bridge on the river does not affect the quality of water.

Table – 4.33 : Analysis of statement – 6 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	13 (37.14%)	3 (8.57%)	19 (54.29%)	12.310	2	0.01 df = 9.210
Control	7 (17.07%)	20 (48.78%)	14 (34.15%)			0.05 df = 5.991

The computed value of χ^2 12.310 is higher than the table value of χ^2 9.210 at 0.01 level against 2 degrees of freedom. So, the null hypothesis is rejected. It reveals that both the groups differ significantly in environmental sensitivity.

Statement : 7 The useful micro organisms in the water body are killed due to industrial waste.

Table – 4.34 : Analysis of statement – 7 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	33	4	0	1.166	2	0.01 df = 9.210
Control	31	8	2			0.05 df = 5.991

The computed value of χ^2 1.166 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 2 degrees of freedom. So, the null hypothesis that there will be no significant difference between Environmental Sensitivity of the Experimental group and Control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on Environmental Sensitivity, yet both the groups have been found to have high level of Environmental Sensitivity.

Statement : 8 The wash out of fertilizers leads to the mushroom growth of algae into the water body which is not dangerous.

Table – 4.35 : Analysis of statement – 8 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	2	15	20	2.282	2	0.01 df = 9.210
Control	6	20	14			0.05 df = 5.991

The computed value of χ^2 2.282 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 2 degrees of freedom. So, the null hypothesis that there will be no significant difference between Environmental Sensitivity of the Experimental group and Control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on Environmental Sensitivity, yet both the groups have been found to have high level of Environmental Sensitivity.

Statement : 9 The available water is polluted due to excessive use of fertilizer.

Table – 4.36 : Analysis of statement – 9 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	30 (81.08%)	3 (8.11%)	4 (10.81%)	6.529	2	0.01 df = 9.210
Control	19 (48.72%)	9 (23.08%)	11 (28.21%)			0.05 df = 5.991

The computed value of χ^2 6.529 is lesser than the table value of χ^2 9.210 at 0.01 level against 2 degrees of freedom. So null hypothesis is not rejected at 0.01 level. While the χ^2 value 6.529 is higher than table χ^2 value 5.991 at 0.05 levels against 2 degrees of freedom. So the null hypothesis is rejected at 0.05 levels. It reveals that both the groups differ significantly in environmental sensitivity at 0.05 level.

Statement : 10 The suspended particles of solid wastes generate adverse effect in the drinking water.

Table – 4.37 : Analysis of statement – 10 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	32 (86.49%)	0 (0.00%)	5 (13.51%)	7.459	2	0.01 df = 9.210
Control	26 (65.00%)	9 (22.5%)	5 (12.5%)			0.05 df = 5.991

The computed value of χ^2 7.459 is lesser than the table value of χ^2 9.210 at 0.01 level against 2 degrees of freedom. So null hypothesis is not rejected at 0.01 level. While the χ^2 value 7.459 is higher than table χ^2 value 5.991 at 0.05 levels against 2 degrees of freedom. So the null hypothesis is rejected at 0.05 levels. It reveals that both the groups differ significantly in environmental sensitivity at 0.05 level.

Statement : 11 The chemical should be bio degradable or soluble to lower down its effect in water.

Table – 4.38 : Analysis of statement – 11 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	29	4	4	0.614	2	0.01 df = 9.210
Control	25	7	4			0.05 df = 5.991

The computed value of χ^2 0.614 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 2 degrees of freedom. So, the null hypothesis that there will be no significant difference between Environmental Sensitivity of the Experimental group and Control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on Environmental Sensitivity, yet both the groups have been found to have high level of Environmental Sensitivity.

Statement : 12 It is desirable to keep vehicles and fire place or stoves well maintained.

Table – 4.39 : Analysis of statement – 12 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	34	1	2	0.569	2	0.01 df = 9.210
Control	38	1	2			0.05 df = 5.991

The computed value of χ^2 0.569 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 2 degrees of freedom. So, the null hypothesis that there will be no significant difference between Environmental Sensitivity of the Experimental group and Control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on Environmental Sensitivity, yet both the groups have been found to have high level of Environmental Sensitivity.

Statement : 13 Choose not to smoke.

Table – 4.40 : Analysis of statement – 13 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	33	0	4	2.714	2	0.01 df = 9.210
Control	41	0	0			0.05 df = 5.991

The computed value of χ^2 2.714 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 2 degrees of freedom. So, the null hypothesis that there will be no significant difference between Environmental Sensitivity of the Experimental group and Control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental

group and Control group reveals that both the groups do not differ significantly on Environmental Sensitivity, yet both the groups have been found to have high level of Environmental Sensitivity.

Statement : 14 It is better to use synthetic cleaners instead of natural cleaners.

Table – 4.41 : Analysis of statement – 14 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	4	2	31	1.409	2	0.01 df = 9.210
Control	1	5	35			0.05 df = 5.991

The computed value of χ^2 1.406 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 2 degrees of freedom. So, the null hypothesis that there will be no significant difference between Environmental Sensitivity of the Experimental group and Control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on Environmental Sensitivity, yet both the groups have been found to have high level of Environmental Sensitivity.

Statement : 15 Environment friendly products are costly. So it is better not to use them.

Table – 4.42 : Analysis of statement – 15 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	3	1	33	0.157	2	0.01 df = 9.210
Control	2	3	36			0.05 df = 5.991

The computed value of χ^2 0.157 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 2 degrees of freedom. So, the null hypothesis that there

will be no significant difference between Environmental Sensitivity of the Experimental group and Control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on Environmental Sensitivity, yet both the groups have been found to have high level of Environmental Sensitivity.

Statement : 16 We can avoid using perfumes to keep our home atmosphere clean.

Table – 4.43 : Analysis of statement – 16 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	29	4	4	4.811	2	0.01 df = 9.210
Control	23	14	4			0.05 df = 5.991

The computed value of χ^2 4.811 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 2 degrees of freedom. So, the null hypothesis that there will be no significant difference between Environmental Sensitivity of the Experimental group and Control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on Environmental Sensitivity, yet both the groups have been found to have high level of Environmental Sensitivity.

Statement : 17 It is preferable to use CNG vehicle in place of petrol vehicle.

Table – 4.44 : Analysis of statement – 17 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	35	2	0	0.162	2	0.01 df = 9.210
Control	38	2	1			0.05 df = 5.991

The computed value of χ^2 0.162 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 2 degrees of freedom. So, the null hypothesis that there will be no significant difference between Environmental Sensitivity of the Experimental group and Control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on Environmental Sensitivity, yet both the groups have been found to have high level of Environmental Sensitivity.

Statement : 18 If it is a long queue to park the car at decided destination, it is better to park it a little away then waiting in a queue.

Table – 4.45 : Analysis of statement – 18 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	14	1	20	5.777	2	0.01 df = 9.210
Control	10	10	20			0.05 df = 5.991

The computed value of χ^2 5.777 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 2 degrees of freedom. So, the null hypothesis that there will be no significant difference between Environmental Sensitivity of the Experimental group and Control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on Environmental Sensitivity, yet both the groups have been found to have high level of Environmental Sensitivity.

Statement : 19 Dust particles are necessary in the air to a certain extent.

Table – 4.46 : Analysis of statement – 19 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	26	5	6	4.305	2	0.01 df = 9.210
Control	20	13	7			0.05 df = 5.991

The computed value of χ^2 4.305 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 2 degrees of freedom. So, the null hypothesis that there will be no significant difference between Environmental Sensitivity of the Experimental group and Control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly on Environmental Sensitivity, yet both the groups have been found to have high level of Environmental Sensitivity.

Statement : 20 Amount of CO₂ gas cannot be reduced by population control.

Table – 4.47 : Analysis of statement – 20 of Environment Sensitivity Test.

Group	Agree	Undecided	Disagree	χ^2	df	Levels of significance
Experimental	7 (18.92%)	0 (0.00%)	30 (81.08%)	7.484	2	0.01 df = 9.210
Control	11 (26.83%)	8 (19.51%)	22 (53.66%)			0.05 df = 5.991

The computed value of χ^2 7.484 is lesser than the table value of χ^2 9.210 at 0.01 level against 2 degrees of freedom. So null hypothesis is not rejected at 0.01 level. While the χ^2 value 7.484 is higher than table χ^2 value 5.991 at 0.05 levels against 2 degrees of freedom. So the null hypothesis is rejected at 0.05 levels. It reveals that both the groups differ significantly in environmental sensitivity at 0.05 level.

Cumulative table**Table – 4.48 :** Cumulative table of χ^2 analysis of Environment Sensitivity Test.

Statement No.	χ^2 Value	Level of Significance
1	0.528	Not Significant
2	1.518	Not Significant
3	6.373	0.05 level
4	0.244	Not Significant
5	0.017	Not Significant
6	12.310	0.01 level
7	1.166	Not Significant
8	2.282	Not Significant
9	6.529	0.05 level
10	7.489	0.05 level
11	0.614	Not Significant
12	0.569	Not Significant
13	2.714	Not Significant
14	1.407	Not Significant
15	0.157	Not Significant
16	4.811	Not Significant
17	0.162	Not Significant
18	5.777	Not Significant
19	4.305	Not Significant
20	7.484	0.05 level

4.5.5 Interpretation

Out of twenty statements the computed value of χ^2 has been found significant on five statements, out of which one (statement no.6) on 0.01 level, whereas, four (statements 3,9,10 & 20) on 0.05 levels. Therefore, the null hypothesis is rejected against five statements. This reveals that there is significant difference between the Environmental Sensitivity of the Experimental Group and Control Group. Further it is evident

through the distribution of frequencies that the Experimental Group has higher Environmental Sensitivity than Control Group.

Against, the remaining fifteen statements the χ^2 value has not been found to be significant neither at 0.01 level nor at 0.05 level. So, the null hypothesis is not rejected against all these fifteen statements. So, there is no significant difference between the Environmental Sensitivity of the Experimental Group and Control Group. However, the frequency distribution against both Experimental Group and Control Group reveals that there has been found high level of Environmental Sensitivity in both the groups.

4.6 DEVELOPMENT OF LIFE SKILLS

Life skills are abilities for adaptive and positive behaviour that enable individuals to deal effectively with the demands and challenges of everyday life. Life skill management for students is the need of today's world. Education of Life Skills makes a person "a balanced adult" who contributes meaningfully to society. These skills are applied in various aspects of life, human relationships, learning about rights & responsibilities and in health issues. It empowers students to take positive actions to protect themselves and to promote health and positive social relationships. The United Nations' associate organization, the UNICEF also requires that quality education must include life skills – based education, and has thus been made a critical element in their definition of quality education. The important life skills identified by WHO are;

- Decision making
- Problem solving
- Creative thinking
- Critical thinking
- Effective communication
- Interpersonal relationship skills
- Self-awareness
- Empathy
- Coping with emotions
- Coping with stress

The Researcher has tried to take care of this aspect in developing the Wholistic Science Education Program.

4.6.1 Objective

To study the effectiveness of WSEP in developing life-skills among students

4.6.2 Hypothesis

There will be no significant difference between the life skill enhancement of the Experimental and Control group.

4.6.3 Data Collection

The researcher has implemented the WSEP. After treatment the wholistic development tool (WDT) was administered and particularly for the mentioned objective Life skill Inventory was employed on both the groups to collect the data.

4.6.4 Data Analysis

To measure the effectiveness of employed tool, i.e., Life Skill Inventory, the chi-square (χ^2) analysis was done. The Researcher computed the percentage scores and frequencies against various points of scale with respect to both the groups. The analysis of the same is presented below;

Situation – 1

Suppose one of your friends does not have computer at home and he wishes to complete his project. For that he requires your help as you are having your own computer. But at the same time you also have to work for your own project and your friend asks for the help that he wants to use your computer for a few hours. What will you do?

- Both of you will mutually adjust the schedule as per the need.
- You will say no to him because your work is left out.
- You will advise him to use other resources like cyber café.
- You spare your computer for none.

Table – 4.49 : Analysis of situation – 1 of Life Skill Inventory.

Group	4	3	2	1	χ^2	df	Levels of significance
Experimental	36	1	0	0	0.0178	3	0.01 df = 11.341
Control	40	0	1	0			0.05 df = 7.815

The computed value of χ^2 0.0178 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 3 degrees of freedom. So, the null hypothesis that there will be no significant difference between the life skill enhancement of the

experimental and control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly in life skill enhancement for this particular statement, yet both the groups have been found to have high level of life skill development.

Situation – 2

At your home your mother is using Baygon spray to kill the insects. As you know it creates the air pollution but at the same time it is necessary for her to use the spray to keep the house healthy. What will you do?

- You will keep yourself out of the home for that particular time to avoid hazard created due to the spray.
- Suggest her to use natural cleaners like Neem leaves and turmeric powder.
- You will be indifferent.
- Assign that work to house keeper for your family safety

Table – 4.50 : Analysis of situation – 2 of Life Skill Inventory.

Group	4	3	2	1	χ^2	df	Levels of significance
Experimental	31	3	0	3	0.0636	3	0.01 df = 11.341
Control	34	5	0	2			0.05 df = 7.815

The computed value of χ^2 0.0636 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 3 degrees of freedom. So, the null hypothesis that there will be no significant difference between the life skill enhancement of the experimental and control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly in life skill enhancement for this particular statement, yet both the groups have been found to have high level of life skill development.

Situation – 3

We are using different types of soaps and shampoos for cleaning purpose. All these products are colloidal in nature. These do not dissolve fully in water and put the aquatic life in danger. What do you think about it?

- Their lives do not have much importance for us.
- The intensity of danger created by one individual is very less as compare to large resource like industry.
- You will try your level best to use the natural cleaners or herbal products which are bio degradable.
- You will not bother about it.

Table – 4.51 : Analysis of situation – 3 of Life Skill Inventory.

Group	4	3	2	1	χ^2	df	Levels of significance
Experimental	34	2	1	0	3.6980	3	0.01 df = 11.341
Control	32	2	1	5			0.05 df = 7.815

The computed value of χ^2 3.6980 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 3 degrees of freedom. So, the null hypothesis that there will be no significant difference between the life skill enhancement of the experimental and control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly in life skill enhancement for this particular statement, yet both the groups have been found to have high level of life skill development.

Situation – 4

You have been given one free period of 30 minutes to do the work of your own choice other than academics. What will you do in the given time slot?

- You will write some article or poem.

- You will chitchat with peers.
- You will sit idle.
- You will play indoor game with your friend

Table – 4.52 : Analysis of situation – 4 of Life Skill Inventory.

Group	4	3	2	1	χ^2	df	Levels of significance
Experimental	9 (24.324%)	26 (70.270%)	1 (2.703%)	0 (0.00)	13.480	3	0.01 df = 11.341
Control	25 (37.567%)	9 (24.324%)	7 (18.919%)	0 (0.00)			0.05 df = 7.815

The computed value of χ^2 13.480 is higher than the table value of χ^2 11.341 at 0.01 level and table χ^2 value 7.815 at 0.05 levels against 3 degrees of freedom. So null hypothesis is rejected at both the levels. It reveals that both the groups differ significantly in enhancement of life skill for this particular statement.

Situation – 5

Some undesirable accident happens in your family which disturbs you. After one week you are having examination and not in a position to prepare for the exam. What will you do?

- You will not take exam and drop.
- You will make up your mind to take exam, independently.
- You will seek support from peers for preparing for the exam.
- You will remain in a conflict whether to take exam or not.

Table – 4.53 : Analysis of situation – 5 of Life Skill Inventory.

Group	4	3	2	1	χ^2	df	Levels of significance
Experimental	25	8	3	1	1.454	3	0.01 df = 11.341
Control	30	5	5	1			0.05 df = 7.815

The computed value of $\chi^2 1.454$ is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 3 degrees of freedom. So, the null hypothesis that there will be no significant difference between the life skill enhancement of the experimental and control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly in life skill enhancement for this particular statement, yet both the groups have been found to have high level of life skill development.

Situation – 6

Suppose in your group your peers motivate you to bunk the classes and go for movie. How will you respond?

- Go to movie with friends.
- Will not go to movie.
- You will go to movie after seeking due permission from Parents and Teachers.
- You often bunk classes like that.

Table – 4.54 : Analysis of situation – 6 of Life Skill Inventory.

Group	4	3	2	1	χ^2	df	Levels of significance
Experimental	15	18	0	4	2.5839	3	0.01 df = 11.341
Control	19	20	1	0			0.05 df = 7.815

The computed value of $\chi^2 2.5839$ is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 3 degrees of freedom. So, the null hypothesis that there will be no significant difference between the life skill enhancement of the experimental and control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly in life skill enhancement for this particular statement, yet both the groups have been found to have high level of life skill development.

Situation – 7

Your friend could not attend classes for two weeks due to illness. He has started coming to the class from this week only. He requests you to help him in covering up the loss of studies, and also to share your class notes. Half yearly exams are scheduled next week. What will you do?

- You will refuse bluntly.
- You agree to share only class notes.
- Agree to share class notes, as well as, note books.
- Agree to share class notes, note books and also devote time to solve his difficulties.

Table – 4.55 : Analysis of situation – 7 of Life Skill Inventory.

Group	4	3	2	1	χ^2	df	Levels of significance
Experimental	29	1	5	2	4.3762	3	0.01 df = 11.341
Control	29	8	3	0			0.05 df = 7.815

The computed value of χ^2 4.3762 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 3 degrees of freedom. So, the null hypothesis that there will be no significant difference between the life skill enhancement of the experimental and control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly in life skill enhancement for this particular statement, yet both the groups have been found to have high level of life skill development.

Situation – 8

You come to know through your friends, that a competition for model talent hunt is being organized in your city. The group will select a few students for modeling assignments. Fees for participation is Rs. 15000/-. You have aspiration to become

model. Your parents agreed to provide money for the event, if you agree to leave your sports and tuition classes. What will be your reaction?

- You will agree to bear the study loss.
- You will first check the authenticity of the group.
- Argue with the parents that you want to participate in talent hunt along with sports and tuition classes.
- You will not attend this kind of competition.

Table – 4.56 : Analysis of situation – 8 of Life Skill Inventory.

Group	4	3	2	1	χ^2	df	Levels of significance
Experimental	13	2	9	13	0.800	3	0.01 df = 11.341
Control	13	1	12	11			0.05 df = 7.815

The computed value of χ^2 0.800 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 3 degrees of freedom. So, the null hypothesis that there will be no significant difference between the life skill enhancement of the experimental and control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly in life skill enhancement for this particular statement, yet both the groups have been found to have high level of life skill development.

Situation – 9

Suppose you are a member of a group which is very united, cooperative and performing well academically, too. Through some incidence you realized that the group is being divided into two sub-groups. You face a kind of tug of war between them. You get disturbed and it affects your academic activities. How will you react to this situation?

- You will support either of the subgroups.

- You will leave both the groups.
- You will communicate to both sub-groups and take appropriate decision.
- You will behave neutrally.

Table – 4.57 : Analysis of situation – 9 of Life Skill Inventory.

