CHAPTER I
INTRODUCTION

What are the basic things that compose curriculum? What are the questions that may be posed about these things? Joseph Schwab’s conception of curriculum is used to introduce a scheme of questions concerning the nature, elements, and practice of curriculum (Dillon, 2009). The elements of curriculum include aim, teacher, student, subject, milieu, activity and result. These elements are interrelated and curriculum emerges from complex interactions among many factors such as educational philosophies, social needs and actors such as politicians, administrators, teachers and students (Mitzel, 1982). A review of curriculum from ancient to the present in the light of this framework gives a scheme to evaluate any practicing curriculum.

A review of history of curriculum reveals that until seventeenth century, school curriculum was subject-centred and was dominated by Idealism. Generally, Idealists believe that ideas are the only true reality. They hold that material world is characterised by change, instability, and uncertainty (Ozmon & Craver, 1999; Armstrong, Henson & Savage, 1989). Literature describes (Ozmon & Craver, 1999) prominent thinkers of Idealism: Platonic Idealism (Plato, 427-347, B.C.E), Religious Idealism (Augustine, 354-430, B.C.E), and Modern Idealism (Rene Descartes, 1596-1650; George Berkeley, 1685-1753; Immanuel Kant, 1724-1804; Georg Wilhelm Friedrich Hegel, 1770-1831; and Josiah Royce, 1855-1916).

In the middle ages (middle of 5th century to middle of 15th century) a programme of study developed was identified as the “seven liberal arts.” These were divided into
‘Trivium’ and ‘Quadrivium.’ The three lower divisions of the seven liberal arts consisting of grammar, rhetoric, and logic are called Trivium. The remaining four, arithmetic, music, geometry and astronomy were the Quadrivium (Blackburn, 2006; Ornstein & Hunkins, 1993; Douglass, 1947). In the later middle ages (beginning of the 11th century to the 16th century) the movement known as ‘Scholasticism’ developed. It combined religious doctrine, study of the church fathers, and philosophical and logical work based particularly on Aristotle and commentators, and to some extent on themes from Plato (Blackburn, 2006; Armstrong, Henson & Savage, 1989). The period of modern idealism can be arbitrarily set with the rise of scientific revolution in the fifteenth and sixteenth centuries and largely identified with systematisation and subjectivism (Ozmon & Craver, 1999). The method of instruction prevalent in Rome was ‘imitation.’

In the seventeenth century, there was a new appreciation for education directed towards practical and useful ends due to Realism. Nicolous Copernicus (1473-1543) and Francis Bacon (1561-1626) had great influence on seventeenth century thought. The most central thread of Realism is what may be called the principle or thesis of independence. This thesis holds that reality, knowledge and value exist independently of the human mind. In other words, Realism rejects the Idealists’ notion that only ideas are real. So the slogan ‘learning by doing’ reflected in the theory and practice and thus emphasised the ‘needs of society’ (Ozmon & Craver, 1999; Armstrong, Henson & Savage, 1989). To understand this complex philosophy, it will be necessary to examine its development from classical times to its various versions (Ozmon & Craver, 1999; Armstrong, Henson & Savage, 1989). They are Classical Realism or Aristotelian...
Realism (Aristotle, 384-322, B.C.E), Religious Realism (Thomas Aquinas, 1225-1274), Modern Realism (Francis Bacon, 1561-1626; John Locke, 1632-1704) and Contemporary Realism (Alfred North Whitehead, 1861-1947; Bertrand Russell, 1872-1970; Hilary Putnam, 1926-; John R. Searle (1932-).

In the eighteenth century, the organisation of curriculum was centred on the learners due to the influence of Naturalism. The important thinkers were Jean Jacques Rousseau (1712-1778), Johann Heinrich Pestalozzi (1746-1827), Johann Friedrich Herbart (1776-1841) and Friedrich Froebel (1782-1852). The industrial revolution, which roots in the eighteenth century, became an explosive force in the nineteenth century (Armstrong, Henson & Savage, 1989).

