RELATIONSHIP BETWEEN EPISTEMOLOGICAL BELIEFS AND ACHIEVEMENT IN PHYSICS AMONG SECONDARY SCHOOL STUDENTS

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DECLARATION

I, **ANJUSHA V.V.**, do hereby declare that this dissertation entitled **RELATIONSHIP BETWEEN EPISTEMOLOGICAL BELIEFS AND ACHIEVEMENT IN PHYSICS AMONG SECONDARY SCHOOL STUDENTS** has not been submitted by me for the award of any Degree, Diploma, Title or Recognition before.

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CERTIFICATE

I, **Dr. NIRANJANA K.P.**, do hereby certify that the dissertation titled, **RELATIONSHIP BETWEEN EPISTEMOLOGICAL BELIEFS AND ACHIEVEMENT IN PHYSICS AMONG SECONDARY SCHOOL STUDENTS**, is a record of bonafide study and research carried out by **ANJUSHA V.V.** under my supervision and guidance, has not been submitted by her for the award of any Degree, Diploma, Title or Recognition before.

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Dr. NIRANJANA K.P.
Supervising Teacher

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Education has been interpreted by different people on different ways. Some people refer to it as a formal schooling or lifelong learning. Some others refers to it as acquisition of knowledge, skills and attitudes. Some says that education is nothing but training of people's mind in a particular direction to bring about desired changes. Education is a systematic process through which child or on adult acquires knowledge, experience, skill and sound attitude. It makes an individual civilized, refined, cultural and educated. The goal of education should be full flowering of the human on the earth. Education is the process by which society deliberately transmits its accumulated knowledge skills and values from one generation to another.

In a wider sense, education is not limited to a classroom or a school only. It is considered to be a lifelong process where all the experiences, knowledge and wisdom that that an individual acquires at different stages of one's life through different channels. Education is the basis for development and empowerment of every nation. It plays a vital role in understanding and participating in day to day activities of today's world. It build's one's character and play significant role in transmitting one's beliefs and values to others in society. Student's learning has a major role in every education system. Two factors that influence learning are factors associated with learner and factors related to learning process. Some of the factors associated with learner are motivation, readiness and will power, ability of the learner, level of aspiration and achievement, attention, general health condition, maturation of the learner and learner's epistemological beliefs. Factors related to

learning process include methods of learning and teaching, good physical atmosphere. Recently, most of the educational researches and psychological research focus on epistemological beliefs of a learner.

The Greek word 'Episteme, is the root of epistemology, is a philosophical term commonly associated to enquiry of truth and knowledge. Greek philosopher seeded the study and from this cultivation of thought stem the growth of many sciences. Epistemology has always concerned with issues such as nature, extent, source and legitimacy of knowledge. Philosophers have concentrated sometimes some of these questions. What is knowledge? What is the extent of our knowledge? What are the sources of knowledge and it mere any genuine knowledge? First question has predominated in philosophy since the middle of twentieth century. Second question seems to have begin with Plato, the third question is also important. The fourth question raises the issues of skepticism, a topic which has generated interest and discussion from antiquity to the present day. Now it is the question what is a justified beliefs? It has been a crucial question for many philosophers in the twenty first century. It enquires into the origin of knowledge and condition of its validity. Four main theories about the origin of knowledge are rationalism, empericism, aperiorism and intution. Rationalism regards reason as the true source of knowledge. Descartes is a typical exponent of rationalism. Empiricism regards experience as the true source of knowledge. Locke and Hume are typical exponent of empiricism. Kant advocates apriorism and regards reason and experience both as the source of knowledge. Kant's theory is called critical theory of knowledge, regard intuition as the origin of knowledge.

Epistemology is an area of philosophy concerned with the nature and justification of human knowledge. Epistemology is the study of the origin nature and limitation of knowledge. Etymologically, epistemology is the theory (logos) of knowledge (episteme). Epistemological beliefs refer to study of knowledge and knowing. Epistemological beliefs mean ones beliefs about the nature of knowledge and knowing. Piaget (1970) used the term to 'genetic epistemology' to describe his theory of intellectual development. Psychologist and educators have become interested in epistemological beliefs and how the beliefs influence the cognitive process of thinking and reasoning. Various research studies revealed that epistemological beliefs to be a strong predictors of students cognitive performances and affective responses.

Piaget (1950) introduced the frame work of genetic epistemology with its four mains stages the sensory motor stage (0-2 years), the pre operational stage (2-7 years), the concrete operational stage (7-11 years) and formal operational stage (11-15 years). The study of epistemological beliefs was started by Perry (1970) who studied students beliefs from a developmental point of view, suggesting that the development of a person's epistemological beliefs progress through the stages of dualism, multiplism, relativism and commitment. Inspired by Perry's work on personal epistemology, Schommer (1990) argued for multidimensional model where epistemological beliefs do not simply a mirror of a person's cognitive development. Personal epistemological belief has several dimensions which are more or less independence. Schommer (1990) has proposed five dimensions of epistemological beliefs, originally formulated as the structure of knowledge, source of knowledge,

certainty of knowledge, innate ability and speed of knowledge acquisition. Epistemological beliefs of students play an important role in their learning process.

Studies related to epistemological beliefs mention three different characteristics of epistemological beliefs. Epistemological beliefs have a developmental nature. Learning is affected by individual's epistemological beliefs. Epistemological beliefs might be defined as individual theories regarding knowledge and knowing and their epistemological resources. The beliefs affect learning by activating tendencies to learn in associated context with the beliefs.

National Curriculum Framework (2005) highlighted "good science education is true to the child, true to life and true to science" in context of national curriculum framework, true to child. It means that the science teaching should be understandable to the child and be able to engage the child in a meaningful and joyful learning. True to life means that the science teaching should relate to the environment of the child, prepare them for the world of work, promote in them concern for life and preservation of environment. True to science means the science should convey significant aspects of science content at appropriate level and engage the child in learning the process of acquiring and validating scientific knowledge. Students epistemological beliefs has significant role in their learning. So science teacher must aware about epistemological beliefs of students.

Physics is the science subject that attempt to describe how nature works using the language of mathematics. It is often considered as the most fundamental of all the natural sciences and its theories attempt to describe the behavior of the smallest building blocks of matter, light, the universe and everything in between. In

this study the investigator analyses the relationship between epistemological beliefs in physics and achievement in physics among secondary school students.

Need and Significance of the Study

The main problem of our education system is the complex nature of certain discipline and it makes difficulties in student's learning. The student does not interest to study such subject they face so many difficulties in learning. Physics education researchers have identified students difficulties in learning a broad range of Physics concept curricula targeting these difficulties have produced dramatically improved conceptual understanding. In recent years, the physics education research community also has begun to look at students' attitudes, expectations and epistemologies. Students may think of physics knowledge as disconnected facts and formulas are interconnected concepts. Students may think of learning physics as absorbing information from authority are building up their own ideas. This discipline specific epistemological research can open a path to solve these type of problem.

Curriculum developers should understand how epistemological beliefs affect learning. In designing curriculum, developers should give equal importance to epistemological beliefs as well as conceptual, social or affective factors. Curriculum develops can take up the challenge of helping students associate their productive epistemological resources with the activity, the course and the discipline. Classroom teacher must understand how epistemological beliefs affects learning. Teacher must consider students' strength and difficulties of an epistemological nature teacher must identify the epistemological resources that student possess and to understand which

resources they are using during the learning process. Teacher can help the student to choose the more productive approaches to learning.

Student's epistemological beliefs play a significant role in their learning and motivation in classroom. The review of literature reveals that student's epistemological beliefs greatly influence their learning and achievement in particular subject. Arslantus (2016) found that there is a significant positive negligible relationship between the epistemological beliefs and academic achievement. Stockton (2010) investigated a study on relationship between epistemological Beliefs and self regulated learning among advanced placement calculus students in the context of mathematical problem solving. The result of the study showed that problem solving performance was positively related to epistemological beliefs of the students. Students with less nature epistemic believes have low level of comprehension, and students with more advanced nature of epistemic beliefs were found to deeper level of comprehension. So it is essential to study how epistemological beliefs affect student's achievement.

Student's epistemological beliefs influence learning through a link with learning approaches. Chan (2003) reported that there exist significant relationship between epistemological beliefs and conception of learning and learning strategies. Surface learning focused on outcome goals such as obtaining a qualification, where as deep approach involves intrinsic motivation and abstract meaning. Tanriveeli (2012) conducted a study on teachers' epistemological beliefs and approaches to learning. The result of the study showed that student who believe that learning depend upon innate ability was likely to be surface motivated and utilize a surface

strategy on their studying while student who believe learning depend on effort would be deep motivated and adopt a deep study strategy. Nature epistemological beliefs have been associated with surface learning approaches where as sophisticated beliefs associated with deeper approaches. Teachers can identify the epistemological beliefs of students and change their approaches to learning.

Education system mainly has three dimensions teaching, curriculum and assessment. In order to provide appropriate learning experiences and appropriate learning strategies, for developing curriculum and for assessment purpose we should know the students epistemological beliefs. Physics is one of the difficult subjects studied in secondary schools. Many students find it difficult due to its complex nature. Classroom teacher and curriculum developers should understand how epistemological beliefs affect students learning. Thus, the teachers and resource persons can design their teaching and learning process with regard to student's epistemological beliefs. Most of the studies on epistemological beliefs in relation to achievement are conducted outside the country. So it is essential to study how student's epistemological beliefs affect their achievement. The purpose of the study is to know how the epistemological beliefs in physics of secondary school students are related to their achievement in physics.

Statement of the Problem

The study is entitled as "RELATIONSHIP BETWEEN EPISTEMOLOGICAL BELIEFS AND ACHIEVEMENT IN PHYSICS AMONG SECONDARY SCHOOL STUDENTS"

Definition of Key Terms

The definition of key terms in the statement of the problem is

Epistemological Beliefs

Hofer and Pintrich (1997) refer to "Epistemological beliefs as the individual's conception about both nature of knowledge and the nature or process of knowing their work."

In the present study, epistemological beliefs is operationally defined as the beliefs possessed by the students about physics and process of acquiring knowledge in physics as measured by using Scale on Epistemological Beliefs in Physics.

Achievement in Physics

Gora (2001) defined "Achievement as the overall accomplishment that student achieve in a specific course measures by their scores."

In the present study, Achievement in Physics is operationally defined as how much the knowledge in Physics acquired by an individual in half yearly physics examination of 9^{th} standard conducted by the school.

Secondary School Students

Secondary School Students are those students studying in VIII, IX and X standards in Kerala state.

For the present study, students studying in standard IX of various high schools in Kerala who follow state syllabus is considered as secondary school students.

Variables for the Study

Present study designed with two variables viz., Epistemological Beliefs and Achievement in Physics.

Objectives of the Study

The objectives set for the study are

- To know whether there exist any difference in the mean scores of Epistemological Beliefs of secondary school students with respect to subsample
  - Gender
  - Locale of the schools
  - Type of Management of schools
- To know whether there exist any difference in the mean scores of Achievement in Physics of secondary school students with respect to subsample
  - Gender
  - Locale of the schools
  - Type of Management of schools

- To find out the relationship between Epistemological Beliefs and Achievement in Physics among secondary school students for the total sample.
- To find out the relationship between Epistemological Beliefs and Achievement in Physics among secondary school students for the subsample based on
  - Gender
  - Locale of the schools
  - Type of Management of schools

Hypotheses of the Study

The hypotheses formulated for the study are

- There will be no significant difference in the mean scores of Epistemological Beliefs among secondary school students for the subsample based on
  - Gender
  - Locale of the schools
  - Type of Management of schools
- There will be no significant difference in the mean scores of Achievement in Physics among secondary school students for the subsample based on
  - Gender
  - Locale of the schools
  - Type of Management of schools

- There is no significant relationship between Epistemological Beliefs and Achievement in Physics among secondary school students for the total sample.
- There is no significant relationship between Epistemological Beliefs and Achievement in Physics among secondary school students for the subsample based on
  - Gender
  - Locale of the schools
  - Type of Management of schools

Methodology

The study is intended to investigate the relationship between Epistemological Beliefs and Achievement in Physics among secondary school students. The investigator used survey method for the study. A precise description of sample, tool and statistical technique used for the study are described.

Sample of the Study.

The population for the study comprised of secondary school students of Kerala State. The present study was conducted on the sample of 600 secondary school students from various schools of Kozhikode and Malappuram districts of Kerala state, selected by stratified sampling technique giving due to the representation of to gender, locale of the schools and type of management of schools.

Tool used for the Study

To measure the variable Epistemological Beliefs, investigator developed Scale on Epistemological Beliefs in Physics (Anjusha & Niranjana, 2017) with the help of supervising teacher.

Statistical Techniques used for the Study

For the purpose of analyzing the data, investigator carried that statistical techniques such as

- Descriptive statistics
- Test of significance difference obetween mean scores of large independent sample(t test)
- Pearson's product moment co-efficient of correlation (r)

Scope and Limitations of the Study

Scope of the study

The study is intended to investigate the relationship between Epistemological Beliefs and Achievement in Physics among secondary school students. Appropriate and standard tool was employed to measure the data. The investigator developed the tool with the help of supervising teacher. The study was conducted on a sample of 600 secondary school students of various secondary schools of Kozhikode and Malappuram districts of Kerala state. Due representation was given to factors like gender, type of management and locale of the schools while selecting the sample. Analysis and interpretation were made by use of authentic statistical techniques.

Hence, the investigator hope the result yielded from the study would be reliable, valid and dependable. It is very essential to study the epistemological beliefs of students in every education system. It helps the teacher and curriculum developers to design the curriculum and plan teaching learning of physics according to the beliefs possessed by the students.

Limitations of the study

The investigator tried to make the study as successful as possible, certain limitations have crept to the study.

- Sample selected for the study is not a state wide sample. Due to the time limitation it was confined into two districts of Kerala state , Kozhikode and Malappuram.
- Unaided secondary school students are ignored from the subsample due to time limitation.
- Only those students studying in studying in IX standard were considered

Organization of the Report

The whole report is presented in five chapters.

Chapter I

The first chapter presents a brief introduction of the problem, need and significance of the study, statement of the problem, definition of key terms variables for the study, objectives of the study, hypotheses of the study, methodology, scope and limitations of the study.

Chapter II

The second chapter gives a theoretical overview of Epistemological Beliefs and a summary of related studies of Epistemological Beliefs and Achievement in Physics.

Chapter III

The third chapter describes methodology of the study in detail with description of variables, objectives, hypotheses, tools employed for data collection, sample selected, data collection procedure and statistical technique used for the analysis.

Chapter IV

The fourth chapter includes the details of the analysis of data as per the objectives of the study.

Chapter V

Chapter five contains the description regarding the study in retrospect major findings, conclusion, educational implications and suggestions for further research.

Chapter II

REVIEW OF RELATED LITERATURE

- *Theoretical Overview of Epistemological Beliefs*
- *Studies Related to Epistemological Beliefs*
- *Studies Related to Achievement in Physics*
- *Conclusion*

REVIEW OF RELATED LITERATURE

A literature review is a body of text that aims to review the critical point of current knowledge including substantive findings as well as theoretical and methodological contribution to a particular topic. A literature review is a search and evaluation of the available literature in our chosen topic area. The review of literature helps the investigator to survey the literature in the chosen area of study as well as to synthesis the information in to a summary

The review of literature also help the investigator to critically analyses the information gathered by identifying gaps in current knowledge by showing limitations of theories and point of view and by formulating area for further research and reviewing are of controversy. It enable the researcher to presents the literature in an organized way. The study is an attempt to understand the relationship between Epistemological Beliefs and Achievement in Physics among secondary school students in Kerala. The review of literature were classified and presented in the following heads:

- Theoretical overview of Epistemological Beliefs.
- Review of Related Studies.