Group	4	3	2	1	χ^2	df	Levels of significance
Experimental	23	9	4	1	3.3623	3	0.01 df = 11.341
Control	17	19	3	0			0.05 df = 7.815

The computed value of χ^2 3.3623 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 3 degrees of freedom. So, the null hypothesis that there will be no significant difference between the life skill enhancement of the experimental and control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly in life skill enhancement for this particular statement, yet both the groups have been found to have high level of life skill development.

Situation – 10

You are having a wedding party of one of your family relatives in a near by city. You along with your parents and one family of your relative are going to attend the function. Which mode of transport will you choose?

- Public transport.
- Your personal car.
- You will decide not to go.
- Hire a big vehicle for both the families to go.

Table – 4.58 : Analysis of situation – 10 of Life Skill Inventory.

Group	4	3	2	1	χ^2	df	Levels of significance
Experimental	13	7	12	5	4.9184	3	0.01 df = 11.341
Control	10	9	20	0			0.05 df = 7.815

The computed value of χ^2 4.9184 is lesser than the table value at both the levels, i.e., 0.05 and 0.01 level against 3 degrees of freedom. So, the null hypothesis that there will be no significant difference between the life skill enhancement of the experimental and control group is not rejected. However, the distribution of frequencies against various points of the scale with respect to both the Experimental group and Control group reveals that both the groups do not differ significantly in life skill enhancement for this particular statement, yet both the groups have been found to have high level of life skill development.

Cumulative table

Table – 4.59 : Cumulative table of χ^2 analysis of Life Skill Inventory.

Situation No.	χ^2 Value	Level of Significance
1	0.0178	Not Significant
2	0.0636	Not Significant
3	3.6980	Not Significant
4	13.480	0.01 level
5	1.454	Not Significant
6	2.584	Not Significant
7	4.376	Not Significant
8	0.800	Not Significant
9	3.362	Not Significant
10	4.918	Not Significant

4.6.5 Interpretation

Out of ten statements the computed value of χ^2 has been found significant against one statement, (statement no.4) at 0.01 level. Therefore, the null hypothesis is rejected against this statement. This reveals that there is significant difference between the Enhancement of life skill of the Experimental Group and Control Group. Further it is evident through the distribution of frequencies that the Experimental Group has higher level of enhancement in life skill than Control Group.

Against, the remaining nine statements the χ^2 value has not been found to be significant neither at 0.01 level nor at 0.05 level against 3 degrees of freedom. So, the null hypothesis is not rejected against all these nine statements. Therefore, no significant difference was observed between the Experimental group and the Control group for enhancement in life skill. Also the life skill development in both the groups has been found to be at higher level.

4.7 SPIRITUAL DEVELOPMENT

Spirituality can refer to an ultimate or an alleged immaterial reality; an inner path enabling a person to discover the essence of his/her being; or the “deepest values and meanings by which people live.” The definition of spirituality is that which relates to or affects the human spirit or soul as opposed to material or physical things.” The harmony between words, action and deeds is spiritual essence. The values of life like, Truth – the ultimate truth, Dharma – the universal brotherhood, Shanthi – the inner peace, Prema – the eternal love, and Ahimsa – the non-violence, i.e., not to harm anybody by word, action, and sight. Through the noble action attainment of self realization or supreme knowledge.

The researcher has tried to input the spiritual inputs in students through wholistic approach specifically through the content matter which is prescribed in the text book. Therefore, in the age of modernization students should understand the real essence of their existence. If it has been done through the regular studies specifically with science subject the evil characteristics like destroying can be reduced to the desirable extent. The researcher has developed spirituality test to collect the data for the mentioned objective. The qualitative analysis of which is described below.

4.7.1 Objective

To study the effectiveness of WSEP in terms of spiritual development of students.

4.7.2 Data Collection

The researcher has implemented the WSEP. After treatment the wholistic development tool (WDT) was administered and particularly for the mentioned objective Spirituality Test was employed on both the groups to collect the data.

9.4 Data Analysis

The collected data for this particular tool were analyzed qualitatively using content analysis. The analysis is presented in the form of given consolidation of responses of the students followed by inference based on spiritual sense.

Q-1 There is a problem due to mosquitoes at home. What will you do and why?

- a) Use all-out
- b) Use Kachua chhap repeller
- c) Use electric bat
- d) Keep the home and environment clean

Responses of the Experimental group

In response to this particular question, a majority of the students, i.e., 62.16% had chosen option (d), i.e., Keep the home and environment clean. Majority of them have given the reason that by maintaining the cleanliness in environment the number (60.86%) of mosquitoes will be reduced which also helps to reduce pollution because the use of any repeller creates the pollution. It will also not create any harm to human health and prevention is always better than cure and suggested to use mosquito net as a better option. A few students (13.04%) have responded that killing any living organism is considered as sin. So it is better to be away from such type of sin by keeping the clean environment.

Some students (26.47%) have chosen the option (C), i.e., Use electric bat. The reasons given are; it is not creating pollution, not dangerous to health, it is easy to use and fun to play with it. Even it can be used as per one's own conveniences.

Very few students (5.88%) have chosen option (b), i.e., Use Kachua Chhap Repeller, being cheaper in cost.

Responses of the Control group

A majority of the students (77.5%) have chosen the option to keep the home and environment clean. The reasons given for this choice were; many of the students (74.19%) don't like the mosquitoes because they cause the diseases, such as, malaria, typhoid affecting the human health. A few of them (6.45%) have responded that the other repellents do not work out effectively. These all are the temporary solutions and mosquitoes come again and again. Therefore, keeping the environment clean is a better option and also an individual's responsibility. A few students (6.45%) were of the opinion that killing mosquitoes is a wrong action. Some of the students (20.00%) have chosen the option (C), i.e., To use electric bat. They felt that it is very easy to

operate, convenient to transfer from one place to another, save time and affordable. They responded that it kills mosquitoes which guards human health.

Only one student (1%) had chosen the option (A), i.e., To use All-out. He believed that it is good for mosquitoes as well as human beings.

Inference

The universe is made up of five basic elements, i.e., Earth, Sky, Water, Fire and Air. The entities, living or non living is a part and partial of the elements. Each entity has its own significance. Therefore, it is the responsibility of human beings to maintain the glory of these five elements and universe at large. Killing mosquitoes appears to be a small common action but this is against one's own virtue. Even, harming the environment is also a dangerous for survival and existence. The researcher has tried to nurture the virtue of compassion and balance in nature through this topic. The response patterns(Experimental 13.04% and Control 6.45%) revealed that the experimental group was found to be more inclined towards this endeavour than the control group.

Q-2 Do you like to be hard like solids, fluid like liquids and free like gases?

Yes / No Substantiate your answer.

Responses of the Experimental group

In response to this question, i.e., Do you like to be hard like solid, fluid like liquid and free like gases? Yes / No, Many students (62.85%) responded that depends on situation. To be comfortable in life one has to take different forms, like, solid, liquid and gas, hard like solid to face the situation, fluid like liquid which is in between state, that is, flexibility in behavior helps in better adjustment and free like gas to enjoy their freedom, would like to be open minded and take their own decision.

A few of them (8.57%) would like to be tough because of the advancement in world and the profiles of the present generation, so that, one can fight for survival.

Very few of them (2.85%) have responded that it is not possible for human being who are full of emotions to be solid, liquid or gas.

Responses of the Control group

In response to the question, i.e., Do you like to be hard like solid, fluid like liquid and free like gases? Yes / No, many students (72.22%) have responded 'Yes'. Some of them (34.61%) would like to be hard like solid to enemies. Also, hard means to them is to be bold, to face the situations in life. A few students (11.5%) have given the reason that, according to them fluidity means adjustment in any situation and also forgiveness. Very few of them (3.85%) would like to be fluid with soft spoken people.

Some students (27.78%) have responded 'No' to this question. The reason put forward was that there is disadvantage in all the three states. If a person is hard like solid will not be able to move. A few students (10%) responded that they can't be hard because the heart is full of emotions and politeness. Some of them (30%) said fluidity, i.e., freedom should be there but with restriction and proper control, even the fluid ones will be over ruled by someone else, one will not follow his/her own way but will be directed by someone else. A few of them (10%) would also not like to be free like gases because after some time they are bound to lose their own existence and merge with others.

A few students (30%) would like to be free like gases because of freedom.

Inference

Hardness and softness are the beauty of life to realize the self. And for that the freedom is an indispensable part. Freedom, not the worldly but freedom from all bondages, pain and pleasure of life. This is the key aspect to attain the self actualization or supreme knowledge, the highest aim of life. To attain this one must pass through different phases and situations of life. One has to be hard to certain things and situations in life like, removal of attachments and bondages of life or adhering to the truth. Therefore, the hardness like solids is required for an individual. Even fluidity like liquid is also needed to move on the path of self realization and also to direct others for the same. This requires many types of adjustments in life. Liquids, especially, water has the quality to dissolve many things in it. Therefore, it is called a universal solvent in the chemical language. This precious quality has to be picked up from this wonder liquid because of the quality of dissolving and at the same time remaining neutral. Gases, the important aspect of life, have the

characteristic of freedom of movement. Freedom even from existence and merging with ultimate power. All these three characteristics, i.e., hard like solid, fluid like liquid and free like gases lead an individual to the highest aim of life.

In this attempt the researcher found the experimental group (62.85%) more sensitive than the control group (11.5%). The responses of both the experimental and control groups converge to that a person can take different forms in life as per situation for harmonious living.

Q – 3 Force and Friction Co-exist. Both are necessary for life and living. Reflect.

Responses of the Experimental group

Reflecting on giving statement that, Force and Friction are necessary for life and living and both co-exist a majority of the students (48.28%) reflected that both are necessary in daily life. For taking part in any competition one has to apply force but hurdles come in between like friction. To overcome these is the goal of life.

Many of them have responded (41.37%) that force is change in a state and friction opposes that change, for example, movement of the body, running vehicle, doing work and launching rocket.

Responses of the Control group

A majority of the students (84.62%) have responded that force and friction are necessary to carry out daily work, to move our body and to keep hold to stand on the surface of earth, for walking, writing and driving. In addition to that it is necessary to control the movement of different things.

One student (3.84%) has responded that both are inter-related and two sides of the same coin.

Inference

The responses of both the Experimental and Control groups converge to that force & friction both goes together in life.

Q – 4 Solute, Solvent and Solution are inter-related. Why?**Responses of the Experimental group**

All the students agreed to the statement that the solute, solvent and solution are inter-related. A majority of the students (79.17%) responded that a solute is dissolved in solvent in a required proportion and the resultant mixture is called solution. Therefore, they are inter-related, like, salty water and sugar water.

Responses of the Control group

All the students agreed to the statement that the solute, solvent and solution are inter-related. A majority of the students (89.47%) responded that the solute is dissolved in solvent in a required proportion and the resultant mixture is called solution. Therefore, they are inter-related. Some of them have given the examples, like, salt water and sugar water.

Inference

This question is also related to overcome problems in life. This is also related to the interrelation of the existing world. It is very much essential to become solute, solvent and solution at the required point of time. Becoming a solute requires the quality of merging with others. It is not easy to practice. It requires the ability to compromise and sometimes sacrifice, the highest level of compromise. Becoming solvent is another prime quality to be considered. The main function of solvent is to dissolve the solute. To dissolve the things in one's own self is not that easy to do. Even if an individual wants to dissolve one's own anger, it becomes difficult. When it comes to dissolving other's good or bad quality and compromising with one's own ego is always difficult. Solution always comes as a resultant. Its nature, i.e., positive or negative depends on the quality of solute and solvent. If the characteristics of solute and solvent are matching then the solution automatically comes in a positive direction. Therefore, these three are always inter-related.

Making students aware about the beauty of this interrelation, the researcher tried to convey the message with the help of course content. The researcher found that the awareness of the potent inter relation could be significantly developed. The students could experience that water is an ideal neutral solvent.

Q – 5 What is the role of nature in providing Energy, Force, Work, Power and Existence? Discuss.

Responses of the Experimental group

Reflecting to this particular question majority of the students (92.00%) were of the opinion that nature is very important for human existence. It provides energy in different forms like solar energy, wind energy etc., provides forces like gravitational force, and also provides food to different living organisms. It provides power to do work and power of existence.

Responses of the Control group

In response to this question majority of the students were of view that nature is a mother which provides various types of sources of energy like, solar, wind and water. Many of them (77.78%) have also responded that energy is converted into different forms which give force, which is necessary to do work, which generates power and due to that the human existence is possible.

Some students (22.22%) have responded that nature contains good amount of vegetation which human beings are using as food in the form of natural food, i.e., vegetable and fruits which gives energy to sustain.

A few students (11.11%) had given the definition of energy, i.e., capacity to do work and power as work done per unit time.

Inference

Nature is a pure form of almighty to be experienced. One must appreciate the nature as it provides everything without which existence is impossible. Nature is considered as mother of the world. It has been worshiped from the ancient time by all. Till today the same tradition is being followed. Due to some imbalance like, effect of modernization, industrialization and globalization, the nature is being disturbed. The rate of imbalance is becoming faster in present time. This is the time to realize that the purest form should be pure as it was earlier to experience the pure lap of mother. In this attempt the researcher found that the students of both the groups were sensible but students of experimental group has been found more sensitive than the control group

because majority of the students (92.00%) were in a position to understand the concept and reflected in a positive manner.

Q – 6 Why hydrocarbons are found in various forms, such as, Methane, Ethane, Propane, Butane?

Responses of the Experimental group

Responding to this question a majority of the students (60.00%) responded that they are necessary for human survival; they play an important role due to different uses in life. God has created them to established balance in nature. Even they are necessary for different inventions and development.

A few of them (26.67%) have responded that it is possible because these are made up of C and H and catenation property of Carbon of gaining and losing electrons.

Responses of the Control group

A majority of the students (40.74%) have responded that these hydrocarbons are the compounds of hydrogen and carbon. Some of them (18.51%) had given the reason that they are found to be different due to the difference in their structure. Some of them (18.51%) have written that difference is due to different chemical formula and different number of atoms.

A few of them (7.40%) have responded that carbon contains four valences. It has different properties like catenation and isomerism.

One of the students (3.70%) gave the answer that difference is found due to the distribution in saturated and unsaturated hydrocarbons. One of the students (3.70%) has written that it is due to reaction between the oxides of carbon and hydrogen.

Inference

Variety or diversity is the beauty of the universe. The supreme power has created large number of variety and in each and everything. These all diverse form of material and non-material things are unique in nature yet necessary for the world to function. Each and every creation has its own role to be performed. Therefore, unity in diversity is essential feature. Unity not only means to get united with people, but unity in thought, action and deeds. This type of unity requires purity of heart, purity of

thoughts and universal brotherhood. These all requirements come when a person practices all right virtues and follow one's own conscience; respecting others, accepting others and loving others need proper practices. When the talk has started with unity and accepting uniqueness and differences of everybody, sometimes it may happen that all the diversified entities are not so easy to accept. This especially when the difference of opinion comes between two heads, it may create problem or hatred at some point of time. An individual has to come above all such things and welcome the variety in all forms.

The given statement indicates the importance of unity in diversity and to overcome the danger of fear and ego. The students were significantly sensitized towards this reality by the investigator.

Q – 7 Why does a fruit from a tree when ripe falls to the ground at a particular moment?

- a) **Due to Earth's gravitational pull.**
- b) **Due to less holding power of the tree when the fruit is ripe.**
- c) **Due to wind swing.**
- d) **All the factors, such as above.**

Substantiate your response.

Responses of the Experimental groups

Fruit from a tree when ripe falls down on ground at particular moment, in response to this question a majority of the students (76.67%) have chosen the alternative (a), i.e., due to earth's gravitational force. Many of them (73.33%) have not given reason for their choice. Some of them (66.67%) have written that it is due to gravitational force. One of them (6.67%) has written when the fruit is ripe then the holding power becomes less and the gravitational attraction becomes greater.

One student (6.67%) responded that not only the gravitational force but wind is also responsible. Some of them (10.00%) have chosen option (b), i.e., due to less holding power of a tree when fruit is ripe. The reason given was that when the fruit becomes ripe then the weight becomes less.

Very few students (13.33%) have chosen option (d), i.e. all the above but not substantiated by any reason.

Responses of the Control group

Fruit from a tree when ripe falls down on ground at a particular moment, in response to this question majority of the students (76.92%) have chosen the alternative (a), i.e., due to earth's gravitational force. Some of them (23.33%) have opined that two bodies attract each other due to the effect of gravitational force. One of the students (3.33%) has written that earth is an imaginary magnet which attracts the things towards it. Some of them (6.66%) have responded that as the fruit becomes ripe the juice and weight is increases so the holding capacity of a tree decreases.

Some of the students (35.89%) had chosen the option (d), i.e., All factors such as gravitational force, holding power of a tree and wind swing are responsible for the falling down of a fruit from a tree. Many of them (64.28%) have not given any reason for the particular choice.

A few of them (10.25%) have chosen an option (b), i.e., less holding power of a tree.

Inference

Fruit is considered as expected result of actions. The human nature is bound with expectations. Expectation from each and everything in surroundings and expectation from all relations. When some action has been performed, the result is expected. There is a need to do cluster analysis. The WSEP tried to sensitize the students to the multiple causes of an effect.

Q – 8 Why do we people worship Sun? Reflect.

Responses of the Experimental group

Why do we people worship sun? A majority of students (94.12%) responded that, Sun is very much useful for human life because it gives light and vitamin - D, very valuable source of energy as blessings, important for the process of photosynthesis, which is the basis of food chain, important for human existence and removal of darkness. Therefore, it is considered as God.

One of the students (5.88%) responded that it has been considered as God since olden days and that message is passed from generation to generation.

Responses of the Control group

A majority of the students (71.43%) reflected that, sun is very useful for human existence and survival. It gives energy, light, vitamin – D and plays an important role in the process of photosynthesis and therefore in food chain. Along with this they have also opined that plants can only grow due to sun. A few students (2.86%) also responded that it is very much useful to maintain physical and mental health. Worshiping the sun increases the concentration. Good number of students (40.00%) reflected that according to Hindu mythology sun is considered as God. So they are worshipping the sun.

One of the students (2.86%) believes that by worshipping sun most of the problems are solved. One of the students (2.86%) responded that Sun has many utilities, but basically it is a source of light, due to which invention of light would have been possible. Another student responded that Sun is the centre of solar system.

One of the student (2.86%) reflected that according to science sun is a fire ball and worshipping means giving respect, people give respect to sun due to its utility.

Inference

The sun, central part of solar system and the main source of energy, provides a good force of attraction to planets in the solar system to move in an orbital path. It also provides the energy which can be converted in many forms and the work gets done. The humanity at large is very well aware of its utility. Since ancient time it has been worshiped as God. Being worshiped means to communicate the attitude of service, submission, reverence and sacrifice. This type of respect is only possible when one must understand the importance of each and every creation. The sun is also a creation of almighty, the supreme source of energy. Due to this supreme energy the living entities can survive on this earth. Like the planets moving around the sun, all living beings are working on a spiritual centre call PARAMA TATVA- ATMA. The sun is considered to be a spiritual source due to its noble characteristics of giving and not accepting anything from anybody still continuously doing its own selfless service of providing light and energy, without which the living existence becomes impossible.