The theory of Mental Discipline dominated the curriculum organisation during the most of the nineteenth century (Kliebard, 1982). During the first twenty years of the nineteenth century, a few innovations were made in educational practices. The technological innovations open the way to broaden the educational experiences more “useful” and “practical.” The organisations such as American Federation of Teachers (AFT) and National Education Association (NEA, 1893) were organised in America. Twentieth century witnessed the emergence of Intelligence Tests and Measurement Driven Instruction (MDI). The National Society for the Study of Education (NSSE) took a strong stance against nature study and advocated an integrated approach to secondary school science. The Progressive Education Association (PEA, 1938) further accented the need for a science programme based on factors of social utility, solving social problems, growing commitment to objectives related to “scientific method” and “problem solving.”
Pragmatism and Progressive Education movements gave a surprising vision in the arena of education. Although Pragmatism is primarily viewed as a twentieth century philosophy developed by Americans for the most part, its roots can be traced back to British, European, and ancient Greek philosophical traditions (Ozmon & Craver, 1999). The background of Pragmatism can be found in the works of such figures of induction (Francis Bacon, 1561-1626), the importance of human experience (John Locke, 1632-1704; Jean Jacques Rousseau, 1712-1778) and the relationship between science and culture (August Comte, 1768-1857; Charles Darwin, 1809-1882). But the philosophical elements that gave Pragmatism a consistency and system as a philosophy in its own right are primarily the contributions of Charles Sanders Pierce (1839-1914), William James (1842-1910) and John Dewey (1859-1952).

A short historical excursion will be helpful to see how the processes of science came to be recognized as the foundation for scientific activity. In 1957, the United States felt deeply humiliated by the launching of Sputnik by Russians and it challenged the presumed American technological supremacy. Reacting to the pressures to ‘do something’ about the schools, the US Federal government in 1958 passed the National Defense Education Act (NDEA). In 1960s, the National Science Foundation (NSF) initiated projects to improve elementary science curricula and to implement those curricula through teacher education institutes. These curriculum projects were philosophically based on the structure of discipline approach. In the mid 1960s, the NSF supported seven major elementary and junior high school science curriculum projects and many teacher education workshops. The major elementary science curriculum projects
produced were Biological Science Curriculum Study (BSCS), Physical Science Study Committee (PSSC), Elementary School Science Project (ESSP), Earth Science Curriculum Project (ESCP), Science: A Process Approach (SAPA) of the American Association for the Advancement of Science (AAAS), Elementary Science Study (ESS), Elementary School Science Project (ESSP), Science Curriculum Improvement Study (SCIS), Science Manpower Project (K-12 Science Programmes), Chemical Education Material Study (CHEM Study), Conceptually Oriented Programme in Elementary Science (COPES), Minnesota Mathematics and Science Teaching Project (MINNEMAST) and the Chemical Bond Approach (CBA) (Herr, 2008; Gallagher, 2007; Llewellyn, 2002; Dana, Campbell & Lunetta, 1997; Duschl, 1990; Armstrong, Henson & Savage, 1989; Blough & Schwartz, 1974; Victor & Lerner, 1971; Anderson, DeVito, Dyrli, Kellog, Kochendorfer & Weigand, 1970; Carin & Sund, 1970; Kuslan & Stone, 1969; UNESCO, 1962).

The main emphasis of the above mentioned projects was on subject matter, including conceptual schemes and major principles and on the process of science. Consequently, both textbooks and laboratory work were important (Wittrock, 1986). Influenced by the work of cognitive scientists, including Robert Mills Gagne (1916-2002), Jean Piaget (1896-1980), and Jerome Seymour Bruner (1915-), the programmes garnered strong support from the U.S. government and from the science education communities. The projects emphasised learning scientific inquiry process or “process skills,” learning valid scientific concepts, and engaging students actively in exploration with materials (Dana, Campbell & Lunetta, 1997).
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The major changes in the arena of philosophy contributed changes in the field of psychology also. The period of educational philosophy which based on observing and testing the behaviour of animals under controlled settings shaped a new era called behaviourism (Llewellyn, 2002). Behaviourism focuses on a new behavioural pattern being repeated until it became automatic (Schuman, 1998) in the sense that response to stimulus can be observed quantitatively, totally ignoring the possible thought process occurring in the mind. The fundamental methods employed by instructional designers such as task analysis, behavioural objectives and criterion-reference evaluation, are all based on behavioural conceptions of learning (Jonassen, 1991). Some key players in the development of behaviourist theory were Pavlov (1849-1936), Watson (1878-1958), Thondike (1874-1949), and Skinner (1904-1990) (Good & Brophy, 1990). This group of theorists heavily influenced educational practices from 1920s through the 1950s. Their ideas continue to have implications for our present system of education (Llewellyn, 2002).

