ANALYSIS OF EXAMINATION QUESTION PAPERS IN EDUCATION USING THE COGNITIVE LEVELS OF BLOOM'S TAXONOMY OF EDUCATIONAL OBJECTIVES

BY

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Submitted in Partial Fulfillment for the requirement of the Degree of Doctor of Philosophy in Education of Mizoram University, Aizawl

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CERTIFICATE

This is to certify that **Ms. Lalchhuanmawii, Ph.D Scholar, Department of Education, Mizoram University, Regn.No. MZU/Ph.D/425 of 15.05.2012**, has written her thesis titled **'Analysis of Examination Question Papers in Education using the Cognitive Levels of Bloom's Taxonomy of Educational Objectives'**, under my guidance and supervision. In preparing the thesis, Ms. Lalchhuanmawii has complied with all the requirements as laid down in the Ph.D Regulation of Mizoram University. The thesis is the original work of the scholar and has not been submitted for any degree to any other University.

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DECLARATION

I, Lalchhuanmawii, hereby declare that the subject matter of this thesis entitled 'Analysis of Examination Question Papers in Education using the Cognitive Levels of Bloom's Taxonomy of Educational Objectives' is the record of work done by me, that the contents of this thesis do not form the basis of the award of any previous degree to me or to the best of my knowledge to anybody else, and that this thesis has not been submitted by me for any research degree in any other University/Institute.

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(LALCHHUANMAWII)

CONTENTS

List of Tables

List of Figures

List of Appendices

CHAPTER I

CONCEPTUAL FRAMEWORK

1.0 Introduction

The word ‘evaluation’ refers to the act or process of determining the value of something, or the act of placing a value on something. In other words, evaluation is the process by which value judgements are formed about the status or achievement of an idea or object. It is a systematic process of collecting and analyzing data in order to make decisions about something and includes quantitative or qualitative description about the desirability of results. Oxford Advanced Dictionary describes evaluation as a means to form an opinion of the amount, value or quality of something after thinking about it carefully. Wikipedia defined it as a systematic determination of merit, worth and significance of something or someone using criteria against a set of standard. Thus it can be said that to evaluate means to form judgement on the level of achievement and this presupposes that there is a predetermined level available.

In education, evaluation means a study designed to determine the effectiveness of instruction. It provides empirical evidences about the effectiveness of teaching strategies, tactics and aids and suggests modifications and improvements for remediation. The primary concern of evaluation is to bring about improvement in the teaching-learning process so that the learner develops his potential to the

optimum level. So far as education is concerned, evaluation is the assessment of the progress made in the field of education in a scientific and adequate manner. Hence, educational evaluation is the continuous inspection of all available information concerning the student, teacher, educational programme and the teaching-learning process to ascertain the degree of change in students and form valid judgement about the students and the effectiveness of the programme. The modern concept of evaluation is put forward by B.S. Bloom and is based upon a triangular model showing relationship between educational objectives, learning experiences and evaluation procedures.

An important use of evaluation is to determine the usefulness of special programmes of new curricula, the effectiveness of instruction and the mastery of certain learning objectives. Evaluation of students' skills and abilities is used to select students for special programmes, to diagnose their strengths and weaknesses, to report their progress to parents, to help them make career decisions, etc. For students, one of the most important classroom events is taking tests or exams, return of the graded paper and hearing the mark they received, receiving progress report and the like. These things are important to students because they test accomplishment, they signal success or failure and indicate how the students are faring.

Some of the most important objectives of education are to provide students with lasting learning of concepts, to improve their knowledge and thinking skills, to prepare them for the demands of society, etc. In other words, it can be

summarized that the most important aim of education is to provide the best quality education so that students can develop to their maximum potential and make substantial contributions to the world and to mankind. In order to achieve this goal, regular and qualitative evaluation of various aspects of the educational system is needed.

Experts in the field of education have given four pillars of quality education, namely:- 1) curriculum development & design, 2) classroom teaching-learning/curriculum transaction, 3) students' level of learning and learning styles, and 4) evaluation/assessment of learning outcomes. These four pillars of education are closely interlinked with each other. One aspect affects or determines the success of all the other aspects. If the curriculum package is of high quality, then classroom teaching-learning, students' level of learning and evaluation methods will also be of high quality and vice versa. Therefore, these four pillars of quality education need to be given due attention and focus by educational administrators, curriculum planners, policy makers, teachers and other concerned personnel. Regular or periodic evaluation of these different aspects of education is a necessity. Then only the aims and objectives of education will be successfully achieved and the quality of education will be greatly improved.

One of the important educational goals of the 21st century is to improve the students' problem-solving, critical thinking, and higher order thinking skills in order to help them adapt to the rapidly changing 'Information Age'. Although developing higher level cognitive abilities has been considered as one of

the major educational goals in the past decade, the results of different studies show that learners have limited abilities to think at higher levels of cognition. One of the basic questions facing educators has always been, 'Where do we begin in seeking to improve human thinking?'. One place to begin is in defining the nature of thinking. Learning, teaching, identifying educational goals and thinking are all complicated concepts interwoven in an intricate web. Education is a process that attempts to change an individual's behaviour. Educational institutions worldwide are recognizing that teaching core courses in the curriculum alone is not sufficient to equip students for the knowledge economy. To be prepared for the demands of the knowledge economy, students 'need to know' how to use their knowledge and skills - by thinking critically, applying knowledge to new situations, analyzing information, comprehending new ideas, communicating, collaborating, solving problems, and making decisions. These skills are termed as higher order cognitive skills and their development and promotion is considered an important goal of the educational process.

Knowledge, as an outcome of education, is no longer believed to be sufficient to create the kind of citizens needed to effectively cope with the social, economical and technological changes in the world. In the last few decades, there has been an intense call to raise the level of educational achievements. Experts claim that citizens who think critically and creatively are guarantees of political stability, economic growth, scientific and cultural enrichment, psychological health, and the general prosperity of any society in the 21st century. As a result, more attention has been given all over the world to the importance of developing students' higher order

thinking skills. Many nations have become more concerned with the incorporation of the cognitive skills within their national curricula. Curriculum reforms have been carried out and higher-order thinking skills (HOTS) have been included in educational policies in many countries. (Ibtihal & Smadi, 2015).

Higher-order thinking is an instructional strategy supported by research. Often referred to as critical thinking skills, it is more than simple recall of facts or information retrieval but rather a function of the interaction between cognitive strategies, meta-cognition, and nonstrategic knowledge during problem solving. Higher-order thinking skills are 'goal directed, multi-step, strategic processes such as designing, decision-making and problem solving' that require analysis, evaluating, connecting, imagining, elaborating and synthesizing (Iowa Department of Education 1989). Higher-order thinking is based on the concepts in the cognitive domain of Bloom's Taxonomy and suggests that some types of learning require more cognitive processing than others. Bloom's Taxonomy suggests that skills involving analysis, synthesis and evaluation are of a higher order, requiring different instructional practices. It also suggests that higher-order thinking involves 'the learning of complex judgmental skills such as critical thinking and problem solving.' Higher-order thinking is thought to be more useful because such skills (analysis, synthesis) are considered more likely to be useable in situations other than those in which the skill was initially learned. (Burton, 2010)

Most faculties would agree that academic success should be measured not just in terms of what students can remember, but what students are able to do

with their knowledge. It is commonly accepted that memorization and recall are lower order cognitive skills (LOCS) that require only a minimum level of understanding, whereas the application of knowledge and critical thinking are higher-order cognitive skills (HOCS) that require deep conceptual understanding. Students often have difficulty performing at these higher levels. In the past decade, considerable effort has been directed toward developing students' critical-thinking skills by increasing student engagement in the learning process.

Teaching is a very important activity, but evaluation of the effectiveness or results of teaching is an equally important task. Everyone knows that when something is done, it is to be judged or evaluated as to whether it has been done properly and how far it has achieved set objectives. Examination is one of the common methods to assess knowledge acceptance of the students. One has to ask questions such as '*Are we teaching what we think we are teaching?*' and '*Are students learning what we think they are learning?*'. Planning, teaching, and assessment stages are used to achieve educational aims, where assessment is the final stage in determining whether students have developed higher order cognitive skills. Further, assessment aims to make judgements and decisions about students' learning outcomes and teachers' teaching effectiveness (Hawks, 2010). Since assessment has such an important and significant part in the future of students, there is little doubt that any assessment system will determine what and how students learn, and what and how we teach.