Theoretical Overview of Epistemological Beliefs

Theoretical frame work of epistemological beliefs is outlined briefly in this section of the report.

Epistemological Beliefs

Epistemological beliefs refer to the beliefs about the nature of knowledge and knowing. Hofer and Pintrich (1997) refer to epistemological beliefs as the individual conception about both nature of knowledge and the nature of process of knowing their work. Personal epistemology or Epistemic belief have become a target of increased research interact in developmental and educational psychology. Epistemic Belief shall be consistently used to refer to a person's belief and nature of human knowledge like its certainty and how it is conceptualized and a person's belief about the nature of human knowledge.

Epistemological beliefs as a branch of philosophy in education and psychology started with Piaget's work on genetic epistemology. Later, Perry (1970) who conducted the first studies in this issue described epistemological beliefs as those reflecting individual perspective on the criteria of defining knowledge, its limitation, and precision and how it is acquired. Perry (1970) defined four different characteristics related to epistemological belief that individual has during their education including dualism, multiplism, relativism and commitment. Perry and most of those following him have assumed that personal epistemology is a unidimensional concept and developed in a fixed progression of a stage.

In contrast to the view of unidimensional concept Schommer (1990) believed personal epistemology is a belief system that is composed of several more or less independent dimensions. Schommer (1990) proposed that personal epistemology composed of five dimension which consists of the structure, certainty and source of knowledge and the control and speed of knowledge acquisition.

According to Schommer (1990) epistemological belief initially divided in to two categories .i.e., belief about knowledge and belief about knowing. Belief about knowledge are then further divided in to two beliefs pertaining to the structure of knowledge (simple/complex) and certainty of knowledge (certain/tentative).Belief about knowing are further divided in to three factors, such as the source of knowing, speed of knowing and innate ability. These factors are labelled as authority/justification, effort/process and innate/acquired. The factors affecting epistemological beliefs are age, formal education, different culture, socio economic background, gender, regionalism, person's thinking style, intelligence, mind set, attitude, learning environment of institution and home.

Perry Theory of Intellectual and Ethical development

Perry (1970) conducted a 15 year study of the intellectual and cognitive development of Harward undergraduates. Perry described the development of Harward students as progressing from dualistic belief that things are either true or false, good or evil through a stage of relativism in which they feel that all beliefs are equally valid, to a stage of commitment to values and beliefs that recognised to be incomplete and imperfect but are open to correction for further development. Perry's theory delineates the crossections of nine positions along which development take place. The sequence of the nine positions proposed by Perry (1970) can be grouped in to four major categories. Dualism (position 1 and 2), multiplicity (position 3 and 4) Relativism (position 5 and 6) and commitment (within Relativism - position 7 through 9). Perry claimed that the epistemological beliefs college students develop as a result of their journey through nine positions with respect to intellectual and

moral development. These stages can be characterized in terms of the student's attitude towards knowledge. The nine positions, grouped in to four categories are

A. Dualism

Position 1. Basic Duality

A person in this position perceives any knowledge ,act or values to be either right or wrong. In which authorities values knowledge or acts are connected to right. Any knowledge, act or value that differs from an authority ‘s world will be evil.The person is left with no alternative perspective to observe in a different manner

Position 2. Multiplicity Pre-legitimate

A person in this position perceives diversity in opinion and uncertainty as an unnecessary confusion by poorly qualified authorities, or a narrow area of freedom set by the authority for the student’s own exploration

B. Multiplicity

Position 3. Multiplicity Subordinate

A person in this position accepts uncertainty and diversity as unavoidable but only in areas where the authority hasn’t attained the right answers. In areas where the authority has no correct answer, the students is puzzled about the standards against which the authority grades one’s work. Thus student supposes that the authority grades based only on how well the answer is expressed.

Position 4. A person can have two alternative position here

4a : Multiplicity Correlate

In this position , multiplicity is raised from a subordinate to a legitimate status, which is separate and equal to that of authority .equal absolutism that is 'everyone has a right to his opinion" dominates the multiplicity realm while in the authority's domain there remains a right wrong dualism

4b : Relativism Subordinate

A person in this position perceives relativistic reasoning as what the authority wants. The behaviors of weighing different approaches to one problem and developing one's own thoughts occur in the context of an authority's realm out of an individual's desire to conform to authorities demand

C. Relativism

Position 5. Relativism

In this position, all knowledge and values ,including the one of authorities are perceived as relativistic. A person here will analyze ,weigh or evaluate different evidence ,Factors or solutions to develop his/her own opinion ,argument or solution

Position 6. Commitment Foreseen

A person in this position realizes a necessity to commit oneself in a relativistic world .acknowledging that reason itself has a limit and cannot fully justify or assure a person about his or her decision making, individuals must

choose to personally commit themselves through their own faith, assuming the responsibilities that are associated with the choices

C. Commitment

Position 7. Initial Commitment

A person in this position has undertaken one's own responsibilities in some areas of life such as career and education. Along with the decision, an individual also experiences settled reliefs internally because of initial commitment.

Position 8. Orientation in Implications of Commitment

A person in this position has begun to experience implication of commitment. He or she also starts to explore the 'subjective and stylistic issues' that are related with the implication of commitment.

Position 9. Developing Commitment

Individual in this position have developed a maturity in which their identities were affirmed in their commitment and associated responsibilities. Individual here are aware that commitment is an ongoing activity 'to a degree that is partly in the hands of fate, they are to be forever on the move

Schommer's Theory

Schommer (1990) theory is a multidimensional theory of epistemological beliefs. Her theory consisted of five epistemological dimensions based on previous research that address the certainty, structure and source of knowledge and the control and speed of knowledge acquisition.The first of Schommer's (1990)

hypothesized dimensions is *certainty of knowledge* describes a continuum that ranges from a low beliefs of knowledge as absolute truth to a more high belief that knowledge is tentative and evolving. As earlier, developmental theorists says, believes of a person tended to more from an absolutist to a relativistic understanding of knowledge.

The second hypothesized dimension of epistemological belief is the *structure of knowledge* which reflect a continuum ranging from understanding of knowledge as inter related concepts. Other theorist says structure of knowledge as a continuum ranging from knowledge as a simple collection of discrete, concrete knowable facts progressing to a view of knowledge as integrated, complex and contextual.

The third hypothesized dimension of epistemological beliefs is the *source of knowledge*. This dimension reflects a continuum ranging from low belief of knowledge as knowledge is derived from an authority, a high beliefs that knowledge is derived through testing/reasoning etc. i.e., knowledge is constructed by the individual.

The fourth hypothesized dimension of epistemological beliefs is the *innate ability* which was derived from research in implicit theories of intelligence in this dimension, a person with low belief always thinks about intelligence you have only the intelligence you are boon with and no more. A person with high belief thinks that their intelligence or skill is increased through hard work.

The fifth and final hypothesized dimension of epistemological beliefs is the *speed of knowledge acquisition*. This dimension is based on research in math related

beliefs and their influence on learning. A person with low beliefs always think learning happens quickly but a person with high beliefs think learning is a gradual process that requires continued effort and persistence. The five dimensions of epistemological beliefs (Schommer,1990) are presented in Figure 1.

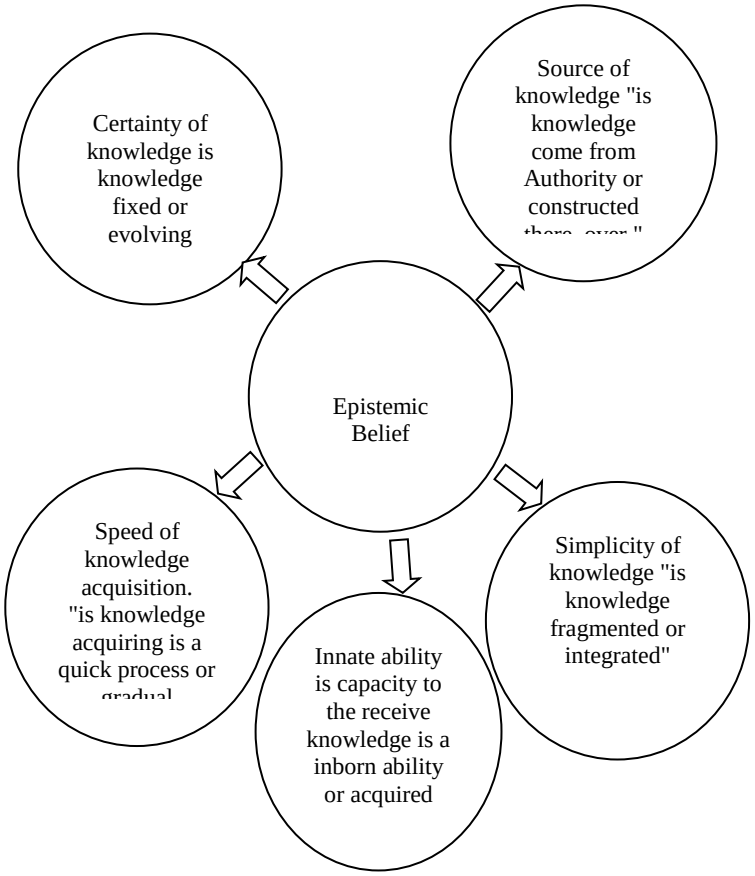

Figure 1. Dimensions of Epistemological Beliefs by Schommer (1990)

Studies Related to Epistemological Beliefs

Niranjana (2018) conducted a study to understand the influence of epistemological beliefs, achievement goals and self regulated learning strategies on achievement in accountancy of higher secondary school students. The sample for the study consisted of 1012 higher secondary

school students of commerce stream in Kerala state. The results of the study indicated that the main effect of epistemological beliefs, achievement goals and self regulated learning strategies on achievement in accountancy of higher secondary school student was significant for total sample and subsample based on gender, locale and type of management of schools. Regression analysis showed that among the variables, epistemological beliefs contribute more in predicting achievement in accountancy among higher secondary school students than achievement goals and self regulated learning strategies.

Koksal and Ozbay (2016) studied the middle school students' scientific epistemological beliefs. The participants of the study were 431 middle school students. The data was collected by using Scientific Epistemological Belief Scale. The findings showed that students had sophisticated belief about verification aspects. While they were naive about the aspects, source of knowledge, development of knowledge and certainty of knowledge.

Gu (2016) conducted a study on epistemic beliefs of middle and high school students in a problem based scientific inquiry unit. The participants were 24 middle and high school students in summer science class. Pre test and post version of the Epistemological Beliefs Questionnaire were conducted to assess students self reported epistemic beliefs before and after the unit. The result of the study showed that students self reported epistemic beliefs were not consistent with their beliefs revealed from scientific inquiry practice. Students' beliefs about nature of knowing directly influenced the approach that adopted to construct knowledge and justify their knowing during scientific inquiry unit.

The person centered approach conducted by Kampa, Neumann, Holfmann and Kremer (2016) focused on epistemological beliefs in science of high school students. Data was collected from 4995 tenth grade students. The result of the study revealed that majority of students were found to show the same pattern and to have quite similar in science epistemological beliefs on all dimensions.

Arslantus (2016) conducted a study on the relationship between teacher candidate epistemological belief and academic achievement. The participants of the study were 363 teacher candidates studying their fourth year at the education faculty. The Epistemological Belief Scale was used by the investigator to collect the required data. The result of the study found that there is a significant positive negligible relationship between the epistemological beliefs and academic achievement.

Sadi (2015) investigated the high school student's epistemological beliefs, conception of learning and self efficacy for learning biology. The participants of the study consists of 384 high school students. The result of the study showed that students epistemological beliefs about justification and development and their conception of learning about applying ,understanding and seeing in a new way directly and positively relate to self efficacy for learning. Epistemological beliefs about source, certainty of knowledge were directly and negatively related to students self efficacy of learning.

Gastos (2015) conducted a study on exploring the significance of social influence on epistemic beliefs. The study was a quantitative analysis using a self reported survey to explore the interaction between social influence and development

of epistemological beliefs. The result of the study indicated that social influences and the development of epistemic beliefs are negatively related.

Hulling (2014) studied the effect of teachers epistemological beliefs on practice. Teachers have adequate nature of science knowledge their knowledge still does not make its way in to practice. The participants of the study were twenty eighth sixth grade teachers, the result of the study showed that the relationship between understanding of nature of science and teachers epistemological beliefs are significant. The magnitude and sign of correlation coefficient shows that there exist positive substantial correlation.

Grice (2014) studied epistemic beliefs among upper secondary students in education for sustainable development. The participants of the study were 208 students from 14 upper secondary schools and 2 folk high school. Tool used for the study was Schommer's Epistemological Belief Questionnaire. The result of the study showed that for educational practice the awareness of the impact of epistemic beliefs on the outcome of the empirical context motivate teacher to challenge their students and to discuss the epistemology of their specific school subject.

Maghadam and Roshn (2013) investigated a study on the relationship between epistemological beliefs and self regulated learning in high school students of traditional and smart schools. Data collected from 600 students through multistage sampling method. The result of the study indicated that promotion and growth of epistemological beliefs of students in smart and traditional school can improve their self regulated learning level.

Roga and Abdorreza (2013) investigated a study on the epistemological beliefs of EFL learner across gender and educational level. The participants of the study were 101 EFL students studying English literature and English translation in the Islamic Azad University,. Tool used for data collection was Persian version of Epistemological Beliefs Questionnaire. The result of the study indicated that there was no statistically significant difference between male and female EFL learners in terms of their epistemological Beliefs. According to their educational level, sophomore students mean score was significantly higher than that of freshman student on the dimension of epistemological beliefs such as certain knowledge and quick learning

Lee (2013) conducted a study on relationship between epistemological beliefs conception of teaching and learning instructional practices of teachers in Chinese perspective. The study examined how the beliefs of Chinese in-service teachers regarding knowledge and knowledge acquisition influence their instructional class room practices in junior secondary school directly or indirectly through their conception of teaching and learning. The results indicated that the factor of learning effort/process is high valued by Chinese in service teachers in their epistemological beliefs.

Tanriveeli (2012) conducted a study on teachers epistemological beliefs and approaches to learning. Participants were 632 pre-service teachers at faculty of education. The tools used for the study were Turkish version of Schommers Epistemological Belief Questionnaire and Turkish version of Biggs revised Two Factor Learning Approach Scale. The result of the study showed that student who

believe that learning depend upon innate ability was likely to be surface motivated and utilize a surface strategy on their studying while student who believe learning depend on effort would be deep motivated and adopt a deep study strategy.

Savanovie and Jokie (2012) studied 'relationship between epistemological belief and motivational orientation among high school students'. The tool used for the study were Schommer's Epistemological Beliefs Questionnaire and Work Preference Inventory. The result of the study showed that there exists negative correlation between naive epistemological beliefs on one side and intrinsic and general motivation on the other. Boys have more mature epistemological beliefs than girls.

Aypay (2010) conducted a study on teacher education student's epistemological beliefs and their conceptions about teaching and learning. The participants of the study were 341 student teachers. The final results of the study indicated students teachers view differ based on gender department and class level. The results also indicated that there exist a relationship between epistemological Beliefs and approaches to teaching and learning.

Stockton (2010) investigated a study on relationship between epistemological Beliefs and self regulated learning among advanced placement calculus students in the context of mathematical problem solving. . The result of the study showed that problem solving performance was positively related to epistemological beliefs of the students.