As early as the 1920s people began to find limitations in the behaviourist approach to understanding learning. Behaviourists were unable to explain certain social behaviours such as children do not imitate all behaviour that has been reinforced and they may model new behaviour days or weeks after their first initial observation without having been reinforced for the behaviour (Dembo, 1994). So in the 1950s some psychologist’s began to rebel against behavioural psychology and developed the basic percepts of cognitive science. Cognitivism is based on the thought process behind the behaviours. Changes in behaviour are observed, and used as indicators as to what is
happening inside the learners’ mind (Schuman, 1996). The cognitivists acknowledge the importance of reinforcement, although they stress its role in providing feedback about the correctness of responses over its role as a motivator. However, even while accepting such behaviouristic concepts, cognitive theorists view learning as involving the acquisition or reorganisation of the cognitive structures through which human beings process and store information (Good & Morphy, 1990).

The cognitive revolution became evident in American psychology during the 1950s. It was revolutionary as it marked by series of meetings of psychologists, linguists, computer scientists, philosophers, anthropologists, and neuro scientists. One of the major players in the development of cognitivism is Jean Piaget, who developed the major aspects of this theory. Although cognitive psychology took over as the dominant theory of learning, it was until the late 1970s that cognitive science began to have its influence on instructional design (Lewis, 2001).

The shift of instructional design from behaviourism to cognitivism was not as dramatic as the move into constructivism appears to be, since behaviourism and cognitivism are both objective in nature. Behaviourism and cognitivism both support the practice of analysing a task and breaking it down into manageable chunks, establishing objectives, and measuring performance based on those objectives. Constructivism on the other hand promotes a more open-ended learning experience where the methods and results of learning are not easily measured and may not be the same for each learner. As a psychological theory, constructivism draws heavily from Jean Piaget (1896-1980), Lev Semanovich Vygotsky (1896-1934), John Dewey (1859-1952), Jerome Seymour Bruner
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The last quarter of the twentieth century focused on learner and learner as a scientist or the constructivist paradigm. As a significant challenge to behaviourism as well as to realism and its impact on education, came from the psychological school of thought called constructivism (Ozmon & Craver, 1999). Gross and Leuitt (1994) pointed out that much of the American post-modernist/constructivist thought can be traced to the French philosophers, Jacques Derrida and Michael Foucault, whose views achieved prominence during the social upheaval in late 1960s in France (cited in Mathews, 2003). Constructivists affirm that truth is made (or constructed), not discovered or uncovered. Thus constructivism challenged that behaviourism should not be seen as a unique new departure (Ozmon & Craver, 1999). Constructivism today has an increasingly significant impact on educational reform and is increasingly being adopted as the accepted theory on how children learn (Llewellyn, 2002). There is a growing body of literature that suggests that constructivist teaching practices are becoming more and more prevalent in teacher education programmes across the world (Gordon, 2008).

1.20. Need and Significance of the Study

Philosophical, psychological and sociological propositions significantly influence educational theory and school practice. Consequently, the philosophical, psychological and sociological orientations of individuals have great relevance to how they are likely to view a given educational programme. To defend their own practices and to understand
the potential views of others regarding these practices, teachers need some knowledge of the major streams of philosophical, psychological and sociological thoughts in education (Armstrong, Henson & Savage, 1989). Successful school reform requires that administrators, teachers, and students internalise the value of improved teaching and learning and of the practices, structures, procedures and behaviours implicit in the reform (Deci, 2009).