Summative assessment qualifies the achievement of a student in a particular field of knowledge at a given time. Questions are an essential component of effective instruction. It is important that the examination questions posed encompass the student's learning experience and level and style of learning. A holistic approach to assessment needs to be applied to accommodate learning style diversity. Examination questions should include a wide range of cognitive levels and be consistent with the learning outcomes of the course (Lucas et al, 2014).

On a daily basis, academics use questions to stimulate thinking and reasoning in students, while at the same time testing their retention and application skills. Effective questions include informational or problem solving questions, and significantly more complex thinking questions that stimulate a student's mental activities. Teachers ask hundreds of questions every day and it is important that they use questioning techniques that challenge the thinking of all of their students. Researchers suggest that professional development on the effective use of questioning strategies and the development of high-level questions is helpful to teachers.

Questioning is the most important component of the education system. Teachers use questioning strategies to review, check on learning, probe thought processes, pose problems, seek out alternative solutions and challenge students to think critically and reflect on issues or values (McBain, 2011). Owing to these factors, questioning techniques have been a major concern for researchers. Some are of the view that creativity in the students cannot be achieved only by

providing knowledge (Azar, 2005). Bloom's Taxonomy has been found effective in improving students' cognitive skills. A mixture of questions from various levels of the taxonomy may result in most effective learning at higher levels. For these reasons, curriculum designers and educators have extensively used the taxonomic model of learning to analyze the cognitive levels of questions (Noble, 2004).

Questions for examination have a vital role and strong base for effective evaluation and learning. These are the key factors to gear up thinking and reasoning in the learners. Examination papers hold mirror to the comprehension and application skills of learners. There are many models for the evaluation of students' learning and achievements. Effective evaluation and examination are totally dependent on the appropriateness and reliability of the questions asked in the papers. These appropriate questions are not only important for the positive learning of students but also for the development and nourishment of their judging quality and cognition. Critical and logical questions lead the students towards the use of the positive power of thinking and creativity. Such questions widen and broaden the thinking horizons of the students. Students who face poor and low quality questions in the papers depend upon their rote memory. These types of questions which kill the creativity of the learner should not be included in question papers. (Cepni, 2003). Written evaluation is the all time popular instrument and with its help the learner achievements are judged in different subjects. Through the specific level of learning, the learners' achievements are defined and explained. These written examinations have been judging the cognitive ability of the students. But these examinations are totally dependent upon the questions set in the examination papers. Therefore, a

proper examination paper should cover all those difficulty levels which can accommodate all the various and hidden capacities of students. The standard of questions determines the level of difficulty of examination papers as well as achievement levels of students (Mehmood, Iqbal, Abdullah & Farooq, 2016).

Accurately measuring students' abilities require a classification of levels of intellectual behaviour important in learning. This classification of cognitive levels was given by Benjamin Bloom in his famous work called "Bloom's Taxonomy". Benjamin S. Bloom extensively contemplated the nature of thinking, eventually undertaking the ambitious task of classifying educational goals and objectives. Bloom was arduous, diligent, and patient while seeking to demystify these concepts and untangle this web. He made the improvement of student learning the central focus of his life's work. Discussions during the 1948 Convention of the American Psychological Association led Bloom to spearhead a group of educators who eventually undertook the ambitious task of classifying educational goals and objectives. In 1956, eight years after the group first began, work on the cognitive domain was completed and a handbook commonly referred to as "Bloom's Taxonomy" was published. While Bloom pushed for the use of the term 'taxonomy,' others in the group resisted because of the unfamiliarity of the term within educational circles. Eventually Bloom prevailed, forever linking his name and the term. The small volume intended for university examiners has been transformed into a basic reference for all educators worldwide (Forehand, 2005).

1.1 Bloom's Taxonomy of Educational Objectives

Benjamin Samuel Bloom, one of the greatest minds to influence the field of education, was born on February 21, 1913 in Lansford, Pennsylvania, USA. As a young man, he was already an avid reader and curious researcher. Bloom received both a Bachelor's and Master's degree from Pennsylvania State University in 1935. He went on to earn a Doctorate degree from the University of Chicago in 1942, where he acted as first a staff member of the Board of Examinations (1940-43), then a University Examiner (1943-59), as well as an instructor in the Department of Education, beginning in 1944. In 1970, Bloom was honored with becoming a Charles H. Swift Distinguished Professor at the University of Chicago.

Bloom's most recognized and highly regarded initial work spawned from his collaboration with his mentor and fellow examiner Ralph W. Tyler and came to be known as Bloom's Taxonomy. These ideas are highlighted in his third publication, *Taxonomy of Educational Objectives: Handbook I - The Cognitive Domain.* He later wrote a second handbook for the taxonomy in 1964, which focuses on the affective domain. Bloom's research in Early Childhood Education, published in his 1964 *'Stability and Change in Human Characteristics',* sparked widespread interest in children and learning and eventually and directly led to the formation of the *Headstart Program* in America. In all, Bloom wrote or collaborated on eighteen publications from 1948-1993.

Aside from his scholarly contributions to the field of education, Benjamin Bloom was an international activist and educational consultant. In 1957, he traveled to India to conduct workshops on evaluation, which led to great changes in the Indian educational system. He helped create the International Association for the Evaluation of Educational Achievement (IEA) and organized the International Seminar for Advanced Training in Curriculum Development. He developed the Measurement, Evaluation, and Statistical Analysis (MESA) program at the University of Chicago. He was Chairman of both the Research and Development Committees of the College Entrance Examination Board and the President of the American Educational Research Association.

Bloom's Taxonomy is easily understood and is probably the most widely applied educational tool in use today. While it should be noted that other educational taxonomies and hierarchical systems have been developed, it is Bloom's Taxonomy which remains, even after sixty years, the de facto standard. Benjamin Bloom died in his home in Chicago on September 13, 1999. In addition to his many accomplishments, he was a dedicated family man and was survived by his wife and two sons.

Bloom's Taxonomy of Educational Objectives is a classification of learning objectives within education proposed in 1956 by a committee of educators headed by Benjamin Bloom. It refers to a classification of the different objectives that educators set for students. The word *'taxonomy'* simply means 'classification of things arranged in a hierarchical order'. Bloom's Taxonomy is a hierarchy of skills

that reflects the growing complexity and ability to use higher order thinking skills. Bloom's Taxonomy divides educational objectives into three domains: **Cognitive** *(knowing/head),* **Affective** (*feeling/heart)* and **Psychomotor** (*doing/hands*). Within the domains, learning at the higher levels is dependent on having attained prerequisite knowledge and skills at lower levels. A goal of Bloom's Taxonomy is to motivate educators to focus on all three domains, creating a more holistic form of education.

B.S. Bloom and his associates, after eight years of intensive work, developed a method of classification for thinking behaviors that were believed to be important in the processes of learning. Bloom and his associates established the taxonomy for educational objectives in order to help the curriculum developers and the teachers to set learning experiences for the students and to develop assessment tools to measure their learning. They suggested that the learning experiences for the students should be categorized into three major domains - Cognitive domain, Affective domain and Psychomotor domain so that the overall development of a student can be ensured. Bloom has given highest amount of priority to the cognitive domain as it deals with recall and recognition of knowledge and the development of intellectual abilities and skills. According to Bloom, this is the domain where most of the work in curriculum development has taken place and where clear definition of objectives is mostly needed. (Naomee & Tithi, 2013). Eventually, this framework became a taxonomy of three domains. A brief explanation of the three domains and their levels are given as follows:

a) Cognitive Domain - Knowledge based domain, covering the recall or recognition of knowledge and the development of intellectual abilities and skills; consisting of six levels which are knowledge, comprehension, application, analysis, synthesis and evaluation.

b) Affective Domain - Attitudinal based domain, covering changes in interests, attitudes and values, and the development of appreciations and adequate adjustments; consisting of five levels which are receiving, responding, valuing, organizing and characterizing.

c) Psychomotor Domain - Physical skills based domain, covering the manipulative or motor skill area; consisting of seven levels which are perception, set, guided response, mechanism, complex overt response, adaptation and origination.