The researcher has tried to sensitize the students to this supreme quality of the sun and lead one's own life in this direction. It is evident through the responses of the experimental group (94.12%) that human life becomes useless without light and energy. The WSEP could sensitize the students to the power of Sun as analogous to the power of Soul.

Q – 9 How light affects the bio-sphere? Discuss.

Responses of the Experimental group

Light affect the bio-sphere, responding to this question, all the respondent students (100%) have answered that bio-sphere is having different layers, i.e., hydrosphere, atmosphere and lithosphere into which light travels faster than the sound. Organisms are also surviving in these layers. So, without light life is not possible, because it is the major source of food. Without light only darkness will be there. Therefore, light affects the bio-sphere.

Responses of the Control group

In response to the question, i.e., How light affects the bio-sphere, majority of the students (73.68%) have responded that light is important for the process of photosynthesis, helps plants to prepare their food and grow. So the food chain is functioning. Due to light the energy can be obtained. Therefore, it is important for human existence. One of the students (5.26%) responded that bio-sphere consists of land, air and water. Light falls on land and water through the medium of air. So it affects the bio-sphere.

A few students (15.79%) responded that light contains UV rays which are responsible for ozone depletion, the intensity of which is higher in summer. So the atmospheric heat increases.

Inference

Spirituality has very significant relation with light. As light signifies the supreme power/energy which is moving this whole earth, planet and universe. In spirituality this light is seen as the essence of Divinity in every human being and he/she can actually see it within if they have received the technique to go within which is the Jnana or self-knowledge. This has been talked extensively in the ancient scriptures

texts specially the Upanishads, the Bhagwath Geetha, the Bible, the Quran, etc. Light has the same significance in spirituality that the sun has in sustenance of life on this earth. Without the spiritual light the darkness of ignorance can never be dispelled, and once the darkness of ignorance is removed through light of self realization, it would lead to eternal bliss and liberation.

The WSEP could sensitize the students to the significance of Sun light in the biosphere as divine light.

Q – 10 Why there is necessity of basic elements to form compound? Discuss.

Responses of the Experimental group

Very few students (5.41%) have answered to this question, that elements are the basic units of compound. The answer was, two or more elements joint with each other and form a compound.

Responses of the Control group

Very few students responded to this question. There is a necessity of basic elements to form compound, in response to the statement, majority of the student (72.73%) opines that one element can't form a compound. Compound is a combination of two or more elements joined to each other by different reactions and different types of bonds, like, covalent bond. For example H₂O. Human beings are also made up of different elements like blood, bone and fluid. Due to which the human existence is possible. Some students responded that each and every thing requires stability. So smaller units form compound to be stable in nature.

A few students (9.09%) responded that, there are five basic elements – Earth, Fire, Air, Water and Space. These all form the Universe. Even human body is made up of these five basic elements. Ancient saint Kanada tried to divide all the material into these five basic elements but in modern times scientists have classified them into physical and chemical elements.

Inference

All human entities can be represented as a compound. Basic elements are same but all human beings are different in several aspects, like, nature, appearance and representation. Different types of people exist in this world. Yet the essence is same.

The basic unit of all diverse compounds is always elements. Similarly the basic unit of all human being is same.

Q – 11 Coal is the mother of beauty. Discuss.

Responses of the Experimental group

In response to this particular question that Coal is a mother of beauty, many students (44.44%) answered that coal is a fossil fuel of plants and animals. It takes longer period of time to form the coal after the burning under the earth crust and it is very much useful for human existence, for example, fuel. It is also called black gold, because gold also required burning under the earth crust. Therefore, it is a mother of beauty.

Many of the respondent students (55.56%) were not agreeing to this particular statement. They have the distinct view regarding the utility of coal that coal is very much useful in our life, but it has no use for any beautification purpose. So it is not the mother of beauty.

Responses of the Control group

Coal is the mother of beauty. Most of students (91.30%) believed the utility of coal in various things. The explanation was given in different manner that it is a useful product to prepare diamond. Diamond is considered as a symbol of beauty; therefore, coal is the mother of beauty. It is useful in thermal power stations, steam engine and in train as fuel. Due to coal the transportation has become faster. It is also useful because its destructive distillation gives useful products like coal-tar, coal-gas, coke and ammonia. Even it is useful in the preparation of water-gas and metallurgy process.

Inference

All the living entities contain carbon as an important element in their body. Even the decomposition of living body releases carbon. A carbon component forms the basis of all known life on earth and the purest form of carbon is natural coal. Coal is a useful gift to mankind from nature. The preparatory procedure of coal under earth crust teaches many important qualities to be cultivated in life. The high temperature, high pressure and time of the procedure are year longer, which teaches a quality values like

patience, tolerance and balance to an individual to progress on their spiritual path. Similarly, if a person has to blossom the inner purity and utility he/she has to undergo different types of pain and pressure with tolerance. This path will lead an individual towards the ultimate aim through selfless services to humanity.

The researcher has tried to convey this fact to the students through the developed program. The researcher found the experimental group to have more understanding than the control group. It can be seen in the responses of the experimental group about the preparation of coal and turning it into a black gold (44.44%). This type of responses were not been observed in the Control group.

Q – 12 The place of all entities, such as, animals, plants and microbes is justified. Discuss.

Responses of the Experimental group

Few students (8.10%) have responded to this question. The given reflections are, earth is only planet where life exists. Only on earth the animals and plants live comfortably, the food chain is also exists and due to that they depends on each other.

Responses of the Control group

Very less students (21.43%) answered this question. The place of all entities, such as, animals, plants and microbes is justified, in response to this particular statement all the students those who have answered believe that, the place of all entities is justified. Many of them (33.33%) have responded that all creatures in nature have their own place and these places are fixed.

Some of the students (22.22%) believe that all these entities get suitable environment in forest. So they like to live in forest. One of the students (11.11%) believes that plants prepare food, animals are eating it and after their death their bodies are decomposed by the microbes. So their place is justified.

Inference

The discussion here again begins with the importance of all existing beings. Each and every body is dependent on each other for their existence. Therefore, harming a part of any chain or cycle for one's own means is considered as sin. Nobody should do

such type of sin during the life. Moreover, they should promote harmonious existence and avoid the disturbance in nature's law.

The researcher found that very few students from both the groups attempted this question. The experimental students have responded in favour by giving responses like earth is the only planet where the life exists and balance of food chain is seen, which should not be disturbed.

Q – 13 Why water is found in four different states, namely, ice, water, vapour and plasma, i.e., H^+ and OH^- ions? Discuss.

Responses of the Experimental group

Very few students (5.41%) have answered to this question. The given reason was, water, i.e., liquid state is the basic state and all other states change from this state at different temperature.

Responses of the Control group

Water is found in four different states. In response to this question, majority of the students (79.17%) responded that due to atmospheric changes, i.e., rise and fall in temperature water is having different states. In line to this one of the students (4.17%) responded that water is the main constituent liquid of human body and has a tendency to remain in a liquid state but due to atmospheric changes it change its states.

Inference

Water is very symbolic for many, often containing deeper spiritual meaning(s). Biblically, water most often represents the Holy Spirit in various forms of water. The river, a fountain, waves, drinking water, vessels of water, watering the seed, baptism, rain, stream, ocean, channel, flood, flow, storm, and cleansing rituals. Each type of water holds a **goal** that He intended us to achieve through the power of the Holy Spirit and accessing these "waters". Here the goal is to give us abundant life and many blessings to help us obtain personal power to live our lives better and to minister others' lives. The goal is to cleanse us of bad habits, old ways, addictions and various other evils the scriptures talk about. Following are the spiritual importance of water;

Water: Gives and sustains of life

Water: Nature's mirror for that which lies within us.

Water: Washes us and cleanses us and purifies us.

Water: Reminds us that we are neither separate from God nor separate from one another.

Water: Brings movement and change

Water: Herald of crisis. The time for healing is now

Water: Represents the emotions & awakens us to our essential nature

The ultimate state Plasma represents the highest form of energy, the supreme energy.

The researcher has tried to explain this awakening fact to the students.

Q – 14 Why darkness affects one’s Psyche? Discuss.

Responses of the Experimental group

Darkness affects one’s psyche, reflecting on the statement many of the students (60.00%) have responded that it is a physical phenomenon. Psyche is related with mental state of a person. Person has many difficulties in life; mind gets disturbed due to them. When darkness comes person feels disappointed and the progress stops. Therefore, person should avoid darkness and keep one’s mind fresh.

Some students (40.00%) have responded that mentally retarded people are much affected by it and it is used for the improvement of their state.

Responses of the Control group

Darkness affects one’s psyche, reflecting on this statement, some of the students (46.66%) have responded that due to darkness one can’t see and also have a fear of darkness.

Some of them (20.00%) have responded that too much darkness is harmful for health because metabolic reactions depend on light. Some students (26.67%) have given the reason that it creates tension and stress to mind. Therefore, affects the mental health. Also, it is harmful for a person suffering from psychological problems.

One student (6.66%) has responded that it is a symbol of evil. Due to darkness only the value of light can be realized.

Inference

Psyche represents consciousness of human mind. The inner consciousness of an individual always guides his action. Listening to this inner voice is important for an individual and ignorance leads to imbalance. Psyche is affected by surroundings. Darkness is one of the components of surroundings. This component comes in every person's life in the form of sad moments or occasions. This type of darkness affects the psyche. In such a situation an individual must strike a balance and find out the ray of light to progress.

The researcher has tried to make students listen to their inner conscious for right deed to avoid darkness.

4.7.3 Conclusion

The WSEP has been successful in initiating the learners to the development of their spiritual domain. Moreover, over all the experimental group was found to realize greater spiritual development than the control group.

Chapter 5

Summary and
Implications

5.1 INTRODUCTION

Education refers to the wholistic development of the human being. Education is a discipline which aims at developing the knowledge, moral values and required understanding in all walks of life. The Education Commission (1964-66) began its report with the expression “The destiny of India is being shaped in her classrooms.” This is not a rhetoric. In a world based on Science and Technology, it is the Education which determines the level of prosperity, welfare and security of the people. On the quality and number of people coming out of our schools and colleges will depend our success in the great enterprise of national reconstruction, whose principle objective is to raise the standard of living of our people. Education is a potent instrument in the development process. The education system must be powerful in itself, so that, it is helpful in solving the problems of the country by developing knowledge, skills, and attitudes.

The strength of modern economy depends on the strength of its industry and industrial development in turn depends upon Science and Technology. All progress grows out of man’s creative capabilities. Hence it has become essential to train and equip men of every level, such as, researchers, manual workers, engineers, executives, technicians, office workers. The wholeness of teaching the subject is an essential feature. As it has been said that science cannot be taught in isolation. All the branches of science are interdependent on each other and also on society and environment. There are number of facts and principles which are common to various science subjects. The education commission in UK put a strong emphasis on the social value of science, by referring not only to knowledge and understanding the scientific approach to inquiry, but also to science as a ‘social enterprise’ i.e. the social practice of community. Science also is a powerful subject to develop the environmental concern among the students.

All the development and training starts from the school level itself. Therefore the education at school level should be up to the mark. At school level the secondary education stage is holding the key position because here the science subject becomes more complicated and comprehensive. This stage is the basis for further learning. Also hands on activities, i.e., experiments are introduced at this level. So dealing with the subject here, demands dedication.

The scenario of secondary school system as the base of higher education is not satisfactory, which demands change in current practices. The subject should be taught lively with different methods, techniques and approaches, which gives proper understanding of science subject to the students and hence brings the overall development – the prime aim of education. Education is meant for all round development and by virtue of its nature wholistic. Wholistic Education in its core challenges the fragmentation of present education. It lays due emphasis to the development of all the domains, i.e., cognitive, affective, psychomotor and spiritual. Here one needs to remember Swami Vivekananda's view that Education is not that amount of information that is put into your brain and runs riot there undigested, all your life. We must have life building, man making, character making, assimilation of ideas. If you have assimilated ideas and made them your life and character, you have more education than any man who has got by heart a whole library. Education, said Albert Einstein, is that which remains when everything that is learnt in school is forgotten. If modern education system is evaluated in this regard, its chief outcomes can easily be identified as aggressive competition, pride and envy. At its best, the modern educational system imparts some professional knowledge and skills, but it lacks cultivation of affect attributes. Because the present education system is more of head oriented, the heart and hands are neglected. So, this is the high time to lay proper emphasis on the implementation of the wholistic education program. To foster a whole and healthy world, we must strive to be whole and healthy individuals, through our education programs and practices.

5.2 CONCEPT OF WHOLISTIC EDUCATION

Throughout the history a group of experts all over the world have pointed out that the education of young human beings should involve much more than simply molding them into future workers or citizens. The important aim of ancient Indian education was to make the students fit to become a useful and pious member of society (Rangachar, S. 1994). Inculcating the civic and social duties among the students was also a part of ancient Indian educational system. The Swiss humanitarian John Pestolozzi, the American transcendentalists, Upanishadic thinkers of India and many stalwarts of the progressive educational movement insisted that education should be understood as the art of cultivating the moral, emotional, physical, psychological,

artistic and spiritual, as well as, intellectual dimension of the developing child (Forbes Scott H and Robin Ann Martin, 2004). An emerging body of science, philosophy and cultural history provides an overarching concept to describe the wholistic education. Wholistic education facilitates the students to identify, meaning and purpose in life through connection to the community, to the natural world and to spiritual values such as compassion and peace. Besides, wholistic education also aims to call forth from students an intrinsic reverence for life and a passionate love of learning. Mahatma Gandhi also emphasized on all wholistic development

The ancient Indian thinkers felt that a healthy society was not possible without educated individuals. They framed educational set up carefully and wisely aiming at the harmonious development of the multiple dimension of the human personality. This is essentially a universally applicable educational framework highlighting the purpose of human life and interconnectedness at all levels of existence as a basis of human values. According to them without a deep understanding of one's relationship with nature, with ideas, with fellow human beings, society and a deep respect for all life, one is not really educated (Ramchandra Rao SK, 1992). Another unique feature of this educational system is that it aims at creating a mind that is both scientific and spiritual at the same time. One that is enquiring, precise, rational and skeptical but at the same time has sense of beauty, wonder, aesthetic, sensitivity and an awareness of the limitations of the intellect (James Moffett, 1994). It also aims at developing a mind, which is rational, flexible and not dogmatic, open to change and not irrationally attached to an opinion or belief.

Wholistic is a phrase being coined by many people or schools, as well as, being used in curriculum descriptions. It can also be found in medicine, business, ecology and many other fields. *Spiral Dynamics* (Beck and Cowan 1996) uses wholistic to describe a particular (*Holistic* is Turquoise, second tier), as well as, to describe an integrated experience that a person might have of a particular. In education it refers to education of integration, integrated curriculum and consideration of whole systems. Jack Miller's notion of Wholistic Education is that it has three key themes: balance, inclusiveness and connectedness. He recommends pedagogies which assist students in connecting self with body, nature, others and inner self. The concept of wholism refers to the idea that not all the properties of a given system in any field of study can be determined by the sum of its parts. Instead, the system as a 'whole' determines

how its parts behave. Wholistic education is concerned with the totality of life. The four different but inter-related aspects of human life can generally be recognized, viz., the physical, emotional, intellectual and spiritual. Wholistic education should cultivate all these aspects in full measure. For example, physical education should include not only the performance of physical exercises to keep body fit but, also the training to use the senses and physical framework wisely. Similarly, emotional education should emphasize the type of training of mind that develops the positive human emotions of universal love, compassion, humanity, equanimity and eradicates the baser instincts such as, greed, envy, pride and aggressiveness. In this way one can establish a healthy relationship with society. Intellectual education should require not only the development of ability to think, but also the ability to act independently, rationally and logically on the basis of a deep understanding of the various phenomena of nature. Finally, spiritual education should cultivate a refinement of mind, understanding of the very purpose of our existence and a clarity of what ought to be done to achieve it. The wholistic education includes identity of own self, inter disciplinary approach, and subject specific cognition, development of affect attributes and relation with real life like situations, co-existence and completeness. Some of the features of wholistic education are as follows;

1. Wholism is complex, it need not be fragmented, the curriculum must emphasize on interconnectedness and the focus should be on understanding of relationship rather than the study of parts. The coordination of all the domains should be well emphasized in a wholistic curriculum. There ought to be coordination between intellect, allies, skill and personal life. The wholeness will be described by an outcome of a person characterized by – Fully human, Creative expression, Growth and Responsibility.
2. The wholistic action should be examined in the context of four ‘E’s – Efficiency, Effectiveness, Ethics and Environment.
3. Philosophers, namely, Vivekananda, Aurobindo and Gandhiji have talked of wholistic education. Indian culture is denoted by wholism. Our education should sustain sensitivities to our basic culture and values.

4. Whole must be based on our own heritage, our own value system. Before thinking of wholistic concept, we must be convinced with our own value system. Wholistic education needs a vision of past, present and future.
5. There is a need to realize globalization but at the same time one need to keep sight of our local perspective.
6. There is a need of spiritualization of organizations. We need to think of moksa, salvation at early age not old age. This will lead to wholistic education.
7. There could be two possibilities of organizing curriculum, one is subject based approach and the other one is problem based approach. The wholistic education makes an effort to follow Problem based approach. The problem must be real. The PPT (Problem, Practice, Theory) should be practiced more than TPP (Theory, Practice, Problem).

In order to achieve the goal of wholistic education, the psychology of learning encompasses different domains on the part of a learner. The affective domain plays a crucial role in integrating all aspects of teaching-learning process. Robin Ann Martin (2004) describes this further by stating, at its most general level, what distinguishes wholistic education from other forms of education are its goals, its attention to experiential learning and the significance that it places on the relationship of primary human values within the learning environment. The wholistic education reflects and responds more fully than conventional education to a new and increasingly accepted view of what it means to be human. This was also visualized by Mahatma Gandhi. He believed that mere academic knowledge is not enough for Wholistic development of child and so wrote: “I am a firm believer in the principle of free and compulsory Primary Education for India. I also hold that we shall realize this only by teaching the children a useful vocation and utilizing it as a means for cultivating their mental, physical and spiritual faculties. It will check the progressive decay of our villages and lay the foundation of a jouster social order in which there is no unnatural division between the ‘haves’ and ‘have – notes’ and everybody is assured of a living wage and the rights to freedom” (Harijan, 11.9.1937).

5.3 AIMS AND IMPORTANCE OF SCIENCE EDUCATION

Science can be defined as “the process by which we increase and refine understanding of our selves and of universe through continuous observation, experimentation, applications and verification.” Science is increasingly being viewed as a subject of life-long utility to all students, whether or not they enter science related careers. In many nations, science and technology education are becoming increasingly identified as the background for economic stability and growth. In the past, only the brighter students have been encouraged to pursue science knowledge. Science has been viewed as knowledge accessible to only the few elite. Now, however, many countries are subscribing to the goal of ‘science for all’.