A brief description of curriculum history provided in the previous pages sets a stage for reviewing present educational practices and problems of implementation. Many contemporary school practices, examined in the absence of an understanding of their historic roots make little sense. Consequently, it is important for teachers and prospective teachers to be aware of some of the key episodes that have shaped present educational practices. Quality education in schools is delivered through a thoughtful curriculum that is based on learning outcomes and mediated through skillful, well-prepared teachers (Rasheed, 2000). Thus teachers are viewed as important agents of change in the reform effort currently underway in education and thus are expected to play key role in changing curriculum, classrooms, schools and society (Pointer Mace, 2008; Prawat, 1992).

Curriculum-in-action is primarily an interaction among teachers and students in the situation. The experiences and personal knowledge of teachers and students brought to instructional situations are the key determiners of how the curriculum is used (Husen & Postlethwaite, 1985). Curriculum evaluation is an important exercise in any curriculum revision to assess its effectiveness and to pinpoint the problems of
implementation. It functions as a feedback to the educational system. Yager and Weld (1999) stated that continuing efforts to evaluate and improve science education programmes will be exciting ones (cited in Yager, 2002). So the present study is undertaken to evaluate the revised biology curriculum at high school level in the light of conceptual background with special emphasis to constructivist practises and problems in classroom transaction.

1.30. Statement of the Problem

EVALUATION OF THE REVISED BIOLOGY CURRICULUM AT HIGH SCHOOL LEVEL IN THE CONSTRUCTIVIST PERSPECTIVE AND PRACTICE.

1.40. Definition of Terms

1.41. Evaluation

Evaluation is the process of examining and judging the curriculum, textbooks, and practice of classroom transaction including role of teacher, nature of student activities, strategies of classroom transaction, nature of group activity, and strategies of assessment in the perspective of constructivism.
1.42. Revised Biology Curriculum

Revised biology curriculum is the new biology curriculum introduced by the (State Council of Educational Research and Training) SCERT in 2002 and 2007 for standard VIII, IX and X in subsequent years as a part of entire curricular revision in Kerala.

1.43. Curriculum

Curriculum is the planned and guided learning experiences and intended outcomes formulated through systematic reconstruction of knowledge and experiences, under the auspices of the school, for the learners’ continuous and willful growth in personal-social competence (Tanner & Tanner, 1975).

1.44. High School

The school division following the elementary school, comprising of grades VIII, IX and X.

1.45. Constructivist Perspective

It is a broad term used by philosophers, curriculum designers, psychologists, educators and others to emphasise the active role of the learner in building and understanding and making sense of information through individual and social activity (Woolfolk, 2004).

1.46. Practice

Constructivism in practice does not refer to the simple application of instructional strategies. It means constructivist principles in action. In the present study it refers to
how the constructivist principles (philosophical, psychological, and sociological) are reflected in the high school biology curriculum transaction including practises and problems of teachers and students.

1.50. Objectives of the Study

1. To evaluate the revised biology curriculum at high school level in the constructivist perspective as perceived by State Resource Group (SRG) with respect to the dimensions such as

   i) Nature and principles of constructivism
   
   ii) Nature of strategies of classroom transaction
   
   iii) Role of teacher
   
   iv) Nature of student activities and
   
   v) Nature of strategies of assessment.

2. To analyse textbook of revised biology curriculum at high school level in the constructivist perspective as perceived by the SRG for the subject of biology.

3. To study the practises and problems of students at high school biology classrooms in the constructivist perspective in the dimensions such as

   i) Role of teacher
ii) Nature of student activities

iii) Nature of strategies of classroom transaction

iv) Nature of group activity and

v) Nature of strategies of assessment.

4. To compare the mean scores of practises and problems of students at high school biology classrooms in the constructivist perspective in the dimensions role of teacher, nature of student activities, nature of strategies of classroom transaction, nature of group activity, and nature of strategies of assessment in the sub groups such as

i) Boys and girls

ii) Rural and urban school students

iii) High achievers and low achievers

iv) Aided, government and unaided school students.

5. To study the practises and problems of biology teachers at high school level in the constructivist perspective in the dimensions such as

i) Role of teacher

ii) Nature of student activities

iii) Nature of strategies of classroom transaction

iv) Nature of group activity and
v) Nature of strategies of assessment.