Sulimma (2009) studied relationship between epistemological beliefs and culture classification. The purpose of the study was to investigate the possibility of using cultural classifications to indicate the development of epistemological beliefs in different countries. The participants of the study were 203 Germans and Australians. A German and English version of the Schraw Epistemic Belief Inventory based on Scommer model is employed for the study. The findings of the study indicated that the cultural comparison of both countries lead to the development of epistemological beliefs is different.

Bruten and Stromso (2005) conducted a study on the relationship between epistemological beliefs, implicit theories of intelligence and self regulated learning among Norwegian part secondary students. The participants of the study were 178 business administration students in a traditional transmission oriented instruction of context and 108 students teachers in an innovative pedagogical context. The result of the study shows that there exist positive moderate relationship between epistemological beliefs, implicit theories of intelligence and self regulated learning.

Chan (2003) investigated a study on Hongkong Teacher education students epistemological beliefs and their relation with conception of learning and learning strategies. 231 teacher education students of Hongkong were participated in this study. Tool used for the study were Epistemological Beliefs Scale, conception of learning inventory and Revised two factor study process questionnaire. The result of the study shows that there exist significant relationship between epistemological beliefs and conception of learning and learning strategies.

Studies Related to Achievement in Physics

Saleh and Subramanian (2018) conducted a study on effect of brain based teaching method on physics achievement among ordinary school students. The effect of the brain based teaching method within the targeted contact was assessed using a quasi-experimental research approach. The sample consisted of 90 students from two ordinary schools in Penang Malaysia. The findings of the study showed that brain based teaching method was effective in improving physics achievement as well as reducing the gender gap in physics achievement among ordinary school students.

Jayakumary and Joseph (2016) conducted a study on the effectiveness of Cognitive Apprenticeship Model on achievement in physics at secondary level. The major objective of the study was to find out the effectiveness of cognitive apprenticeship model on achievement in physics compared with existing activity oriented method among the secondary school students. The study adopted experimental method with pre test post test non equivalent two group design. The findings of the study revealed that there exists significant effect of cognitive apprenticeship model on achievement in physics at secondary level.

Musasia, Ocholla and Sakwa (2016) conducted a study on physics practical work and its influence on students academic achievement. The major objective of the study was to find out the difference in academic achievement in physics between student taught using intensive practical activities and those taught using conventional teaching method. The study involved two groups from sampled average performing secondary schools in Kakamega south sub country Kenya. The

quasi experiment pre test post test non equivalent group research design was adopted. Experimental group recorded better performance than control group.

Veloo, Noor and Khalid (2014) conducted a study on attitude towards physics and additional mathematics achievement towards physics achievement. This research focused on six variables, which is attitude towards physics, career related to physics, importance of physics, difficulty of understanding physics, physics teachers and physics equipment usage Data collected from 203 tenth grade students in science stream who are taking physics as an elective subject. The findings of the study showed that a significant difference in students interest towards physics, career related to physics, importance of physics, difficulty of understanding physics, physics teacher and physics equipment usage where by the male students are higher compared to female students. Also there is a strong relationship between additional mathematics achievement and physics achievement followed by interest towards physics and difficulty of understanding physics and also the relationship between students attitude towards career related to physics, importance of physics, physics teacher and physics equipment usage is not significant towards physics achievement.

Adeyemo and Babjide (2014) investigated a study of effect of mastery learning approach on students achievement in physics. The study was a non randomized pre test - post test control group design. Students in the experimental groups were exposed to mastery learning approach teaching method while those in the control group were exposed to the conventional teaching method. The instrument used for the study were physics achievement test and a questionnaire was used to measure their attitude towards physics. The finding of the study showed that student exposed

in mastery learning approach performed better than those taught using conventional teaching method. Thus mastery learning approach should be encouraged in schools for improved students achievement and positive attitude towards physics.

Josiah (2012) conducted a study on the effect of computer assisted instruction on school location versus academic achievement. The main objective of the study was to know the effect of CAI activity based teaching/learning on achievement in physics of Nigerian rural and urban secondary school students. The result of the study showed that there is no significant difference in the achievement score between urban and rural students taught physics with CAI.

Hussai, Anwar, Majoka (2011) conduct a study on effect of peer group activity based learning on academic achievement in physics of secondary school students of 10^{th} class. The experimental group was taught with peer group activity based method and control group was taught by traditional lecture method. The result of the study shows that peer group activity based learning was more effective for teaching of physics as compared to traditional lecture method of teaching of secondary level.

Kumar (2010) studied the effectiveness of meta cognitive strategies on classroom participation and student achievement in higher secondary school physics classrooms. The study used a two group pre test post test design. The study consisted of two different groups a control group and meta cognitive question group. The sample of the study was two classes of higher secondary students of DBHSS Thiruvalla. The result of the study showed that meta cognitive strategies enhances students achievement and increased participation in classroom.

Gafoor (2010) conducted a study on the relationship of thinking style with physics achievement among higher secondary students in Kerala. The major objective of the study was examined thinking styles that favour short term and long term achievement in science are different, among secondary school students in Kerala. The result of the study showed that legislative and judicial styles contribute to long term achievement and executive (boys) style is unfavourable to long term achievement, however, local style is favourable and global style is unfavouable to achievement in science among boys only. Anarchic style has a negative influence on short term and long term achievements of girls and long term achievement of boys.

Conclusion

The review of related studies enabled the investigator to gather extensive information and gave wide perception on the present problem. It is evident that most of the research studies in epistemological beliefs are done outside the country. Few number of studies of epistemological beliefs are conducted in Kerala context. The review of related studies revealed that epistemological beliefs has a prominent role in students learning. No of studies related to achievement in physics are done in Kerala context, but no one had dealt to the study relationship between epistemological beliefs and achievement in physics among secondary school students in Kerala. Hence the investigator feel that it is worthwhile to undertake study a study to analyze the relationship between Epistemological Beliefs and Achievement in Physics of secondary school students

Chapter III

METHODOLOGY

- *Variable of the study*
- *Objectives of the study*
- *Hypotheses of the study*
- *Sample selected for the study*
- *Tool used for Data collection*
- *Data collection procedure*
- *Scoring and consolidation of data*
- *Statistical technique used for Data Collection*

METHODOLOGY

Research methodology is a science of studying how research is done scientifically. It is a systematic way to solve research problem. It is also defined as the study of methods by which knowledge is gained. Research methodology aims to give the work plan of research. The study is an attempt to understand the relationship between epistemological beliefs and achievement in physics among secondary school students.

The methodology adopted for the study is described under the following major headings:

- Variables of the Study
- Objectives of the study
- Hypotheses of the study
- Tool used for data collection
- Sample used for the study
- Data collection procedure
- Scoring and consolidation of data
- Statistical technique used

Variables

The study is designed with two variables viz., Epistemological Beliefs and Achievement in Physics.

Objectives of the Study

The objectives set for the study are

- To know whether there exist any difference in the mean scores of Epistemological Beliefs of secondary school students with respect to subsample
  - Gender
  - Locale of the schools
  - Type of Management of schools
- To know whether there exist any difference in the mean scores of Achievement in Physics of secondary school students with respect to subsample
  - Gender
  - Locale of the schools
  - Type of Management of schools
- To find out the relationship between Epistemological Beliefs and Achievement in Physics among secondary school students for the total sample.
- To find out the relationship between Epistemological Beliefs and Achievement in Physics among secondary school students for the subsample based on
  - Gender
  - Locale of the schools
  - Type of Management of schools

Hypotheses of the Study

The hypotheses formulated for the study are

- There will be no significant difference in the mean scores of Epistemological Beliefs among secondary school students for the subsample based on
  - Gender
  - Locale of the schools
  - Type of Management of schools
- There will be no significant difference in the mean scores of Achievement in Physics among secondary school students for the subsample based on
  - Gender
  - Locale of the schools
  - Type of Management of schools
- There is no significant relationship between Epistemological Beliefs and Achievement in Physics among secondary school students for the total sample.
- There is no significant relationship between Epistemological Beliefs and Achievement in Physics among secondary school students for the subsample based on
  - Gender
  - Locale of the schools
  - Type of Management of schools

Sample Selected for the Study

Selection of the suitable sample is an important part of any research work. A sample is a small proportion of the population that is selected for observation and analysis, one can make certain inferences about the characteristics of the population from which it was drawn (Best & Khan, 2014).

A good sample must be as nearly representative of the entire population as possible and ideally it must be provide the whole of the information about the population as possible and ideally it must provide the whole of the information about the population from which the sample has been drawn (Koul, 2009).

The population for the study comprised of secondary school students in Kerala state. The sample of the study constituted 600 secondary school students studying in standard IX who were selected from Kozhikode and Malappuram districts of Kerala state.

Stratified sampling technique was conceived to be best suited for selection of the sample of the present study. Total number of 600 sample were collected by giving due representation to gender ,locale and type of management of schools

The breakup of the final sample is given in Table 1.

Table 1

Breakup of the final sample

Sample	Categories	Number of students
Gender	Male	300
	Female	300
Type of school Management	Govt.	300
	Aided	300
Locale	Rural	300
	Urban	300

The factors or strata taken in to consideration while selecting the sample are the following.

Gender

Gender plays a major role in the study. Most of studies in reviewed revealed that sex difference make change in their Epistemological Beliefs and Achievement in Physics. So, the investigator decided to give due weightage to male and female students.

Locale

Locale is an important factor which influence the student epistemological beliefs and achievement in physics. Most of the previous studies showed that the Epistemological Beliefs and Achievement in Physics of urban area students differ from rural area students. So the investigator decided to give due weightages to the locality of the secondary schools.

Type of Management

The existing schools in Kerala fall in to four broad categories viz, school run by state government, school run by central government, school run with the help of

government aid by private agencies and school run by private agencies with approval of either state or central governmentt. The investigator decided to give the due weightages to government and aided secondary schools only.

Details of the school selected for data collection are given as Appendix I

Tool used for Data Collection

The selection of suitable tool is an important aspect of any successful research work. Accurate tool can only measure accurate data. Accurate data is the backbone of any successful research.

For the purpose of collecting data, the investigator used the tool

- Scale on Epistemological Beliefs in Physics (Anjusha & Niranjana, 2017)

Detailed description of the tool is given below.

Scale on Epistemological Beliefs in Physics is a Likert type scale is used. Epistemological Beliefs in Physics means ones beliefs about nature of physics knowledge and the process of acquiring physics knowledge.

The scale was constructed on the basis of Schommer's theory(1990). According to the theory of Schommer, epistemological beliefs consists of five dimensions such as source of knowledge, structure of knowledge, certainty of knowledge, innate ability and speed of knowledge acquisition. The investigator prepared four or five items below each components with the help of supervising teacher. Both sophisticated beliefs items and naïve beliefs items are prepared.

The tool is standardized by the investigator with the assistance of her supervising teacher. The procedure followed in the construction of the tool is described below.

a) Planning of the Scale

The first step in the construction and standardization of a scale was planning of the scale. After selecting the topic, the investigator had gone through the theoretical background and analyzed related studies. It can be found that epistemological beliefs have a major role in teaching learning process. In this study, the investigator try to find out whether there exist any relationship between Epistemological Beliefs and Achievement in Physics of secondary school students. After the discussion with the supervising teacher, the investigator prepared a Likert type tool to measure the Epistemological Beliefs of secondary school students. Scale on Epistemological Beliefs is a Likert type scale with five responses, Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D) and Strongly Disagree (SD). Scale on Epistemological Beliefs was prepared on the basis of theory proposed by Schommer (1990). According to the theory of Schommer (1990), epistemological beliefs consists of five dimensions such as source of knowledge, structure of knowledge, certainty of knowledge, speed of knowledge acquisition, innate ability. Detailed description of the components are given below.

Source of Knowledge

In this dimension, Schommer (1990) describes about knowledge is come from authority or knowledge is derived from reasoning/thinking/testing. Some of the students believe teacher is the only source of knowledge. He/she telling is only

the truth. He is an ultimate authority of knowledge. Some of them think about book is the source of knowledge. Other students believe knowledge is derived through reasoning/thinking/ testing, it was constructed by our self through reasoning/thinking/testing

Example

- Physics teacher is the ultimate authority in physics knowledge
- Knowledge in physics through experimentation and observation are real

Certainty of Knowledge

In this dimension, Schommer (1990) define knowledge is absolute or knowledge is constantly evolving. Here checking one's beliefs about certainty knowledge, someone Believe knowledge is not changing over time, it is fixed, others believe knowledge is dynamic, it is changing over time.

Example

- Knowledge of physics changes by the progress of science
- Knowledge in physics remains same

Simplicity of knowledge

In this dimension, Schommer (1990) define knowledge is compartmentalized or knowledge is highly integrated or interwoven. As conceptualized by Schommer (1990), knowledge is viewed on a continuum as an accumulation of facts or as highly interrelated concepts. The lower level view of knowledge is as discrete,

concrete, knowable fact, at higher level individual see knowledge as relative, contingent and contextual. Here checking one's belief about simplicity of knowledge. Some students believe knowledge as simple, not interrelated, it is independent no contextual etc. Others students believe knowledge as interrelated, complex, relative and contextual.

Example

- Physics concepts are abstract
- Physics is an easy subject to study compared to other science subject

Innate ability

In this dimension, Schommer (1990) define one's ability to learn is genetically pre-determined or ability to learn is acquired by experience. In this dimension thinking about one's belief about the ability to learn oneself is get from genetically. It is their inborn ability not a making ability. Somes tudents believe the ability to learn is acquired through various experiences, it is making by their effort or hard work.

Example

- Physics learning ability is inborn
- Physics learning ability is acquired

Speed of Knowledge Acquisition

In this dimension describes learning is quick or not at all learning is gradual

process. Here some students believe their learning is quick process, other students believe their learning is not quick process it is gradual process

Example

- Physics concepts can be attained quickly
- Physics concepts can be attained only through continuous hard work

b) Preparation of the Scale

Based upon above mentioned components, the investigator developed Scale on Epistemological Beliefs in Physics. The draft scale consists of 47 items related to sophisticated beliefs and some to naive beliefs.

The componentwise distribution of items in Scale On Epistemological Beliefs in Physics are given in Table 2

Table 2

Component wise distribution of items in Scale on Epistemological Belief s in Physics

Sl.No.	Component	Item No. in scale
1	Source of knowledge	1,6,8,11,12,18,19,27,28,36,37,40,44,46
,2	Certainty of knowledge	3,4,20,21,29,30,38,41,42,43
3	Structure of knowledge	7,14,16,23,24,31,33,34,45,47
4	Innate Ability	9,10,15,25,35
5	Speed of knowledge acquisition	2,5,13,17,22,26,32,38

A copy of the draft Scale on Epistemological Beliefs in Physics (Malayalam) is given as Appendix II.

c) Scoring Procedure

Scale on Epistemological Beliefs in Physics is a Likert type scale in which responses can be made in a five point scale as Strongly agree, Agree, Undecided, Disagree and Strongly Disagree.

