

Chapter VI

Summary, Discussion and Implication

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6.0. Introduction

Report of the Education Commission proposed internal transformation of the educational system so that it relates to the life, needs and aspirations of the nation. The realization of the country's aspirations involves changes in the knowledge, skills, interests and values of the people as a whole (Education Commission, 1966). Education has fundamental role in the development of human beings. Education is for the all round development of all. The goal of education is realization of all the possibilities of an individual not only for the self but also for the changing society. To educate people is to empower them. According to Bloom's Taxonomy indicators of empowerment are development of various domains, namely, Cognitive, Affective, and Psychomotor. Education is a dynamic concept as it appears to be of a different nature from various angles. Mahatma Gandhi - Father of our Nation had a wholistic view of Wholistic Education. In his words "By education I mean all round drawing out of the best in child – body, mind and soul." The development of social intelligence, emotional intelligence and physical aspect of personality are also as vital as the development of mental ability. Education is to realise all round development which can be done by developing capacities of human beings, such as, affective, psychomotor, health and environment and spiritual along with cognitive. Education cannot be considered in isolation or planned in a vacuum. It has to be used as a powerful instrument of social, economical and political change which is essential for life. Education plays an important role in preparing the citizens by providing various means for healthy life, such as, knowledge, skills, values, attitudes and spiritual control.

Teaching-learning process plays a crucial role in education. Teaching is both science and art. Science explores and art expresses. Teaching explores scientifically and designs, develops, constructs and communicates artistically. Teaching process includes various approaches for providing learning experiences. These approaches are classified as either teacher centred approaches which include methods, such as,

lecture, lecture cum demonstration, team teaching, or student centred approaches which include methods, such as, laboratory, project, heuristic and assignment. Education Commission Report (1964-66) projected Science Education as “It must become an integral part of school education; and ultimately some study of science should become a part of all courses in the humanities and social sciences at the university stage, even the teaching of science can be enriched by the inclusion of some elements of the humanities and social sciences. The quality of science teaching has to be raised considerably so as to achieve its proper objectives and purposes, namely, to promote deep understanding of basic principles, to develop problem-solving and analytical skills and the ability to apply them to the problems of the material environment and social living, and to promote the spirit of enquiry and experimentation. Only then can a scientific outlook become part of our life and culture.”

In the present era, education is more oriented for development of cognitive domain (head) in comparison to the affective domain (heart) and the psychomotor domain (hands). Even in developing cognitive domain tons of information/knowledge is being loaded ignoring the other aspects of cognitive development. So, there is a need of wholistic education for developing all the three faculties (head, heart and hands) and relating education with real life and environment. The education system should emphasize the development of fundamental social, moral and spiritual values. Pandya (2007) recommended seven spiritual qualities for a person, namely, trust, ideals, honesty, ethics, discipline, regularity and commitment. These qualities will help a person in all walks of life for the development of spiritual intelligence. For the development of an individual as a whole there is a need of wholistic approach in education.

6.1. Wholistic Education

Berg (2010) outlined the components of Wholistic education, such as, active learning, deep understanding, critical and creative thinking, along with an emphasis on social relationships and realising the fullness of human existence. Wholistic education is a philosophy of education and concerned with the development of every person's intellectual, emotional, social, physical, and spiritual potentials. Wholistic education does not exist in a single, consistent form. It is best described as a group of beliefs, feelings, principles and general ideas that share a family resemblance (Forbes, 2003).

Report of Kothari commission (1964-66) has recommended cultivating social, moral and spiritual values as one of the important aims of Education. Further, Miller (1999) has been of the view that “Wholistic Education is based on the premise that each person finds identity, meaning and purpose in life through connections to the community, to the natural world, and to spiritual values such as compassion and peace.” The wholistic education places significance on relationships and primary human values within the learning environment (Martin, 2003). Wholistic education focuses on the fullest possible development of the person, encouraging individuals to become the very best or finest that they can be and enabling them to experience all they can from life and reach their goals (Forbes, 2003). The vision of Wholistic Education must be to organize a child for a satisfying and fruitful life in which their skills and attributes will be continuously challenged, developed and applied as part of their lifetime education.

From the above views, features of wholistic education could be derived as follows:

1. Wholistic education emphasises on interconnectedness and the focus is on understanding of relationship rather than merely the study of parts.
2. Wholistic education focuses on development of all the domains i.e. cognitive, affective, psychomotor, health and environment, and spiritual.
3. Wholistic education aims to nurture humane qualities/ humanity in human beings for peaceful coexistence.
4. Wholistic education connects past, present and future.

6.2. Wholistic Approach

Concept of wholistic approach is that the totality of something which is much greater than the sum of its component parts and their functioning i.e. the whole cannot be understood by the isolated analysis of their parts and their functions rather the whole is integrated functioning of all the parts. So the wholistic approach is not a new approach rather it includes approaches such as Naturalistic approach, Pragmatic approach and Constructivist approach. The wholistic approach includes methods, such as, project method, supervised study method, and experimental method. Wholistic approach is the way of teaching subject as a whole by considering all aspects of the curriculum with a purpose of wholistic development of the students. Wholistic approach considers curriculum as a whole and transaction of it that leads to wholistic

education. The approach comprises of interdisciplinary subjects and integration of content within the subjects and with different scholastic subjects, real life situation, environment, values and social surrounding. The content also caters to knowledge of cognitive domain, affective domain, psychomotor domain and spiritual. In the wholistic approach development of students should be based upon development of all the domains. Thus, wholistic approach emphasises on development of all the domains i.e. all round development. Wholistic approach enables students to perceive and understand the various contexts that shape and give meaning to life (Panigrahi & Rajendran, 2008). The wholistic approach enables students to explore their own potential and that of surroundings in an integrated way.

Maheshwari (2010) has defined holistic approach as an essential element to educating students which one seeks to open the mind, nurture the spirit and awaken the heart. Key concepts of such an approach include fostering a passion for learning and nourishing the sense of wonder. Holistic Approach is one where the education is going beyond narrow focus on the intellect, where every child is more than the future worker with degrees of a formal degree.

From the references researcher has defines the Wholistic approach as follows:

Wholistic Approach is a study of inter-connectedness, inter-dependence and inter-relatedness of various aspects. It is to observe a learning experience as an integral function of all the functional units. Wholistic Approach starts dealing with Education in various ways to achieve Wholistic Education, realizing inter-connectedness and inter-dependence, zooming in and zooming out. Wholistic Development can be achieved through Wholistic Education which is comprised of Cognitive Development (Thinking Skills), Affective Development (Social and Emotional Skills), Psychomotor Development (Mind and Motor Muscles coordination Skills), Spiritual Development (Spiritual control skills, coexistence of Self and Selflessness), Health and Environment (Skills of observing sound health & universal being, healthy relationship between sound Self and surrounding atmosphere, healthy web of nature and society).