6. To compare the mean scores of practises and problems of biology teachers at high school level in the constructivist perspective in the dimensions role of teacher, nature of student activities, nature of strategies of classroom transaction, nature of group activity, and nature of strategies of assessment in the sub groups such as

i) Rural and urban school teachers

ii) Aided, government and unaided school teachers

iii) Qualified, academically more qualified, and professionally more qualified teachers

iv) Less experienced, experienced, and more experienced teachers and

v) Less aged, aged, and more aged teachers.

7. To study the correlation between practises of students with practises of biology teachers at high school level in the constructivist perspective in the dimensions such as

i) Role of teacher

ii) Nature of student activities

iii) Nature of strategies of classroom transaction

iv) Nature of group activity and

v) Nature of strategies of assessment.
8. To study the correlation between problems of students with problems of biology teachers at high school level in the constructivist perspective in the dimensions such as

i) Role of teacher

ii) Nature of student activities

iii) Nature of strategies of classroom transaction

iv) Nature of group activity and

v) Nature of strategies of assessment.

1.60. Hypotheses of the Study

1. There exists a significant difference in the mean scores of practises and problems of students at high school biology classrooms in the constructivist perspective in the dimensions role of teacher, nature of student activities, nature of strategies of classroom transaction, nature of group activity, and nature of strategies of assessment in the sub groups such as

i) Boys and girls

ii) Rural and urban school students

iii) High achievers and low achievers

iv) Aided, government and unaided school students.
2. There exists a significant difference in the mean scores of practises and problems of biology teachers at high school level in the constructivist perspective in the dimensions role of teacher, nature of student activities, nature of strategies of classroom transaction, nature of group activity, and nature of strategies of assessment in the sub groups such as

i) Rural and urban school teachers

ii) Aided, government and unaided school teachers

iii) Qualified, academically more qualified, and professionally more qualified teachers

iv) Less experienced, experienced, and more experienced teachers.

v) Less aged, aged, and more aged teachers.

3. There exists a significant relationship between practises of students and practises of biology teachers at high school level in the constructivist perspective in the dimensions such as

i) Role of teacher

ii) Nature of student activities

iii) Nature of strategies of classroom transaction

iv) Nature of group activity and

v) Nature of strategies of assessment.
4. There exists a significant relationship between problems of students with problems of biology teachers at high school level in the constructivist perspective in the dimensions such as

i) Role of teacher

ii) Nature of student activities

iii) Nature of strategies of classroom transaction

iv) Nature of group activity and

v) Nature of strategies of assessment.

1.70. Research Design and Procedure

The research design and procedure is described as method, population, sample, tools, collection of data, and statistical treatment of data as follows.

1.71. Method: Normative survey method was used in the present study.

1.72. Population

Population of the study includes all schools, all teachers teaching biology at VIIIth, IXth, and Xth standards at high school level and all students studying in standard VIII, IX, and X of Thrissur Revenue District.
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1.73. Sample

The sample consisted of 16 members of State Resource Group (SRG) for the subject biology at high school level of Kerala State, 120 high school teachers teaching biology at VIIIth, IXth and Xth standard from different schools of Thrissur Revenue District and 960 IXth standard students from different schools of Thrissur Revenue District. Due representation was given to each strata of teachers and students such as Government, Aided, Unaided, Male, Female, Rural and Urban using proportionate stratified random sampling technique.

1.74. Tools

For the present study the investigator developed and used five tools as

1. A Philosophical, Psychological, and Sociological Preference Analysis Scale (PPSPAS) to collect data from SRG members

2. A Score card namely Evaluation Scale for Constructivist Biology Textbook (ESCBT) to analyse the biology textbooks at high school level

3. A Questionnaire to collect data from high school teachers about the Practises and Problems of Teachers (QPPT) in the constructivist biology classrooms

4. A Questionnaire to collect data from high school students about the Practises and Problems of Students (QPPS) in the constructivist biology classrooms and

5. Interview Guides to collect data from selected biology teachers and students at high school level.
1.75. Collection of Data

The data were collected from 16 SRG members, 120 teachers and 960 students using the tools described above. The biology curriculum was studied based on the perspectives of constructivism. The textbooks were examined using schemes developed by the investigator. The data so gathered were triangulated with in-depth interviews to corroborate the emerging findings.