For a sophisticated beliefs statements the score given as 5 4, 3, 2, 1 for the options Strongly Agree (SA) Agree (A), Undecided (U), Disagree (D) and Strongly Disagree (SD) respectively. Scoring scheme was reversed for naïve beliefs statements. The score on all the items were added to get the total score on Epistemological Beliefs in Physics of secondary school students.

d) Try out

Try out of the draft scale was done in order to select valid items in the final scale by empirically testing the item characteristics. The Scale on Epistemological Beliefs in Physics was administered on a sample of 100 secondary school students studying in standard IX.

e) Item Analysis

The preliminary scale was administered to a sample of 100 secondary school student selected through stratified sampling technique by giving representation to gender, locale and type of management of schools. The response sheets of 100 students were arranged in the rank order of total score obtained by them. The upper

27 percentage and Lower 27 percentage were taken as the upper group and lower group respectively. The mean and standard deviation of the score obtained for each items for the upper and lower groups were calculated. The t-value (critical ratio) for each item was calculated by using the following formula.

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{\sigma_1^2}{N_1} + \frac{\sigma_2^2}{N_2}}}$$

Where

$\overline{X}_1$ - Mean of the upper group (for an item)

$\overline{X}_2$ - Mean of the lower group (for an item)

σ_1 - Standard deviation of the upper group

σ_2 - Standard deviation of the lower group

N_1 - Sample size of the upper group

N_2 - Sample size of the lower group

The critical ratio obtained for each item is given below in Table 3

Table 3

Data showing t-value of the items

Item No.	t-value	Item No.	t-value
1	1.983	25	0.320*
2	2.347	26	0.414*
3	0.223*	27	2.317
4	3.505	28	3.299
5	2.220	29	2.217
6	1.987	30	2.296
7	2.471	31	2.308
8	2.734	32	2.566
9	0.856*	33	1.949*
10	0.137*	34	2.703
11	0.554*	35	2.728
12	1.135*	36	0.602*
13	3.625	37	2.448
14	3.655	38	2.506
15	1.967	39	3.010
16	1.038*	40	2.801
17	2.639	41	2.854
18	1.028*	42	2.686
19	2.095	43	2.289
20	2.582	44	1.305*
21	0.341*	45	2.053
22	2.414	46	1.972
23	2.637	47	2.058
24	2.284		

* Indicates the rejected items

f) Finalization of the Scale

Items with critical ratio greater than 1.96 were selected for the final scale. Thus out of the 47 items 34 items are selected for the final scale, in which 20 items related to sophisticated beliefs and14 items related to naïve beliefs.

A copy of the final version of the tool Scale on Epistemological Beliefs in Physics (Malayalam Version) is appended as Appendix III

Reliability of the Tool

Reliability is the degree of consistency that instrument or procedure demonstrates whatever it is measuring, it does so consistently (Best & Kahn, 2014). To ensure the reliability of the Scale on 'Epistemological Beliefs in Physics ' Cronbach Alpha is used to determine the internal consistency. The Cronbach Alpha coefficient is 0.74 for the items . Hence the tool is highly reliable.

Validity of the Tool

Validity is that quality of a data gathering instrument or procedure that enables it to measure what it is supposed to measure. (Best & Khan, 2011). The investigator ensured the validity of the tool by using face validity and construct validity. Face validity was ensured by giving the prepared draft scale to the experts and after considering their suggestions, some modification was made.

Construct validity is concerned with the meaning and interpretation of the test scores obtained in terms of psychological or theoretical constructs. (Koul, 2009).

Scale on Epistemological Beliefs in Physics has a strong theoretical support. The scale was constructed on the basis of Schommer's Theory of Epistemological Beliefs (1990).

Data Collection Procedure

The final Scale on Epistemological Belief in Physics was administered to the sample selected for the study. In order to collect data, the investigator asked the permission from Headmasters of high school in advance to administer the tool. Investigator briefed about the purpose of the study and the instruction regarding the manner of the response was given. After administering the tool response sheets were collected back by the investigator.

Scoring and Consolidation of Data

Before scoring, incomplete response sheets were rejected.

For a sophisticated Beliefs statements on the scale given is 5, 4, 3, 2, 1 for the options strongly Agree, Agree, Undecided, Disagree and strongly disagree respectively. Scoring scheme was reversed for naïve beliefs statements. The score on all items were added to get the total score on Epistemological Beliefs in Physics

Statistical Technique Used

The statistical techniques used for the analysis of data are explained below.

Descriptive Statistics

Mean

The mean is the most used method of describing central tendency. The mean is found out using the formula;

$$\text{Mean} = \text{AM} + \frac{\sum fx^1}{N} \text{ x i}$$

Where

AM = Assumed mean

f = Frequency of the class interval

x = deviation of the score from the assumed mean divided by the length of the class interval

i = Length of the class interval

N = Total number of scores

Median

Median is a point in an array, above and below which one half of the scores fall. It is a measure position rather than of magnitude.

The median is calculated using the formula.

$$\text{Median} = 1 + \frac{\left(N/2 - F\right)}{f} \text{ x i}$$

Where,

l = exact lower limit of the class interval upon which the median lies.

i = length of class interval in which the median falls.

f = Frequency within the class interval upon which the median lies

F = sum of all the frequencies below

Mode

The mode is defined as the most frequently occurring score in a distribution. The mode was calculated using the formula.

Mode = 3 median - 2 mean

Standard Deviation

Standard deviation is the most important measure of variability. The standard deviation is the square root of the average of the squares of deviations of the scores taken from mean, standard deviation is calculated using the formula.

$$\sigma = \frac{i}{N}\sqrt{N\sum fx^{1^2} - \left(\sum fx^1\right)^2}$$

Where,

i = Length of the class interval

N = Total number of scores

f = frequency of the class interval

x^1 = deviation of the raw score from the assumed mean divided by the length of class interval

Skewness

A distribution is said to be skewed, if the value of mean, median & mode are different and there is symmetry between the right and left half of the curve such type of curve is inclined more towards the left or right of the centre of the curve.

Skewness was calculated by using the formula.

$$Sk = \frac{3(mean - median)}{SD}$$

Where

SD = Standard Deviation

Kurtosis

The term kurtosis refers to the flatness or peakedness of a frequency distribution as compared with the normal. The following formula for measuring Kurtosis is

$$Kurtosis = \frac{P_{75} - P_{25}}{2(P_{90} - P_{10})}$$

Where,

P_{75} = 75th percentile

P_{25}= 25th percentile

P_{90}= 90th percentile

P_{10}= 10th percentile

Pearson's product moment coefficient of correlation

The most often used and most precise coefficient of correlation is the Pearsons product moment co-efficient of correlation (r).

The degree of relationship is measured and represented by the coefficient of correlation which can be calculated using the formula.

$$r = \frac{N\sum xy - \sum x \sum y}{\sqrt{\left(N\sum x^2 - \left(\sum x\right)^2\right)\left(N\sum y^2 - \left(\sum y\right)^2\right)}}$$

Where,

Σx = Sum of the x scores

Σy = Sum of the y scores

Σx^2 = Sum of squared x score

Σy^2 = Sum of the squared y scores

N = Number of paired scores

Test of significance of difference between means of large independent sample (t test).

The t-value can be calculated using the formulae;

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{\sigma_1^2}{N_1} + \frac{\sigma_2^2}{N_2}}}$$

Where

$\overline{X}_1$ = Mean of the upper

$\overline{X}_2$ = Mean of the lower group

σ_1 = Standard deviation of upper group

σ_2 = Standard deviation of lower group

N_1 = Sample size of the upper group

N_2 = Sample size of the lower group

Chapter IV

ANALYSIS AND INTERPRETATION OF DATA

- *Objectives of the study*
- *Hypotheses of the study*
- *Preliminary Analysis*
- *Major Analysis*
- *Conclusion*

ANALYSIS AND INTERPRETATION OF DATA

Data analysis is the process of extracting information from data. Data analysis is a method in which data is collected and organized so that one can derive helpful information from it. In other words, the main purpose of data analysis to look at what the data is trying to tell us. Analysis of data means studying the organized material in order to discover inherent facts. The data are studied from as many angles as possible to explore new facts. Statistical techniques have contributed greatly in gathering, organizing, analyzing and interpreting numerical data (Koul, 2014).

Data analysis is the process of systematically applying statistical and/or logical techniques to describe and illustrate, condense and recap and evaluate data. An essential component of ensuring data integrity is the accurate and appropriate analysis of research findings. Data analysis is a process of applying statistical techniques to organize, represent, describe, evaluate and interpret data. It aims at evaluating the data using analytical and logical reasoning to examine each component of the data provided.

The main purpose of the study is to find out the relationship between Epistemological Beliefs and Achievement in Physics among secondary schools students. This chapter describes the details of statistical analysis of the data collected. The collected data was analyzed statistically and the results are presented and discussed in this chapter.

Objectives of the Study

The objectives set for the study are

- To know whether there exist any difference in the mean scores of Epistemological Beliefs of secondary school students with respect to subsample
  - Gender
  - Locale of the schools
  - Type of Management of schools
- To know whether there exist any difference in the mean scores of Achievement in Physics of secondary school students with respect to subsample
  - Gender
  - Locale of the schools
  - Type of Management of schools
- To find out the relationship between Epistemological Beliefs and Achievement in Physics among secondary school students for the total sample.
- To find out the relationship between Epistemological Beliefs and Achievement in Physics among secondary school students for the subsample based on
  - Gender
  - Locale of the schools
  - Type of Management of schools

Hypotheses of the Study

The hypotheses formulated for the study are

- There will be no significant difference in the mean scores of Epistemological Beliefs among secondary school students for the subsample based on
  - Gender
  - Locale of the schools
  - Type of Management of schools
- There will be no significant difference in the mean scores of Achievement in Physics among secondary school students for the subsample based on
  - Gender
  - Locale of the schools
  - Type of Management of schools
- There is no significant relationship between Epistemological Beliefs and Achievement in Physics among secondary school students for the total sample.
- There is no significant relationship between Epistemological Beliefs and Achievement in Physics among secondary school students for the subsample based on
  - Gender
  - Locale of the schools
  - Type of Management of schools

The analysis and discussion of results with regard to the above objectives are described in this chapter in two sections i.e., preliminary analysis and major analysis.

Preliminary Analysis

At the first step of analysis the descriptive statistical techniques such as mean, median, mode, standard deviation, skewness and kurtosis were worked out for the variables, Epistemological Beliefs and Achievement in Physics, for total sample and subsample based on gender, locale and type of management of schools to know the basic properties of the variables

The results of descriptive statistics for the distribution of scores for Epistemological Beliefs of secondary school students for total sample and subsample based on gender, locale of schools and type of management of schools are calculated and presented in Table 4.

Table 4

Descriptive statistics of the variable Epistemological Beliefs of secondary school students for total sample and subsample based on gender, locale of the schools and type of management of schools

Variable	Category	N	Mean	Median	Mode	SD	Skewness	Kurtosis
Epistemological Belief	Tota1	600	106.51	106.00	108	7.82	.151	.039
	Male	300	105.98	106.00	104	8.571	.229	-.087
	Female	300	107.03	107.00	110	6.975	.120	.052
	Urban	300	106.68	106.00	105	8.248	.138	.141
	Rural	300	106.33	107.00	99	7.387	.150	.141
	Govt.	300	106.09	106	106	7.564	.027	.141
	Aided	300	106.93	107	99	8.069	.235	.141

Table 4 shows that the obtained value of mean, median and mode of the independent variable, Epistemological Beliefs of secondary school students are 106.51, 106 and 108 for the total sample. It indicates that the value of mean, median and mode coincide approximately for the total sample. The indices of skewness (sk=0.151) shows that the distribution of scores for Epistemological Beliefs of secondary school students is positively skewed for the total sample. The indices of kurtosis for Epistemological Beliefs reveals that the distribution of scores of Epistemological Beliefs (K=0.039) is leptokurtic in nature for the total sample of secondary school students.

Table 4 also shows that the distribution of scores of Epistemological Beliefs for subsample based on gender, locale of schools and type of management of schools coincide approximately. Thus, the distribution of the scores of Epistemological Beliefs of secondary school students shows that the distribution is almost normal for total sample and subsample.

The graphical representation of the distribution of scores of Epistemological Beliefs for total sample is given in Figure 2,

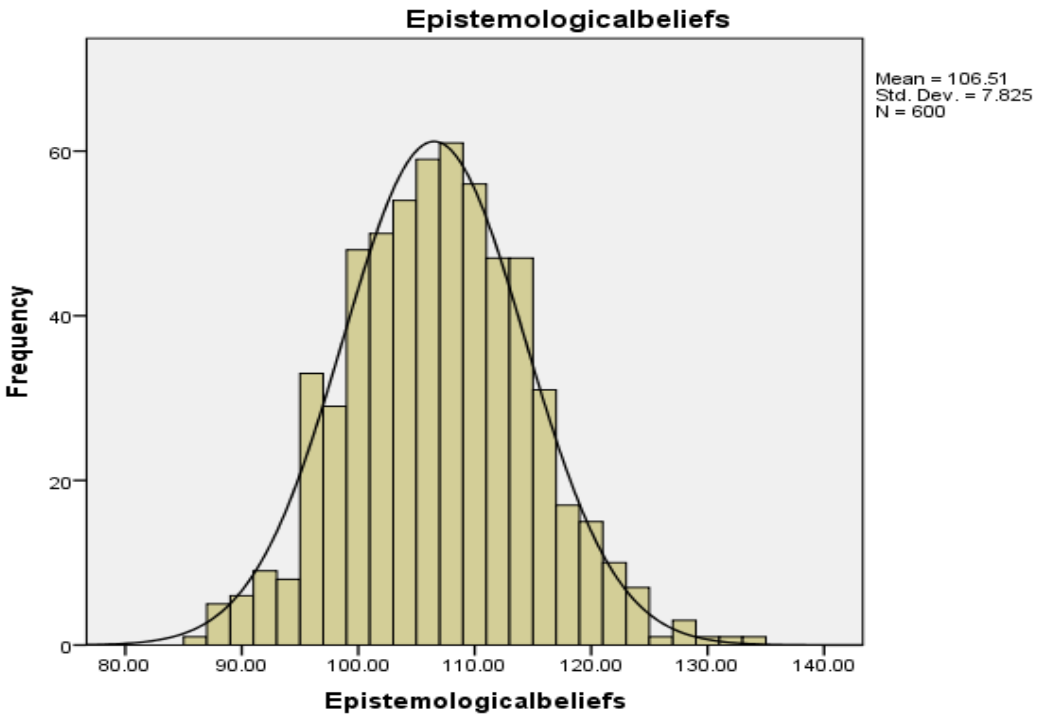

Figure 2: Graphical representation of the distribution of scores of Epistemological Beliefs for the total sample

From Figure 2 it was evident that the distribution of scores of Epistemological Beliefs of secondary school students is approximately normal.

The results of the descriptive statistics for the dependent variable, Achievement in Physics of secondary school students for the total sample and subsample are calculated and given in Table 5.

Table 5

Descriptive statistics of the variable Achievement in Physics of secondary school students for total sample and subsample based on gender, locale of the school and type of management of schools

Variable	Category	M	Mean	Median	Mode	SD	Skewness	Kurtosis
Achievement in Physics	Tota1	600	16.78	16.00	14	8.024	.374	.575
	Male	300	14.90	14.00	8	7.517	.537	-.296
	Female	300	18.66	18.00	14	8.089	.208	-.697
	Urban	300	15.88	15.00	18	7.871	.522	-.255
	Rural	300	17.68	17.00	14	8.088	.235	-771
	Govt.	300	15.91	15.00	9	7.609	.406	-.602
	Aided	300	17.65	17.00	14	8.342	.309	-.604

Table 5 shows that the values of mean, median and mode for Achievement in Physics of secondary school students are 16.78, 16.00 and 14 for the total sample is approximately equal. The coefficient of skewness is 0.374 for Achievement in Physics suggests that the distribution is slightly positively skewed. The measure of kurtosis is 0 .575 for total sample of secondary school students. It indicates that the distribution of scores of Achievement in Physics is slightly platykurtic.