Wholistic Approach can be presented by the following diagram:

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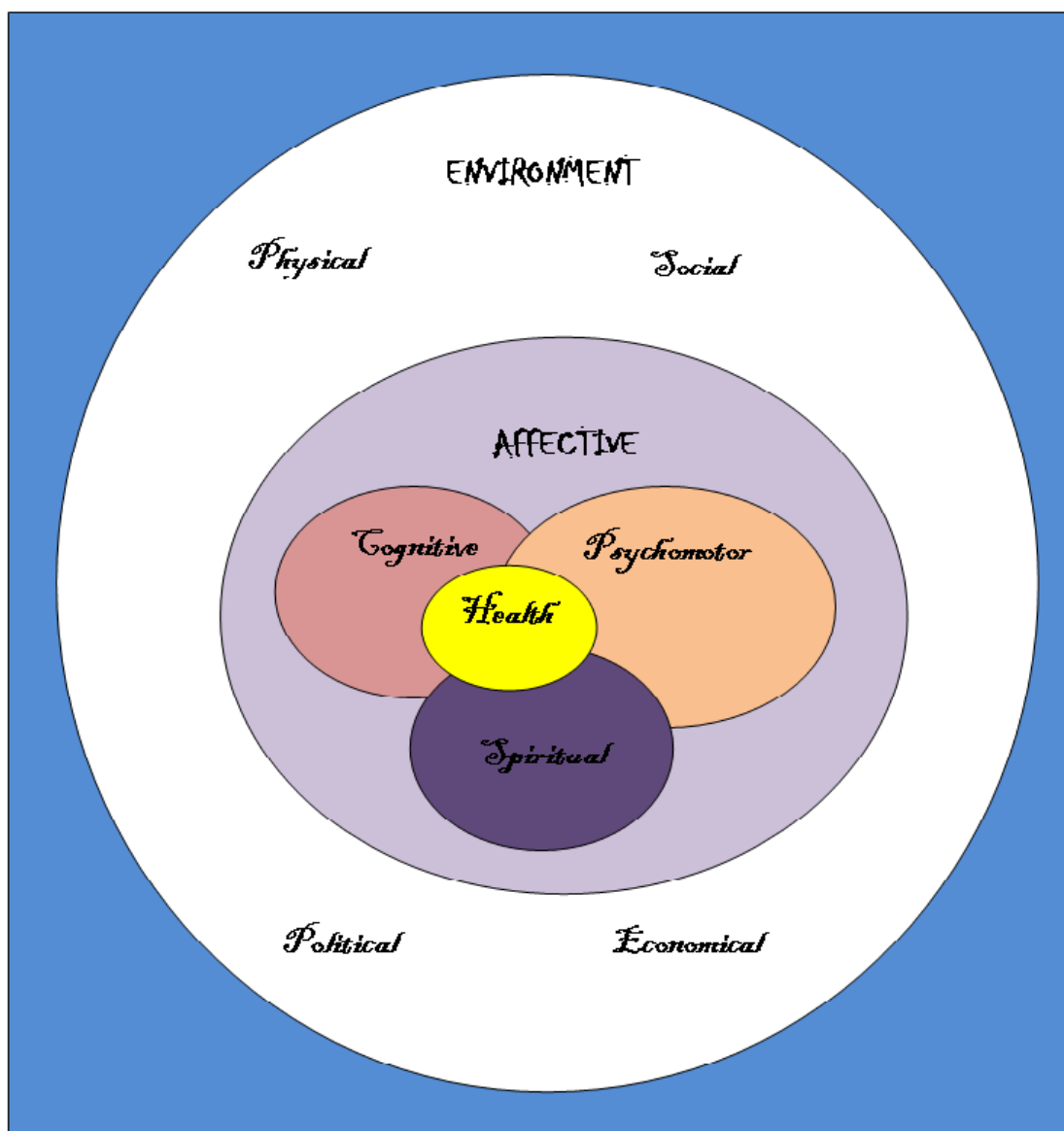


Fig. 6.1.: Diagram of Wholistic Approach

6.3. Need of Wholistic Approach

With a growing body of world research emphasizing the importance of wholistic approach to education, early childhood educators are being challenged to incorporate a teaching practice that focuses less on the traditional milestones of academic development, and more on the complete physical, emotional and psychological wellbeing of a child (UNESCO, 2006). The researches show that over time, even persons with average IQ (Intellectual Intelligence) but with high EI (Emotional

Intelligence) are significantly more successful than those with much higher IQs but low EI (Goleman, 2006). Specialisation is an antithesis of Wholistic Approach. In specialisation there is rare consideration for inter disciplinarily. Teaching should be such which provides knowledge in integrated way. Teaching style should be wholistic i.e. taking content as a whole not as parts. Indian culture is denoted by values of Wholism. Swami Vivekananda also proposed Wholistic Education. In his words “Education is the manifestation of the perfection already in man.” Today’s Education System mainly concentrates on cognitive domain and rarely on other domains. Different subjects should be taught keeping in mind the development of cognitive, affective, psychomotor, spiritual and environmental domains wholistically.

6.4. Wholistic Achievement

The cognitive skills gained through core academic coursework are critical, but it is equally important to develop the social and emotional skills essential for full, healthy and meaningful life. Wholistic Achievement is measured in various domains, namely, Cognitive, Affective, and Psychomotor, Spiritual, health and environment. Very often the scholastic achievement as certified is representative of the cognitive domain or at the most psychomotor domain. The cognitive achievement is limited to knowledge or at the most understanding, higher cognitive abilities are rarely developed and tested. There should be adequate scope for development of communicative, creative, reflective & critical thinking and problem solving ability. The educational experiences could be situation based, activity based, performance based related to reality at grass root. Rarely there is an expression of the affective domain. There should be adequate focus on development of affective domain on factors, such as, empathy, impulse control, communication and co-operation, optimism, emotional self-awareness, self assertion, effective relationship, adjustment, resilience, constructive discontent. Emotions represent self-sensitivity and sensitivity towards the environment. It is empathizing through interpersonal relationships through social skills, such as, mutual trust, co-operation, loyalty, appreciation, attachment, responsibility, sharing, sensibility, sensitivity, openness, love, affection, friendliness, fellow-feeling and patriotism. Emotional Quotient may be expressed as

$$EQ = \frac{\text{Actual Adjustment}}{\text{Expected Adjustment}} \times 100$$

Similarly, spirit is the ultimate controlling power in us which controls all our thinking and action. Could there be added focus on dimensions, such as, God and relation, self-awareness, value based practices, Equality (Gender, caste etc.), Fate-ism, social relationships, divinity and love, leadership, helping and integrity. Spiritual Quotient may be expressed as:

$$SQ = \frac{\text{Manifested Conscience}}{\text{Expected Conscience}} \times 100$$

Health development, Environmental Awareness and Ethics will be estimated through Physical and Mental health and environmental sensitivity enhancement.