As history has shown, this well known, widely applied scheme filled a void and provided educators with one of the first systematic classifications of the processes of thinking and learning. The cumulative hierarchical framework consisting of several categories each requiring achievement of the prior skill or ability before the next, more complex one, remains easy to understand.

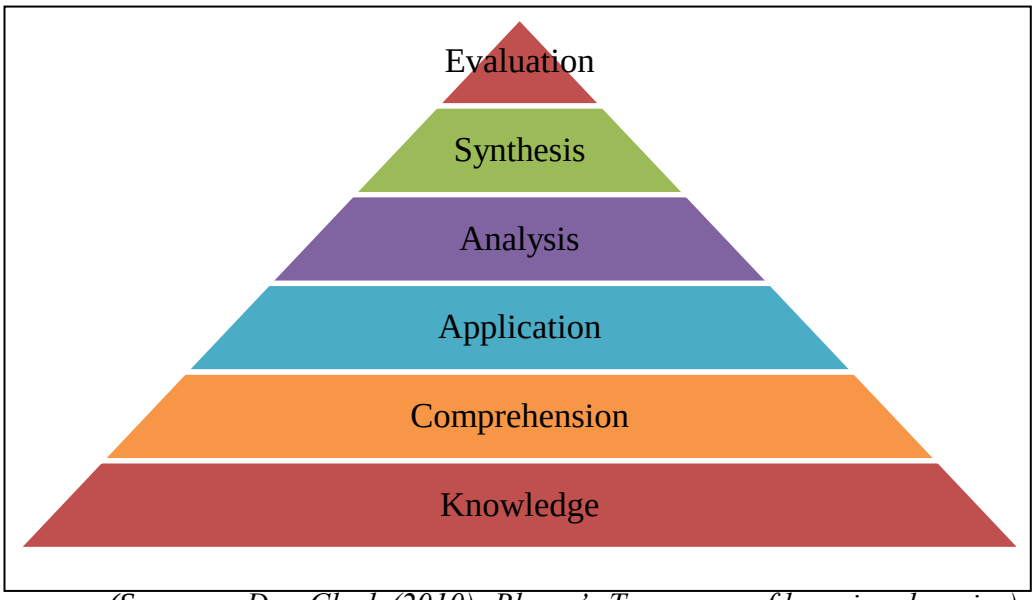
1.2 Cognitive Domain

The Cognitive domain in Bloom's taxonomy involves knowledge and the development of intellectual skills. It includes the recall or recognition of specific facts, procedural patterns, and concepts that serve in the development of intellectual

abilities and skills. The taxonomy is a multi-tiered model of classifying thinking according to six cognitive levels of complexity, which are listed in order starting from the simplest behaviour to the most complex. The categories can be thought of as degrees of difficulties, that is, the first ones must normally be mastered before the next ones can take place. These levels are knowledge, comprehension, application, analysis, synthesis and evaluation.

Table 1.1

Bloom's Taxonomy Cognitive Levels



(Source: - Don Clark (2010): Bloom's Taxonomy of learning domains)

1. Knowledge:- It is defined as the remembering of previously learned material. It represents the lowest level of learning outcome in the cognitive domain.

Eg: What are the health benefits of eating apples?

2. Comprehension:- It is defined as the ability to grasp the meaning of material. The learning outcomes go one step beyond the simple understanding of material and represent the lowest level of understanding.

Eg: Compare the health benefits of eating apples vs. oranges.

3. Application:- It is the ability to use learned material in new and concrete situations. Learning outcomes in this area requires a higher level of understanding than those under Comprehension.

Eg: Which kinds of apples are best for baking a pie, and why?

4. Analysis:- It refers to the ability to break down material into its component parts so that its organizational structure may be understood. Learning outcomes here represent a higher intellectual level because they require an understanding of both the content and the structural form of the material.

Eg: List four ways of serving foods made with apples and explain which ones have the highest health benefits. Provide references to support your statements.

5. Synthesis:- It refers to the ability to put parts together to form a new whole. Learning outcomes in the area stress creative behaviours, with major emphasis on the formulation of new patterns or structures.

Eg: Convert an unhealthy recipe for apple pie to a healthy recipe by replacing your choice of ingredients. Explain the health benefits of using the ingredients you chose vs. the original ones.

6. Evaluation:- Evaluation is concerned with the ability to judge the value of material (statement, novel, poem, research report) for a given purpose. Judgements are to be based on definite criteria.

Eg: Do you feel that serving apple pie for an after school snack for children is healthy?

The six levels of Bloom's Taxonomy can be viewed from the perspective of higher-order and lower-order thinking. Higher order thinking includes those kinds of learning that need more cognitive processing but also have more benefits because they prepare students for challenging and real life situations and involves critical thinking. On the contrary, lower order thinking usually includes information that is needed to be recalled rather than being judged, evaluated, or applied. Regarding Bloom's Taxonomy, some consider the three levels of *evaluation, synthesis, and analysis* as higher order thinking, and the *knowledge* and *comprehension* level are considered as lower order thinking. The *application* level can be considered as higher or lower order of thinking depending on its cognitive complexity. Others consider *evaluation* and *synthesis* as higher order, *analysis and application* as middle order, and *comprehension and knowledge* as lower order thinking. These cognitive levels given by Bloom and his associates have been widely

accepted and applied by educationists all over the world and are considered as the basic parameters for testing the cognitive abilities of students.

1.3 Revised Bloom's Taxonomy

During the 1990's, a former student of Bloom's, Lorin Anderson, led a new assembly which met for the purpose of updating the taxonomy, hoping to add relevance for 21st century students and teachers. This time representatives of three groups were present: cognitive psychologists, curriculum theorists and instructional researchers, and testing and assessment specialists. Like the original group, they were also arduous and diligent in their pursuit of learning, spending six years to finalize their work. Published in 2001, the revision includes several seemingly minor yet actually quite significant changes. The changes occur in three broad categories namely terminology, structure, and emphasis. They made two prominent changes to the original taxonomy: 1) changing the names from noun to verb forms 2) slightly re-arranging them.

The revised Bloom's Taxonomy of the Cognitive Domain consists of the following levels:

1. **Remembering**: Retrieving, recognizing, and recalling relevant knowledge from long-term memory.

Eg: Describe where Goldilocks lived.

2. Understanding: Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.

Eg: Summarize what the Goldilocks story was about.

3. Applying: Carrying out or using a procedure through executing, or implementing.

Eg: Construct a theory as to why Goldilocks went into the house.

4. Analyzing: Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing.

Eg: Differentiate between how Goldilocks reacted and how you would react in each story event.

5. Evaluating: Making judgements based on criteria and standards through checking and critiquing/criticising.

Eg: Assess whether or not you think this really happened to Goldilocks.

6. Creating: Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing.

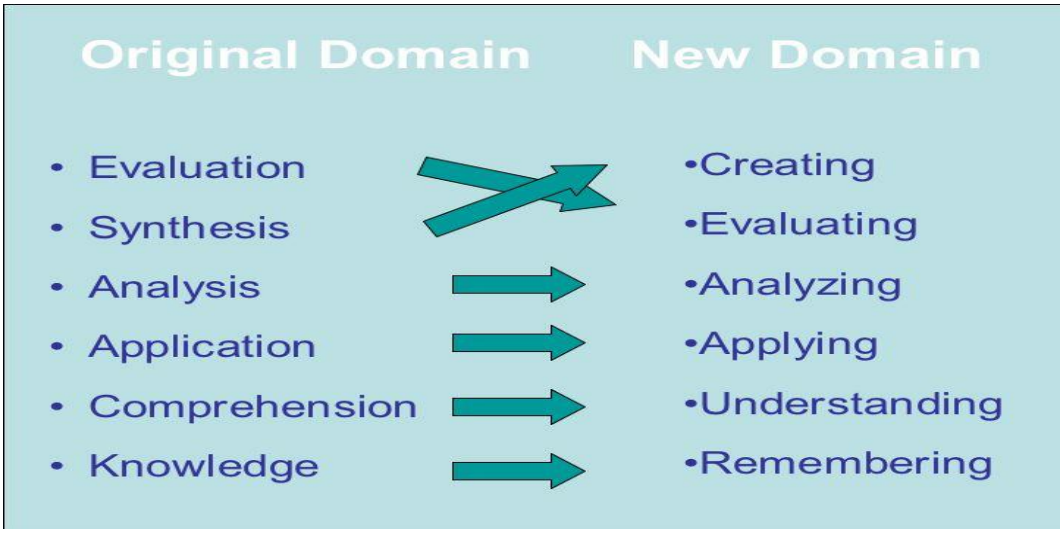
Eg: Compose a song, skit, poem, or rap to convey the Goldilocks story in a new form.