The obtained value of mean, median and mode for the subsample based on gender, locale of schools and type of management of schools indicates the values coincide approximately. Thus, it can be concluded that the distribution of the variable Achievement in physics for the total sample is approximately normal.

The graphical representation of Achievement in Physics for the total sample of the secondary school students is given in Figure 3.

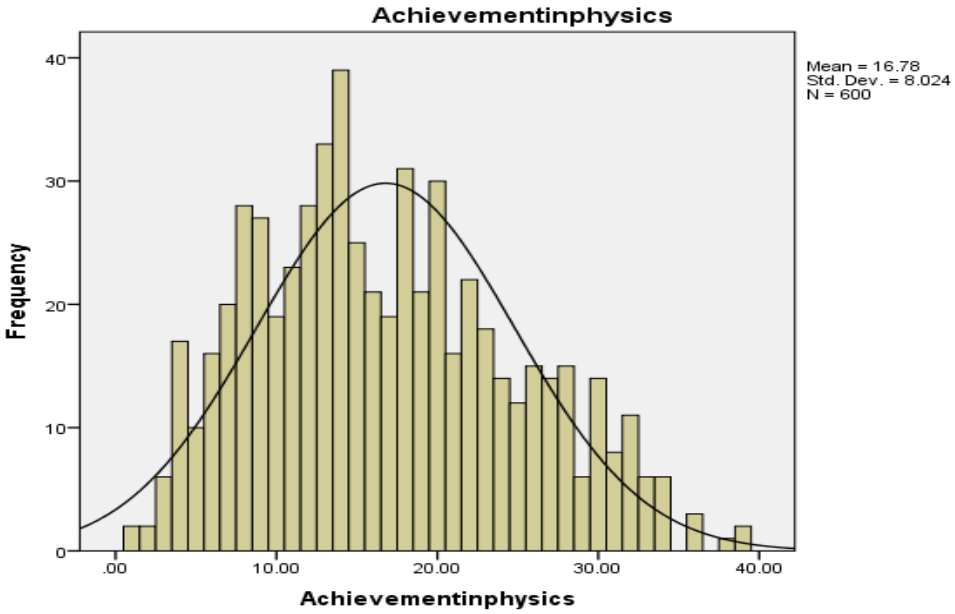

Figure 3: The graphical representation of distribution of scores on Achievement in Physics for the total sample of secondary school students is

Figure 3 reveals that the distribution of scores on Achievement in Physics of secondary school students for the total sample is approximately normal.

Major Analysis

The first and second objectives of the study is to find out whether there exist any significant difference in the mean scores of Epistemological Beliefs and Achievement in Physics of secondary school students with respect to the subsample gender, locale of schools and type of managements of schools. Mean difference analysis was done in order to find out the group difference in the mean scores of Epistemological Beliefs and Achievement

in Physics of secondary school students with respect to gender, locale of schools and type of management of schools.

The third and fourth objectives of the study is to find out whether there exist any significant relationship between Epistemological Beliefs and Achievement in Physics of secondary school students for the total sample and subsample based on gender, locale of schools, type of management of schools. Pearson product moment coefficient of correlation was calculate to know whether the Epistemological Beliefs is related with Achievement in Physics of secondary school students for total sample and subsample based on gender, locale of schools and type of management of schools.

Test of significance difference in the mean scores of Epistemological Beliefs of secondary school students based on gender, locale of the schools and type of management of schools

Comparison of the mean scores of Epistemological Beliefs of secondaryschool students for the subsample based on gender, locale of the schools and type of management of schools were analyzed by using mean difference analysis.

Comparison of mean scores of Epistemological Beliefs of Male and Female Secondary School Students

The data and results of test of significance difference between the mean scores of Epistemological beliefs for male and female secondary school students are presented in Table 6.

Table 6

Data and Result of the test of significance difference between mean scores of epistemological beliefs for male and female secondary schools students

Gender	N	Mean	SD	t-value	Level of significance
Male	300	106.98	8.671	1.651	NS
Female	300	107.03	6.975		

Table 6 indicates that the mean scores of Epistemological Beliefs of male students is 106.98 and the mean scores of Epistemological Beliefs of female students is 107.93. The standard deviation obtained for male students is 8.571 and female student is 6.975. The t-value obtained is 1.61, which is less than the table value at 0.05 level (1.96). Since the t-value obtained is less than table value, it can be concluded that there exists no significant difference in the mean scores of Epistemological Beliefs in Physics of male and female secondary school students..

Discussion

The mean scores of Epistemological Beliefs of male and female secondary school students were analyzed. It was found that there is no significant difference in the mean scores of Epistemological Beliefs of male and female secondary school students. So it can be concluded that male and female secondary school students have same level of Epistemological Beliefs in Physics.

Comparison of mean scores of Epistemological Beliefs of Urban and Rural Secondary School Students

The results of test of significance difference between mean scores of Epistemological Beliefs of urban and rural secondary school students are presented in Table 7.

Table 7

Data and results of the test of significance difference between mean scores of Epistemological Beliefs among urban and rural secondary school students

Locale of the school	N	Mean	SD	t-value	Level of significance
Urban	300	106.33	7.387	0.542	NS
Rural	300	106.68	8.248		

Table 7 indicates that the means scores of Epistemological Beliefs obtained for urban secondary schools students is 106.33 and the mean scores for rural secondary school students is 106.68. Standard deviation obtained for scores of Epistemological Beliefs for rural secondary school students is 7.887 and urban secondary schools students is 8.248. The t value obtained is 0.542, which is less than the table value at 0.05 level (1.96). Since the obtained t value is less than table value, it can be concluded that there exist no significant difference in mean scores of Epistemological Beliefs in Physics of urban and rural secondary school students.

Discussion

The mean scores of Epistemological Beliefs of urban and rural secondary school students were analyzed. It was found that there is no significant difference in the mean scores of Epistemological Beliefs of urban and rural secondary school students, so it can be concluded that, urban and rural secondary school students are having almost same level of Epistemological Beliefs in Physics.

Comparison of Mean Scores of Epistemological Beliefs among Aided and Government Secondary School Student

The results of test of significance difference between mean scores of Epistemological Beliefs for aided and government secondary school students are given in Table 8.

Table 8

Data and Results of the test of significance difference between mean scores of Epistemological Beliefs among Aided and Government School Students

Type of Management	N	Mean	SD	t value	Level of significance
Aided	300	106.09	7.564	1.315	N.S
Government	300	106.93	8.069		

Table 8 indicates that the mean scores of Epistemological Beliefs obtained for aided secondary school students is 106.09 and the government secondary school students is 106.93. Standard deviation obtained of scores of Epistemological Beliefs for aided secondary school students is 7.564 and government secondary

school students is 8.069. The t value obtained is 1.315 which is less than table value at 0.05 level (1.96). It can be concluded that there exist no significant difference in the mean scores of Epistemological Beliefs in Physics of aided and government secondary school students.

Discussion

The analysis of the data shows that there is no significant difference in the mean scores of Epistemological Beliefs of government and aided secondary school students. It can be concluded that, government and aided secondary school students do not differ in their level of Epistemological Beliefs in Physics.

Test of significance difference in mean scores of Achievement in Physics of Secondary School Students based on subsample gender, locale of the schools, and type of management of schools

Comparison of the mean scores of Achievement in Physics based on sub samples such as gender, type of management of schools and locale of the schools were analyzed in the following session.

Comparison of Mean Scores of Achievement in Physics for Male and Female Secondary School Students

The results of test of significance difference between mean scores of Achievement in Physics for male and female secondary school students are given in Table 9.

Table 9

Data and Results of the test of significance difference between mean scores of Achievement in Physics for Male and Female secondary school students

Gender	N	Mean	SD	t value	Level of significance
Male	300	14.90	7.517	5.887	0.01
Female	300	18.66	8.089		

*Significant at 0.01 level

Table 9 indicates that the mean scores of Achievement in Physics obtained for male students is 7.517 and the mean scores of Achievement in Physics obtained for female students is 8.059. Standard deviation obtained for Achievement in Physics for male students is 7.517 and female students is 8.089. The t value obtained is 5.887 which is greater than the tabled value (2.50) at 0.01 level of significance . It can be concluded that there exist significant difference in the mean scores of Achievement in Physics of male and female secondary school students.

Discussion

The mean difference analysis indicated that there exist significant difference in the mean scores of Achievement in Physics of male and female students of secondary schools. The mean scores of achievement in Physics for female secondary school students is 8.089 which is higher than mean scores of Achievement in Physics of male secondary school students i.e., 7.817. This indicates that female students are superior in Achievement in Physics than male students of secondary schools.

Comparison of Mean scores of Achievement in Physics of Aided and Government Secondary School Students

The results of test of significance difference between mean scores of Achievement in Physics of aided and government secondary school students are given in Table 10

Table 10

Data and Results of the test of significance difference in the Mean scores of Achievement in Physics between Aided and Government Secondary School Students

Type of Management	N	Mean	SD	t value	Level of significance
Aided	300	17.65	8.342	2.659	0.01
Government	300	15.91	7.609		

*****Significant at 0.01 level

Table 10 indicates that the mean scores of Achievement in Physics for aided secondary school students is 17.65 and government secondary school students is 15.91. Standard deviation scores obtained for aided secondary school students is 8.342 and government secondary school students is 7.609. The t value obtained is 2.659 which is greater than table value at 0.01 level (2.58). It can be concluded that there exist a significant difference in the mean scores of Achievement in Physics of aided school students and government school students at secondary level

Discussion

The analysis of mean scores of Achievement in Physics of aided and government secondary school student reveled that there exist significant difference

in the scores of Achievement in Physics of aided and government secondary school students. The mean score of Achievement in Physics for aided secondary school students is 17.65 which is higher than mean scores of Achievement in Physics of government school students i.e.,16.91. This indicate that the aided secondary school students are superior in Achievement in Physics than government secondary school students.

Comparison of Mean scores of Achievement in Physics between Urban and Rural Secondary School Students

The results of the test of significance difference between mean scores of Achievement in Physics of urban and rural secondary school students are given in Table 11.

Table 11

Data and Results of the test of significance difference between Mean scores of Achievement in Physics of Urban and Rural secondary school students

Locale of the school	N	Mean	SD	t value	Level of significance
Urban	300	17.68	8.088	2.762	0.01
Rural	300	15.88	7.871		

*****Significant at 0.01 level

Table 11 indicates that the mean scores of Achievement in Physics of urban secondary school student is 17.68 and for rural secondary school students is 15.88. Standard deviation of Achievement in Physics obtained for rural secondary school students is 8.088 and urban secondary school students is 7.871. The t value

obtained is 2.062 which is greater than table value at 0.01 level (2.58). It can be concluded that there exist a significance difference in mean scores of Achievement in Physics of rural and urban secondary school students.

Discussion

The analysis of the data shows that there exist a significant difference in the mean scores of Achievement in Physics of rural and urban secondary school students. The mean scores of Achievement in physics for urban secondary school students is 17.68 which is higher than mean scores of Achievement in Physics of rural secondary school students 15.88. This indicates that urban secondary school students are superior in scores of Achievement in Physics than rural secondary school students.

Pearson's 'r' between Epistemological Beliefs and Achievement in Physics obtained for total sample and relevant subsample based on gender, locale of schools and type of management of schools

The collected data has been analyzed to find out the relationship between Epistemological Beliefs and Achievement in Physics among secondary school students. The relationship between Epistemological Beliefs and Achievement in Physics was estimated by using Pearson's product moment coefficient of correlation.

Pearson's 'r' for the variables Epistemological Beliefs and Achievement in Physics for total sample of Secondary School Students

The details of results of correlation analysis for the variables,

Epistemological Beliefs and Achievement in Physics for total sample of secondary school students are given in Table 12.

Table 12

Result of Pearson's product moment coefficient of correlation for Epistemological Beliefs and Achievement in Physics for total sample of secondary school students.

Variables	N	Coefficient of correlation	Level of significance
Epistemological Beliefs and Achievement in Physics	600	.241	.01

Table 12 indicates that coefficient of correlation between the variables, Epistemological Beliefs and Achievement in Physics for the secondary school students is .241 which is significant at 0.01 level. This indicates that the two variables, Epistemological Beliefs and Achievement in Physics, is significantly related for the secondary school students.

Discussion

The two variables, Epistemological Beliefs and Achievement in Physics are significantly related for the secondary school students. The magnitude of 'r' indicates that the relationship between Epistemological Beliefs and Achievement in Physics among secondary school students is low. The positive sign of 'r' suggests that the Epistemological Beliefs and Achievement in Physics are positively related. That is, for an increase in Epistemological Beliefs there will be

an increase in Achievement in Physics and vice versa among secondary school students.

Pearson's 'r' for the variable Epistemological Beliefs and Achievement in Physics between relevant subsamples based on gender, locale and type of management of schools

The details regarding coefficient of correlation between Epistemological Beliefs and Achievement in Physics for the subsamples based on gender, locale and type of management are given in Table 13.

Table 13

Details regarding the coefficient of correlation between Epistemological Beliefs and Achievement in Physics for the subsample based on gender, locale and type of management of school

Sample	Category	Size of the sample	'r'	Level of significance
Gender	Male	300	.172	0.01
	Female	300	.306	0.01
Locale	Rural	300	.244	0.01
	Urban	300	.247	0.01
Type of Management	Government	300	.126	0.01
	Aided	300	.332	0.01

Discussion

Table 13 indicates that coefficient of correlation between the variables Epistemological Beliefs and Achievement in Physics of male students is .172. The

value of correlation is significance at 0.01 level. The magnitude of 'r' indicates that there is negligible relationship between Epistemological Beliefs and Achievement in Physics among male students of secondary schools The positive sign of 'r' suggest that the Epistemological Beliefs and Achievement in Physics are positively related for male students of secondary schools. Thus, there exist a positive negligible relationship between the Epistemological Beliefs and Achievement in Physics among male students of secondary schools.

Table 13 indicates that the coefficient of correlation between the variables, Epistemological Beliefs and Achievement in Physics for female students is .306. The value 'r' is significant at 0.01 level. The magnitude of 'r' indicates that there is low relationship between Epistemological Beliefs and Achievement in Physics among female students of secondary schools. The positive sign of 'r' suggests that the two variables, Epistemological Beliefs and Achievement in physics are significantly related for the subsample of female students of secondary schools. That is, for an increase in Epistemological Beliefs there will be an increase in Achievement in Physics and vice versa for female secondary school students.

Table 13 depicts that the correlation coefficient between the variables, Epistemological Beliefs and Achievement in Physics for rural secondary school students is .244, which indicates that there exist low positive relationship. The relationship between the variables is significant at 0.01 level. That is, for an increase on Epistemological Beliefs, there will be an increase in Achievement in Physics and vice versa.

Table 13 shows that the coefficient of correlation for the variables Epistemological Beliefs and Achievement in Physics for urban secondary school students is .247 . It indicates that there exist a positive low relationship between the variable Epistemological Beliefs and Achievement in Physics among urban secondary school students. The relationship between the variables, Epistemological Beliefs and Achievement in Physics is significant at 0.01 level. That is, for an increase in Epistemological Beliefs, there will be an increase in Achievement in physics and vice versa for urban secondary school students.