1.76. Statistical Treatment of Data

The tabulated data were subjected to objective-wise analysis using Statistical Package for Social Sciences (SPSS). The statistical techniques used were Percentage Analysis, Tests of Normality and Homoscedasticity, t-test, One-way ANOVA (Analysis of Variance), Correlation (Pearson Product Moment) and Univariate Analysis of Variance.

1.80. Scope and Limitations of the Study

By the present study the investigator intended to evaluate the revised biology curriculum at high school level in the constructivist perspective and practice. Curriculum evaluation is an important aspect in any curriculum revision as it functions as a feedback to the educational system as a whole. Appropriate tools were developed and used by the investigator to collect data. The sample included all strata of population which are relevant for the study, satisfying the norms of randomisation. The sample comprises 960 students and 120 teachers from various strata of population. This includes government,
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aided, unaided, male, female, rural and urban based on stratified random sampling technique. This is done for the purpose of controlling the variables such as locale, gender, type of management, age, teaching experience, and qualification.

The study also focuses on curriculum transaction especially problems of students and teachers in the high school biology classrooms. It may help the authorities concerned with quality education, educational officers, department of education, and teachers to rectify the limitations identified. So the investigator hopes that the study will provide a genuine support to Department of Public Instruction (DPI), State Council of Educational Research and Training (SCERT), Institutes of Advanced Studies in Education (IASEs), District Institute of Education and Training (DIETs), Deputy Directors of Education (DDEs), District Educational Officers (DEOs), Kerala State Council for Science, Technology and Environment (KSCSTE), National Council for Teacher Education (NCTE) and Quality Improvement Programme (QIP) cell of DPI for revisiting the projects, action plans, monitoring system and administrative policies in the context of Right to Education (RTE) act, 2009. The findings and observations of the study will definitely help the whole system to ensure self assessment and to take necessary steps to ensure quality by eliminating the limitations identified. If organically approached, any movement in this connection will strengthen the quality of biology curriculum transaction at high school level with a pedagogic concern in the dimensions role of teacher, nature of student activities, nature of strategies of classroom transaction, nature of group activity, and nature of strategies of assessment.
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The study is not free from limitations. The identified limitations are - - 1) No measure has been taken to assess the level of conceptual awareness of SRG members, for the subject of biology, in Kerala Curriculum Framework (KCF, 2007) and position paper of SCERT, 2) Out of 28 SRG members only 16 numbers were selected for analysing the curriculum and textbooks, 3) Sample was collected only from one district (Thrissur), 4) Perception of teachers regarding constructivist paradigm is not considered or analysed, and 5) No classroom observation was conducted for the purpose of the study.

1.90. Organisation of Research Report

The research report consists of five chapters. The second chapter brings out the review of related literature and studies. It describes a critical analysis of the theoretical background and related studies in the constructivist paradigm. The third chapter describes the methodology of the study. It includes the statement of the problem, objectives, hypotheses, research design and procedure. The research design and procedure includes population of the study, sample for the study, tools and techniques, procedure of data collection and statistical techniques used in the data analysis. The fourth chapter presents how the data were critically analysed using appropriate statistical techniques. It involves interpretations of findings with reference to the objectives and hypotheses. The fifth chapter highlights the overall structure of the present study. It consists of sections such as problem, objectives, hypotheses, research design and procedure in brief, major findings, tenability of the hypotheses, implications, limitations of the study and scope for further work.
CHAPTER 11
REVIEW OF RELATED LITERATURE AND STUDIES
CHAPTER 11
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2.10. Overview

2.20. Conceptual Framework

2.21. Epistemological Roots of Constructivism

2.22. Types of Constructivism

2.23. Cognitive Constructivism

2.24. Social Constructivism

2.30. Review of Related Studies

2.31. Studies in the Discipline of Information Systems Education

2.32. Studies Related with use of Technology

2.33. Studies in the Arena of Teacher Education

2.34. Studies related to General Structure of Constructivism

2.35. Studies in the Discipline of Mathematical Education

2.36. Studies in the Discipline of Science