Changes in terminology between the two versions are perhaps the most obvious differences and can also cause the most confusion. Basically, Bloom's

six major categories were changed from noun to verb forms. Additionally, some of the levels were renamed. The lowest level of the original, i.e., knowledge was renamed and became remembering; comprehension and synthesis were retitled to understanding and creating. The two highest levels in the original taxonomy were also changed from synthesis and evaluation to evaluating and creating. A comparison of the original and revised Bloom's Taxonomy is given in the table below.

Table 1.2

Revised Bloom's Taxonomy Table



(Source: Anderson, Krathwohl et al (2001): A Taxonomy for learning & teaching & assessing: A revision of Bloom's Taxonomy of educational objectives)

Countless people know, love and are comfortable with the original Bloom's Taxonomy and are understandably hesitant to change. The original Bloom's Taxonomy was and is a superb tool for educators. Yet, even the original group always considered the Taxonomy a work in progress, neither finished nor final. The

new century has brought us the Revised Bloom's Taxonomy which really is new and improved.

Due to its long history and popularity, Bloom's Taxonomy has been condensed, expanded, and reinterpreted in a variety of ways. Research findings have led to the discovery of a veritable smorgasbord of interpretations and applications falling on a continuum ranging from tight overviews to expanded explanations. Nonetheless, it has stood the test of time and continues to be the most widely used tool by educators all over the world. For the present study, the researcher will use the original taxonomy developed by Bloom and his associates in the year 1956.

1.4 Bloom's Taxonomy: A framework for teaching, learning and assessment.

Assessment is one of the most important aspect of the education process in which students' learning is measured by diverse procedures. Since the excellence of educational programmes is based on the evaluation practice, exams play a significant role in acting as one of the dimensions of evaluation. While providing suitable exam questions at schools, composing the proper ones may be a problematic issue. In other words, choosing the right question is obviously the most difficult part of designing the exam paper, in addition to being the most time consuming activity (Crow, Dirks & Wenderoth, 2008).

An exam paper is the common choice of teachers for evaluating the learners' degree of success in a particular lesson in which the necessary cognitive

ability of students is determined through the exam scores. That is to say whether the questions presented determine whether the examination manages to assess the learners' performance or not. A good assessment requires an exam paper that covers different cognitive levels to accommodate diverse capabilities of learners (Jones, Harland, Reid & Bartlett, 2009). Within this issue, the matter is to promote functional assessment tools to measure both students' learning and critical thinking skills according to the six stages of the Taxonomy, while most of the assessments only cover calling up the memorized data. Bloom's Taxonomy addresses the arrangement of learning aims in the education process that educators appoint for learners.

The Cognitive domain within Bloom's Taxonomy which is set to confirm a student's cognitive level is the core of classifying statements according to what is expected from students to learn at the end of the instructional activities (Gocer, 2011). As an assessment practice, the employment of Bloom's Taxonomy yields important information for instructors. The Taxonomy causes instructors to be more conscious of the content and the process which they teach and assess, as well as indicating disparities between what is taught and what is assessed. Further, it can perform as a guide to evolve and expand the learning and assessment activities by supplying a concrete consciousness of the content and process which an instructor defines as essential in the development of learners' cognition (Gierl, 1997). Bloom's Taxonomy is a method of classifying educational goals for student performance evaluation. Bloom created this taxonomy for categorizing level of abstraction of questions that commonly occur in educational settings. This taxonomy of learning

behaviors can be thought of as *'the goals of the learning process.'* That is, after a learning episode, the learner should have acquired new skills, knowledge or attitudes. This compilation divides the three domains into subdivisions, starting from the simplest behavior to the most complex.

In Bloom's Taxonomy of Educational Objectives, we are provided with a very helpful tool for considering the range of goals and outcomes from educational experiences. The level of abstraction in the Cognitive domain that emerges from these experiences range from simple knowledge at the lowest level ranging all the way to evaluation at the highest level. The three lowest levels of abstraction in thinking are Knowledge, Comprehension and Application. These are all exhibited at a very early age and continue throughout our lives. The higher order thinking skills are Analysis, Synthesis and Evaluation. These emerge in late childhood and early adolescence and truly mark the beginning of serious consideration and contemplation. These cognitive levels have often been depicted as a ladder or a stairway, where students have to climb systematically to reach the highest level, after mastering the lower levels of thought. The Taxonomy is hierarchical in that each level is subsumed by the higher levels. In other words, a student functioning at the application level has also mastered the knowledge and comprehension levels. This Taxonomy provides a helpful way to discuss the issue of abstract, conceptual or higher order thinking. In the general area of communication/language and mediation skills, the higher order thinking skills should hold the greatest interest of teachers who hope to leave their students stronger and

more prepared than when they found them - especially at as crucial a time as middle school and early high school.

Mastery learning is a concept on which the taxonomy rests. If we master something, we become expert in it. This expertise makes itself known through how we exercise our knowledge and understanding with a high level of skill, precision and accuracy. Mastery gives the individual prowess in the field of which they are expert. They make excellent judgements, adapt themselves to different situations with ease, can improvise highly effectively, can alter and modify things to suit their own interpretation, are able to make something difficult look simple, and can go beyond what exist to do things in a way which is new, different and superior. Bloom's Taxonomy promotes this type of learning because by moving up the levels of the taxonomy, any individual can become more knowledgeable, more skilled and develop a better understanding of things they are seeking to learn. If students are making great progress, they are mastering ideas and information and are thus making great progress. (Gershon, 2015)

The Taxonomy is progressive in that successive levels are more challenging. Climbing the levels means gaining an increasing degree of mastery over the content with which we are concerned. It follows that the taxonomy provides a general framework for assessment. It can be used to structure questions or tasks set for students, whether these are formal assessments such as written exams or informal assessments such as classroom tasks. It can also be used as a basis for written or verbal questioning. Using the taxonomy for framing questions helps elicit the kind

of information needed to successfully assess students' knowledge and understanding. The Taxonomy is a perfect assessment tool as it gives us six separate points on which we can assess students. It helps to create a formal or informal assessment which allows for sufficient discrimination between the relative ability levels of students. It also helps to develop assessments which make a range of cognitive demands on students, thus giving teachers the chance to elicit different kinds of information. (Anderson et al, 2001)

Bloom's Taxonomy was intended as a method of classifying educational objectives, educational experiences, learning processes and evaluation of questions and problems. These led to a natural linkage of specific verbs and products with each level of the taxonomy. Thus, when designing effective lesson plans, teachers often look to it for guidance. In almost all circumstances when an instructor desires to move a group of students through a learning process utilizing an organized framework, it can prove very helpful. Today's teachers must make tough decisions about how to spend their classroom time. Clear alignment of educational objectives with local, state and national standards is a necessity. Like pieces of a huge puzzle, everything must fit properly. Bloom's taxonomy table clarifies the fit of each lesson plan's purpose, essential questions, goals or objectives (Krumme, 2005).

Bloom's Taxonomy provides a clear, concise representation of the alignment between standards and educational goals, objectives, products and activities. It provides an excellent framework for teaching, learning and assessment. When we plan lesssons or schemes of work, we can use the taxonomy to help us

achieve a wider aim of maximising progress. The Taxonomy is inherently progressive in that the levels contain an increasing degree of challenge. This means lessons and assessments using the Taxonomy can be quickly and easily made challenging for all learners. It can be applied across the curriculum and across all age-groups by simply altering the content towards more challenging tasks and altering the extent of what we are asking students to do and learn. However, if a teacher ignores the Taxonomy when planning their lessons and activities, they make life much harder for themselves. They increase the chance that what they produce will not challenge students' abilities and thereby fail to promote and develop the higher cognitive skills of students.