Science education is now major concern in almost all the developing countries. High priority has been accorded to its quantitative expansion as well as qualitative improvement. The general aim of science education is to help to develop well-defined abilities in cognitive and affective domains, besides enhancing psychomotor skills. It helps to foster an uninhibited spirit of inquiry, characterized by creative, innovative and objective approaches. Therefore, science subject has its own importance and significance through out the curriculum.

Science plays a vital role in the development of many qualities in the individual’s life. It helps him to be a good citizen in the society, a useful, productive and progressive member of the society intellectually enlightened, vocationally fit, morally sound and thus contributing to quality life. Realizing the importance of science education, the education commission in its report of education and national development denotes, “Science education must become an integral part of the school education and ultimately some study of science should become a part of all courses in the humanities and social sciences at the university level, even as the teaching of science can be enriched by the inclusion of some elements of humanity and social sciences.”

School education comes closes with the secondary stage. The aim of teaching science at this stage is primarily directed towards the learning of key concepts that span all disciplines of science. At the secondary stage, the pupil should be enabled to develop a more profound understanding of the basic nature, structure, principles, processes and methodology of science, with special reference to its relationship with agriculture,

industry, environment and contemporary technology. The teaching of science at this stage should help pupils to develop insights in health and environment. Greater emphasis needs to be placed on precision and accuracy while handling laboratory equipments and while engaged in procedures. It is aimed at developing scientific and technological skills and attitude among children. The following are some of the important aims of teaching science at secondary level:

- The learner understands the nature of science and technology.
- The learner develops problem solving and decision making skills.
- The learner inculcates the values of science and technology.
- The learner develops manipulative skills which are required in day-to-day life situations.
- To familiarize the pupils to the world in which they live and to make them understand the impact of science on society so as to enable them to adjust themselves to their environment.

To realize all these aims of teaching science, the science education must be in the form of whole and not separate one. Looking at whole began to be seen as necessary for understanding even traditional disciplines. Scientists namely, David Bohm, David Peat, Karl Pribram and Ilya Prigogine were even insisting that seeing things as a whole was better way to understand their traditionally reductionist disciplines, as well as, most other things. They said that for the sake of convenience we can look at parts, but separate parts do not actually exist. So the subject should be understood in totality i.e. wholeness for students to have the feel of it.

Thus, whether science is taught to the future scientist or to future citizens, there is a pressing need to ensure that the purpose of science education is changing, the content and its delivery are evolving and the expectations for students' achievement are rising. Today's students will be the tomorrow's citizens. They will enter a workforce that needs the talents of better educated students, capable of life-long self-directed learning and of contributing to sound decision-making for their community and their country.

5.4 PRESENT SCENARIO OF SCIENCE EDUCATION

Science is a subject which cannot be taught in separation. As it has interrelated branches, has relation with life, environment and society as well. The present day traditional or conventional methods of teaching are dominated by memorization, dictation, and verbalism and give insufficient scope for practical and productive work. These methods are devoid of correlating and integrating various subjects and experiences. The science courses should be so structured and taught so that the nature of science pervades curriculum. Science teaching should stress the different aspects, such as, science as a body of knowledge, as a method and as a way of thinking.

But unfortunately the present education is more of teacher centered and rigid. The teaching learning process does not have any link with daily life of the students. It is more of mechanical and memorization of content and reproducing it in the examination. Science, which is more of a practical subject, is mostly being taught as theory based subject in the classrooms. It is quoted that in the prevailing system the content from the teacher's note is being transferred to the students' notes without any understanding, which really needs change in the prevailing system. Umashree (1999) in her study revealed that lecture method was found in 70% of cases, lecture cum demonstration method in 10% and lecture cum activity teaching strategy only in 6% of the cases. Malhotra (2006) also found that teachers often provide lectures and students mostly observe the teacher and their participation in classroom is very less. Most of the teachers are of view that the courses of science subject are vast and so to finish the course in time, the lecture method is the better option. But the fact is that it does not provide the proper understanding of the subject to students. The theory and practical work are not properly co-related. If the theory portion is not properly clear to the students, then the basic objective behind the practical also is not clear to them. When teachers are not able to clear the theoretical concepts, the students are not aware about their practical implications. The proper grasp of the subject is not acquired and so students find the subject difficult.

One of the objectives of teaching science at secondary level is to cultivate scientific temper, scientific attitude, social, moral, ethical and aesthetic values. But in present system there is lack in satisfactory attainment of this objective. Umashree (1999) in her study founded the reason for that is, the development of all these qualities is less

feasible as specific guidelines how to achieve or develop these are not available to the teachers. She also stated the other reasons that science at secondary level is just ones among other subjects and many students may discontinue with science. Hence, there is a need to improve the status of science subject at secondary level.

5.5 NEED TO INTRODUCE WHOLISTIC APPROACH

Present practices reveal that science teaching is more of head oriented and the higher objectives are neglected. Science, the dynamic subject is taught as a static one. So it requires an immediate change in current practices. The nature of the subject demands the dynamic and progressive methods of teaching which provide suitable opportunities for learning by doing, observation, experimentation, co-operation and dignity of labour to the students. Such good methods can result from the constant observation of certain broad principles. These include orderly procedure in teaching, an arrangement of subject matter, which will avoid waste of time and energy and secure the greatest co-operation from the pupils and maintain their active interest. The wholistic approach of teaching science is appropriate to cater to the demands of present time and provides a comprehensive way of teaching the subject matter relating them with life like situations. The classroom teaching may lead to wholistic development of the child, if the following aspects can broadly be taken care of.

- Cognition of the convention, terms, examples, concepts, principles and theories

This is an era of the modernization and globalization. To cope up with such competitive world an individual must be having thorough understanding of the subject. Therefore, students must cognize the conventions, examples, concepts, principles and theories. If students are not having this cognition, they will not be in a position to apply their knowledge into the practical world.

- Establishing relation with other disciplines

The child is interested to learn the things which are related to his experience. They cannot learn the various subjects in isolation. The interrelationship makes study easier, more interesting and natural. It develops knowledge by dove-tailing with each other the bits of similarities existing in the diversity of subjects and compounds them into such a complex whole which the mind of the child is willingly ready to accept.

The principle of correlation demands that various subjects contribute to the child's education in the manner and to the extent that they help him to understand his environment better and carry out activities that have meaning for him. This relationship should be made clear to the students for their clear understanding. Hence, it becomes necessary to establish the relationship of one subject with the other subject. By doing so students are in a position to understand the relative importance of each subject.

- Development of feeling faculty through inculcation of values

For all round development of an individual, all the domains have equal importance. While imparting knowledge to the students most of the teachers emphasize on the development of cognitive domain. Even the examination patterns also support the same. Though students are getting knowledge, the development of affective domain is lacking somewhere which is indeed necessary for an individual to be a good human being. It is an important aim of education. Values play an important role to realize this aim of education. This drawback can be overcome to a large extent by introducing wholistic education, because, with the help of values only the individuals respect themselves, society and environment. Also the harmonious development of the human being can be visualized and realize.

- Development of Psychomotor Skills

This is an age of science and technology. Technology has taken an important place in man's life, because technology has entered in all walks of life. Handling technology is a challenging task which requires proper training on the part of students. Science Policy Resolution, Government of India (1958), visualized training of men in scientific and technical skills, so that; they will solve the national problems of hunger, disease, scarcity and underdevelopment. Therefore, students must be having these skills of handling the technology for their own survival. To develop such skills, development of psychomotor domain is needed. In the present education system it is not observed fully.

- Establishing Relationship with the Environment

Environmental concern is the major issue throughout the world among all the scientists, researchers, industrialists and even for a common man. With the help of science and technology, man overcomes the natural barriers. He can travel from one

part of world to other part, in a matter of a few hours, undertake journey to outer space and planets, dive down to the bottom of seas and explore the wonders there. But at the same time, the environment became more and more polluted and degraded. As a result of man made activities – deforestation, urbanization, industrialization, hazardous waste and pollution - the quality of environment suffered which has threatened the survival of man himself, as well as, other organisms on the earth. Scientists are in search of environment friendly systems to overcome these problems. Thus, there is a need to educate the children about ecology and environmental problems, as well as, protection. One of the ways to protect the environment is to generate the environmental awareness among the children.

The Stockholm conference (UN) on human environment (1972) initiated efforts to develop program of environmental education at all levels - primary, secondary and tertiary and also to motivate general public in rural and urban areas about environmental awareness. This was followed by Belgrade (1975) and Tbilisi (1977) conference of environmental education. These laid stress on developing basic concepts of quality of life plus environmental knowledge, awareness, attitude, skills and participation. To develop this concern among students teaching of subjects should be in such a way which serves the purpose. For transaction of environmental education science is one of the powerful subjects. This subject can also be helpful to establish ecological equilibrium, to learn the proper use and conservation of natural resources and also the control of environmental pollution. Therefore, teaching the content matter of science in wholistic manner is of great help to create environmental awareness, understand, interpret and put into practice the knowledge gained by students from school life itself.

- Development of Life Skills

One of the important aims of education is the harmonious progress of nation. To achieve this aim school should produce the good and responsible citizens. For that students should be equipped with proper skills which help them to develop the healthy attitude towards their lives and nation at large. Curriculum transaction may be a suitable option to develop this attitude. Life skills enable to translate knowledge and attitude which one believes and feels into action. According to WHO (1997), “Life skills are living skills or abilities for adoptive and proper behavior that enable individuals to deal effectively with demands and challenges of everyday life.” Life

skill based education empowers the students to increase their capabilities. These skills are required for individual to navigate everyday situations and help them to live a healthy and productive life. The wholistic education gives place for a teacher to develop the life skills, namely, Self-awareness, Coping with emotions, Coping with stress, Empathy, Interpersonal relationship skills, Effective communication, Creative thinking, Critical thinking, Decision-making and Problem solving into the students while teaching a particular subject.

- Development of Spiritual Domain

Spirit is the ultimate power resident within organism which controls and regulates various actions and functions of the organism. Spiritual faculty is essentially intuitive, creative, constructive and wholistic in nature as against cognitive intelligence, which by its very nature is analytical and atomistic. The spiritual abilities synthesize the experiential data, whereas, the experimental data are analyzed by the cognitive processes. Now, the question is whether the spiritual abilities and their development are measurable? The measurement of spiritual abilities is beyond the domain of psychometrics, but their estimation is possible qualitatively. The atoms constituting the organisms have their scientific configuration though having no manifest real intelligence of their own. The intelligence creating the atoms which are the embodiments of various entities – animate and inanimate is metaphysical. Similarly, the centre of location of the spirit is still unknown which controls all our actions, functions and constellations. While thinking and initiating any action we obey and disobey the inner power fully or partly. The development of spirit is a function of adherence to this inner power. The spiritual quotient (SQ) thus, may be expressed as,

$$SQ = \frac{\text{Multi – dimensional self awareness of a person}}{\text{Self awareness in totality}}$$

Self awareness in totality

The awareness / consciousness is power and therefore, in situations of life this can be translated as the degree by which we are masters of ourselves, commanding knowledge and overcoming limitations.

5.6 IMPLICATIONS OF REVIEWED LITERATURE FOR THE STUDY

All the studies reviewed above on wholistic education focusing on wholistic schools (Forbes, S. & Robin, M., 2004), whole task instructional approach (Jung Hyun, L., 2006), whole school initiative (Morris & Windhan, R., 2005), wholistic work (Robbins, Marian & D. Min, 2005), levels of wholetheme instructions (Yuejin, Xn., 2005), development of spirituality and wholeness (Osment, Timothy, A. & Min, D., 2008), development of soul-spiritual capacities and personal transformation (Kelly L. V., 2006), identification of affect attributes for whole person development (Benson, J. H., 2009), relationship between holistic scoring and written language abilities (Gay, H. R., 2009), awareness of dynamics of thought through Innate Health approach (Larimer, D. M., 2008) and Gandhi, D. A., 2011 suggested introduction of Sevenfold Sustainability in Higher Education system reveal that various wholistic approaches have their own contribution in bringing out the desirable changes. Similarly, there is a need to design, develop and implement wholistic science education program for the all round development of students.

5.7 RATIONALE

‘Why does this magnificent applied science which saves work and makes life easier bring us so little happiness. The simple answer runs: Because we have not learnt to make sensible use of it.’
- **Albert Einstein**

Science is a dynamic, expanding body of knowledge covering every new domain of experiences, which helps in preparing pupils to think and sharpen their intellect making them more careful and systematic in reasoning, as well as, providing a unique training in truth, inculcating a spirit of inquiry, developing the capacity to know the unknown. The students need to know that science is established through science courses that emphasize the connection between science, technology and society. The important thing in learning science is the capacity to analyze and classify data, to gather evidence about solution, to solve problems and to test theories. The knowledge base in science is expanding too fast to ensure that students cover all aspects of knowledge of science within the duration of school education. The alternative is to

offer students the learning experiences that allow for conceptual exploration and acquisition of skills needed for their future learning.

The general aim of science education is to help students to develop well-defined abilities in cognitive and affective domains, besides enhancing psychomotor skills. In addition, in many countries there seems to be a growing recognition that science education is important not just for scientists, but all the students who are not going to become scientists. Many problems that humanity faces today will be solved through the active involvement of a scientifically and technologically knowledgeable citizenry. Therefore, it is necessary that the students should have thorough and proper understanding of the subject. As the world has witnessed a huge scientific and technological explosion in recent decades, the students should have the ability to master and apply the science and technology into the process of modernization and development of economies. Well aware of this fact as early as the 1960's, developing countries embarked on programs to support the development of science education at secondary and higher secondary stage.

At the secondary stage the objective is to develop an understanding of the nature of scientific knowledge and its relationship to its manifestation in nature and in daily life. Also the students should be able to develop the capacity to use science to solve the problems and arrive at right decision. Students are also expected to develop the skills required to operate equipments and to design simple experiments to seek and find explanations for natural phenomena. At this stage, science education should help the students to develop an understanding and appreciation of the joint enterprise of science and technology and the interrelationships of these with other aspects of life, society and environment. Also, this is the stage where most of the students build their interest in the subject for further learning. Therefore, dealing with the subject should be such which generates and holds the interest of students in science subject. But unfortunately in the present time this wonderful subject has lost its real feel. It has become more theoretical rather than practical. It should be transacted in such a way which in turn helps students to achieve their real goal. Hence, the subject should be taught in totality or wholistically for clear understanding and its application. All the above aspects point to the fact that there is a need to integrate wholistic approach for teaching of science.

The present learners are facing many challenges of life and living in a complex set of conditions. So the educational system of 21st century must be oriented towards creating conditions that allow learners to think critically and become creative and innovative to learn freely in productive collaboration with their teachers, peers and other members of the community. The time has come to incorporate innovative mental processes and activities into learning process. But, the traditional classes have been dominated by the spoken and printed word. In India, as reported by Kurrien (2007) it is observed from a large scale study that the students perform poorly in questions testing understanding or application of knowledge to new situation and majority of students were unable to answer questions that appear to be different from what they typically encountered in their books, they could only be able to answer questions based on recall or standard procedure. It is clear that memorizing will not serve the purpose.

Dalene (2007) in her paper emphasizes on wholistic education as an alternative, more wholistic approach to conceptualizing learning as a process of coming to know through the imagination as a starting point for all students, rather than through what the student 'already knows'. Wholistic education includes identification with the self, interrelation, interdependence, rhythm, co-existence and completeness. It contributes in the development of cognitive, affective psychomotor and spiritual domains. Janet McIntyre (1997) in his paper on Consideration of categories and tools for wholistic thinking, also emphasizes on wholistic thinking. According to him 'wholistic thinking is understood as the ability to think in terms of many cybernetically interconnected variables, instead of in terms of an independent and dependent variable linearly related as cause and effect. Wholistic thinking is useful both for understanding the nature of the problem and working out negotiated solutions.' The purpose of the wholistic education is to prepare students to meet the challenges of life. The teaching of science has become atomistic, isolated and mechanistic. The product approach of science could not contribute significantly to the realization of reality. The discipline based micro specialization has resulted into fragmentation. As a result we have not been in a position to address the problems wholistically. Special and deliberate inputs are required to realize wholistic education. The scientific realism should be comprehensive enough to encompass development of all the domains – cognitive, affective, psychomotor and spiritual – through intra and inter disciplinary approaches

establishing relation with environment. So there is a need of developing wholistic science education program for harmonious development.

5.8 TITLE OF THE STUDY

Designing, Developing and Implementing a Wholistic Science Education Program at Secondary School Level

5.9 OBJECTIVES OF THE STUDY

1. To design and develop a wholistic science education program (WSEP).
2. To study the effectiveness of WSEP in terms of cognitive development of students.
3. To study the effectiveness of WSEP in terms of affective development of students.
4. To study the effectiveness of WSEP in terms of development of psychomotor skills.
5. To study the effectiveness of WSEP in establishing environmental sensitivity.
6. To study the effectiveness of WSEP in developing life-skills among students.
7. To study the effectiveness of WSEP in terms of spiritual development of students.

5.10 HYPOTHESES

1. There will be no significance difference between adjusted mean scores of the Experimental group and the Control group when the standard eight science comprehensive scores is considered as covariate on Content test.
2. There will be no significance difference between adjusted mean scores of the Experimental group and the Control group when the standard eight science comprehensive scores is considered as covariate on Activity based test.
3. There will be no significant difference between the demonstration ability of experimental group and control group.
4. There will be no significant difference in the sensitivity of control group and experimental group towards environment.
5. There will be no significant difference in the value inculcation of experimental group and control group.
6. There will be no significant difference between the life skill enhancement of the experimental and control group.

7. There will be no significant difference in the spiritual development of experimental group and control group.

5.11 METHODOLOGY OF THE STUDY

5.11.1 Population of the study

All the secondary school students of Baroda city following Gujarat Secondary and Higher Secondary Education Board (GSHSEB) syllabus constituted the population.

5.11.2 Sample of the study

- Two of the English medium schools following Gujarat Secondary and Higher Secondary Education Board (GSHSEB) syllabus were selected by convenient sampling.
 - Jay Ambe School, VIP Road, Vadodara was selected as experimental group looking into the facilities (Computer lab, AV room, and Science Laboratory) and readiness of the school to give permission to conduct the required sessions.
 - Baroda High School, Bagikhana, Pologround, Vadodara was selected as control group.
- All the students of standard IX from Jay Ambe School, VIP Road, Vadodara constituted the experimental group, whereas, that of the Baroda High School, Bagikhana, Pologround, Vadodara control group. Selection of students was done by cluster sampling.

5.11.3 Operationalization of the terms

Wholistic Science Education Programme (WSEP):

In the context of present study the WSEP refers to the teaching of science using interdisciplinary approach and establishing its relationship with environment. The program aims at development of cognitive, affective, psychomotor and spiritual domains and life skills. This program is constituted of various methods, such as, Discussion, Lecture cum Discussion, Project, Demonstration, Laboratory and Activity. Various media and modes are used as per the nature of contents.