6.5. Teacher Education

Teacher has capability to lead community and nation for better life and humanity. For that a teacher has to be enlightened, empowered and emancipated. Teacher shapes future of the students, such as, teacher can make IAS officer, IPS officer, pilot, engineer, doctor, painter, musician, scientist, politician, teacher and above all human being. Teacher finds inner abilities of students and gives them guidance to cultivate these. NCF 2005 stated “No system of education can rise above the quality of its teachers, and the quality of teachers greatly depends on the means deployed for selection, procedures used for training, and the strategies adopted for ensuring accountability.”

Teaching is a noble profession where teacher is a product and teacher education is a process for development and preparation of teachers. The qualities of teachers directly depend upon quality of teacher education programme (NCF, 2005). Teacher education has precious role in the life of a teacher, because, it fosters values in teacher, such as, ideal, discipline, curiosity, innovation, ethics and rhythmic life. Teacher education must prepare teacher for teaching, pedagogical and development of skills required for all the phases of life. The ultimate aim of teacher education is to prepare effective teachers who are competent enough to bring out desired all round change in students.

The general objectives of teacher education are (Curriculum Framework for Quality Teacher Education, 2009) to

- Promote capabilities for inculcating national values and goals as enshrined in the Constitution of India.

- Enable teachers to act as agents of modernization and social change.
- Sensitize teachers towards the promotion of social cohesion, international understanding and protection of human rights and rights of the child.
- Transform student-teachers into competent and committed professionals willing to perform the identified tasks.
- Develop competencies and skills needed for becoming an effective teacher.
- Sensitize teachers and teacher educators about emerging issues, such as environment, ecology, population, gender equality, legal literacy.
- Empower teachers to cultivate rational thinking and scientific temper among students.
- Develop critical awareness about the social realities.
- Develop managerial and organizational skills.

6.6. Importance of Teaching of Science at B.Ed. level

Scientific and technological progress provides knowledge of new methods of production which enlarge the area of capitalistic production methods. Therefore, scientific and technological progress has maintained an important role in the growth of human society. The scientific and technological instruments of a country also affect the determining elements of economic development. The country, where the standard of these elements are higher, will be having the fast speed of development. The evaluation of the situation of any nation can be made by the standard of scientific and technological means also. A main method of the proper circulation of social arrangement is the development of scientific view point among people. Scientific view and science education help people to find out scientific bases of phenomena and not to be a victim of superstitions.

6.7. Present Scenario of Science Education and Science Teaching

There are so many recommendations of various commissions pre-independence and post-independence, but, science education is still lacking. Recommendations of various commissions on science education are, such as, Macaulay's Minute on Education (1835), Wood's Despatch (1854), Indian Education Commission (1882-83), Zakir Hussain Committee (1938), Sargent Report (1944), Secondary Education

Commission (1952-53), Tara Devi Report (1956), Indian Education Commission (1964-66), The National Policy on Education (1968), The National Policy on Education (1986), Ishwarbhai Patel Commission (1977), Nation Curriculum Framework (2000), National Curriculum Framework (2005), National Curriculum Framework Review (2005). Earlier various commissions had recommended for promotion and inclusion of science education at various levels. Some of these are, that, money should be provided for introduction and promotion of knowledge of science among the inhabitants of the British territories, science education needs attention and promotion, encouragement of science education at all levels, fostering scientific temper, inculcation of accurate observation skills and testing experience by experiments, inclusion of General Science at middle and secondary level and pure sciences and applied sciences at high school level. After inclusion of science education at various levels there are some recommendations for quality improvement of science education, such as, inspire students through stories about scientists and their discoveries, method of science teaching should be modified by giving stress on investigatory approach and understanding of basic concepts, importance of quality in science education, provision of science kit and science equipments for quality improvement of science education at various level, students should acquire process skills, science teaching should engage learners acquiring methods and processes that will nurture their curiosity and creativity.

There are so many recommendations by various commissions and committees but even then there is lack of science teaching and science education. Science education is a process for developing scientific temper, scientific attitude and scientific knowledge, which can be used in day to day life. Studies, namely, Vaidya (1997), Malhotra (1998), Umashree (1999), Bhide (2002), Kumar (2004) and Shelat (2013) revealed that science is still taught through lecture method rather than student centered methods. During science teaching students are passive recipients'. They are not getting opportunity to do things on their own.

Science should be taught in such a manner that the students apply the concepts of science in day to day life and understand the significance of science in life. Science is a subject which is interrelated and interconnected with other subjects, such as, mathematics, social science, economics, geography, psychology, and economics. So, Science should be taught in interrelated ways.

6.8. Wholistic Approach Teacher

For teaching through wholistic approach teacher should be a mentor, a facilitator, and a companion (Forbes, 1996). For wholistic approach teacher should raise issues or problem from reality. For resolving issues or solving problems open and honest sharing is expected amongst teachers and students. Different abilities of individuals are respected and appreciated by the teacher. The reward of helping one another and growing together should be emphasised by teacher. For imparting knowledge through wholistic approach problem/issue should be identified first. Efforts for solving the problem should be made by considering all the aspects of the problem. Teacher should be a researcher, because, teaching of science and research are synonyms. This will lead to wholistic development of the students.