Table, 13 indicates that the correlation coefficient between the variables Epistemological Beliefs and Achievement in Physics for secondary school students of government school is .126, which is significant at 0.01 level. It also indicates that the relationship between the variables, Epistemological Beliefs and Achievement in Physics is positive and negligible for government secondary school students. Thus, for an increase in Epistemological Beliefs there will be increase in Achievement in Physics and vice versa for government secondary school students .

Table 13 depicts that the coefficient of correlation for the variables Epistemological Beliefs and Achievement in Physics for secondary school students of aided schools is .332 which is significant at 0.01 level. It also depicts that there exist low positive relationship between Epistemological Beliefs and Achievement in Physics for aided secondary school students. Thus, for an increase in Epistemological Beliefs there will be corresponding increase in Achievement in Physics of aided secondary school students.

Conclusion

The distribution of the variables Epistemological Beliefs and Achievement in Physics among secondary school students are approximately normal. The analysis of data shows that there exists a positive low correlation between Epistemological Beliefs and Achievement in Physics among secondary school students.

There exists low positive correlation between the variables, Epistemological Beliefs and Achievement on Physics in the case of female, aided, urban and rural secondary school students. There exist negligible correlation between the variables Epistemological Beliefs and Achievement in Physics in the case of male and government secondary school students.

The results indicate that Epistemological Beliefs in Physics of secondary school students do not differ on the subsamples of gender, locale of the schools and type of management of schools. There exists significant difference in Achievement in Physics of secondary school students based gender, locale of the school and type of management of schools . The results shows that female students are superior in Achievement in physics than male secondary school students , aided school students are superior than government school students and urban school students are superior than rural secondary school students in Achievement in Physics.

Chapter 5

SUMMARY FINDINGS, CONCLUSION AND SUGGESTIONS

- *Study in Retrospect*
- *Major findings*
- *Conclusion*
- *Tenability of Hypotheses*
- *Educational implications for the study*
- *Suggestions for further Research*

SUMMARY, FINDINGS, CONCLUSION AND SUGGESTIONS

This chapter provide an overview of the significant aspects of the various stages of the study. This chapter includes study in retrospect, major findings of the study, educational implications and suggestions for the further research in the area.

Study in Retrospect

This section tries to make a retrospective study of the title, variables, objectives, hypotheses, methodology, tools and statistical technique used for the study.

Restatement of the Problem

The study is entitled as the relationship between Epistemological beliefs and Achievement in Physics of secondary school students in Kerala.

Variables for the Study

Present study designed with two variables viz., Epistemological Beliefs and Achievement in Physics.

Objectives of the Study

The objectives set for the study are

- To know whether there exist any difference in the mean scores of Epistemological Beliefs of secondary school students with respect to subsample
  - Gender
  - Locale of the schools
  - Type of Management of schools
- To know whether there exist any difference in the mean scores of Achievement in Physics of secondary school students with respect to subsample
  - Gender
  - Locale of the schools
  - Type of Management of schools
- To find out the relationship between Epistemological Beliefs and Achievement in Physics among secondary school students for the total sample.
- To find out the relationship between Epistemological Beliefs and Achievement in Physics among secondary school students for the subsample based on
  - Gender
  - Locale of the schools
  - Type of Management of schools

Hypotheses of the Study

The hypotheses formulated for the study are

- There will be no significant difference in the mean scores of Epistemological Beliefs among secondary school students for the subsample based on
  - Gender
  - Locale of the schools
  - Type of Management of schools
- There will be no significant difference in the mean scores of Achievement in Physics among secondary school students for the subsample based on
  - Gender
  - Locale of the schools
  - Type of Management of schools
- There is no significant relationship between Epistemological Beliefs and Achievement in Physics among secondary school students for the total sample.
- There is no significant relationship between Epistemological Beliefs and Achievement in Physics among secondary school students for the subsample based on
  - Gender
  - Locale of the schools
  - Type of Management of schools

Methodology

The study is intended to investigate the relationship between Epistemological Beliefs and Achievement in Physics among secondary school students. The investigator used survey method for the study. A precise description of sample, tool and statistical technique used for the study are described.

Sample of the Study.

The population for the study comprised of secondary school students of Kerala State. The present study was conducted on the sample of 600 secondary school students from various schools of Kozhikode and Malappuram districts of Kerala state, selected by stratified sampling technique giving due to the representation of to gender, locale of the schools and type of management of schools.

Tool used for the Study

To measure the variable Epistemological Beliefs, investigator developed Scale on Epistemological Beliefs in Physics (Anjusha & Niranjana, 2017) with the help of supervising teacher.

Statistical Techniques used for the Study

For the purpose of analyzing the data, investigator carried that statistical techniques such as

- Descriptive statistics

- Test of significance difference obetween mean scores of large independent sample(t test)
- Pearson's product moment co-efficient of correlation (r)

Major Findings of the Study

Major findings of the study are as following

- From the study it is clear that, the values of mean, median and mode for Epistemological Beliefs in Physics for total sample of secondary school students are 106.51, 106 and 108 which is approximately equal. The coefficient of skewness is. 151 suggesting that the distribution is slightly positively skewed. The measure of kurtosis is. 039 that is, the curve is Leptokurtic. For the subsample mean, median and mode are approximately equal. It can be concluded that the distribution of the variable Epistemological Beliefs for the total sample is approximately normal.

- From the study, it is evident that the values of mean, median and mode for Achievement in Physics for total sample of secondary school students are 16.78, 16 and 14 which is approximately equal. The co-efficient of skewness is. .374 suggesting that the distribution is slightly positively skewed. The measure of kurtosis is .575 that is the curve is slightly plutykurtic. For the subsample mean median and mode are approximately equal. It can be concluded that the distribution of the variable achievement in physics for the total sample is approximately normal.

- The t value obtained for Epistemological Beliefs is 1.651 for the subsample based on gender which is less than the table value at 0.05 level (1.96). Since the obtained value of t is less than table value. It can be concluded that there is no significant difference in Epistemological Beliefs in Physics of male and female students of secondary schools of secondary schools.

- The t value obtained for Epistemological Beliefs for the subsample based on locale of schools is 0.542 which is less than table value at 0.05 level (1.96). Since the obtained t value is less than table value. It can be concluded that there is no significant difference in Epistemological Beliefs in Physics of urban and rural secondary school students.

- The t value obtained for Epistemological Beliefs is 1.315 for subsample based on type of management which is less than table value at 0.05 level (1.96). It can be concluded that there is no significant difference in the mean scores of Epistemological Beliefs in Physics of aided and government secondary school students.

- The t value obtained for achievement in physics for subsample based on gender is 5.887 which is greater than table value at 0.01 level (2.58). Since the obtained t value is greater than tabled value. It can be concluded that there exist a significant difference in the mean scores of Achievement in Physics of male and female secondary school student. Female students (*M*= 18. 66 *SD*=8.059)) are superior in achievement in physics than male students *(M*= 14.90, *SD*=7.517).

- The t value obtained for Achievement in physics is 3.659 for Achievement in physics for subsample based on type of management of schools which are greater than table value at 0.01 level (2.58). It can be concluded that there exist a significant difference in the mean scores of Achievement in Physics of aided secondary school students and government secondary school students. Aided secondary school students (*M* =17.65, *SD*=8.342) are superior in Achievement in Physics that government secondary school students.(*M*= 15.91, *SD* =7.609)

- The t value for Achievement in Physics obtained is 2.062 for subsample based on locale of school which are greater than table value at 0.05 level (1.95). Urban secondary school students (*M* = 17.68, *SD*=8.088) are superior in Achievement in Physics than rural secondary school students (*M*=15.88, *SD*= 7.871).

- The coefficient of correlation between the variable Epistemological Beliefs and Achievement in Physics for the secondary school students is .241. The magnitude and sign of 'r' indicates low positive correlation between Epistemological Beliefs and Achievement in Physics. It means that an increase in Epistemological Beliefs results in to increase in Achievement in Physics and decrease in Epistemological Beliefs results in decrease on Achievement in Physics.

- The coefficient of correlation between the variable Epistemological Beliefs and Achievement in Physics of male students of secondary school is .172. The value of correlation is significant at 0.01 levels. The magnitude of

'r' indicates that there is negligible relationship between these two variables. The positive sign of 'r' suggests that the two variables are positively related.

- The coefficient of correlation between the variables Epistemological Beliefs and Achievement in Physics of female students at secondary level is .306. The value of 'r' significant at 0.01 levels. The magnitude and sign of 'r' indicates that there exist low positive relationship between the variable for female secondary school students

- The coefficient of correlation between the variables Epistemological Beliefs and Achievement in Physics for rural secondary school students is .244.which is significant at .01 level. It shows that there exist low positive relationship between Epistemological Beliefs and Achievement in physics among rural secondary school students

- The coefficient of correlation for the variables Epistemological Beliefs and Achievement in Physics for urban secondary school students is .247 which is significant at .01 level. it indicates that positive low relationship between Epistemological Beliefs and Achievement in Physics among urban secondary school students

- The correlation coefficient between the variables epistemological beliefs and achievement in physics for secondary school students who are studying in government school is .125 which significant at .01 level .it indicates that there exist positive negligible relationship between Epistemological beliefs and Achievement in physics among govt. secondary school students

- The coefficient of correlation for the variables Epistemological Beliefs and Achievement in Physics for secondary school students who are studying in aided school is .332 which significant at .01 level .it indicates that there exist positive low relationship between Epistemological Beliefs and Achievement in physics among aided secondary school students.

Conclusion

The distribution of the variables Epistemological Beliefs and Achievement in Physics among secondary school students are approximately normal. The analysis of data shows that there exists a positive low correlation between Epistemological Beliefs and Achievement in Physics among secondary school students.

There exists low positive correlation between the variables, Epistemological Beliefs and Achievement on Physics in the case of female, aided, urban and rural secondary school students. There exist negligible correlation between the variables Epistemological Beliefs and Achievement in Physics in the case of male and government secondary school students.

The results indicate that Epistemological Beliefs in Physics of secondary school students do not differ on the subsamples of gender, locale of the schools and type of management of schools. There exists significant difference in Achievement in Physics of secondary school students based gender, locale of the school and type of management of schools . The results shows that female students are superior in Achievement in physics than male secondary school students , aided school students are superior than government school students and urban school

students are superior than rural secondary school students in Achievement in Physics.

Tenability of Hypotheses

The first hypotheses states that there will be no significant difference in the mean scores of Epistemological Beliefs among secondary school students for the subsample based on gender, locale of schools and type of management the schools. The results showed that all the relevant subsample based on gender, locale of the schools and type of management of schools do not differ significantly in the level Epistemological Beliefs in Physics for secondary school students. Thus, the first hypothesis is accepted.

The second hypothesis states that there will be no significant difference in the mean scores of Achievement in Physics among secondary school students for the subsample based on gender, type of management of schools and locale of the school. In this study it was found there exist significant difference in the mean scores of Achievement in Physics for the subsample based on gender, locale of the schools and type of management of the schools. Hence, second hypothesis is rejected.

The third hypothesis states that there is no significant relationship between Epistemological Beliefs and Achievement in Physics among secondary school students for the total sample. In this study it was found that there exists low positive correlation between Epistemological Beliefs and Achievement in Physics for the total sample of secondary school students. Thus, the third hypothesis is rejected.

The fourth hypothesis states that there is no significant relationship between Epistemological Beliefs and Achievement in Physics among secondary school students for the subsample based on gender, locale of schools and type of management of schools. The study reveals that there exist significant positive relationship between Epistemological Beliefs and Achievement in Physics among secondary school students for the subsample based on gender, locale and type of management of schools. Hence, the fourth hypothesis is rejected.

Educational Implications of the Study

The result of the study has various implications in educational field which may help curriculum developers and teachers to their attempt to enhance quality of education in Kerala. Epistemological beliefs influence one's cognitive and meta-cognitive operations in a significant way. The results indicated that the epistemological beliefs and achievement are significantly related. An increase in achievement of students is possible by increasing level of epistemological beliefs in physics subject. Teachers should understand the epistemological beliefs held by the students related to a particular subject. The understanding of epistemological beliefs in physics of secondary school students help the teacher to organize the learning experiences according to the the beliefs of the students.

Curriculum developers should understand low epistemological beliefs affect learning. Epistemological beliefs can help to understand why a piece of curriculum optimized to address conceptual difficulties as ineffective for some students. Curriculum developer can take up the challenge of helping students associate their

productive epistemological beliefs with the activity of the course and the discipline. Classroom teacher should understand how epistemological beliefs affects learning. Classroom teacher must consider student's strength and difficulties of an epistemological nature. Teacher must learn to identify the epistemological resources that student possesses and to understand which resources students are using during learning process so that teacher can help them to choose more productive approaches to learning physics subject.

Sometimes student's conceptual difficulties make difficulties in doing experiment and problem solving in physics. Teacher's proper planning and execution of class by considering student's epistemological beliefs can resolve this problem. Physics teacher can influence student's epistemological beliefs in a particular subject, through giving different tasks, activities, experiment or problem by considering student's epistemological beliefs. Through this student's dislikes about a particular subject can be reduced.

Teacher can strengthen student's native epistemological beliefs in physics subject to sophisticated epistemological beliefs. Epistemological beliefs influence learning through a link with learning approaches. Surface learning focuses on outcome goals such as obtaining a qualification where as deep approach involves intrinsic motivation and abstract meaning. Naive epistemological beliefs have been associated with surface learning approaches where as sophisticated beliefs associated with the deeper approaches. So teacher can influence to make changes in student's approaches to learning.

Suggestion for Further Research

The finding of the study and limitations encountered in the present study helped the investigator to suggest the following areas for further research.

- The present study is concluded in Kozhikode and Malappuram districts. The same study can be extended to other districts of Kerala.
- A comparative study on epistemological Beliefs in physics and other science subject among secondary level and higher secondary level can be carried out
- The same study can be conducted at higher secondary and college level.
- A study on pre-service teacher's epistemological beliefs in relation to their achievement can be carried out
- A study can be conducted to understand the relationship between epistemological beliefs and process skill in science of higher secondary school students.
- A study can be conducted to understand epistemological beliefs of secondary school students in relation to their problem solving ability.
- Experimental study to understand the effectiveness of strategies of epistemological beliefs in physics can be carried out
- A study on various cognitive and affective factors influencing Epistemological Beliefs can be carried out.

BIBLIOGRAPHY

BIBLIOGRAPHY

Arslantus, A. H. (2015). Epistemological beliefs and academic achievement .*Journal of Education and Training Studies .4*(1*).* 18-32. Retrieved from : http://dx.doi.org/10.11114/jets.v4i1 .1107\

Aypay. (2010). Teacher education students epistemological beliefs and their conception about teaching and learning . *Procedia - Social and Behavioural Sciences. 2*(2). 2599- 2604. Retrieved from http;///doi .org / jsbspro. 2010

Best, J.W. & Khan, J. V. (2014). *Research in education* . (10th ed.). New Delhi : Prentice Hall of India.

Bruten, I. & Stromso, I. H. (2005). The relationship between epistemological beliefs, implicit theories of intelligence and self regulated learning among Norweign post secondary students . *Learning and Instruction, 75*, 539-565. Retrieved from www.bpsjournal.co.uk.

Esma, S. M. & Serdar, O. (2016) . School students scientific epistemological beliefs .*The Online Journal of New Horizons in Education. 6*(1). 92 -103. Retrieved from htttp://www.tojnet .net journal /tojnet article /v0601 /vo16101.

Chan, K. W. (2003). Honking teacher education students epistemological beliefs and approaches to learning. *Middle British Journal of*

Educational Psychology, 4(1). 259-269. Rretrieved from http://www.research gate .net /publication /238745395.