Bloom's Taxonomy has been applied to a variety of situations ranging from corrosion training to medical preparation. This widely applied scheme filled a void and provided educators with one of the first systematic classifications of the processes of thinking and learning. The cumulative hierarchical framework consisting of six categories, each requiring achievement of the prior skill before the next more complex one, remains easy to understand. Bloom's Taxonomy has given rise to educational concepts such as high and low level thinking. It has also been closely linked with multiple intelligences, problem solving skills, creative and critical thinking, technology integration and others. It has stood the test of time and has been extensively used by curriculum planners, administrators, researchers and classroom teachers worldwide at all levels of education. It is one of the most widely used educational tool in the world even today.

Table 1.3
Bloom's Taxonomy Table

Category	Example and Key Words (verbs)
Knowledge: Recall data or information.	**Examples**: Recite a policy. Quote prices from memory to a customer. Knows the safety rules. **Key Words**: defines, describes, identifies, knows, labels, lists, matches, names, outlines, recalls, recognizes, reproduces, selects, states.
Comprehension : Understand the meaning, translation, interpolation, and interpretation of instructions and problems. State a problem in one's own words.	**Examples**: Rewrites the principles of test writing. Explain in one's own words the steps for performing a complex task. Translates an equation into a computer spreadsheet. **Key Words:** comprehends, converts, defends, distinguishes, estimates, explains, extends, generalizes, gives an example, infers, interprets, paraphrases, predicts, rewrites, summarizes, translates.

Application : Use a concept in a new situation or unprompted use of an abstraction. Applies what was learned in the classroom into novel situations in the work place.	**Examples**: Use a manual to calculate an employee's vacation time. Apply laws of statistics to evaluate the reliability of a written test. **Key Words**: applies, changes, computes, constructs, demonstrates, discovers, manipulates, modifies, operates, predicts, prepares, produces, relates, shows, solves, uses.
Analysis : Separates material or concepts into component parts so that its organizational structure may be understood. Distinguishes between facts and inferences	**Examples**: Troubleshoot a piece of equipment by using logical deduction. Recognize logical fallacies in reasoning. Gathers information from a department and selects the required tasks for training. **Key Words**: analyzes, breaks down, compares, contrasts, diagrams, deconstructs, differentiates, discriminates, distinguishes, identifies, illustrates, infers, outlines, relates, selects, separates.

Synthesis : Builds a structure or pattern from diverse elements. Put parts together to form a whole, with emphasis on creating a new meaning or structure	**Examples**: Write a company operations or process manual. Design a machine to perform a specific task. Integrates training from several sources to solve a problem. Revises and process to improve the outcome. **Key Words:** categorizes, combines, compiles, composes, creates, devises, designs, explains, generates, modifies, organizes, plans, rearranges, reconstructs, relates, reorganizes, revises, rewrites, summarizes, tells, writes.
Evaluation : Make judgements about the value of ideas or materials.	**Examples**: Select the most effective solution. Hire the most qualified candidate. Explain and justify a new budget. **Key Words**: appraises, compares, concludes, contrasts, criticizes, critiques, defends, describes, discriminates, evaluates, explains, interprets, justifies, relates, summarizes, supports.

(Source: B.S Bloom et al (1956) : Taxonomy of Educational Objectives:Handbook I - Cognitive Domain)

1.5 Rationale of the Study

One of the most important aim of education is to produce useful graduates who are productive, useful, highly intelligent and can contribute to the knowledge-based global economy. This means producing graduates who are intuitive and creative, and who are able to use their cognitive skills when faced with critical problem solving tasks. The ability to reason effectively and to solve problems creatively are higher order cognitive skills which must be acquired through appropriate instruction and training. Teachers can provide this type of instruction and training to students by using a blend of higher, middle and lower order cognitive questions given in Bloom's Taxonomy.

Assessment is the crucial stage in determining whether students' conceptual development has reached higher order cognitive skills or not. Written examination is a conventional yet universal tool to evaluate the student's performance in a subject area. Whether or not the written examination is able to assess the student's ability very much depends on the questions presented in the examination paper. A good and reasonable examination paper must consist of various difficulty levels to accommodate the different capabilities of students. Improving students' conceptual understanding depends on the question types asked by the teachers, whether in the classroom or in examinations. The art of skilful questioning is a key to stimulate student's mental activities, thereby engaging students in higher-order thinking.

While questioning is identified as one of the most effective instructional strategies, research on questioning indicates that the use of questions by teachers is predominantly low level. Teachers tend to teach and ask questions in the knowledge category 80% to 90% of the time (Azar, 2005). While these questions are not bad in themselves, using them all the time is not good practice, either for the teachers or students. It is preferable to try to utilize higher order level of questions which require more critical thinking or problem solving skills.

The assumption exist that questions relating to application skills and above should start to dominate the higher academic levels in education, with a corresponding reduction in questions requiring retention skills. One must set good/proper questions where appropriate attention is given to maintaining the correct balance between lower, middle and higher order cognitive questions as given by Bloom's Taxonomy. The different cognitive abilities possessed by students should be tested and given equal coverage in the examination questions. All these have made the investigator curious to know the level of teaching-learning and evaluation existing in the higher educational institutions of Mizoram, and the following questions are raised in her mind:-

1. At what level of the cognitve domain of Bloom's Taxonomy are the students of higher secondary, college and university stages functioning?
2. At what cognitive level are the students being taught and examined?
3. What is the prevailing standard of question paper setting in the higher educational institutions of Mizoram?

4. How can the standard of teaching-learning and question setting be improved towards higher order thinking?

5. How can Bloom's Taxonomy be applied to improve teaching-learning and evaluation methods of higher educational institutions in Mizoram?

In Bloom's Taxonomy of Educational Objectives, we are provided with six cognitive levels that begin with simple knowledge at the lowest level ranging all the way to evaluation at the highest level. These cognitive levels consist of knowledge, comprehension, application, analysis, synthesis and evaluation. These levels have often been depicted as a stairway, leading many teachers to encourage their students to climb to a higher level of thought. It is widely believed that if we can gradually adjust our way of teaching and questioning towards higher order cognitive skills given in Bloom's Taxonomy, it will not only improve the cognitive abilities of students but improve the overall quality of education. Bloom's Taxonomy is a valuable tool in the construction and assessment of question papers. Using Bloom's Taxonomy to help design examinations and analyze the results could greatly improve the quality of assessment in education. Hence the need arises for conducting analysis of question papers from the perspective of the cognitive levels of Bloom's Taxonomy.

Though there are some studies which have looked into the analysis of question papers using Bloom's Taxonomy in various parts of the world, none is there to throw light on the analysis of question papers in Mizoram. To get proper answers to the questions raised above and to fill a research gap, a study on question paper

setting is conducted. By undertaking this study, the investigator hopes that the findings will lead us to know at what level we are examining our students. It will help us to understand where we are functioning at present and where we have yet to go. Knowledge of this result will, hopefully, pave the way to work out good training programmes for teachers with new and improved teaching and assessment techniques.

1.6 Statement of the Problem

The problem under investigation reads as "Analysis of Examination Question Papers in Education using the Cognitive Levels of Bloom's Taxonomy of Educational Objectives".

1.7 Objectives of the Study:

The present study has the following objectives:

1. To analyze selected question papers in Education at Higher Secondary, Collegiate and University levels in terms of the Cognitive domain of Bloom's Taxonomy of Educational Objectives.
2. To study the progression of question paper setting from the lower to higher level cognitive objectives in Education at Higher Secondary, Collegiate and University levels.

3. To find out the cognitive level of students of Higher Secondary, Collegiate and University in terms of the Cognitive domain of Bloom's Taxonomy of Educational Objectives.
4. To study teachers' understanding of Bloom's Taxonomy of Educational Objectives and its implications in question paper setting.
5. To study the impact of training of teachers in Bloom's Taxonomy on their question paper setting.

1.8 Operational Definitions of the Terms Used in the Study:

The key terms used in the present study are as follows:

1. **Analysis** : Analysis means the act of assessing, appraisal or evaluation of an object, person or things. In the present study, analysis refers to the assessment or evaluation of a student's achievement or performance on a selected course, i.e, Education.