6.9. Skills required for Teachers to teach through Wholistic Approach

1. Perception Skill

- 1) Skill of Closure and Pragnanz
- 2) Skill of Proximity
- 3) Skill of Grouping and Classifying

2. Cognitive skill

- 1) Skill of Synthesis
- 2) Skill of Integration
- 3) Skill of Analysis
- 4) Info-savvy Skills
- 5) Micro Teaching Skills
- 6) Science Process Skills

3. Psychomotor skill

- 1) Mind and Motor Muscles coordination skills

4. Life skill

- 1) Human Development Skill/ Social Skill
 1. Self-awareness

2. Empathy
3. Inter Personal relationship
4. Communication Skill
- 2) Emotional skill/ Affective Skill
 1. Skill of Coping with Stress
 2. Skill of Coping with Emotion
- 3) Thinking Skill
 1. Critical Thinking
 2. Creative Thinking
 3. Decision making
 4. Problem Solving
- 5. Health and Environment Awareness Skill**
 - 1) Skills of observing sound health and universal being
 - 2) skills for healthy relationship between sound self and surrounding atmosphere
 - 3) Skills for healthy web of nature and society
- 6. Skill of Spiritual Development**
 - 1) Skill of Differentiation and Reconciliation
 - 2) Skill of Interconnecting and Interdependence
 - 3) Skill of coexistence of self and selflessness
 - 4) Spiritual Control skill

6.10. Science Education

According to Dewey (1916) the heart of Science lies not in the conclusions reached, but in the method of observation, experimentation and mathematical reasoning by which conclusions are reached. Science education has added new dimensions to life and education. The goal of Science education is that students should achieve scientific literacy. The scientific literacy is “The knowledge and understanding of scientific concepts needed in daily living. Scientific literacy enables students not only to use scientific principles and processes in making personal decisions but also to participate

in discussions of scientific issues that affect society. Understanding scientific knowledge and processes contributes in an essential way to these skills. The economic productivity of society is related to the scientific and technological skills of the people” (Yager, 2010).

6.11. Nature of Science

Science word is originated from Latin verb ‘Scere’ meaning ‘to know’ and Latin noun ‘scientia’ meaning knowledge. Science can be defined as ‘The systematic observation of natural events and conditions in order to discover facts about them and also to formulate laws and principles based on these facts’. Science is both a body of knowledge and the process of acquiring it (Fitzpatrick, 1960). Nature of science can be identified by three basic principles, i.e. an accumulated and systematized body of knowledge, the scientific method of inquiry and the scientific attitudes. Science is both product as well as process. Scientific knowledge is based upon facts, concepts, generalizations, theories and laws. The American Association for the Advancement of Science (AAAS) provided thirteen processes for the scientific inquiry. Namely, Observation, Classification, Number relations, Measurement, Space/Time relations, Communication, Prediction, Inference, Making operational definitions, Formulating Hypotheses, Interpreting Data, Identifying and controlling variable and Experimenting.

6.12. Aims of Science Education

NCERT Focus Group (2005) focused on wholistic education and summarized that Science Education should enable the learner to

1. Know the facts and principles of science and its applications, consistent with the stage of cognitive development.
2. Acquire the skills and understand the methods and processes that lead to generation and validation of scientific knowledge.
3. Develop a historical and developmental perspective of science and to enable the learner to view science as a social enterprise.
4. Relate to the environment (natural environment, artefacts and people), local, as well as, global, and appreciate the issues at the interface of science, technology and society.

5. Acquire the requisite theoretical knowledge and practical technological skills to enter the world of work.
6. Nurture the natural curiosity, aesthetic sense and creativity in science and technology.
7. Imbibe the values of honesty, integrity, co-operation, concern for life and preservation of environment.
8. Cultivate 'scientific temper'-objectivity, critical thinking and freedom from fear and prejudice.

Thus, science education is to develop human beings for peaceful coexistence in the world.

6.13. Importance of Science in Everyday Life

Science plays tremendous role in human life. Sankhala (2007) said that man is able to conquer time and distance with the help of Science. It saves mankind from doing excessive hard work. The cloths, the facilities available in home and office, the agricultural methods which help in producing food, electrical appliances used in home, such as, lamp, mobile, laptop, plasma television, palmtop are based on scientific principles. Science is changing entire existence in various aspects, such as, health, communication and transportation. Science has helped in giving eyes to blind, hearing to deaf and legs to lame. Science improves the quality of human life. Life is full of activities; individual makes use of various technologies and there is science involved in everything, like, cooking, walking, writing, medicine and different systems of body. Science is very useful in routine life. Kumar (1999) stated that Science provides systematic and organised information comprising scientific facts, concepts, generalisation, laws and theories which may prove helpful in enhancing the span of knowledge but also in finding the solution of problems.

6.14. Wholistic Approach in Teaching of Science

Wholistic approach deals with all the domains, such as, cognitive, affective, psychomotor, health and environment, and spiritual. Science is a discipline where students learn many laws which are related to their routine life. In the study of Science students are doing practical and by that they can experience success and failure. The aim of wholistic education is developing student as a whole not as part.

While imparting knowledge through the wholistic approach, the curriculum should be such that it takes care of development of all the domains. Through the Science subject, development of affective domain is done because in curriculum there are so many topics related to self, relationship, health and environment. The students are able to learn and feel the environment. Also spiritual Qualities can be developed through Science.

6.15. Implication of the Related Literature Reviewed for the Study

The researcher attempted to review literature related to Wholistic Education, Wholistic Development and Wholistic Approach. Studies related to Wholistic Education were conducted by Conti (2002) on The Spiritual Life of Teachers, Enns (2003) on Holistic and Analytical Cognition, Forbes & Robin (2004) focusing on An Analysis of Holistic Schools'. Grimes (2007) studied on Multidimensional Classrooms, Kelly (2006) carried out study on Development of soul-spiritual capacities and personal transformation, Larimer (2008) conducted a study on awareness of dynamics of thought through Innate Health approach, Macklin (1997) has conducted study on Enhancing Wholeness, Creativity, and Connections in the Classroom, Malekpour (2003) focusing on Holistic Science Education, Merritt (1994) conducted a study on Transforming Secondary-Science Education for the 21st Century, Morris (2005) has conducted a study on The Whole School Initiative, Rathnam (2013) conducted a study on A Holistic Education Perspective on Krishnamurti's Educational Philosophy Rudge (2008) has integrated humanistic education with spiritual philosophical ideas to define Wholistic education, further, the principles of wholistic education have been synthesized in eight broad principles, namely, spirituality, reverence to life, interconnectedness, human wholeness, individual uniqueness, caring relations, freedom and democracy, and Xu (2005) conducted a study on Levels of Wholetheme Instruction. Asha (2008) had conducted a study on student teachers and developed folk song mixed pattern for selected content area of school subject, Parekh (2012) conducted a study on Wholistic Science Education Program at Secondary School Level, and Sarangi & Mishra (2008) have conducted a study for promoting wholistic learning.