5.11.4 Delimitation of the study

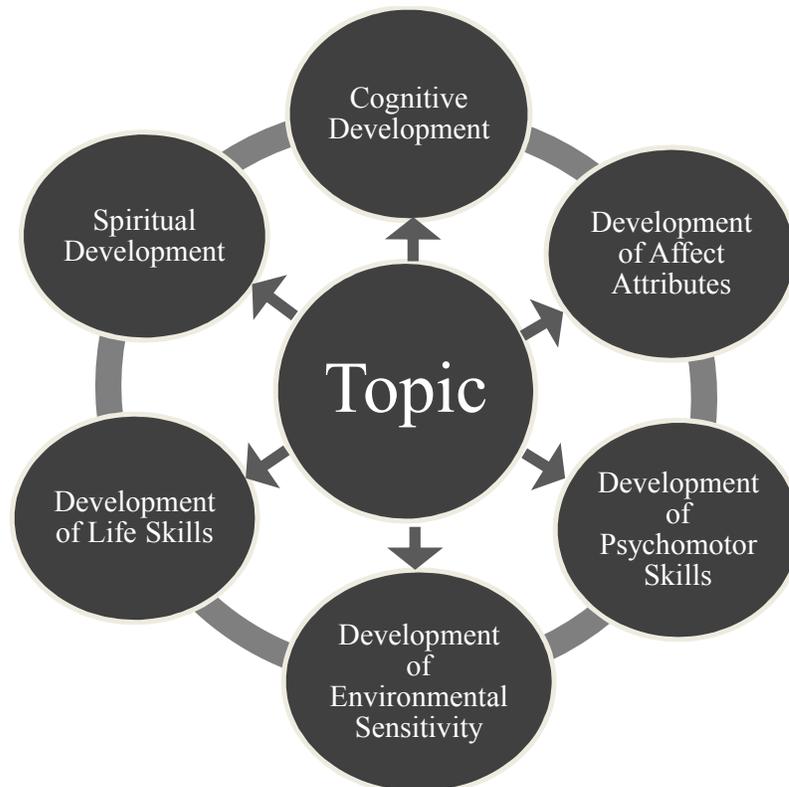
The study was delimited to the selected topics of science subject of standard IX.

5.11.5 Design of the study

The study employed both the quantitative and qualitative designs. For objectives two, three, four, five and six control group – experimental group post test design was employed, whereas, for the remaining objectives qualitative techniques, namely, content analysis was employed. It was conducted in following phases;

Phase-1 : Development of WSEP

The researcher developed the content matter for the program on the basis of the science syllabus of standard IX as follows;



Phase – 2 : Implementation of the program

The researcher implemented the WSEP over three months period.

5.12 TOOLS FOR THE STUDY

The researcher constructed the Wholistic Development Tool (WDT) (Appendix –I) collect the data. It was inclusive of the following sections:

Section-A: Achievement test

Section-B: Value Inventory

Section-C: Activity based test and demonstration observation scale to test the development of psychomotor skills

Section-D: Environment sensitivity test

Section-E: Situational test to test the development of life skills

Section-F: Spirituality test

5.13 DESIGNING OF WSEP

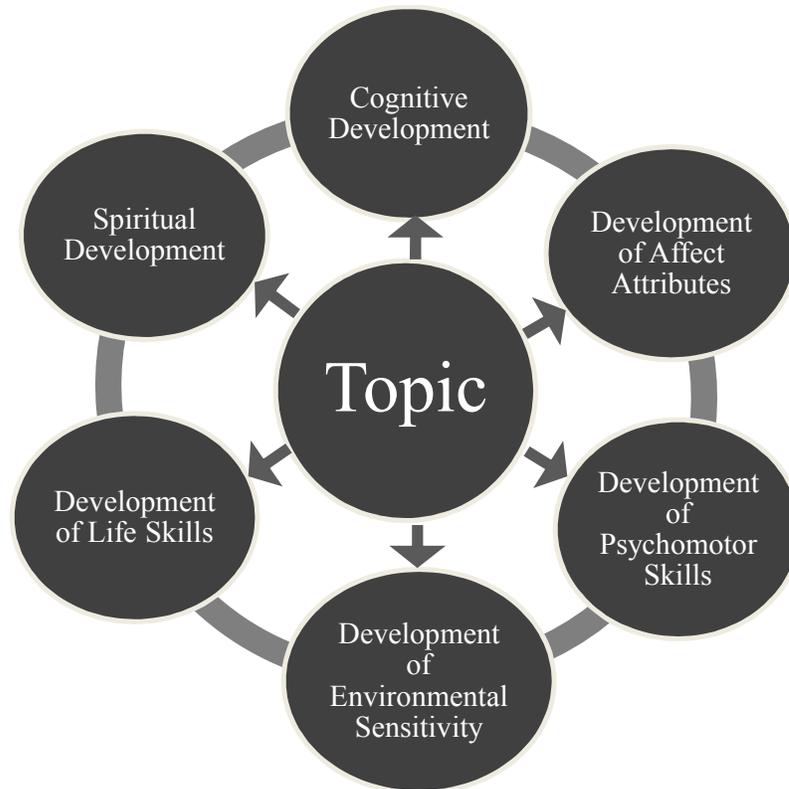
Design encompasses the layout of the plan of action. To design the WSEP the researcher tried to find the related site to review the literature on Wholistic education. The researcher then went through the science and technology syllabus of 9th standard. The syllabus was divided into three parts chemistry, physics and life sciences. Then the researcher went through the sub topics and exercises given in a particular chapter of each part. The researcher did excessive search on internet to collect the literature. The researcher also referred different reference books and CBSE syllabus text book to make the idea clear. The activities related to different topics of science subject were also referred. After having the concept clarity and an idea about the form of program the researcher selected the topics looking into the scope of Wholistic development. Looking into the nature of Wholistic education the researcher felt that the program should contain more than one mode and method of teaching – learning. The researcher made exhaustive efforts to access internet, specially two search engines, Google and Wikipedia to access the relationship between science and spirituality, environmental protection and ethics, science and value inculcation through the content, points related to life skills and practicum components related to selected topics and their practical implications. Same search was also done from books. The researcher also took the opinion of subject teachers to design the program.

5.14 DEVELOPMENT OF WSEP

To develop the program on Wholistic science education the researcher has categorically observed the subject matter of science syllabus. After lot of brain storm and thought researcher has selected 10 topics from each part of the syllabus. The selected topics are;

- Matter
- States of Matter
- Mixture
- Coal
- The Breath of Life – Air
- Water – A Wonder Liquid
- Work
- Energy
- Power
- Force

After the selection was over the researcher started developing the content matter of selected topics in the following syntax.



The scope of above mentioned areas were found out from each selected topic and the learning experiences were developed. In the development of a program the researcher has used varieties of leaching – learning modes, media and methods, like, games, puzzles, experimentation, demonstration, discussion, presentation, exercises based on spiritual inputs, informal talk, citation of incidence from the life of a person, like, Vivekananda, Gandhiji, value based stories which will help to increase concentration and sociometry to enhance collaborative and cooperative learning, sharing of articles from news paper and magazine related to various environmental issues to make the program Wholistic and interesting.

5.15 IMPLEMENTATION OF WSEP

The researcher approached five schools to implement the program. One of the approached schools gave permission to conduct the required sessions. That school has three sections of the same standard. One of them was selected as the experimental group. Then researcher approached other schools to get the permission for the control group. This school also has three sections of same standard out of which one was selected as the control group as per the convenience of the school management. The

researcher then implemented the program on the experimental group for about three months. The researcher took the regular sessions of the developed program on the experimental group.

5.16 DATA COLLECTION

Standard VIII comprehensive scores of both the selected schools were considered to find out the homogeneity in the science achievement by computing the significance of difference between two mean scores. The t-value was not found significant between the experimental group and control group. This means, both the groups were found to be parallel.

Table : 5.1 t – value for finding the significance of difference between the Mean scores of the Experimental and Control group with respect to standard VIII comprehensive scores, along with N, Mean, SD, SEM, df and Levels of significance.

Group	N	Mean	S.D.	SEM	t-value	df	Level of significance
Experimental Group	37	64.08	14.96	2.46	1.45	77	0.01 – 2.576 0.05 – 1.960
Control Group	42	59.26	14.45	2.23			

The researcher then implemented the WSEP. After treatment the wholistic development tool (WDT) was administered on both the groups to collect the data. The data collection be \presented comprehensively with respect to all the objectives. The data analysis s presented in chapter IV objective wise.

5.17 DATA ANALYSIS

The analysis procedure has been presented objective wise below in the tabular form.

Table – 5.2 : Objective – wise analysis of Wholistic Development Tool

Objective No.	Theme	Tool Employed	Analysis Technique
2	Content Test of students of both the groups on Content test.	Content test	ANCOVA
3	Value inculcation of both the groups	Value Inventory	Chi-square
4	a) Achievement of students of both the groups on Activity based test b) Observation of students of both the groups to assess the demonstration ability	a) Activity based test b) Demonstration Observation Scale	a) ANCOVA b) Chi-square
5	Effectiveness of environment sensitivity test of both the groups	Environment Sensitivity Test	Chi-square
6	Development of life skills in both the groups	Life skill Inventory	Chi-square
7	Spiritual development of students of both the groups	Spirituality Test	Content Analysis

5.18 FINDINGS

1. The adjusted mean score of the Experimental group on Content test was found to be significantly greater than that of the Control group when standard VIII comprehensive scores were considered as covariate. Hence, the WSEP has resulted into significant cognitive development.
2. The analysis of the data with respect to the development of Affect attributes reveals that against 75% of the statements (15 out of 20) there is no significant difference in the status of both the Experimental and the Control group on Affect attributes. Further, it is evident through the frequencies distribution that the development of the Affect attributes of both the groups has been found to be on the higher side. Against 25% of the statements (5 out of 20) there has been found to be significant difference in the status on Affect attributes of

both the Experimental and Control groups. Again the frequencies distribution reveals that in both the cases positive polarity has been found. Though, in a large majority of the statements no significant difference has been found in the status of the Experimental and the Control group on the Affect attributes, yet both the groups have been found to be on the higher side on the Affect attributes.

3. The adjusted mean score of the Experimental group on Activity Based test found to be significantly greater than that of the Control group when standard VIII comprehensive scores were considered as covariate. Hence, the WSEP has resulted into significant psychomotor development. The experimental group has been found to have better demonstration skills than the control group.
4. The analysis of the data with respect to environmental sensitivity reveals that the experimental group was found to be significantly greater than that of control group against 25% of the statements (5 out of 20), whereas, no significant difference was found in the environmental sensitivity of experimental group and control group against the remaining 75% of the statements (15 out of 20). Again the frequencies distribution reveals that in both the cases positive polarity has been found. Though, in a large majority of the statements no significant difference has been found in the status of the Experimental and the Control group on the Environment sensitivity, yet both the groups have been found to be on the higher side on the Environment sensitivity.
5. The analysis of the data with respect to the development of Life skills reveals that against 90% of the situations (9 out of 10) there is no significant difference in the status of both the Experimental and the Control group on life skill development. Further, it is evident through the frequencies distribution that the development of the life skills of the groups has been found to be on the higher side. Against 10% of the situations (1 out of 10) there has been found to be significant difference in the status on life skill development of both the Experimental and Control groups. Again the frequencies distribution reveals that in both the cases positive polarity has been found. Though, in a large majority of the statements no significant difference has been found in the status of the Experimental and the Control group on the development of life

skill, yet both the groups have been found to be on the higher side on the life skill development.

6. The analysis of data with respect to the spiritual awareness reveals that the experimental group was found to have significantly greater spiritual development than the control group.
7. Overall the WSEP have been found to achieve greater tendency towards Wholistic Development of the Experimental group than the Control group.

5.19 DISCUSSION

Wholistic development refers to the development of all the four domains of human personality, i.e., cognitive, affective, psychomotor and spiritual. Development of all the domains with human qualities requires conscious and continuous efforts. These efforts have to be made from early life. Childhood is the best time to sow the seeds of human development. The Wholistic Science Education Program is designed keeping in mind the overall development of students emphasized by ancient seers, educationalist and thinkers. In the present study the researcher has designed, developed and implemented the WSEP for secondary school section. After the implementation phase the data were collected by employing Wholistic Development Tool. The analysis and findings of the same are discussed below.

It is evident through the above findings that the WSEP has been found to be effective in realization of cognitive, psychomotor and spiritual development. The obtained results of cognitive domain show the enhancement in the understanding level of the Experimental group students. Students were in a position to answer the questions beyond the prescribed text book content. The obtained results of Activity Based test and Demonstration Observation Schedule of both the groups clearly indicates the understanding and application ability, as well as, performance ability of the Experimental group students. The questions in the Activity Based test were framed considering two factors; i) content knowledge and ii) application in daily life. It is evident through the scores obtained by the experimental group students that there has been development of the psychomotor domain. Similarly, the Spiritual development of the Experimental group is also evident.

It has also been evident through the findings that the significant difference in terms of the development of affect attributes, environmental sensitivity and life skill, both the groups are found to be parallel in majority of the statements like, 80% in case of value inculcation, 75% in case of environmental sensitivity and 90% in case of life skill development. However, the effectiveness of WSEP is being observed in some of the statements in development of these three dimensions i.e. 20% in inculcation of value, 25% in development of environmental sensitivity and 10% in life skill development. The effect of extraneous variables like family background, the efficiency of a regular science teacher, exposure of students to the dimensions like value education, life skill material, environmental awareness, exposure of students to different media, like, news paper, magazines, TV, internet, work of NGOs or social organizations can be the probable causes for the non significance difference between both the groups.

The findings of the reviewed literature, i.e., five studies indicated the effectiveness in terms of cognitive development, matching with the findings of the present study; three studies clearly indicated the development of spirituality, again matching with the findings of the present study, one study talked about modification in ethical behaviour, one study for moral and social behaviour while one study has identified the dimensions of affective domain under wholisitc development. No study has covered more than three dimensions under the investigation. From the reviewed literature it can also be seen that majority of studies focused on measurement of one or maximum three dimensions under the investigation while the other positive impact, like, judgemental ability, expression of their interpretation, feelings, social and moral development is discussed in the concluding remarks. Similarly in the present study some of the positive responses in each and every dimension covered under the study indicate the Wholistic development to certain extent and realization of all these dimensions requires a reasonably longer period of time. One of the similar kind of reviewed study conducted by Frobes, S. and Robin, M. (2004) also supports the same.

Thus, the findings of present study indicates the effectiveness of developed Wholistic Science Education Program.

5.20 IMPLICATIONS OF THE PRESENT STUDY

1. Wholistic Science Education approach could be made an integral part of teacher education program.
2. In – service teacher training program needs to be organized on orienting the in-service teachers on WSEP.
3. Level specific open source ware could be developed on WESP.
4. Text books can be designed on the pattern of WSEP.
5. Modules could be developed on WSEP.

5.21 SUGGESTIONS FOR FURTHER RESEARCH

- The same study can be conducted using Case study method.
- The same study can be conducted using qualitative method.
- A longitudinal study can be conducted to check the Wholistic development.
- The same approach can be utilized at primary section of school system.
- The same approach can be utilized at higher education system.
- The same approach can be utilized for all subjects.
- The Wholistic development can be attempted with the tie up of corporate sector for working professionals.
- A study can be conducted to enhance teaching methodology of the teachers at different levels using Wholistic approach.

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Appendices

Appendix I

Date:

Place: Vadodara

Dear Friends,

I Ms. Shilpa D. Parekh, pursuing my doctoral degree research in Education, at CASE, Faculty of Education and Psychology, The Maharaja Sayajirao University of Baroda, Vadodara. My research topic is “Designing, Developing and Implementing a Wholistic Science Education Program at Secondary School Level”.

Read each statement / situation thoroughly and record your responses. Put a “√” mark on one of the choices given on the right side of each item wherever applicable. Repeat the same procedure for the rest of the statements / situations. You are expected to supplement with descriptive views / answers wherever required.

Your valuable responses will be kept confidential. The data will be utilized for research purpose only.

Thanking You,

Ms. Shilpa D. Parekh

Section 1

Content Test

School Name:

Name :

Roll No.:

Date :

Time : 40 min

Marks: 30

Select the correct alternative from the given options.

8

- 1) If the magnitude of the force acting on a body is doubled then what would be the change in acceleration?

a) Gets halved	c) Remains same
b) Doubles	d) Becomes four times
- 2) The force per unit area acting perpendicular to a surface is known as?

a) Friction	c) Pressure
b) Reaction	d) Momentum
- 3) A diver is able to cut through water in a swimming pool. Which property of matter does this observation show?

a) Force of attraction	c) Inter-particle distance
b) Compressibility	d) Diffusion
- 4) A gas exerts pressure on the walls of the container due to
 - a) Random motion of particles.
 - b) The force of attraction between the particles.
 - c) Volume decreased due to compressibility.
 - d) Loosely packed particles.
- 5) The state of matter which is used as source of energy is?

a) Solid	b) Gas	c) Liquid	d) Plasma
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- 6) Where do we find the diffusion property of liquid and gas in our surrounding?

a) Dissolved oxygen in water	c) Dissolved NaCl in water
b) Moisture in air	d) Oil in water
- 7) Which one of the following is heterogeneous mixture?

a) Soda water	b) Vinegar	c) Dust free air	d) Soil
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- 8) What is the major reason for difference in properties of solution, colloidal and suspension?

a) Density	b) Different particle size	c) Tyndall effect	d) Solubility
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- 9) The proportion of water in the air depends on which of the following physical concept?

a) Density	d) Pressure	c) Temperature	d) Kinetic energy
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- 10) Which of the following process is responsible to get energy from glucose molecule in human body?

a) Combustion	b) Cell respiration	c) Cleavage	d) Hydrolysis
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- 11) Which one of the following is acting as a nucleus in the process of cloud formation?
 a) Moisture b) Condensation c) Evaporation d) Dust particles
- 12) Which one of the following is not water harvesting technique?
 a) Dug – out b) Percolation pit c) Terrace – roof tank d) Water-table
- 13) The nature of metabolic reaction is?
 a) Physical b) Chemical c) Neutral d) Both (a) and (b)
- 14) What happens to the potential energy of a spring when it is compressed or stretched?
 a) Increases b) Decreases c) Does not change d) None of the above
- 15) A body is moving with velocity V and after some time it comes to halt. By measuring work done in this period we can calculate?
 a) Potential energy b) Motion c) Kinetic energy d) Velocity
- 16) Man-made source of air-pollution is
 a) Forest fire b) Dust storm c) Pollens d) Burning of fossil fuels

Write agree or disagree with respect to following statements.

4

1. Power is defined as work done per unit area.

2. Earth surface is taken as reference to decide the value of potential energy.

3. Work is a product and not a process.

4. In nature single force may exist.

5. Frictional force offered by an extra smooth surface is zero.

6. The general formula of alkynes is $C_n H_{2n+2}$.

7. A body with relative density less than 1 floats in water.

8. Carbon is not the only element having the catenation characteristic.

Answer the following questions.