2. Cognitive : Cognitive refers to the ability (or lack of) to think, learn and memorize; it is an expression of intellectual capacity pertaining to the mental processes of comprehension, judgement, memory, and reasoning. In the present study, cognitive will refer to the mental skills such as knowing, understanding, perceiving, memorizing, reasoning, judging, etc. that are used in the process of acquiring knowledge.

3. Examination Question Papers : It is an assessment tool for evaluating students' performance in a given subject area. Items of various difficulty levels are constructed to test the different cognitive capabilities of students. Question papers in this study will refer to Class XII Education Board Examination question papers, B.A Education and M.A Education End Semester Examination question papers of five consecutive years, i.e 2011 - 2015.

4. Taxonomy of Educational Objectives: The word '**taxonomy'** simply means **'classification of things arranged in a hierarchical order'**. Taxonomy of Educational Objectives, often called Bloom's Taxonomy, is a classification of the different objectives and skills that educators set for students (learning objectives). Bloom's Taxonomy divides educational objectives into three domains – Cognitive, Affective and Psychomotor. For the present study, Taxonomy of Educational Objectives will refer to Bloom's Educational Objectives in the Cognitive Domain i.e. Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation.

5. Lower Order, Middle Order and Higher Order Cognitive Objectives/Skills: The six levels in the cognitive domain of Bloom's Taxonomy have been divided into three groups:

i) Knowledge and Comprehension (Lower Order Cognitive Objectives)

ii) Application and Analysis (Middle Order Cognitive Objectives)

iii) Synthesis and Evaluation (Higher Order Cognitive Objectives)

1.9 Delimitations of the study:

The present study has been delimited to the following:-

1) The study is delimited to analysis of Education question papers of HSSLC (Class XII) Board Examinations, B.A (Education) End Semester Examinations and M.A (Education) End Semester Examinations of five consecutive years, i.e., 2011, 2012, 2013, 2014 and 2015.

2) The study is delimited to Class XII students reading Education subject in Aizawl, Vth Semester B.A Education Core students studying in various colleges in Aizawl, and Ist and IIIrd Semester M.A Education students studying in the Department of Education, Mizoram University and ICFAI University in Aizawl.

3) The study is delimited to teachers teaching Education subject in various Higher Secondary schools, Colleges and two Universities in Mizoram.

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CHAPTER II

REVIEW OF RELATED LITERATURE

2.0 Introduction

This chapter deals with the review of related literature. The purpose for reviewing related studies is to understand what type of studies have been done and what has been explored before. The review of related literature gives any research a direction and insight into the problem that the researcher is going to undertake. It helps the investigator by giving an overview of the work that has been done in the field and helps him to keep up with recent developments. It not only provides conceptual frame of reference but also suggests methods, procedures, sources of data, tools and statistical techniques appropriate for the solution of problems selected for the present study. In fact, most of the methods and tools used in this study were developed based on these related works.

In this chapter, the investigator has made an attempt to survey the earlier work done and reviewed the research studies related to the present investigation conducted in India and abroad. These studies immensely helped the investigator in planning and designing the research work. Although Bloom's Taxonomy has been around for many years, the number of researches done in this area are not many. Very few literature related to setting question papers using the cognitive levels of Bloom's Taxonomy has been found. These works were mostly conducted abroad and most of it was found online, so the researcher could review

only a few empirical research works. The existing researches which are directly or indirectly related to the present study are presented in the following sections:

2.1 Studies done in India

The researcher was able to find only a few studies conducted on Bloom's Taxonomy in India. Among the 50 reviews presented in this chapter, only 6 were studies conducted in India.

Singh, P (1992) conducted an investigation into the empirical validity of Bloom's Taxonomy of Educational Objectives. The study was based on the syllabus of life sciences prescribed by CBSE where five units relating to physiology were selected for evaluation of students' learning. The study was confined to 812 students from Class IX, X and XI from eight schools of Delhi. The study found that only four-tier taxonomy emerged in the study in the order of knowledge, comprehension, application and evaluation.

Agrawal, Tewari, Singh, Chandrashekhar & Sreekanth (2006) undertook an exercise to analyse Class X Board exam question papers of Jammu & Kashmir in six different subject areas regarding the weightages given to different abilities and skills that the questions used in the test, the forms of questions and the content units they covered. It was found that the questions did not provide any opportunity to the students to go beyond memorisation of facts and concepts. As the questions were largely based on text, and even the topics used for testing writing skills were those

done in the class or available to students in the guidebooks, it amounts to testing rote memory only.

Sreekanth (2007) conducted a comparative study of question papers in Social Sciences of different Boards with respect to various aspects of evaluation such as design, blueprint, marking scheme and question-wise analysis. The Boards of Manipur, Mizoram, Punjab and Karnataka were selected for study and it was found that there were wide variations in the setting of question papers, their design, blueprint, marking scheme and question-wise analysis. There was indiscriminate and unsuitable usage of action verbs such as define, describe, narrate, justify etc which misled the candidates in many of the question papers.

Choudhary, T & Raikwal, J (2014) investigated the impact of Bloom's taxonomy in introductory computer programming course to improve student's learning experience and performance. A framework for the automatic classification of exam questions as per the Bloom‟s Taxonomy was developed which was able to extract the questions and then categorize them into appropriate level as per the Taxonomy. The framework was tested on students to identify the cognitive level of the students. Results showed that applying Bloom's Taxonomy in teaching-learning process improved the performance of students significantly by providing an appropriate feedback to the instructor about students' progress in their course. This helps instructors to concentrate more on the areas where students are weak in their course and which helps in deciding/changing the strategy for a teacher so that maximum learning happens in a class.

Narayanan, S & Adithan, M (2015) conducted an analysis of end - semester question papers in Engineering with respect to assessing the proportion of questions involving Higher Order Thinking Skills (HOTS) as proposed by Bloom's Taxonomy. The analysis revealed that questions based on HOTS are more (above 63%) in the case of disciplines like Applied Sciences and Electrical Engineering. Questions based on HOTS are less in the case of disciplines like Bio Sciences, Computer Science, Information Technology and Electronics and Communication Engineering and Mechanical Engineering. In respect of these disciplines, the low percentage of HOTS could be due to the nature of curriculum presently followed at the VIT University or due to inadequate exposure of faculty to the concept of HOTS in the teaching-learning process.

Dhainje, Chatur, Borse & Bhamare (2018) proposed a rule – based approach in determining the Bloom's Taxonomy cognitive levels of examination questions through Natural Language Processing (NLP) in the computer programming domain. NLP was used to identify important keywords and verbs to assist in the identificatin of examination questions so as to place each question in their correct cognitive level. A set of 100 questions were analyzed and categorized based on Bloom's Taxonomy cognitive level. This was done in order to assist academicians in setting up suitable exam questions according to requirements.

2.2 Studies done Abroad

Various studies have been done abroad concerning the topic undertaken for research on one or more aspect of the investigation. 44 reviews from abroad have been studied and analysed and although not all of them directly deal with question paper setting or questioning on the basis of the Cognitive levels of Bloom's Taxonomy, the various factors affecting the study or related to the study undertaken have been selected and reviewed as under:

Gierl, M.J (1997) conducted a study on 30 Grade VII students (16 boys and 14 girls) in a mathematics class where they wrote a test for the unit they had just completed. The researcher hoped to accurately predict which of the cognitive processes will be used by students writing the exam. Each question was designed with one of Bloom's cognitive processes in mind. The questions and the students' approaches to solving the questions were categorized using Bloom's Taxonomy. It was found that majority of the cognitive responses reported by the students belonged to the three lowest levels of Bloom's Taxonomy. In fact, comprehension tasks make up the lion's share of educational experiences in schools.

Sultana, Q (1997) evaluated the lesson plans submitted by 67 student teachers in Kentucky. The lesson objectives in the lesson plan were analysed using Bloom's Taxonomy. The result was that 77% of the lesson objectives were aimed at the three lowest cognitive processes, i.e. knowledge, comprehension and application. 41% of the lesson objectives were of knowledge domain and only 3.2% were

considered to be of evaluation domain. This study clearly highlights that colleges are sending out new teachers with limited higher order thinking skills.