Benson (2009) has studied the core affective dimensions of the whole person for Wholistic development, Hooten (2009) has found relationship between holistic scoring and written language abilities, Karmer (2010) conducted a study on An

exploration of caring and creative visual art classrooms, Kim (2006) focused on ESL Education for whole child development, Lim (2006) conducted a study on Effect of Part-task and Whole-task instructional approaches, McMullin (2014) conducted a study on The Holistic Development of Teachers: A Conceptual Model of Integrative Education and Pilot Program for Pre-service Teachers Based on Mindfulness and Social Emotional Learning, Osment (2008) conducted a study on Spiritual and wholeness, Pearsall (2009) conducted a study on Reframing human development in public education, Robbins (2005) carried out a study on Wholistic Workplace Ministry (WWM), Gandhi (2011) has suggested Seven fold sustainability for ensuring a holistic life in contemporary India, Pathak (2008) conducted a study on integration of life skills in the pre-service teacher education had focused on Wholistic Development.

Borowski (2003) has conducted a study on A Holistic Approach to Teacher Education, Burnett (2010) conducted study on Holistic Approaches to Creative Problem Solving, Johnson (2014) conducted a study on Twenty-first Century Transformation: A Holistic Pedagogical Approach, Neves (2009) conducted a study on A Holistic Approach to the Ontario Curriculum: Moving to a more Coherent Curriculum, Norris (2009) a Holistic Approach to Teacher Reflection about Practice, Piccone (2013) A Holistic Approach to College Developmental Reading and English Courses, Shneyder (2006) conducted a study on Holistic Approach to Biology Instruction, Silva (2005) conducted study on A Holistic Approach to Student Support and Engagement, Sledge (2009) conducted a study on A Plan to Span the Learning Gap: A Freshman Seminar class representing a holistic approach to education that seeks to enhance students' mental, emotional, and physical well-being and to promote student retention conducted studies on Wholistic Approach, Văcărescu-Hobeanu (2013) conducted study on Human resources management, and Paliwal (2008) conducted survey cum experimental study on B.Ed. students on Wholistic Approach for English language teaching and found significant difference.

It is evident through the related literature that there have been very rare studies on Wholistic Approach to Educational Instruction for Wholistic Development The review of the related studies reveals that there is a need of wholistic approach in School Education and Teacher Education for Wholistic Development. Wholistic approach has been used in teaching learning process of English Language, Biology

Instruction, and Science Education. There have been found rare studies on Wholistic Approach to Science Instruction. One study has been conducted on Wholistic Approach to Science Instruction at the School level. It is evident from the field that Lesson Designs for Practice Teaching at Teacher Education levels have been limited only to Cognitive Domain, at the most Psychomotor Domain. There are rare lessons addressing Affective Domain, Environmental Domain and Spiritual Domain. Both, the Teacher Educators & Student Teachers feel diffident entering affective domain. The various disciplines have gone conservative & closed not to open up to the environment. There is a notion that the Spiritual Domain is not the concern of Formal Education. There are very rare lessons which relate lesson design contents in a particular subject with the other subjects, that is, interdisciplinarity finds rare expression in practice teaching. There is a need of immediate transformation in Practice Teaching focusing on the Wholistic Approach. Unless the teachers are Educated on Wholistic Approach in Teacher Education it will not find expression at the School Education. The investigator having Science background has attempted to employ Wholistic Approach to Science Education in Pre-Service Teacher Education to study its effectiveness at the School level.

6.16. Rationale for the Present Study

Jiddu Krishnamurti anticipated education as “understand the whole of life, not just one little part of it”. Integrated activities of an individual are inter-related and inter-connected with each other which determine the whole. Education aims at realizing the whole. Healthy life demands understanding of the whole, irrespective of the disciplines we belong to. So, teaching-learning ought to be wholistic rather than fragmented and scattered bits of information. So, the execution of educational activities demands Wholistic Approach of teaching.

The inquiry and imaginative human mind has responded to the wonders and awes of the nature in different ways. One kind of response from the earliest time has been to observe the physical and biological environment carefully, look for any meaningful pattern and relations, make and use new tools to interact with nature, and build conceptual models to understand the world. This human endeavour is called science. Science is a dynamic, expanding body of knowledge covering every domains of

experience. Scientific method involves science processes, which plays an emancipative role in the world.

National Curriculum Framework (2005) has emphasized on science processes such as observation, looking for regularities and patterns, making hypotheses, devising qualitative or mathematical models, deducing their consequences, verification or falsification of theories through observations and controlled experiments, and thus arriving at the principles, theories and laws governing the natural world. If these processes are observed in integrated way then the wholistic education could be realized. Further, NCF (2005) suggested reforms in science teaching and emphasis on the meaning making learning rather drilling of the content and rote learning. This demands that teaching-learning process should have wholistic approach that integrates interconnected and interdependent content with life, environment and wisdom. Thus, by using wholistic approach in science education teacher could realize wholistic development.

NCFTE (2009) reported “The level and quality of subject matter knowledge, the repertoire of pedagogical skills that the teachers possess to meet the needs of diverse learning situations, sensitivity to contemporary issues and problems and also to learners and the level of motivation critically influence the quality of curriculum transaction in the classrooms and thereby student learning and the larger processes of social transformation.” To prepare an effective and quality teacher is the responsibility of Teacher educator. To bring desired quality in student teachers, a teacher educator should practice and orient them towards it. Thus, it is essential for Teacher Educator to practice and orient student teachers for the wholistic approach, so that, they can use this approach in classroom for the development of whole.

Bhatia (2009) reported that the Wholistic approach was found to be effective for science teaching and helpful to understand the wholistic nature of science. The researcher felt that the same study should be extended to the school level. The research is intended to teach the student teachers through wholistic approach in such a way that it facilitated their wholistic development. The researcher envisaged developing Wholistic Approach of Science teaching cutting across cognitive, affective, psychomotor, spirituals, health and environment domains to develop teacher as a promising member of larger society facilitating wholistic development.

6.17. Present Study

Effectiveness of Educating Student Teachers on Wholistic Approach to Science Teaching

6.18. Objectives of the Study

1. To design a programme for orienting student teachers on Wholistic Approach to Science Teaching.
2. To study the efficacy of Wholistic Approach to Science Teaching in terms of wholistic development of student teachers.
3. To study the reactions of student teachers towards Wholistic Approach to Science Teaching.