1. What do you understand by navigation in the context of role of water in human body?
2. You have to help your gardener to decorate the garden of your home. Which type of plants and trees will you choose? Why?
3. What type of energy conversation is taking place in case of overflow of water from dam?
4. Differentiate fractional distillation from destructive distillation.
5. How Indian economy is dependent on the import business of petroleum?
6. In what things are we using organic compounds?
7. How the concept of pressure is related with concept of movement of air?
8. How saline water is related with water pollution?
9. How phenomenon of capillary action is related to ground water?

Section 2
Value Inventory

Situations	Agree	Disagree
Science funfair is organized by the school. We have to help school management in to the arrangements of the function in decided groups. This type of working will be joyful for us.		
One of the boys has come in our class from the other school from this academic year. Teacher has made us to sit with him in the class to make him comfortable. We will like to do that.		
Due to the difference of opinions in classroom arguments a dispute has begun amongst two students of our class. It is very unpleasant. We will like to resolve the dispute and revive healthy classroom climate.		
A group discussion was carried out on choice based credit system in the school. The group arrangement was decided by the teacher. Being a member one has to be open to the ideas of others.		
Summer camp has been organized for children of our age group. We are participating in the camp. The selected location is very remote and the facilities there are negligible as compared to our routine life. It is difficult to bear with those facilities. In spite of all this there is meaningful learning. So we are all enthusiastic and ready to fit into that particular set up and enjoy the exposure.		
We are performing drama on the theme 'United India'. For that we have to learn the culture of different types of people and we are going to meet such people in their real settings. We would like to become one amongst them to learn about their lives.		
After conducting an interview of different people; we come to know different types of nature of people and different types of thoughts about each other. We know that the heterogeneity exists in people around us. We can filter out the meaningful ideas. We can differentiate good and bad, fact and opinion.		
Science Olympiad has been announced by our Principal. Our group has decided to take part in that. The competition will be held after 2 months and we have started preparation to get success. We got one free period. Some friends of our class have decided to play football during that period instead of preparing for the Olympiad. Still, we would like to prepare for the Science Olympiad during that period.		
Blood donation camp has to be organized in our school on coming Sunday. The choices have been given to us to select our group partners. Some students are unnecessarily doing the show off. We will like work for blood donation camp.		
Within school timings our group has to complete three different tasks, namely, morning assembly, presentation on motivational theme in inaugural session of annual day function and folk dance. In spite of difficulties we will complete all the three tasks.		
Nowadays our nation is coming at par with the developed nations. Due to technological revolution the globe has become a small village. We know that directly or indirectly, we are also a part of the development. For that we have to develop the feeling of oneness amongst us.		
Personality development seminar has been organized in school. We have to undergo rigorous training. The nature of the training is quite		

demanding. It is left to us whether we would like to join or not. But our group has decided to join that training.		
The painting competition has been organized in a school. We have to prepare our own paintings using common materials, like, paint colors, brush, pencil and eraser. The time period is very short. Still, we love to share the things and enjoy the competition.		
We are asked to bring prepared food from home and collect it at school. In the afternoon session we have to go to nearby slum area with our teacher for distribution. The area is very dirty and unhygienic. It is very difficult to enter and deal with those people. It is a voluntary activity. But we will prefer to do that service.		
During the exam time the tension increased. One of our classmates could not prepare due to his personal problems. Still two days are there to prepare. It is a hard time now. But we are ready to make his work easier by discussing the concepts.		
One of our classmates met with an accident due to which he is not able to write with right hand. As he is righty he has to practice hard to write with left hand. He is not in a position to complete the assignments due to the decreased speed. He is very much disturbed. We are trying our level best to make him adjust with the present situation.		
We are asked to conduct a survey on use of mobile phone by school going children in our surrounding area. It has nothing to do with our academics but we know that it will be helpful to make the children aware about the disadvantage of mobile phone at certain age. We are willing to do that work.		
Now it's a time to elect the class monitors. Three boys and four girls are trying their candidature. One of the boys is from our own group but he is over proud. We have decided that we will vote for those two candidates who are capable and normal.		
We have been given two exercises. <ol style="list-style-type: none"> 1. Go and play on playground and 2. Clean the school garden. We have decided to go and play.		
We have been given an assignment to get the data of children who are deprived of education due to several reasons. For this principal has declared two days holiday we would like to collect data in the given time span, as much as we can.		

Section 3

Performance Test

Marks: 10

Time: 25 min.

DEMONSTRATE THE GIVEN EXPERIMENT AND ANSWER THE QUESTIONS MENTIONED BELOW

Experiment: Particles of matter have space between them.

Requirement: Common Salt, Glass rod and Beaker.

Questions :

1. What do you think has happened to the salt?
2. Does the level of water change? Why?
3. Draw the diagram of the performed experiment.
4. Where do you find this exercise happening in your daily life?
5. Which conclusion can be drawn from the given experiment?

Marks: 10

Time: 25 min.

DEMONSTRATE THE GIVEN EXPERIMENT AND ANSWER THE QUESTIONS MENTIONED BELOW

Experiment: Particles of matter are of very small size.

Requirement: KMnO_4 crystals, water and test tubes.

Questions :

1. Does the colour of water remain pink throughout?
2. Can particles of KMnO_4 be seen by naked eyes?
3. Draw the diagram of the performed experiment.
4. Where do you find this exercise happening in your daily life?
5. Which conclusion can be drawn from the given experiment?

Marks: 10

Time: 25 min.

DEMONSTRATE THE GIVEN EXPERIMENT AND ANSWER THE QUESTIONS MENTIONED BELOW

Experiment: Illustrate the concept of heterogeneous mixture using the given material.

Requirement: KMnO_4 crystals, NaCl powder, water and beakers.

Questions :

1. Write your observation on the uniformity in colour of the obtained mixture.
2. Write your observation on the uniformity in texture of the obtained mixture.
3. Draw the diagram of the performed experiment.
4. Give the example of heterogeneous mixture from your daily life.
5. Which conclusion can be drawn from the given experiment?

Marks: 10

Time: 25 min.

DEMONSTRATE THE GIVEN EXPERIMENT AND ANSWER THE QUESTIONS MENTIONED BELOW

Experiment: Illustrate the difference between true solution and suspension mixture.

Requirement: CuSO_4 powder, wheat flour, water, beakers and torch.

Questions :

1. Are the particles in the following mixture visible?
 - a) True solution
 - b) Suspension mixture

2. Is the Tyndall effect observed in both the mixtures?

3. Is the mixture stable or do the particles begin to settle after some time in both the mixtures?

4. Differentiate between True solution and Suspension mixture on the basis of the observation recorded above.

5. Give one example of true solution and suspension mixture each from daily life.

Marks: 10

Time: 25 min.

DEMONSTRATE THE GIVEN EXPERIMENT AND ANSWER THE QUESTIONS MENTIONED BELOW

Experiment: Illustrate the difference between true solution and colloidal solution.

Requirement: CuSO_4 powder, milk, water, beakers and torch.

Questions :

1. Are the particles in the following mixtures visible?
 - a) True solution
 - b) Colloidal solution

2. Is the Tyndall effect observed in both the mixtures?

3. Is the mixture stable or do the particles begin to settle after some time in both the mixtures?

4. Differentiate between True solution and Colloidal solution on the basis of the observation recorded above.

5. Give one example of true solution and colloidal solution, each from daily life.

Marks: 10

Time: 25 min.

DEMONSTRATE THE GIVEN EXPERIMENT AND ANSWER THE QUESTIONS MENTIONED BELOW

Experiment: Illustrate the difference between Suspension mixture and Colloidal solution.

Requirement: Wheat flour, milk, water, beakers and torch.

Questions :

1. Are the particles in the following mixtures visible?
 - a) Suspension mixture
 - b) Colloidal solution

2. Is the Tyndall effect observed in both the mixtures?

3. Is the mixture stable or do the particles begin to settle after some time in both the mixture?

4. Differentiate between Suspension mixture and Colloidal solution on the basis of the observation recorded above.

5. Give the example of suspension mixture and colloidal solution, each from daily life.

Marks: 10

Time: 25 min.

DEMONSTRATE THE GIVEN EXPERIMENT AND ANSWER THE QUESTIONS MENTIONED BELOW

Experiment: Demonstrate the effects of external force on the state of body.

Requirement: Rubber ball, wooden block and table.

Questions :

1. What happens when ball is pressed by the palm?
2. If a ball is pushed after keeping it on table then what happens?
3. If a ball is pushed again little bit with greater force then what will happen?
4. What will happen if an obstacle comes in between the path of ball?
5. Which types of effects of external force can be observed by performing the experiment?
6. Where do you experience this exercise happening in your daily life?

Marks: 10

Time: 25 min.

DEMONSTRATE THE GIVEN EXPERIMENT AND ANSWER THE QUESTIONS MENTIONED BELOW

Experiment: Demonstrate the effect of more than one force acts on a body.

Requirement: Wooden block, string and table.

Questions :

1. When the force is applied from left side, i.e., A string, What will be the effect of resultant force?
2. When the force is applied from right side, i.e., B string, What will be the effect of resultant force?
3. What will happen if forces of equal magnitude are from both the sides?
4. Differentiate between Balanced force and Unbalanced force on the basis of the above recorded observation.
5. Where do you observe these types of forces in your daily life?

Demonstration observation scale

Name : _____ Roll No.: _____

	Excellent (5)	Good (4)	Average (3)	Poor (2)	Very poor (1)
Way of presentation					
Apparatus handling skills					
Demonstration dedication					
Validity of observation					
Response relevance and level					
Concepts attained / formed					
Sensibility to relate life like situations					
Recapitulation					
Demonstration Efficiency					
Steps Syntax					

Section 4
Environmental Sensitivity Test

Sr. No.	Statements	Agree	Can't say	Disagree
1.	The domestic sewage wastes are to be discharged into the water body.			
2.	The industrial wastes are not dangerous for the growth of aquatic life.			
3.	We have to use desirable amount of soap and shampoo to keep our body clean.			
4.	The excessive amount of fertilizer is useful for the growth of plants.			
5.	Leakage of petroleum oil on the surface of water body has no relation with aquatic life.			
6.	Construction of bridge on the river does not affect the quality of water.			
7.	The useful micro organisms in the water body are killed due to industrial waste.			
8.	The wash out of fertilizers leads to the mushroom growth of algae into the water body which is not dangerous.			
9.	The available water is polluted due to excessive use of fertilizer.			
10.	The suspended particles of solid wastes generate adverse effect in the drinking water.			
11.	The chemical should be bio degradable or soluble to lower down its effect in water.			
12.	It is desirable to keep vehicles and fire place or stoves well maintained.			
13.	Choose not to smoke.			
14.	It is better to use synthetic cleaners instead of natural cleaners.			
15.	Environment friendly products are costly. So it is better not to use them.			
16.	We can avoid using perfumes to keep our home atmosphere clean.			
17.	It is preferable to use CNG vehicle in place of petrol vehicle.			
18.	If it is a long queue to park the car at decided destination, it is better to park it a little away then waiting in a queue.			
19.	Dust particles are necessary in the air to a certain extent.			
20.	Amount of CO ₂ gas cannot be reduced by population control.			

Section 5**Life Skills Inventory**

- 1) Suppose one of your friends does not have computer at home and he wishes to complete his project. For that he requires your help as you are having your own computer. But at the same time you also have to work for your own project and your friend asks for the help that he wants to use your computer for a few hours. What will you do?
 - Both of you will mutually adjust the schedule as per the need.
 - You will say no to him because your work is left out.
 - You will advise him to use other resources like cyber café.
 - You spare your computer for none.
- 2) At your home your mother is using Baygon spray to kill the insects. As you know it creates the air pollution but at the same time it is necessary for her to use the spray to keep the house healthy. What will you do?
 - You will keep yourself out of the home for that particular time to avoid hazard created due to the spray.
 - Suggest her to use natural cleaners like Neem leaves and turmeric powder.
 - You will be indifferent.
 - Assign that work to house keeper for your family safety
- 3) We are using different types of soaps and shampoos for cleaning purpose. All these products are colloidal in nature. These do not dissolve fully in water and put the aquatic life in danger. What do you think about it?
 - Their lives do not have much importance for us.
 - The intensity of danger created by one individual is very less as compare to large resource like industry.
 - You will try your level best to use the natural cleaners or herbal products which are bio degradable.
 - You will not bother about it.
- 4) You have been given one free period of 30 minutes to do the work of your own choice other than academics. What will you do in the given time slot?
 - You will write some article or poem.
 - You will chitchat with peers.
 - You will sit idle.
 - You will play indoor game with your friend
- 5) Some undesirable accident happens in your family which disturbs you. After one week you are having examination and not in a position to prepare for the exam. What will you do?
 - You will not take exam and drop.
 - You will make up your mind to take exam, independently.
 - You will seek support from peers for preparing for the exam.
 - You will remain in a conflict whether to take exam or not.

- 6) Suppose in your group your peers motivate you to bunk the classes and go for movie. How will you respond?
 - Go to movie with friends.
 - Will not go to movie.
 - You will go to movie after seeking due permission from Parents and Teachers.
 - You often bunk classes like that.
- 7) Your friend could not attend classes for two weeks due to illness. He has started coming to the class from this week only. He requests you to help him in covering up the loss of studies, and also to share your class notes. Half yearly exams are scheduled next week. What will you do?
 - You will refuse bluntly.
 - You agree to share only class notes.
 - Agree to share class notes, as well as, note books.
 - Agree to share class notes, note books and also devote time to solve his difficulties.
- 8) You come to know through your friends, that a competition for model talent hunt is being organized in your city. The group will select a few students for modeling assignments. Fees for participation is Rs. 15000/-. You have aspiration to become model. Your parents agreed to provide money for the event, if you agree to leave your sports and tuition classes. What will be your reaction?
 - You will agree to bear the study loss.
 - You will first check the authenticity of the group.
 - Argue with the parents that you want to participate in talent hunt along with sports and tuition classes.
 - You will not attend this kind of competition.
- 9) Suppose you are a member of a group which is very united, cooperative and performing well academically, too. Through some incidence you realized that the group is being divided into two sub-groups. You face a kind of tug of war between them. You get disturbed and it affects your academic activities. How will you react to this situation?
 - You will support either of the subgroups.
 - You will leave both the groups.
 - You will communicate to both sub-groups and take appropriate decision.
 - You will behave neutrally.
- 10) You are having a wedding party of one of your family relatives in a near by city. You along with your parents and one family of your relative are going to attend the function. Which mode of transport will you choose?
 - Public transport.
 - Your personal car.
 - You will decide not to go.
 - Hire a big vehicle for both the families to go.

Section 6**Spirituality Test**

- 1) There is a problem due to mosquitoes at home. What will you do and Why?
 - a) Use all-out.
 - b) Use Kachua Chhap repeller.
 - c) Use electric bat.
 - d) Keep the home and environment clean.

- 2) Do you like to be hard like solids, fluid like liquids and free like gases?
Yes / No Substantiate your answer.

- 3) Force and Friction Co-exist. Both are necessary for life and living. Reflect.

- 4) Solute, Solvent and Solution are inter-related. Why?

- 5) What is the role of nature in providing Energy, Force, Work, Power and Existence? Discuss.

- 6) Why hydrocarbons are found in various forms, such as, Methane, Ethane, Propane, Butane?

- 7) Why does a fruit from a tree when ripe falls to the ground at a particular moment?
 - a) Due to Earth's gravitational pull.
 - b) Due to less holding power of the tree when the fruit is ripe.
 - c) Due to wing swing.
 - d) All the factors, such as above.
Substantiate your response.

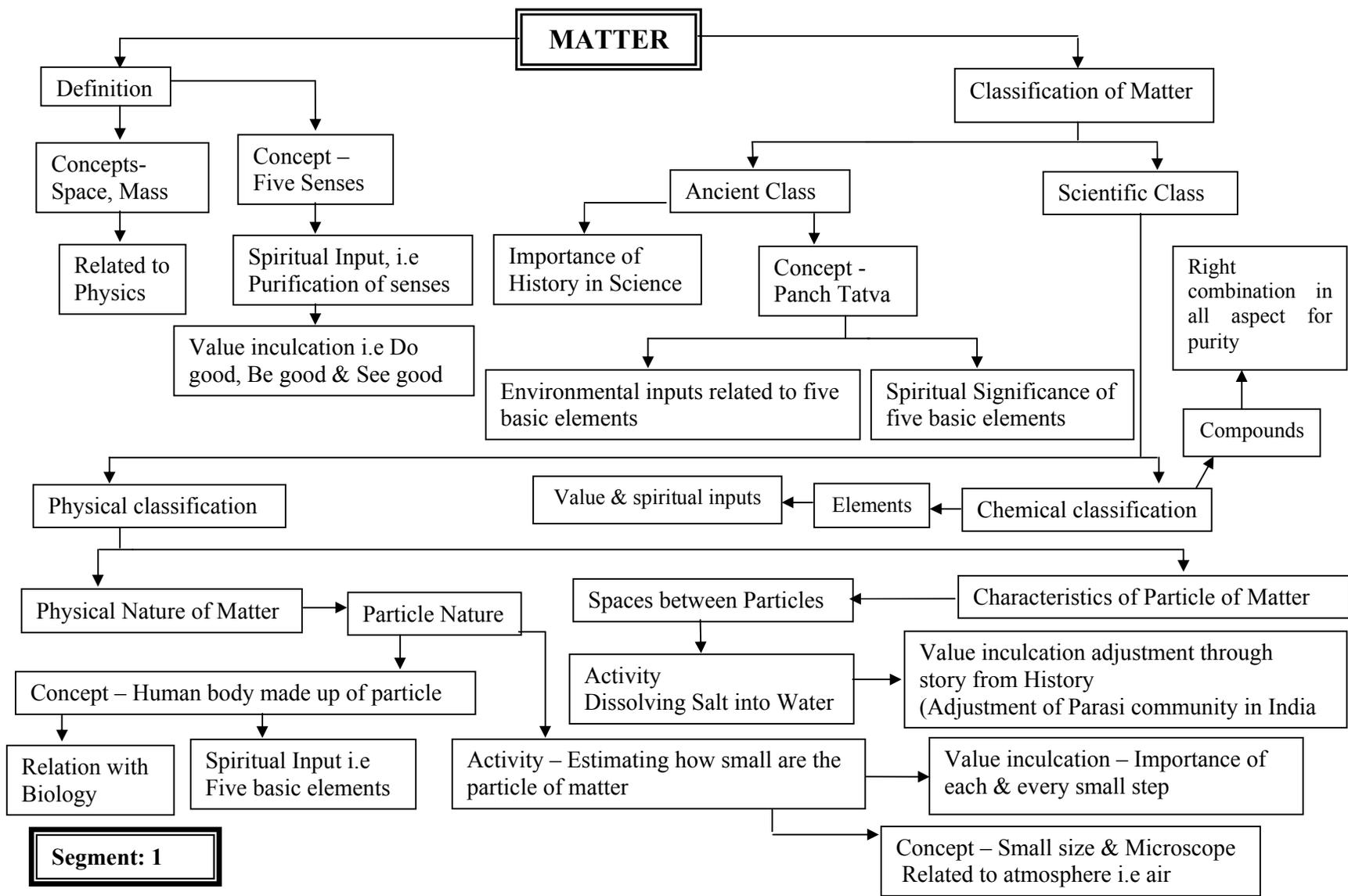
- 8) Why do we people worship Sun? Reflect.