Jackson, L (2000) tried to integrate critical thinking into the mathematics curriculum to improve students' critical thinking skills. A total of 17 students of Grade VI were the subjects in this study. By allowing students to approach problems in many different ways such as drawing a graph, using a formula, counting, journal writing, co-operative learning, etc., the researcher hopes to promote the top three cognitive processes in Bloom's Taxonomy (analysis, synthesis and evaluation). They were given pre-test and post-test in order to measure the efficacy of the intervention. The study revealed that out of the 17 students, 9 showed a statistically significant improvement in higher order thinking skills in mathematics. This study emphasised the need for continuous training in higher order thinking and that such training must be incorporated into a programme of life-long learning.

Bennett, J and Kennedy, D (2001) examined the written examination results from testings done in a total of 29 schools in chemistry and 30 schools in physics (366 and 337 students respectively). The first year, there was no practical portion to the exam and the next year, there was. This was a correlational study comparing the data from the examinations to control studies done of students' knowledge and abilities.The results were also analysed using Bloom's Taxonomy. The results showed that the practical assessment not only correlated more strongly with students previously assessed abilities, it also tapped into the higher order thinking skills where the written exam did not. This study clearly demonstrates how

Bloom's Taxonomy must be used both in instruction and assessment of high school students.

Stabile, C (2001) conducted a study in a sixth grade world history classroom in Florida where the class had been dealing with low-level assessment and very few opportunities for taking the content to critical level. The students were taught Bloom's Taxonomy, thus creating a vernacular for exploring higher order thinking skills within the subject matter being covered. The idea of incorporating Bloom's Taxonomy in order to develop higher order thinking was a success for both the teachers and students.

Karamustafaoglu, Sevim and Cepni (2003) analysed and compared the chemistry questions asked in exams at different schools in two cities in Turkey in terms of the levels of cognitive domain of Bloom's Taxonomy. The study was carried out in three types of high schools (student age: 14-17): Ordinary, Anatolian and Vocational, from the cities of Trabzon and Amasya, with 17 chemistry teachers. 403 questions set in school examinations were analysed. It was found that 96% of the questions were of the lower-order cognitive skills (LOCS) type. Statistical tests showed that the question types were related to school type. On the other hand, more than half of the questions asked in the university entrance examination (OSS) were of the higher-order cognitive skills (HOCS) type. This contradiction causes a problem between the assessment at high school and that at the OSS.

Salih Cepni (2003) analyzed exam questions prepared by university lecturers who worked at different science departments according to the cognitive levels of Bloom's Taxonomy. In the study, 787 exam questions from the physics, chemistry, biology, and mathematics departments were collected and analyzed by using the document analysis method. A scale prepared by the researcher based on the Bloom's Taxonomy was used. Results showed that 81% of the questions were at the first three levels and 19% of the questions were at the last three levels in the taxonomy. This means that examination questions used to assess university students' achievement levels are at low cognitive levels.

Vidakovic, D., Bevis, J. & Alexander, M. (2003) developed a database for online formative assessment for a precalculus mathematics course using Bloom's Taxonomy for their framework. Emphasis is on the use of assessment items as reflective tools for students and as informative tools for instruction. By using tasks at higher levels of Bloom's Tazxonomy, students are forced to move beyond uniformed use of rules so as to help them retain knowledge as well as improved understanding and attitudes. The task or item is classified in a certain level of Bloom's Tazxonomy based on the highest level of cognitive task posed to the student. It was found that Bloom's Tazxonomy was a useful framework for developing multiple choice, short answer, matching and essay type questions that can involve students in complex cognitive tasks.

Feinstein, A.H. (2004) developed a model for evaluating the effectiveness of online instruction based on Bloom's Taxonomy of Educational

Objectives. This model evaluates the cognitive ability increases in learners and also helps to identify which participant characteristics might be significantly moderating these cognitive increases. This model is a helpful tool in assisting instructional system designers to develop rubrics of assessment for their online courses and contribute to the body of literature on instructional systems assessment.

Noble, T. (2004) created a tool to help teachers better deliver a differentiated curriculum to learners at all levels within the same classroom by combining the revised Bloom's Taxonomy with Gardners's Multiple Intelligence. This matrix provides sentence stems to suggest learning activities and questions that range from simple to complex thinking. Sixteen teachers ranging from kindergarten to grade six were observed using this tool for 18 months. The outcomes indicate that using the RBI/MI tool helped teachers to target higher order thinking skills of students at every level.

Ali Azar (2005) compared the physics questions of the university entrance exam with the questions asked at the physics courses at high schools according to Bloom's Taxonomy. Twelve physics teachers teaching in high schools located in the centre of Eregli of Turkey form the sample of this study. The data of the study was obtained by examining the documents. 76 physics questions asked at University Entrance Exams between the years of 2000 and 2003 were collected and examined with respect to Bloom's Taxonomy. Then, 556 physics questions collected from the physics teachers were also collected and examined regarding the cognitive levels of Bloom's Taxonomy. The results showed that physics questions asked at

Turkish University Entrance Exams have the quality of measuring the ability of application, analysis, synthesis and evaluation. But the high school questions have the qualities of measuring the ability of knowledge, comprehension and application.

Crowe, Dirks and Wenderoth (2008) developed the Blooming Biology Tool (BBT), an assessment tool based on Bloom's Taxonomy, to assist science faculty in better aligning their assessments with their teaching activities and to help students enhance their study skills and metacognition. The BBT was first designed and extensively tested for a study in which they ranked almost 600 science questions from college life science exams. The BBT was then implemented in three different collegiate settings. Implementation of the BBT helped to adjust their teaching to better enhance students' current mastery of the material, design questions at higher cognitive skill levels, and assist students in studying for college-level exams and in writing study questions at higher levels of Bloom's Taxonomy. From this work, they also created a suite of complementary tools that can assist biology faculty in creating classroom materials and exams at the appropriate level of Bloom's Taxonomy and students to successfully develop and answer questions that require higher-order cognitive skills.

Ferranie (2008) analysed two subjects, i.e. Mathematics and Science test papers 2007, of Form 2 Sekolah Menengah Sharif Ali (SMSA). From each subject, three 2007 assessment papers were analysed, i.e. First-term test, Mid-year/term examination and End of Year examination. The analysis of question papers were based on Bloom’s Taxonomy thinking skill levels, using key words given by

Taylor in The Use of Questioning in Raising Higher Order Thinking as guidelines. It was found that the test papers from First term, Mid-year and End-year examinations concentrate on testing the students' knowledge. The percentage on assessing the knowledge only was 53.5%, it shows that percentage of this type of questions increases from one assessment to the other. The questions that required comprehension skills were higher in the First-term but decreases by the End-year exam; at which more questions were given on application skills. Questions which required the students to analyse were decreasing for the End-year exam but remained the same for the other two. The ability of the students to synthesize and to evaluate was not truly assessed in these subjects throughout the year.

Khairuddin, N and Khairuddin, H (2008) conducted software engineering assessment using Bloom's Taxonomy. The aim of the study is to assist software engineering teaching and learning; and improve the quality of software engineering education. Sample questions are given to software engineering students and categorized according to the relevant Bloom's Taxonomy levels. Assessment questions are either formative or summative in nature and can be in the form of assignments, quizzes or formal examination. This will help educators in designing their questions for software engineering assessments, given the level of question types. It will also help to assess and ensure that software engineering students' knowledge level and skills acquired are as defined by the learning outcomes.

Thompson, Luxton-Reilly, Whalley, Hu and Robbins (2008) used Bloom's Taxonomy to help design examinations to improve the quality of

assessment in computer science courses. For this study, exam scripts from first-year programming courses were supplied by 6 institutions from Australasia and the USA. Each exam script was independently analysed by the 5 authors, and its questions classified according to the categories in Bloom's Taxonomy. During the analysis, it was found that questions could be reworded in such a way that the cognitive level is altered. Using the Bloom's Taxonomy forced them to review the exam questions in terms of how the paper/subject was taught. Simply reading the questions did not always give a clear indication of the cognitive skill involved in addressing the question.It was felt that a shared understanding of the interpretation of the Bloom's Taxonomy to the programming domain would prove valuable to teaching staff developing examination questions, particularly in courses that involve multiple staff members.