6.19. Hypotheses of the Study

1. There will be no significant difference among the two subsequent pre-test mean scores of student teacher on Knowledge and Skill Check up.
2. There will be no significant difference among the two subsequent post-test mean scores of student teacher on Knowledge and Skill Check up.
3. There will be no significant difference between the pre-test mean score and post-test mean score of student teachers on Knowledge and Skills Check up.
4. There will be no significant difference between observed frequencies and expected frequencies of student teachers against equal probability on various statements of the Reaction Scale.

6.20. Operational Definition of the Terms

1. **Efficacy:** Efficacy was studied in terms of significance of difference between the pre-test mean scores and post-test mean scores on Knowledge and Skills Check up of student teachers, wholistic development of student teachers and reaction of student teachers.
2. **Cognitive Development:** cognitive (knowledge, comprehension, application, analysis, synthesis and evaluation) development was studied in terms of significance of difference between mean achievement scores on pre-test and post-test.

3. Affective Development: affective (receiving, responding, valuing, value organization and characterization by a value complex) development was studied in terms of significance of difference between affective domain mean scores on pre-test and post-test.

4. Psychomotor Development: psychomotor (impulsion, imitation, manipulation, precision, articulation, and naturalization) development was studied in terms of significance of difference between psychomotor domain mean scores on pre-test and post-test.

5. Health & Environment Development: The Health & Environment Development is constituted of Health Awareness, Healthy Relation between Self & Nature, Contribution to Healthy Self, Contribution to Healthy Environment, and Realizing Health Entrainment Ratio as contained in the observation schedule. The development of Health & Environment was measured through the items in the observation schedule on five point scale.

6. Spiritual Development: The Spiritual Development is constituted of Wholistic Perception, Immersion, Interrelation, Emerging Action, and Universal Becoming as contained in the observation schedule. The Spiritual Development was measured through the items in the observation schedule on five point scale.

6.21. Explanation of the Term

Wholistic Approach: Wholistic approach in the context of present study attempts to realize cognitive, affective, psychomotor, health and environment and spiritual development.

6.22. Delimitations of the Study

The study has been delimited to the student teachers, who had opted for Science Method in B.Ed. Programme of Gujarat. Further the study was delimited to the selected English medium B.Ed. colleges of Gujarat.

6.23. Methodology of the Study

6.23.1. Design of the Study

It was an intervention study at the B. Ed. Level. Time Series Design, i.e. one group was repeatedly pretested until pre-test scores were stable, then the group was exposed to the treatment and after the treatment Post tested, repeatedly.

O₁ O₂ X O₃ O₄

O₁, O₂ are Pre-tests

O₃, O₄ are Post-tests

O₁ → Initial Pre-test

O₂ → Pre-test after 10 days of O₁

X → Treatment

O₃ → Post-test after treatment

O₄ → Post-test after 10 days of O₃

The post-test was same as the pre-test.

6.23.2. Population of the Study

The present study was conducted in Gujarat state. There are total 9 Departments of Education and colleges of Education where the medium of instruction is English. Among these 9 Departments of Education and Colleges of Education 2 are only offering English as a method of teaching. So, the rest of the Departments of Education and Colleges of Education which are offering Science as method of teaching comprise the Population for the present study.

6.23.3. Sample of the Study

For the present study one English medium B.Ed. College was selected randomly. All the student teachers having science method of the selected college of Education comprised the sample. Thus, sampling technique was cluster sampling. For the present study Navrachana School of Science & Education, Vadodara was selected as the sample. All the student teachers of academic year 2013-2014 having science method as one of the teaching methods, constituted the sample. Eighteen of the student teachers who opted for teaching of science as one method constituted the

sample for the present study. Replication of the study was done in academic year 2014 – 2015 on student teachers of Waymade College of Education, Vallabh Vidhyanagar. All the student teachers of academic year 2014-2015 having Science method as one of the teaching methods constituted the sample. 49 student teachers opted for teaching of science as one of the methods. On the first day of administration of pre test 21 students were present. All of them constituted the sample for the present study.

6.24. Plan and Procedure of the Study

Phase I: Pre Intervention (Administration of Pre-tests)

1. Knowledge and Skills Check up (**KSC1**) was administered on the Student Teachers of the Experimental Group as Pre-test.
2. Story and Crossword Puzzle (**SC1**) were administered on the Student Teachers of Experiment Group as Pre-test.
3. Knowledge and Skills Check up (**KSC2**) was administered on the Student Teachers of Experiment Group after 10 days of KSC1 as Pre-test.
4. Story and Crossword Puzzle (**SC2**) were administered on the Student Teachers of Experiment Group after 10 days of SC1 as Pre-test.

Phase II: Intervention Programme

1. Group Discussion was conducted with Student Teacher of the Experimental group on present reforms in curriculum & its transaction, evaluation and their impact on Science Teaching.
2. Orientation on Wholistic Approach to Science Teaching was given to Student teachers of the Experimental Group.
3. The lesson plans prepared through Wholistic Approach to Science Teaching were implemented in Experiment Group.
4. Student Teachers were asked to design and implement two lesson plans through Wholistic approach to Science Teaching. These lesson plans were checked by the researcher.

Phase III: During Practice Teaching Phase

1. The Experiment Group Student Teachers had implemented designed lesson plans prepared through Wholistic approach to Science Teaching in school during their Practice Teaching Phase.
2. The Researcher observed all the lessons designed and implemented by the Student Teachers through Wholistic approach to Science Teaching during their Practice Teaching Phase.
3. Efficacy of the lesson plans implemented by Student Teachers was tested by the researcher through observation schedule.

Phase IV: Post Intervention Programme after Practice Teaching Phase

1. Focused Group Discussion was conducted on teaching Science through Wholistic Approach with Student Teachers of Experiment Group.
2. Interview Schedule was administered on the Student Teachers of Experiment Group.
3. Knowledge and Skill Check up (**KSC3**) was administered on Student Teachers of Experiment Group as Post-test.
4. Story and Crossword Puzzle (**SC3**) were administered on the Student Teachers of Experiment Group as Post-test.
5. Knowledge and Skill Check up (**KSC4**) was administered on the Student Teachers of Experiment Group after 10 days of KSC3 as Post-test.
6. Story and Crossword Puzzle (**SC4**) were administered on the Student Teachers of Experiment Group after 10 days of SC3 as Post-test.
7. Reactions of student teachers of Experimental Group were collected and efficacy of the Educational programme was tested.