Gafoor, A. K. (2010). Relationship of thinking style with physics achievement among higher secondary school students in Kerala. *Indian Education Review*. *46*(1). 50-63

Gatsos, D. (2015). *Exploring the significance of social influences on epistemic beliefs.* Doctoral Dissertation. Retrieved from https://uknowledge .uky.edu/epe_etdu.

Good, C. V. (1959). *Dictionary of education*. New Delhi: Mc Graw Hill.

Gora, M. (2001). Distance learning in accounting. J*ournal of Educational Media*, *28* (9), 58-65.

Grey, K. E. (2008). Student know what physicist believe but they do n agree a study using the class survey. *Physics Education Research, 3*(1), 1-8.

Grice, M. (2014). Epistemic beliefs among upper secondary students in education for sustainable development. *Research in Higher Education, 84*(1), 521-534. Retrieved from http;/ /handle.net/2077/37806.

Gu, J. (2016). *Epistemic Beliefs of Middle and High School Students in a Problem-Based, Scientific Inquiry Unit: An Exploratory, Mixed Methods Study*. Doctoral Dissertation. Retrieved from http://digitalcommons.usu. edu/etd/4674

Hofer, B. K. & Pintrich ,P. R (1970). Development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning. *Review of Educational Research, 67*(2), 88-140 retrieved from http://doi.org/ 10.3102/00346543067001088

Hofer, B. K. and Pintrich, P. R. (Eds.) (2002). *Personal epistemology: The psychology of beliefs about knowledge and knowing.* Mahwah, NJ: Lawrence Erlbaum Associates.

Hofer, B. K. (2000). Dimensionality and disciplinary differences in personal epistemology. *Contemporary Educational Psychology*, 25 (4), 378-405, doi: 10.1006/ rep. 199.1026.

Huling, D. M. (2014). *The effect of teachers' epistemological beliefs on practice*. Doctoral Dissertation Retrieved from http://scholarcommons.usf. edu/etd/ 5044.

Hussai, S., Anwar, S., & Majoka, M. (2011). Effect of peer group activity based learning on students academic acheivement in physics at secondary level. *Journal of Academic Research, 3*(1). 940-944.

Jayakumari, S. & Joseph, C. (2016). Effevctiveness of cognitive apprenticeship model on achievement in physics at secondary level . *Educational extracts. 4*(1), 63-70

Josiah, M. M. (2012). School location versus academic achievement in physics .does computer assisted instruction has any effect. *Journal of*

Educational and social research, 2(8), 162-168. Doi 10.5901/jesr.2012v2n8p162

Kampa, N., Neuman,I,, & Heltman, P., & Kremer, K. (2016). Epistemological beliefs in science a person centered approach to investigate high school students profile . *Contemporary Educational Psychology*. *46* (1). 81-93. Retrieved from http;///doi.org/10.1016/j.cedpsych.2016

Kaymak, E., & Bekirogly, F. O. (2013). How students epistemological beliefs in the domain of physics and their conceptual change are related. *European Journal of Physics Education, 4*(1),10-25. Doi: 10.9300079.

Korter, M, G. (2007). Correlation student discussion , attitude and learning , physical review special topics. *Physics Education Research, 3*(1), 1-8.

Koul, L. (2009). *Methodology of education research*. Noida India : Vikash Publishing House.

Kumar, U. L. V. (2010). Effectiveness of meta cognitive strategies on classroom participation and student achievement in higher secondary school physics classroom . *Endeavours In Education, 2(1).50-64.*

Lee, J. (2013). Effects of epistemological and pedagogical beliefs on the instructional practices of teachers: A chinese perspective. *Australian Journal of Teacher Education, 38*(12). Retrieved from http://ro.ecu.edu. au/ajte/vol38/iss12/8.

Maghadam, H. R. & Roshan, M. J. (2012). Relationship between epistemological beliefs and self regulated learning in high school student of traditional and schools. *Journal of Behavioural Science in Asia, 1*(1), 1-11. Retrieved from http;//www.joursa.com.

Musasia, M. A., Ocholla, A. A., & Sakwa. (2016). Physics practical work and its influence on students academic achievement. .*Journal of Education and Practice, 28*(7).129-134.

NCERT (2005). *National Curriculum Framework.* Retrieved from http;//www.ncert. nic.in/rightside/link/pdf/framework/englishnf2005.pdf

Niranjana, K. P. (2018). *Influence of epistemological beliefs, achievement goals and self regulated learning strategies on achievement in accountancy of higher secondary school students* (Unpublished Doctoral thesis). University of Calicut: Department of Education.

Paulsen, M. B. & Feldman, K. A. (2005). Student motivation and epistemological beliefs. *New direction for teaching and learning*, 78,77-80. Doi:10 .100z/1.7802.

Page, G. & Thomas, J. B. (1977). *International dictionary of education*. U.S.A: Nicholas publishing company.

Perry, W. G. (1970). *Forms of intellectual and ethical development in the college years: A scheme*. New York:Holt, Rinehart and Winston.Rogaa ,L,M. & Abdorreza ,T(2014). A Study of epistemological beliefs of EFL learners across gender and educational level .international journal of

research studies in psychology .3(30.17-28. Retrieved from doi 10.5861 /ijrsp 2014 .754 Retrieved from DOI: 10.5861/ijrsp.2014.754

Piaget, J. (1970). *The principles of genetic epistemology*. London : Routledge

Savanvic, L., & Jokie, T. (2012). Relationship between epistemological beliefs and motivational orientation among high school students. *Psihologua*, 45 (4), 451-465. Retrieved from doi 10.2298PSI 1204451S

Sadi, O. (2015). High school students epistemological beliefs, conception of learning biology, a study of their structural model. *Eurasia journal of mathematics, science and technology education,* 11(5), 1061-1079. Doi 10.12973/ Eurasia.2015.1375a.

Saleh, S. & Subramaniam. (2018). Effect of brain based teaching method on physics achievement among ordinary school students. *Journal of Technology Studies*, 35 (2), 56-64. Retrieved from http;//doi.org/10.1016/j.kjss.2017

Schommer, M. (1990). Effect of beliefs about the nature of knowledge on comprehension . *Journal of Educational Psychology, 82(3*), 498-504. Retrieved from http:// dr. doi.org 10.10370022- 066382,3498.

Schommer, M. (1993). Epistemological development and academic performance among secondary students. *Journal of Educational Psychology, 85*(3), 406-411

Sinha, J. N. (1985). Introduction to philosophy. Kolkata: New Central Book Agency..

Stockston, J. C. (2010). A study of the relationship between epistemological beliefs and self regulated learning among advanced placement calculus student in context of mathematical problem solving. *Journal of Education,* 2(1), 67-89. Retrieved from http;//digital commons .kennesaw.edu

Sulimma, M. (2009). Relation between epistemological beliefs and culture classification. M*ulticultural education and Technology*, *3*(1).78-89. Retrieved from http;// doi.org / 10.118/17504970910951165.

Tanriverdi, B. (2012). Preservice teachers epistemological beliefs and approaches to learning. *Procedia - Social And Behavioural science*, *46*(1), 2635- 2642. Retrieved from https://doi.org/10.1016/j .sbspro.2012.05.538

Veloo, A., Noor, R., & Majoka, M., (2015). Attitude towards physics and additional mathematics achievement towards physics. *Intertnational Journal of Education Studies, 8*(3), 35-43. Doi .10.5539/ies.v8n3p35

APPENDICES

APPENDIX I

List of Schools

No.	Name of the Schools
1.	Ramanattukara Higher Secondary School, Ramanattukara
2.	V.H.M.H.SS Morayur
3.	G.H.S.S Peruvallur
4.	M.S.P. Malappuram
5.	G.H.S.S. Thirurangadi
6.	G.M.H.S.S. Cu Campus, University
7.	G.V.H.S.S Kondotty
8.	G.G.H.S.S Manjeri
9.	U.H.H.S.S. Chaliyam
10.	C.M.H.S.S. Mannur
11.	G.H.S.S Kuttikattoor
12.	G.H.S.S. Mavoor
13.	G.G.V.H.S.S Feroke
14.	G.V.H.S.S Cheruvannur
15.	Sevamandir Post Basic H.S.S Ramanattukara
16.	Farook Higher Secondary School Farook College
17.	N.M.H.S.S. Chelambra
18.	G.H.S.S Neeleswaram, Mukkam

APPENDIX II

FAROOK TRAINING COLLEGE
SCALE ON EPISTEMOLOGICAL BELIEFS IN PHYSICS

(DRAFT)

Niranjana.K.P
Assistant Professor

Anjusha.V.V
M.Ed Student

Name of the student :
Name of the school :
Urban/Rural
Type management : Govt/Aided

Gender : M/F
Locale :

\nÀt±-i-§Ä:

Xmsg slmSp-¯n-cn-¡p¶ {]kvXm-h-\-lÄ {i²m-]qÀÆw hmbn-¡p-l. Ah `uXnlimkv{X-¯nse hnizm-k-hp-ambn _Ô-s¸-«-Xm-Wv. Hmtcm {]kvXm-h-\bpw \n§sf kw_Ôn-¨n-S-t¯mfw F{X-am{Xw icn-bm-sW¶v Xocp-am-\n-¡p-l. \n§-fpsS Xocp-am\w A©v Xc-¯n-em-lmw. 1. ]qÀ®-ambpw tbmPn-¡p-¶p. 2. tbmPn-¡p-¶p, 3. A`n-{]m-b-an-Ã, 4. hntbm-Pn-¡p-¶p, 5.]qÀ®-ambpw hntbm-Pn-¡p-¶p. AXXv {]kvXm-h-\-lÄ¡v t\scbpÅ tImf-¯nÂ \n§-fpsS {]Xn-I-cWw "✓' AS-bmfw D]-tbm-Kn¨v tcJ-s¸-Sp-¯p-l. FÃm {]kvXm-h-\-I-fÄ¡pw {]Xn-I-cWw tcJ-s¸-Sp-¯p-hm³ {]tXyIw {i²n-¡p-l.

{]la\-¼Å	{]kvXm-h-\-lÄ	]qÀ®-ambpw [illegible]	tbmPn¡p¶p	A`n-{]m-b-anÃ	hntbmPn¡p¶p	]qÀ®-ambpw hntbmPn¡p¶p
1.	A[ym-]-I³]d-ªp-X-cp¶ Bi-b-§Ä am{X-amWv `uXn-I-im-kv{X-¯nÂ hmkvX-h-am-bn-«p-ÅXv					
2.	`uXn-I-im-kv{X-¯nse Bi-b-§sf a\-kn-em-¡m³ hf-sc-b-[nIw kabw Bh-iy-am-Wv.					
3.	`uXn-I-im-kv{X-¯nse Bi-b-§sfÃmw hkvXp-\n-jvThpw amä-an-Ãm-¯-h-bp-amWv					

{]a\-¼Å	{]kvXm-h-\-lÄ	]qÀ®-amÀpw	tbmPn¡p¶p	A`n-{]m-b-anÂ	hntbmPn¡p¶p	]qÀ®-amÀpw hntbmPn¡p¶p
4.	`uXn-l-im-kv{X-¯nse Bi-b-§Ä imkv{X-]p-tcm-K-Xn-b-\p-k-cn¨v amä-§Ä¡v hnt[-b-am-bn-s¡m--n-cn-¡pw.					
5.	`uXn-l-im-kv{X-¯nse Bi-b-§Ä s]s«¶v {Kln-¡m³ km[n-¡m-dp-v					
6.	A[ym-]-l³]Tn-,n-¡p¶ lmcy-§Ä Rm³ A\p-`-h-§-fn-eqsS Adn-ª-tijw am{Xta kzol-cn-¡m-dpÅq					
7.	a\-]m-T-am-¡m-hp¶ X¯z-§fpw \nb-a-§fpw AS§nb hnj-b-amWv `uXn-l-imkv{Xw					
8.	`uXn-l-im-kv{X-¯nse Bi-b-§Ä \nXy-Po-hn-X-hp-ambn _Ô-s,-Sp¯n]Tn-¡p-t¼m-gmWv lqSp-XÂ hyà-am-hp-¶Xv					
9.	`uXn-l-im-kv{Xw]Tn-¡m-\pÅ lgnhv P·\m DÅ-Xm-Wv.					
10.	lTn-\-{]-bXv\w sN¿p-l-bm-sW-¦nÂ]Tn-¡m-hp¶ Hcp hnj-b-amWv `uXn-l-im-kv{Xw					
11.	A[ym-]-l³]dªp-X-¶mÂ am{Xw]Tn-¡m-hp¶ Hcp hnj-b-amWv `uXn-l-im-kv{Xw					
12.	A[ym-]-l³]dªp-X-cp-¶-Xn-t\-¡m-fp-]cn `uXn-l-im-kv{X-¯nse Bi-b-§Ä kzbw ls-¯n kzol-cn-¡p-¶p.					
13.	BZy hmb-\-bnÂ Xs¶ `uXn-l-im-kv{X-¯nse Bi-b§Ä]Tn-¡m³ km[n-¡m-dp--v.					

{]a\-¼Ã	{]kvXm-h-\-IÄ	]qÀ®-ambpw	tbmPnjp¶p	A`n-{]m-b-anÃ	hntbmPnjp¶p	]qÀ®-ambpw hntbmPnjp¶p
14.	CXc imkv{X-hn-j-b-§sf At]-£n¨v Ffp-,-¯nÂ]Tn-¡m-hp¶ hnj-b-amWv `uXn-I-im-kv{Xw					
15.	`uXn-I-im-kv{X-¯nse]co-£Ww sN¿p-¶-XnÂ Rm³ kaÀ°-\m-Wv.					
16.	CX-c-hn-j-b-§-fp-ambn hf-sc-b-[nIw _Ô-apÅ hnj-b-amWv `uXn-I-im-kv{X-w					
17.	IrXy-amb]T-\-{]-hÀ¯-\-¯n-eqsS `uXn-I-im-kv{X-¯nepÅ Ah-Kmlw hÀ²n-¸n-¡p-hm³ km[n-¡pw.					
18.	imkv{Xo-b-ambn sXfnª `uXn-I-im-kv{X-¯nse Bi-b§Ä Ah-tem-I\w IqSmsX Rm³ kzoI-cn-¡m-dp-v					
19.	]co-£W \nco-£-W-§-fn-eqsS e`n-¡p¶ `uXn-I-im-kv{X-¯nse Bi-b-§Ä am{X-amWv bYmÀ°-am-bn-«p-Å-Xv.					
20.	`uXn-I-im-kv{X-]T-\-¯nÂ kÀKm-ß-I-Xbv¡v Øm\-anÃ					
21.	A[ym-]-I³ BÀPn-¡p¶ Adn-hn-\-\p-k-cn¨v `uXn-I-im-kv{X-¯nse Adn-hp-IÄ amä-§Ä¡v hnt[-b-am-bn-s¡m-n-cn-¡pw.					
22.	ka-b-sa-Sp¯v]Tn-¨mÂ `uXn-I-im-kv{X-¯nse GXv Bi-bhpw]Tn-¡m³ km[n-¡pw.					
23.	hfsc Ffp,w a\-kn-em-hp¶ hkvXp-X-IÄ \ndª Hcp hnj-b-amWv `uXn-I-im-kv{X-w					
24.	\nKq-V-amb kz`m-h-apÅ Bi-b-§Ä AS-§nb hnj-b-					