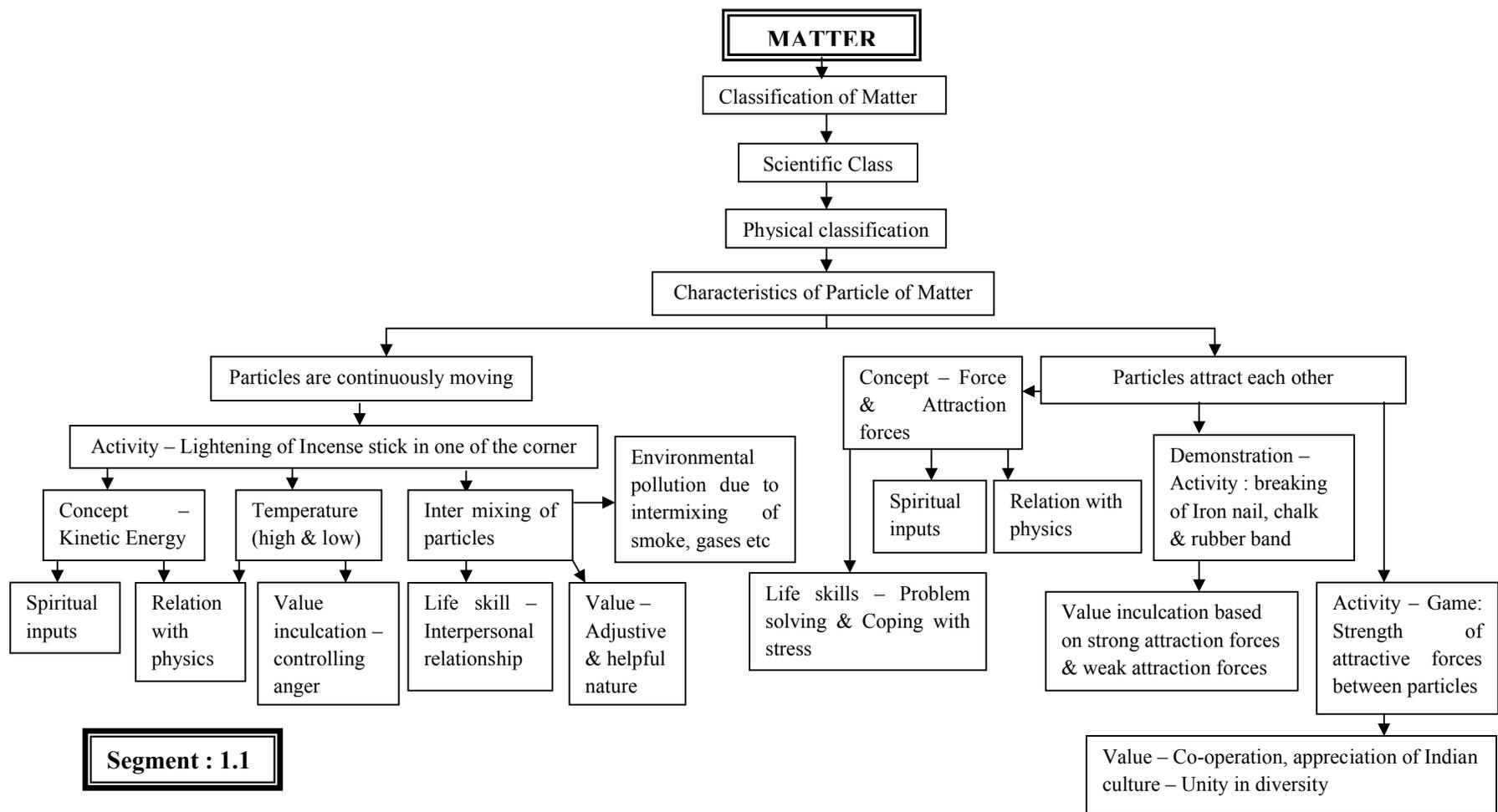
- 9) How light affects the bio-sphere? Discuss.

- 10) Why there is necessity of basic elements to form compound? Discuss.
- 11) Coal is the mother of beauty. Discuss.
- 12) The place of all entities, such as, animals, plants and microbes is justified. Discuss.
- 13) Why water is found in four different states, namely, ice, water, vapour and plasma, i.e., H^+ and OH^- ions? Discuss.
- 14) Why darkness affects one's Psyche? Discuss.

Appendices

*Appendix II Lessons
Design on WSEP*

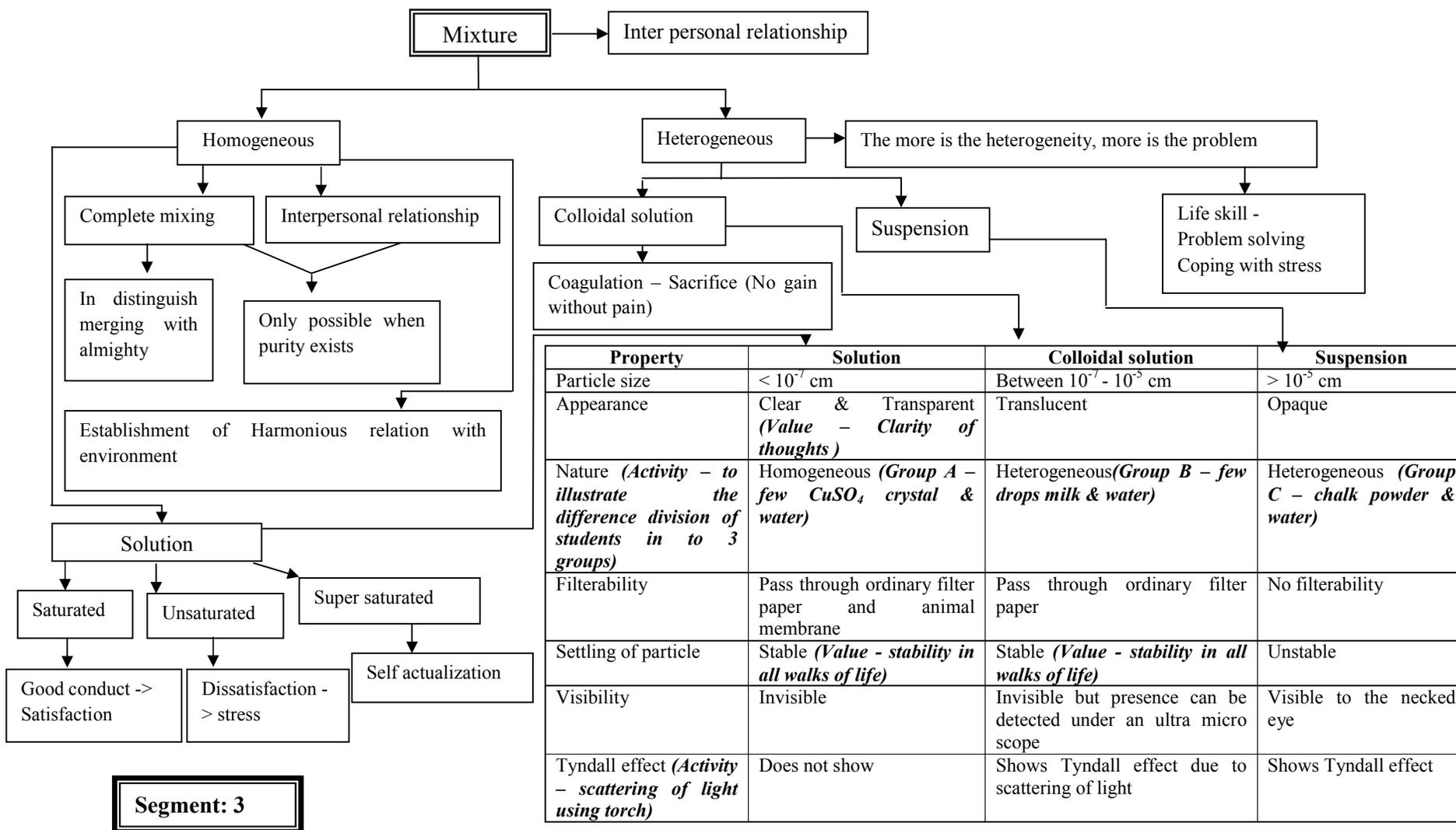


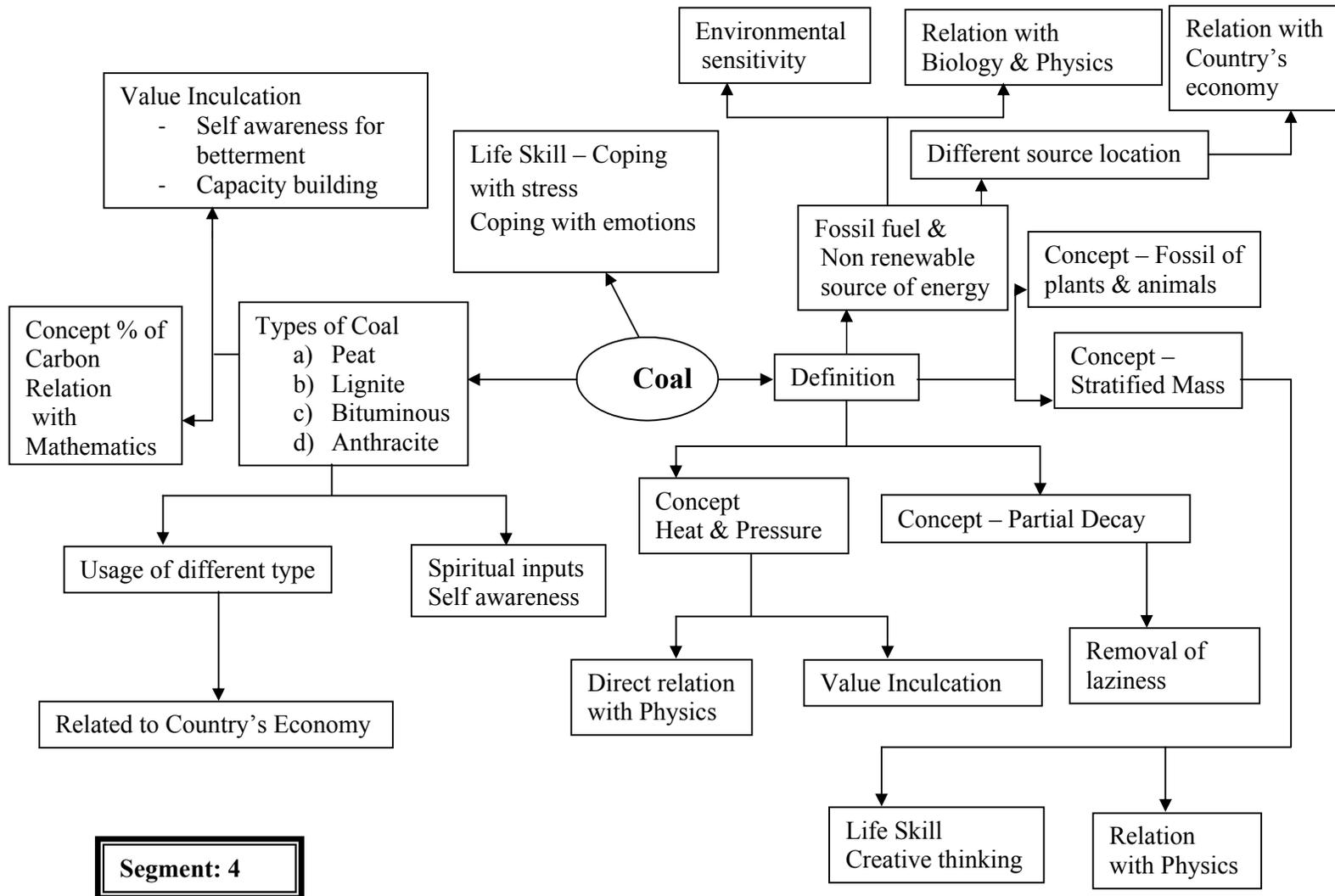


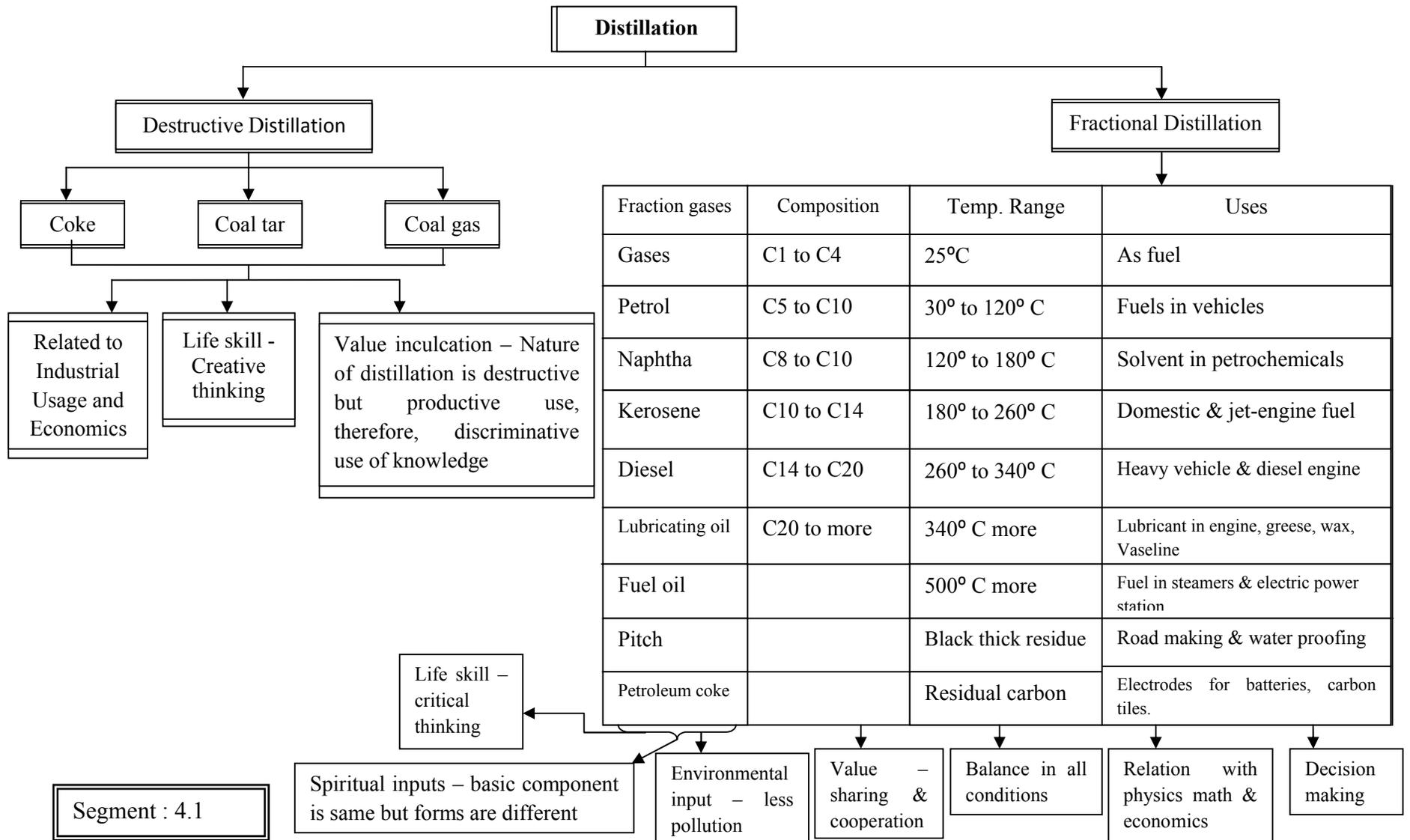
States of Matter

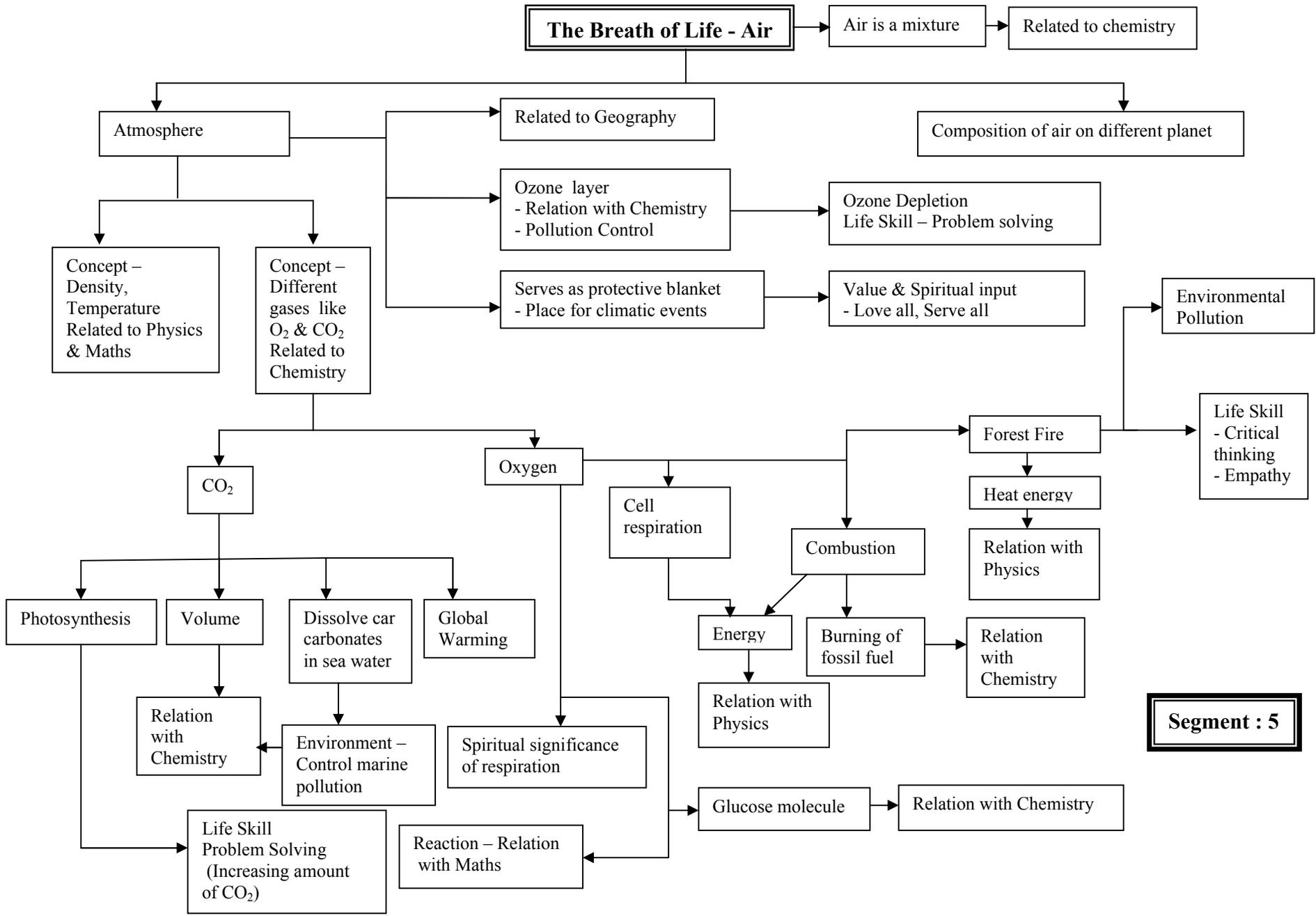
Property	Solid	Liquid	Gas	
Packing (<i>family value & its importance</i>)	Closely packed	Less closely packed	Free to move about.	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; text-align: center;">Plasma</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; text-align: center;">Super energy – Spiritual inputs</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; text-align: center;">Super excited – Value – managing over enthusiasm</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">Self awareness to actualization</div>
Inter particle distance	Smallest (<i>value – Difference of opinion is permissible but it should not create the distance between two persons</i>)	Larger than solid & smaller than gases	Largest	
Interparticle force of attraction (<i>Activity - Game: Strength of attractive forces between particles</i>)	Strongest (<i>Value – Co-operation, appreciation of Indian culture – Unity in diversity</i>)	Weaker than solid – stronger than gases	Weakest	
Shape & volume	Definite shape & volume (<i>value - Definite goals to be achieved</i>)	Definite volume but no definite shape	Neither definite shape nor volume	
Compressibility (<i>Activity – To show the compressibility of all the three states – 100 ml syringe, chalk powder & water</i>)	Incompressible	Almost incompressible	Highly compressible	
Rigidity / Fluidity (<i>Value – openness of mind</i>)	Possess rigidity	Possess fluidity	Highest fluidity	
Density (<i>Relation with Maths & Physics</i>)	High density	Lower than solid – higher than gases	Very low	
Diffusion (<i>Value – all the value related to intermixing</i>)	Do not show this property	Show this property	Rapid diffusion (Activity – Incense stick)	