6.25. Tools and Techniques for Data Collection

6.25.1. Knowledge and Skill Check up (KSC)

Knowledge and Skill Check up was constructed to evaluate knowledge and skill of the student teachers on wholistic approach to science teaching. It was constructed on the basis of various principles of wholistic approach in terms of understanding of the whole, i.e., understanding of interrelation, interdependence and coherence and its

relation with self, health, community and environment; ability to impart the whole i.e. teaching skills to impart interrelated, interdependent and coherent contents and its relation with self, health, community and environment for developing values, attitude, spiritual qualities, morality, ethics, reflective thinking, and ability to solve a problem as a whole. There are total 25 items in the Knowledge and Skill Check up.

6.25.2. Story

A situation based story was provided to the experimental group Student Teachers to identify Spiritual Qualities contained therein. Further they were asked to draw moral out of the story.

6.25.3. Crossword Puzzle

Student Teachers were given a crossword to solve, the puzzle of Wholistic Approach with the clues down and across. There were 10 across and 17 down in the crossword puzzle.

6.25.4. Group Discussion

The researcher had conducted group discussion with the Experimental Group about present Education system for science teaching. Group discussion was conducted with Student Teacher of the Experimental group on prevailing science education i.e. present reforms in curriculum & its transaction, evaluation and their impact on Science Teaching, need and scope of improvements in science education. For group discussion the researcher had divided class in three groups. They were given topics and time of 30 minutes for discussion and 10 minutes for presentation. All the groups' representative presented their group views on the basis of their discussion. Their presentation was further discussed in class and it was concluded.

6.25.5. Observation Schedule

An Observation Schedule was constructed by the researcher to observe the implementation of lessons designed by Student Teachers through Wholistic Approach to teaching science during practice teaching. Student teachers were observed when they implemented the lesson plans through wholistic approach. The observation schedule contains the elements to be observed, namely, content covered, audio-visual material, performance on skills, students' participation, classroom environment, time

management, interactive behaviour and wholistic flow of teaching of the student teacher.

6.25.6. Focused Group Discussion

The researcher had conducted Focused Group Discussion on teaching Science through Wholistic Approach with Experimental Group Student Teachers. Focused of the Discussion was as follows:

- (1) Why there is a need of Wholistic Approach of teaching Science?
- (2) What should be the efforts for preparing lesson plans for Wholistic Approach to teaching science?
- (3) What ought to be the age of students for implementing Wholistic Approach of teaching science? Why?

6.25.7. Interview Schedule

A structured interview schedule was prepared for interviewing student teachers for gathering data. Student teachers of the Experimental Group were interviewed for gathering feedback on their experience of implementing lessons designed through wholistic approach.

6.25.8. Reaction Scale

To study the reactions of the student teachers towards the implemented intervention programme and Wholistic Approach of Teaching Science, a reaction scale was developed. Five point Reaction Scales were employed for gathering the reactions of the student teachers on the wholistic approach of teaching science. Five Points of the reaction scale are Strongly Agree, Agree, Neutral, Disagree and Strongly Disagree. The reaction scale consisted of a total of 26 statements.

6.26. Data Collection

The researcher took permission from the Colleges of Education to conduct the study. The researcher had also taken permission from the schools for observation of student teachers' lessons during practice teaching phase. The College of Educations and schools were assured that the data collected would be kept confidential and will be used only for research purpose. Data collection of the study was done as follows:

1. Data were collected by administering Knowledge and Skill Check up, Story and Crossword on student teachers of the Experimental group as Pre-test. The

Experimental Group was repeatedly pretested for second time after 10 days of the first pre-test.

2. Data were collected through Group Discussion in the Present Education System for science teaching.
3. Data were collected by observation of the implementation process by the student teachers on Experimental Group school students through Observation Schedule.
4. Data were collected through Focused Group Discussion and by implementing Interview Schedule on the Experimental Group Student Teachers.
5. Data were collected by administering Knowledge and Skill Check up, Story and Crossword on student teachers of the Experimental group as Post-test. Experimental Group was repeatedly post-tested for second time after 10 days of first post-test.
6. Reactions of the student teachers were gathered with the help of reaction scale on the wholistic approach.

The data collection was done personally by the researcher in Navrachana School of Science and Education, Vadodara during academic year 2013 – 2014 and the Waymade College of Education, Vallabh Vidhyanagar during academic year 2014 – 2015.

6.27. Data Analysis

Data collected through Knowledge and Skill Check Up was analyzed through content analysis and t-test. Data collected through story were analyzed by content analysis. Data collected through crossword were analyzed by mean, median, mode and O-give curve. Data collected through pre-tests and post-tests were analyzed by employing the t-test to find out significance of difference between the pre-tests and post-tests mean scores. Data of the reaction scales and observation schedule were analyzed by computing frequency, percentage and chi-square. Data collected through Group Discussion, Focused Group Discussion and Interview schedule were analyzed through content analysis.

6.27.1. Tools / Techniques for Data Analysis and Analysis Techniques Employed Objective-wise

No.	Objectives	Tools / Techniques	Analysis Technique
1.	Objective 2	Group Discussion	Content Analysis
2.	Objective 2	Knowledge and Skill Check up	content analysis and t (Test of Difference Means for Correlated Groups Difference Method)
3.	Objective 2	Story	Content Analysis
4.	Objective 2	Cross Word	mean, median, mode and O-give curve
5.	Objective 2	Focused Group Discussion	Content Analysis
6.	Objective 2	Observation Schedule	frequency, percentage
7.	Objective 2	Interview Schedule	Content Analysis
8.	Objective 3	Reaction Scale for student teachers	frequency, percentage and chi-square

Table 6.1.: Data Analysis Techniques Employed Objective-wise

6.28. Findings of the Study

Findings of the present study are as follows:

1. There was a significant difference in the mean score on Knowledge and Skill Check up.
2. There was a significant difference in the awareness of student teachers and their ability to identify spiritual attributes from the story.
3. On pre tests a majority of the Student Teachers were not able to solve complete crossword on the constituents of the Wholistic Approach but on Post tests many of the student teachers were able to solve the complete crossword without error.
4. Group Discussion on the present day science education revealed that, nowadays activity based science education is implemented but it was found to be mainly on cognition of contents as evident through Formative

Assessment & Summative Assessment. No focus was found on the other faculties which are required for Wholistic Development of a child.