{]la\-¼Å	{]kvXm-h-\-lÄ	]qÀ®-amÀpw	tbmPn¡pdp	A`n-{]m-b-anÂ	hntbmPn¡pdp	]qÀ®-amÀpw hntbmPn¡pdp
	amWv `uXn-l-im-kv{X-w					
25.	`uXn-l-imkv{Xw kzbw]Tn-¡m-\pÅ lgnhv F\n-¡p--v.					
26.	lTn-\-{]-bXv\w sN¿p-l-bm-sW-¦nÂ `uXn-l-im-kv{X-¯nse Bi-b-§Ä BÀ¡pw a\-kn-em-¡m³ km[n¡pw					
27.	`uXn-l-im-kv{X-¯nse Pb-]-cm-P-b-§Ä A[ym-]-lsâ lgn-hns\ B{i-bn-¨n-cn-¡pw.					
28.	A[ym-]-l³]Tn-,n-¡p¶ Bi-b-§Ä lmc-W-§Ä ls-¯n]cn-tim-[n-¨-tijw am{Xta kzol-cn-¡m-dp-Åq.					
29.	`uXn-l-im-kv{X-¯nse tNmZy-§Äs¡Ãmw lrXy-amb D¯cw D-v.					
30.	`uXn-l-im-kv{X-¯nse Bi-b-§Ä Hmtcm-cp-¯cpw hyXy-kvX-am-bmWv ho£n-¡p-¶-Xv.					
31.	`qcn-`mKw hnZymÀ°n-lÄ¡pw `uXn-l-imkv{Xw s]s«¶v]Tn-¡m³]äp¶ Hcp hnj-b-am-Wv.					
32.	lmcy-lm-c-W-§Ä a\-kn-em-¡n-bmÂ `uXn-l-im-kv{X-¯nse GsXmcp Bi-bhpw]Tn-¡m³ km[n-¡pw.					
33.	`uXn-l-im-kv{X-¯nse hkvXp-X-lÄ]c-kv]cw _Ô-an-Ãm-¯-h-bmWv					
34.	F{X lTn-\-{]-bXv\w sNbvXmepw a\-kn-em-¡m³ lgn-bm-¯-h-bmWv `uXn-l-im-kv{X-¯nse kn²m-´-§Ä					
35.	`uXn-l-im-kv{X-¯nse lW-¡p-lÄ ssllmcyw sN¿m³/D¯cw ls--¯m³ {]tXyIw lgn-hpÅ hyàn-bm-bn-					

{]a\-¼Ã	{]kvXm-h-\-IÄ	]qÀ®-ambpw	tbmPnp¡p	A`n-{]m-b-anÃ	hntbmPnp¡p	]qÀ®-ambpw hntbmPnp¡p
	cn¡pw `uXn-I-im-kv{X- hnZ-Kv[³.					
36.	F\n¡v a\-Ên-em-hm¯ `uXn-I-im-kv{X-¯nse Bi-b-§Ä Nne-t¸mÄ A[ym-]-I³]d-bp-¶-Xp-sIm-v am{Xw Rm³ kzoI-cn-¡m-dp-v					
37.	hyà-a-Ãm¯ `uXn-I-im-kv{X-¯nse Bi-b-§Ä d^-d³kv _p¡v D]-tbm-Kn¨v hyàX hcp-¯m-dp--v.					
38.	`uXn-I-im-kv{X-¯nse C¶s¯ hkvXpX \msf¯ hkvXpX Bhm-Xn-cn¡mw					
39.	`uXn-I-im-kv{X-¯nse GXv]co-£-Whpw AXnsâ X¯zw a\-Ên-em-¡n-bmÂ s]s«¶v sN¿m³ km[n-¡pw.					
40.	d^-d³kv _p¡n-eqsS e`n-¡p¶ `uXnIimkv{X-¯nse Bi-b-§Ä Ah-tem-I\w IqSmsX Rm³ kzoI-cn-¡m-dp--v.					
41.	Hmtcm Ime-L-«-¯n-sebpw imkv{X-Ú-cpsS ho£-W-¯n-\-\p-k-cn¨v `uXn-I-im-kv{X-¯nse hkvXp-X-IÄ¡v amäw hcmw.					
42.	`uXn-I-im-kv{X-¯nse ASn-Øm\ hkvXp-X-I-sfÃmw amä-an-Ãm-¯-h-bmWv					
43.	`uXn-I-im-kv{X-¯nse hkvXp-X-I-sfÃmw AXy-´n-I-amb kXy-§-f-Ã.					
44.	CâÀs\-än-eqsS e`n-¡p¶ `uXn-I-im-kv{X-¯nse Bi-b-§Ä Ah-tem-I\w IqSmsX Rm³ kzoI-cn-¡m-dp--v.					
45.	`uXn-I-im-kv{X-¯nse X¯z-§sf hyXykvX kµÀ`-§-fp-					

{la\-¼Å	{]kvXm-h-\-IÄ	]qÀ®-ambpw	tbmPnçp	A`n-{]m-b-anÃ	hntbmPnçp	]qÀ®-ambpw hntbmPnçp
	ambn _Ôn-¸n-¡m³ km[n-¡m-dnÃ					
46.	kzbw]cn-tim-[n¨v Dd-¸n-¡p¶ sXfn-hp-I-fpsS ASn-Øm-\-¯nÂ am{Xta `uXn-I-im-kv{X-¯nse GsXmcp hkvXp-X-I-sfbpw hniz-kn-¡m³ Ign-bp-I-bp-Åq.					
47.	imkv{Xob]Z-§Ä D]-tbm-Kn¨v `uXn-I-im-kv{X-¯nse ka-hmIyw cq]-s¸-Sp-¯n-sb-Sp-¡m³ hfsc {]bm-k-s¸-Sm-dp--v.					

APPENDIX III

FAROOK TRAINING COLLEGE
SCALE ON EPISTEMOLOGICAL BELIEFS IN PHYSICS

(FINAL)

Niranjana.K.P
Assistant Professor

Anjusha.V.V
M.Ed Student

Name of the student :
Name of the school :
Urban/Rural
Type management : Govt/Aided

Gender : M/F
Locale :

\nÀt±-i-§Ä:

Xmsg sImSp-¯n-cn-¡p¶ {]kvXm-h-\-lÄ {i²m-]qÀÆw hmbn-¡p-l. Ah `uXnlimkv{X-¯nse hnizm-k-hp-ambn _Ô-s¸-«-Xm-Wv. Hmtcm {]kvXm-h-\bpw \n§sf kw_Ôn-¨n-S-t¯mfw F{X-am{Xw icn-bm-sW¶v Xocp-am-\n-¡p-l. \n§-fpsS Xocp-am\w A©v Xc-¯n-em-Imw. 1. ]qÀ®-ambpw tbmPn-¡p-¶p. 2. tbmPn-¡p-¶p, 3. A`n-{]m-b-an-Ã, 4. hntbm-Pn-¡p-¶p, 5.]qÀ®-ambpw hntbm-Pn-¡p-¶p. AXXv {]kvXm-h-\-lÄ¡v t\scbpÅ tImf-¯nÂ \n§-fpsS {]Xn-I-cWw "✓' AS-bmfw D]-tbm-Kn¨v tcJ-s¸-Sp-¯p-l. FÃm {]kvXm-h-\-l-fÄ¡pw {]Xn-I-cWw tcJ-s¸-Sp-¯p-hm³ {]tXyIw {i²n-¡p-l.

{]Ia\-¼Å	{]kvXm-h-\-lÄ	]qÀ®-ambpw	tbmPn¡p¶p	A`n-{]m-b-anÃ	hntbmPn¡p¶p	]qÀ®-ambpw hntbmPn¡p¶p
1	A[ym-]-I³]d-ªp-X-cp¶ Bi-b-§Ä am{X-amWv `uXn-I-im-kv{X-¯nÂ hmkvX-h-am-bn-«p-ÅXv					
2	`uXn-I-im-kv{X-¯nse Bi-b-§sf a\-kn-em-¡m³ hf-sc-b-[nIw kabw Bh-iy-am-Wv.					
3	`uXn-I-im-kv{X-¯nse Bi-b-§Ä imkv{X-]p-tcm-K-Xn-					

{]a\-¼Å	{]kvXm-h-\-lÄ	]qÀ®-ambpw	tbmPn¡pdpw	A`n-{]m-b-anÂ	hntbmPn¡pdpw	]qÀ®-ambpw hntbmPn¡pdpw
	b-\p-k-cn¨v amä-§Ä¡v hnt[-b-am-bn-s¡m--n-cn-¡pw.					
4	`uXn-l-im-kv{X-¯nse Bi-b-§Ä s]s«¶v {Kln-¡m³ km[n-¡m-dp-v					
5	A[ym-]-l³]Tn-,n-¡p¶ lmcy-§Ä Rm³ A\p-`-h-§-fn-eqsS Adn-ª-tijw am{Xta kzol-cn-¡m-dpÅq					
6	a\-]m-T-am-¡m-hp¶ X¯z-§fpw \nb-a-§fpw AS§nb hnj-b-amWv `uXn-l-imkv{Xw					
7	`uXn-l-im-kv{X-¯nse Bi-b-§Ä \nXy-Po-hn-X-hp-ambn _Ô-s¸-Sp¯n]Tn-¡p-t¼m-gmWv lqSp-XÂ hyà-am-hp-¶Xv					
8	BZy hmb-\-bnÂ Xs¶ `uXn-l-im-kv{X-¯nse Bi-b§Ä]Tn-¡m³ km[n-¡m-dp--v.					
9	CXc imkv{X-hn-j-b-§sf At]-£n¨v Ffp-¸-¯nÂ]Tn-¡m-hp¶ hnj-b-amWv `uXn-l-im-kv{Xw					
10	`uXn-l-im-kv{X-¯nse]co-£Ww sN¿p-¶-XnÂ Rm³ kaÀ°-\m-Wv.					
11	lrXy-amb]T-\-{]-hÀ¯-\-¯n-eqsS `uXn-l-im-kv{X-¯nepÅ Ah-Kmlw hÀ²n-,n-¡p-hm³ km[n-¡pw.					
12	]co-£W \nco-£-W-§-fn-eqsS e`n-¡p¶ `uXn-l-im-kv{X-¯nse Bi-b-§Ä am{X-amWv bYmÀ°-am-bn-«p-Å-Xv.					
13	`uXn-l-im-kv{X-]T-\-¯nÂ kÀKm-ß-l-Xbv¡v Øm\-anÃ					

{]ta\-¼Å	{]kvXm-h-\-lÄ	]qÀ®-ambpw	tbmPn¡p¶p	A`n-{]m-b-anÂ	hntbmPn¡p¶p	]qÀ®-ambpw hntbmPn¡p¶p
14	ka-b-sa-Sp¯v]Tn-¨mÂ `uXn-l-im-kv{X-¯nse GXv Bi-bhpw]Tn-¡m³ km[n-¡pw.					
15	hfsc Ffp,w a\-kn-em-hp¶ hkvXp-X-lÄ \ndª Hcp hnj-b-amWv `uXn-l-im-kv{X-w					
16	\nKq-V-amb kz`m-h-apÅ Bi-b-§Ä AS-§nb hnj-b-amWv `uXn-l-im-kv{X-w					
17	`uXn-l-im-kv{X-¯nse Pb-]-cm-P-b-§Ä A[ym-]-lsâ lgn-hns\ B{i-bn-¨n-cn-¡pw.					
18	A[ym-]-l³]Tn-,n-¡p¶ Bi-b-§Ä lmc-W-§Ä ls-¯n]cn-tim-[n-¨-tijw am{Xta kzol-cn-¡m-dp-Åq.					
19	`uXn-l-im-kv{X-¯nse tNmZy-§Äs¡Ãmw lrXy-amb D¯cw D-v.					
20	`uXn-l-im-kv{X-¯nse Bi-b-§Ä Hmtcm-cp-¯cpw hyXy-kvX-am-bmWv ho£n-¡p-¶-Xv.					
21	`qcn-`mKw hnZymÀ°n-lÄ¡pw `uXn-l-imkv{Xw s]s«¶v]Tn-¡m³]äp¶ Hcp hnj-b-am-Wv.					
22	lmcy-lm-c-W-§Ä a\-kn-em-¡n-bmÂ `uXn-l-im-kv{X-¯nse GsXmcp Bi-bhpw]Tn-¡m³ km[n-¡pw.					
23	F{X lTn-\-{]-bXv\w sNbvXmepw a\-kn-em-¡m³ lgn-bm-¯-h-bmWv `uXn-l-im-kv{X-¯nse kn²m-´-§Ä					
24	`uXn-l-im-kv{X-¯nse lW-¡p-lÄ ssllmcyw sN¿m³/D¯cw ls--¯m³ {]tXylw lgn-hpÅ hyàn-bm-bn-					

{]ta\-¼Å	{]kvXm-h-\-lÄ	]qÀ®-ambpw	tbmPn¡pÞp	A`n-{]m-b-anÂ	hntbmPn¡pÞp	]qÀ®-ambpw hntbmPn¡pÞp
	cn¡pw `uXn-l-im-kv{X- hnZ-Kv[³.					
25	hyà-a-Ãm¯ `uXn-l-im-kv{X-¯nse Bi-b-§Ä d^-d³kv _p¡v D]-tbm-Kn¨v hyàX hcp-¯m-dp--v.					
26	`uXn-l-im-kv{X-¯nse C¶s¯ hkvXpX \msfs¯ hkvXpX Bhm-Xn-cn¡mw					
27	`uXn-l-im-kv{X-¯nse GXv]co-£-Whpw AXnsâ X¯zw a\-Ên-em-¡n-bmÂ s]s«¶v sN¿m³ km[n-¡pw.					
28	d^-d³kv _p¡n-eqsS e`n-¡p¶ `uXnlimkv{X-¯nse Bi-b-§Ä Ah-tem-l\w lqSmsX Rm³ kzol-cn-¡m-dp--v.					
29	Hmtcm lme-L-«-¯n-sebpw imkv{X-Ú-cpsS ho£-W-¯n-\-\p-k-cn¨v `uXn-l-im-kv{X-¯nse hkvXp-X-lÄ¡v amäw hcmw.					
30	`uXn-l-im-kv{X-¯nse ASn-Øm\ hkvXp-X-l-sfÃmw amä-an-Ãm-¯-h-bmWv					
31	`uXn-l-im-kv{X-¯nse hkvXp-X-l-sfÃmw AXy-´n-l-amb kXy-§-f-Ã.					
32	`uXn-l-im-kv{X-¯nse X¯z-§sf hyXykvX kµÀ`-§-fp-ambn _Ôn-¸n-¡m³ km[n-¡m-dnÃ					
33	kzbw]cn-tim-[n¨v Dd-¸n-¡p¶ sXfn-hp-l-fpsS ASn-Øm-\-¯nÂ am{Xta `uXn-l-im-kv{X-¯nse GsXmcp hkvXp-X-l-sfbpw hniz-kn-¡m³ lgn-bp-l-bp-Åq.					
34	imkv{Xob]Z-§Ä D]-tbm-Kn¨v `uXn-l-im-kv{X-¯nse					

{]a\-¼Ã	{]kvXm-h-\-IÄ	]qÀ®-ambpw [illegible]	tbmPnjp¶p	A`n-{]m-b-anÃ	hntbmPnjp¶p	]qÀ®-ambpw hntbmPnjp¶p
	ka-hmIyw cq]-s¸-Sp-¯n-sb-Sp-¡m³ hfsc {]bm-k-s¸-Sm-dp--v.					