Segment : 2



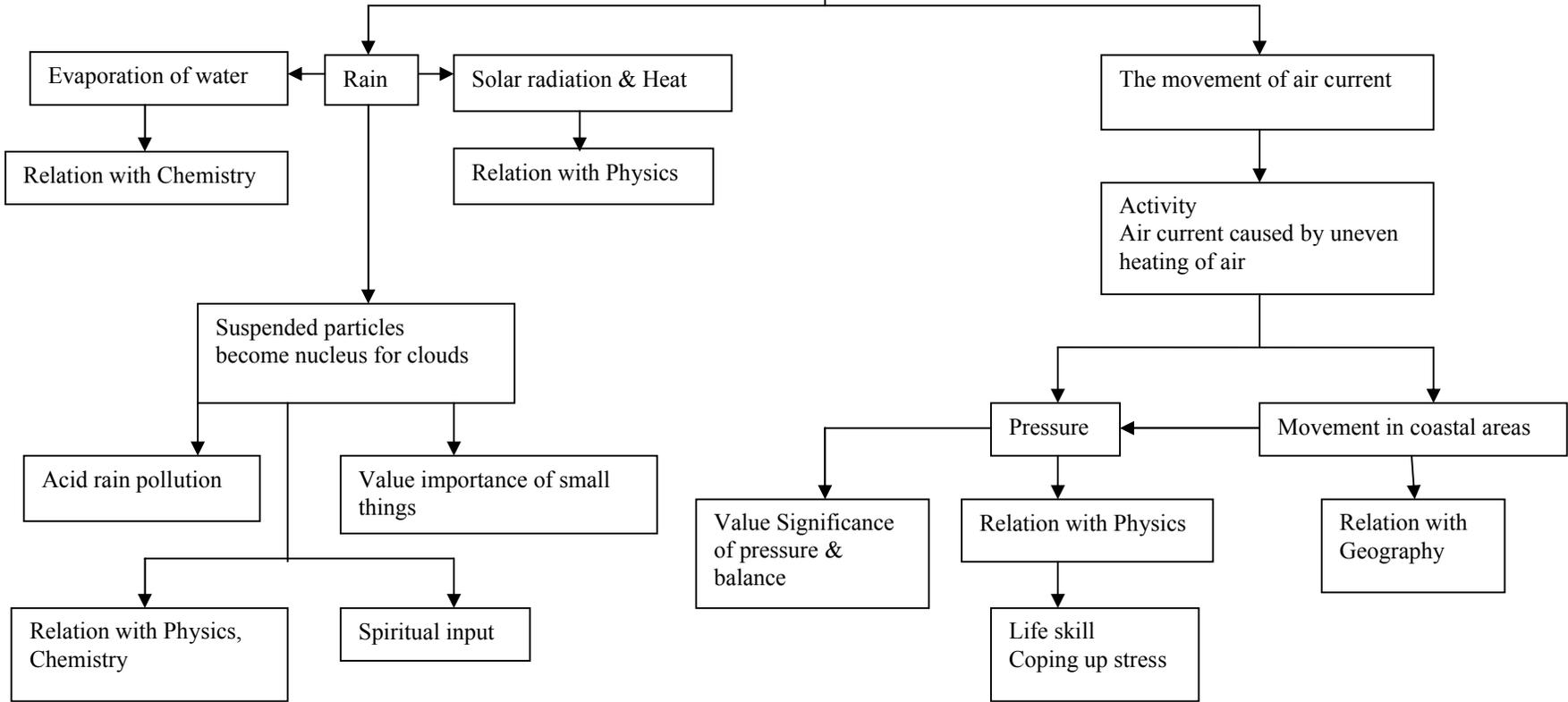




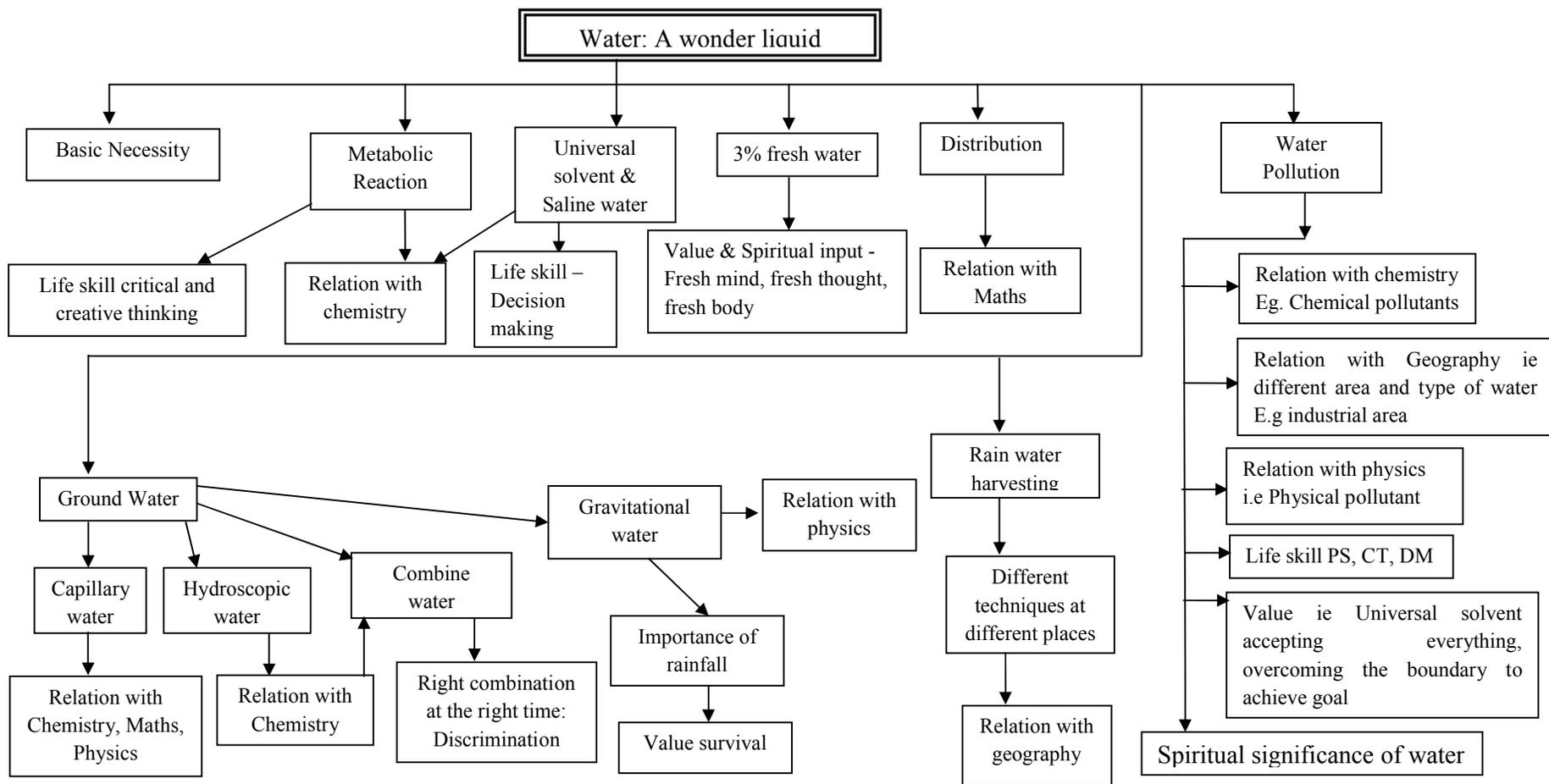


Segment : 5

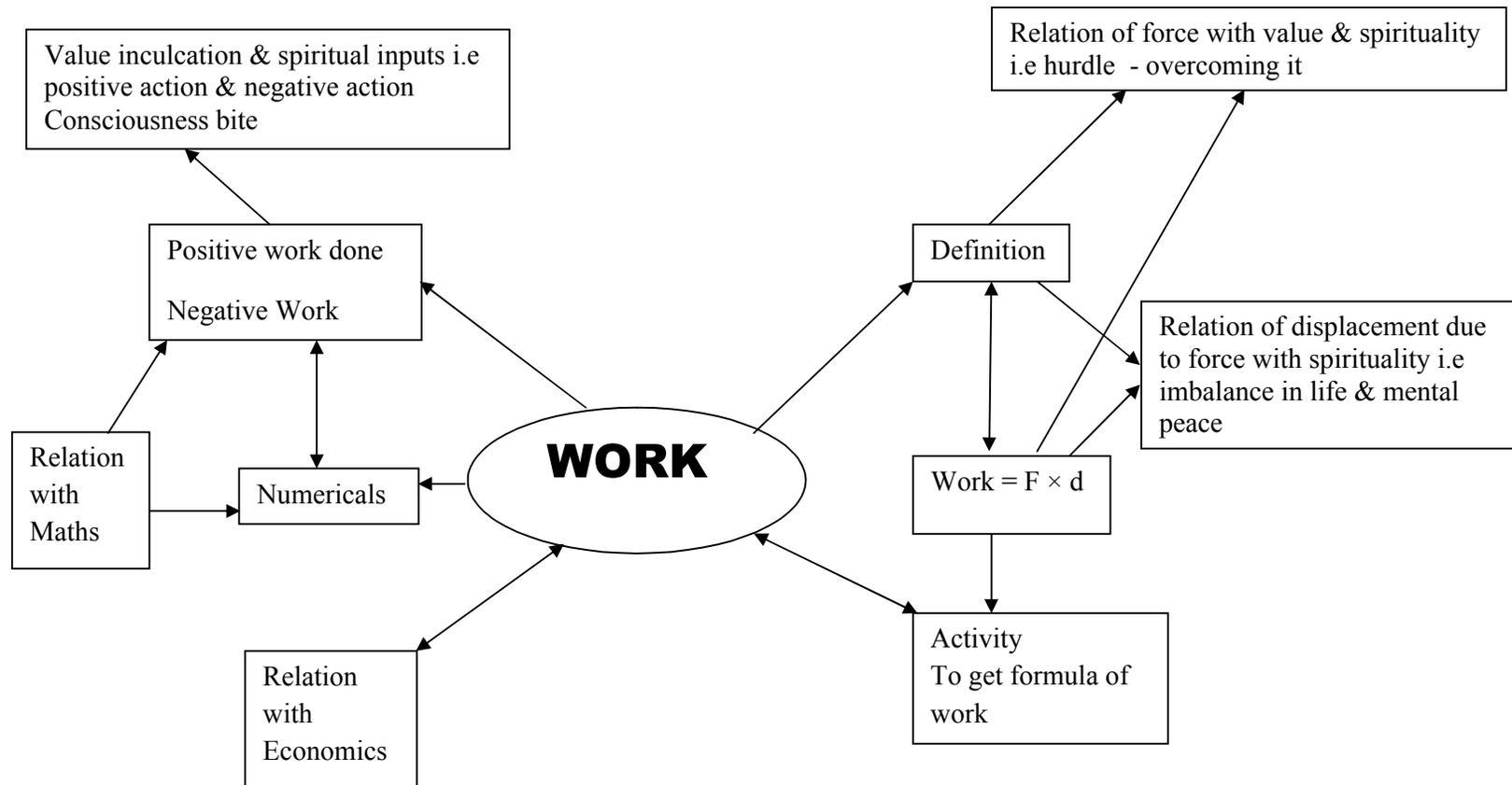
The Breath of Life - Air



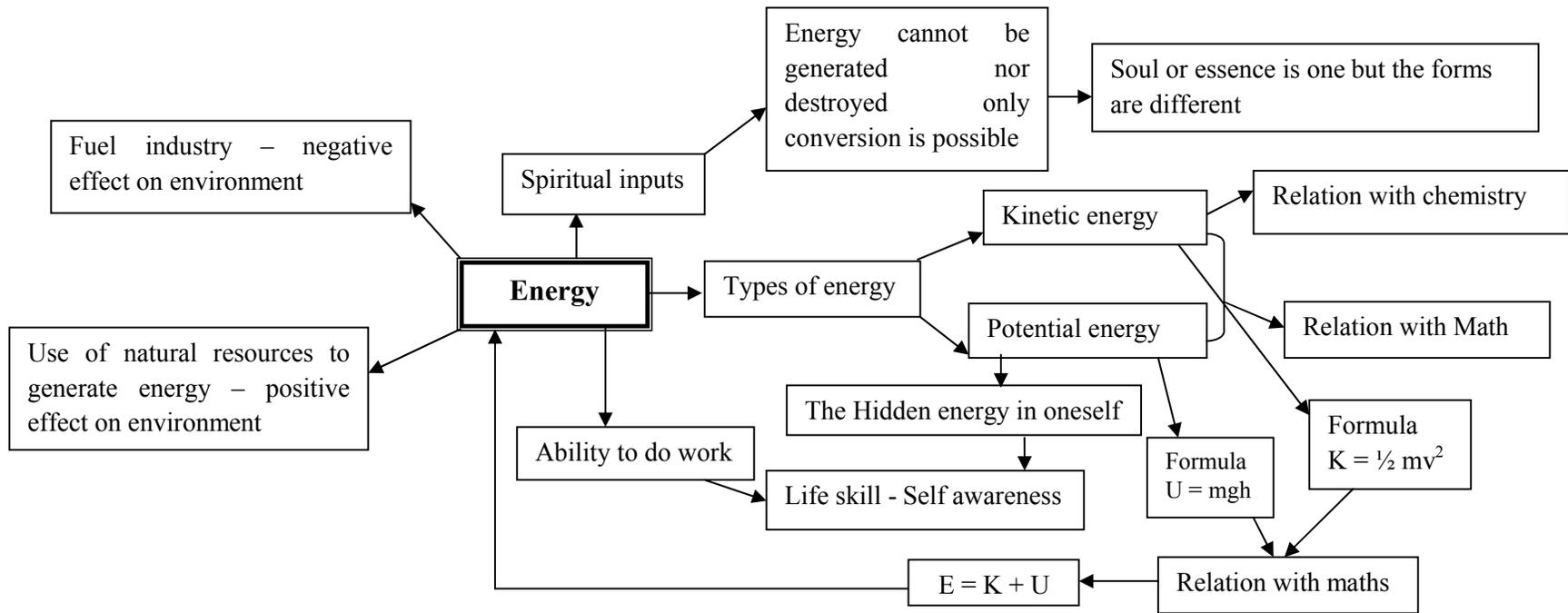
Segment : 5.1



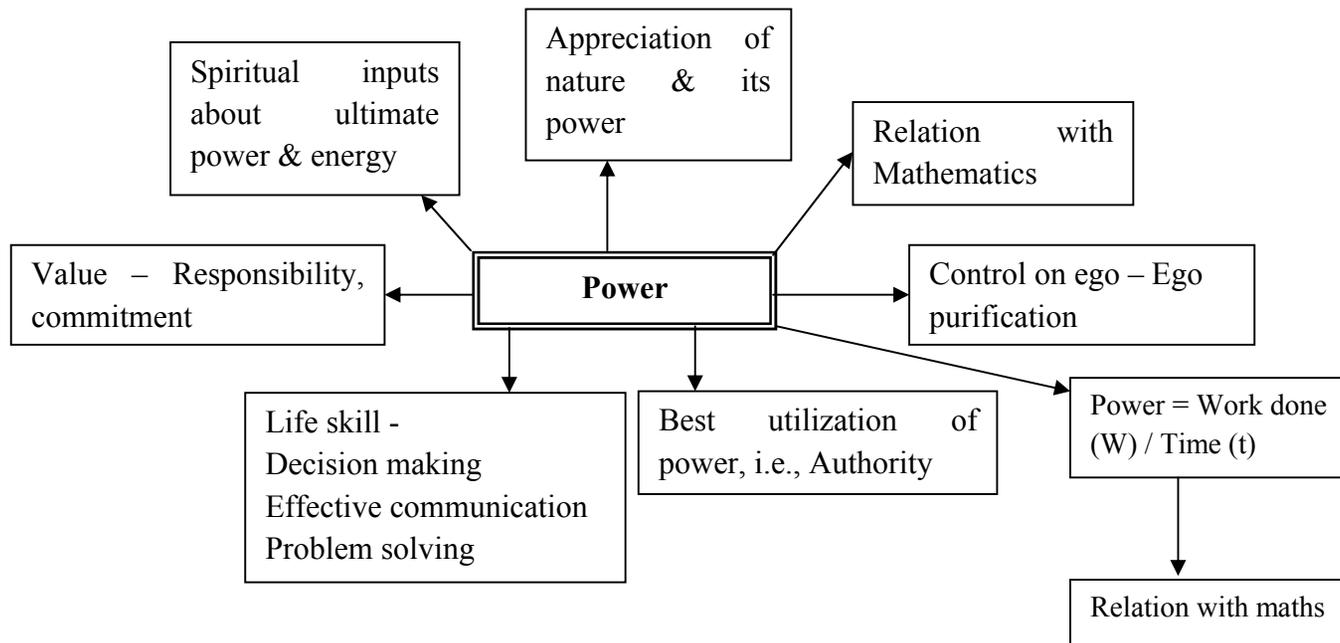
Segment : 6



Segment : 7



Segment : 8



Segment : 9