5. When student teachers were observed in school during their practice teaching phase while they implemented their lessons for science teaching through Wholistic Approach, the Researcher found that if the student teachers were having content mastery and were good at teaching skill than they could easily implement the lessons through Wholistic Approach. Some student teachers were found to have both the content mastery and good teaching skills but they were lacking on Spiritual Essence of the contents.
6. The Focus Group Discussions established the need for Wholistic Development. This could be achieved through Wholistic Education of child at every stage and every level. The Wholistic Approach of teaching science needs to initiate efforts to relate science content with real life situation, problems related to health and environment and transforming students as humane.
7. The Wholistic Approach of teaching Science was found to be interesting and effective as manifested by the Student Teachers through Interview schedule by the Investigator.
8. Reactions of student teachers were found to be favourable with respect to the Wholistic Approach of Teaching Science.

6.29. Discussion

Wholistic Approach refers to the wholistic development of individual i.e. development of all domains, such as, cognitive, affective, psychomotor, spiritual, health and environment. For developing all the domains of children it is necessary that teachers are well equipped with wholistic development and they are able to realize wholistic development of their students. In present study the researcher has developed orientation programme for Wholistic Approach and intervention programme for Wholistic Approach to educate student teachers regarding Wholistic Approach for Teaching Science. These orientation programme and intervention programme were implemented on the student teachers for finding efficacy of the Wholistic Approach to Science Teaching in terms of wholistic development of student teachers. Pre and Post

implementation phase the data were collected by employing different tools. The analysis and findings of the present study are discussed below.

The Wholistic Approach to Teaching Science was found to be effective in realization of development of all the domains, such as, cognitive, affective, psychomotor, spiritual, health and environment. The results on Knowledge and Skill check up, story and crossword puzzle indicated the enhancement in understanding of wholism.

It is evident from the values of Chi-square which are significant against all the 26 statements of reaction scale, at 0.01 level against 4 degree of freedom except statements Sr. No. 22-24. The null hypothesis against statement-23 is rejected at 0.01 level, but, not rejected at 0.05 level. It means the null hypothesis that there will be no significant difference between the observed frequencies and those expected against equal probability stands rejected against all these statements at the respective levels. Most of these frequencies are either against strongly agreed or agreed. Hence the student teachers have been found to have favourable reactions towards the Wholistic Approach of Science teaching. Against the statement 22 and 24 the null hypothesis is not rejected. It means the student teachers are equally divided against these areas, namely, I find it time consuming to design lesson plan through Wholistic Approach for teaching Science, and I feel that infrastructure of school hinders in implementation of lessons designed through Wholistic Approach to Science Teaching.

The findings of the reviewed literature focus on Wholistic Education, Wholistic Development and Wholistic Approach. There are four studies which indicated the effectiveness in terms of spiritual development, matching with the findings of the present study. There are six studies which indicated the effectiveness in terms of cognitive development again matching with the findings of the present study. There are studies related to affective domain, such as, ethical behaviour, emotional development in classroom, emotional development of children in school, affective dimensions for the development of whole person, social environment affects the development of student's affective domain and whole theme instruction which are again matching with the findings of the present study. One study reveals health as a part of a comprehensive approach to educating the whole person which is matching with the findings of present study. One study has focused on psychomotor development of students and it is in tune with the finding of the present study. One study has covered all the domains under the investigation and found it effective for

secondary school students. There are five studies conducted on different subjects for finding effectiveness of wholistic education, wholistic development and wholistic approach, one for biology subject, two for English subject, one for folk art and one for language. These found significant difference in favour of wholistic instruction. There are eight studies conducted for teachers to investigate effect of wholistic development, wholistic education and wholistic approach. They found teachers' well-being and strong professional identity can foster well-being of their own students, teachers' overall attitude can develop children as a whole and teachers' goal clarity and professional development can foster the development of learners. The present study also presents the similar view. The Science Teaching employing wholistic approach by Student-Teachers and its observation by the investigator in the present study employing time series design reveal progressive proficiency in Wholistic Approach to Science Teaching. The present study found that the teaching through Wholistic Approach requires reasonably longer period of time and more efforts than traditional ways of teaching. Forbes and Robin (2004) also support the same. Thus, the findings of the present study establish the effectiveness of the Wholistic Approach to Teaching Science.

6.30. Implications of the Present Study

1. Wholistic approach could be made an integral part of Pre-Service Teacher Education program.
2. In-Service Teacher Education programs need to be organized focusing on the Wholistic Approach.
3. Conversion from the traditional approach of Science Teaching to Wholistic Approach of Science Teaching demands that sizable number of lessons must be taught employing Wholistic Approach to Teaching in Practice Teaching of Teacher Education.
4. Modules could be developed on the basis of Wholistic Approach of Teaching.

6.31. Suggestions for Further Research

1. A longitudinal study can be conducted to study the efficacy of Wholistic Approach of Science Teaching from elementary to higher levels.
2. Wholistic Approach to Science Teaching can be studied at various levels of Education.

3. Wholistic Approach to Teaching can be studied at various levels of Education with respect to various subjects.
4. The Wholistic development can be studied with the tie up of corporate sector for the working professionals.
5. Efficacy of any Teaching Lesson Design for any level and subject should be evaluated on the bases of enunciate of lesson objectives with respect to all the domains- Cognitive, Affective, Psychomotor, Health and Environment, Spiritual and their realization.

6.32. Conclusion

It is always desirable to have balanced wholistic development. What use is knowledge without feeling, skills, health and spiritual control? To realize balanced development, the investigator conducted the study to educate student teachers on wholistic approach to Science Teaching. It was a struggle on time series to groom the student teachers on wholistic approach, wherein, the objectives of the Science lessons designed were enunciated with respect to all the domains-cognitive, affective, psychomotor, health and environment, and spiritual and wholistic approach of transaction was employed, analytically & comprehensively. Though, initially, the student teachers were diffident in employing wholistic approach to Science Teaching, attributing it to many a limiting factor, such as, rigid school time-space-personnel-material management, but, progressively they gained confidence in applying wholistic approach overpowering the time-space rigidities and infrastructural limitations. Observations of the wholistic approach during practice teaching employed by the Student Teachers by the investigator reveals, that, progressively there was significantly sizable gain on wholistic approach from pre-test to post-test. Also, the gain is evident through the identification of the various attributes through the narratives & crossword puzzle. Though initially there were varied scattered reflections, but, finally, the student teachers were found to have favourable reactions towards the wholistic approach of Science Teaching. Though the Wholistic approach of Science Teaching has been found to be highly demanding, but, its returns are significantly valuable in realizing wholism. There is a need to integrate wholistic approach of teaching science, so as to make it more meaningful, joyful, and related to life.