Cole, H; Hulley, K & Quarles, P (2009) conducted a survey on teacher trainees in the Lincoln Memorial University graduate program to determine how assessment affects classroom instruction and student learning. 791 teachers were surveyed, out of which almost 90% were classroom teachers. The survey found that the teachers felt the current test questions heavily emphasised testing what the students can or cannot recall. They favoured the use of authentic assessment tests which focus on the development of higher order thinking skills and knowledge transfer, especially for application and synthesis skills.

Jones, Harland, Reid and Bartlett (2009) attempts to distinguish between three different types of questions, namely Low Order Cognitive Questions,

Intermediate Order Cognitive Questions and Higher Order Cognitive Questions in light of Bloom's Taxonomy. The aim is to ascertain whether engineering academics are assessing critical thinking and problem-solving skills by using effective questions. The examination papers presented in one academic year to second and final-year students on eight programmes were evaluated and categorized into low, intermediate or higher order cognitive questions using the verb list provided by Dalton and Smith. These programmes constitute Bachelor of Engineering (BEng) degrees and Bachelor of Science (BSc) degrees in a range of engineering and technology subjects in the general field of electronics, and encompass some 29 examination papers. The study provided the results of 0%, 67% and 33% for LOCQ, IOCQ and HOCQ respectively.

Khorsand, Narjess (2009) examined the cognitive levels of questions used by Iranian EFL teachers in advanced reading comprehension tests. Twenty teachers participated in this study and generated 215 questions which were then categorized according to Bloom's taxonomy. The results of this study showed that the most dominant question type was 'knowledge' (54.21 %) followed by 'comprehension' questions (38.74 %). This indicated that 92.43% of questions aimed at the first two levels of the taxonomy. Next to these two levels, the teachers' questions aimed at 'synthesis' (2.33%), 'application' (1.86 %), 'evaluation' (1.39%) and 'analysis' (0.47 %) level respectively. According to this analysis, only 4.19% Iranian EFL teachers-generated questions were directed toward the highest three levels of Bloom's taxonomy, and 95.81% questions were aimed at the three lowest

levels of Bloom's taxonomy. So, this study indicated that Iranian EFL teachers were aiming their teaching and testing primarily at the lowest cognitive levels.

Garekwe, Masaitsiweng (2010) conducted a study aimed at describing and analysing the examination questions set over a four year academic period, at the University of KwaZulu-Natal School of Nursing, in terms of Bloom's levels of cognitive domains. A total of 1319 questions from 39 examination papers from 2003-2007 were examined. The findings revealed that all six categories of the cognitive domains in Bloom's taxonomy were used across the four levels in the Bachelor of Nursing (BN) programme. Overall about 57 % of the questions were aimed at lower level (knowledge and comprehension) whilst only 43.4% were aimed at higher levels (application, analysis, synthesis and evaluation).

Ayvaci, H.S and Ali Turkdogan, Ali (2010) evaluated science and technology examination questions based on Bloom’s Taxonomy and tried to determine the extent to which these questions comply with the learning theory of constructivism. The study employed the document analysis research method. 100 examination papers in total prepared by Grade VI science and technology teachers in the fall term of 2008-2009 educational years in the city of Trabzon were examined in accordance with Bloom’s Taxonomy. The data obtained were tabulated according to Bloom’s Taxonomy and its subdivisions by using pie charts of knowledge dimension. Finally, graphs demonstrating percentages of levels of Bloom’s cognitive process dimensions in the examination papers were formed. The findings of the study revealed that 38.4% of questions asked by the teachers were in knowledge, 16.3%

were in comprehension, 13.5% were in application, 8.5% in analysis, 0.5% were in synthesis and 23.1% in evaluation levels. Majority of the questions asked in the examination papers required recall or memorizing ability. Clearly, teachers avoid asking analysis and reorganizing level questions. The distribution of the questions shows that the teachers are not concerned with knowledge and scientific process dimensions of Bloom's taxonomy.

Hawks, Williams Kristel (2010) conducted a study to determine if teachers who developed lessons based on Bloom's Taxonomy and the Virginia Standards of Learning Curriculum Framework saw increased scores on the Mathematics benchmark assessment for fourth grade. Two classes taught by different Mathematics teachers participated in the test. The mean of the posttest scores for the experimental group in which the teachers developed lessons using Bloom's Taxonomy was significantly higher than the mean of the group which used textbook bound instruction.

Prasetyo, M.T (2010) conducted a study aimed at knowing the students' cognitive skills by analyzing their questions based on Bloom's Taxonomy, so that teachers can plan appropriate teaching and learning processes to improve and develop students' critical thinking. The test was conducted on 20 students of Grade XI of SMA N1 Depok in English subject. The students were given a short English text and asked to frame questions based on the text. The students' questions were analyzed using Bloom's Taxonomy. The students' cognitive domain were further classified by analyzing their questions using Bloom's Taxonomy. It was found that

20% of the questions belonged to knowledge domain, 20% to application domain and 60% to synthesis domain.

Riazi, M and Mosalanejad, N (2010) reports a study that investigated the types of learning objectives represented in Iranian senior high school and pre-university English textbooks using Bloom's Taxonomy of learning objectives. Three high-school textbooks and the sole pre-university textbook were included in the analysis. To codify the learning objectives, a coding scheme was developed based on Bloom's Taxonomy of learning objectives. The exercises and tasks of the textbooks were codified and the frequencies and percentages of occurrence of different learning objectives were calculated. Results of the study indicate that in all grades, lower-order cognitive skills were more prevalent than higher order ones. Furthermore, the difference between the senior high school and the pre-university textbooks in terms of the levels of the taxonomy were significant in so far as the pre-university textbook used some degrees of higher-order learning objectives. Results of this study have implications both for teaching and materials development.

Ranganathan, P and Nygard, K (2010) developed an assessment test called Bloom's Online Assessment Test (BOAT) for a distance education course on the basis of cognitive learning given by Bloom's Taxonomy. By using BOAT, educators can assess students on multiple learning outcomes that are aligned to different objectives of the course. Within each level of the taxonomy, there are various tasks that move students through the thought processes. This test will serve as a guide and a good assessment instrument for any online course.

Kocakaya, S and Gonen, S (2010) analysed and compared the physics questions of the university entrance exam (OSS) with those asked at exams at different schools in Turkey in terms of the levels of cognitive domain of Bloom's Taxonomy. The study was carried out in four types of high schools (student age: 14–17): 'Ordinary', 'Vocational, 'Anatolian' and 'Science' from Diyarbakır, with 19 physics teachers. It was found that 72.5 % of the questions were of the lower-order cognitive skills (LOCS) type. Statistical tests showed that the question types were related to school type . On the other hand, about half of the questions (50.9%) asked in the university entrance examination (OSS) were of the higher-order cognitive skills (HOCS) type and the rest (49.1%) were of the lower-order cognitive skills (LOCS) type. This contradiction causes a problem between the assessment at high school and that at the OSS.

Veeravagu, J; Muthusamy, C; Marimuthu, R & Subrayan, A (2010) investigated the relationship between the level of thinking processes in English language comprehension questions and the students` performance. A total of fifty Part 3 diploma students studying in the Academy of Language Studies, Universiti Teknologi MARA, Malaysia were chosen for this research. A set of reading comprehension questions was used where thirty-five multiple choice items were tested. The students' reading comprehension scores against the level of thinking processes of the questions using Bloom Taxonomy was analyzed quantitatively. The study found that the students performed better in questions with low level thinking process (knowledge, comprehension and application) compared to high order

questions. 66.0 % of students responded to the Knowledge level questions correctly. As for the Comprehension level, 57.2% of students got them right. 47.0 % of the students were able to answer the Application level questions correctly. Only 48.4% of students managed to answer the Analysis level questions correctly. As for the Synthesis questions, 33.6% of the students got them right. Only 28.0 % of the students were able to answer the evaluation level questions accurately. The findings concluded that there is a relationship between the level of thinking and the students' ability to answer them correctly.

Gocer, Ali (2011) tried to determine whether the distribution of the written examination questions on the cognitive domain sublevels is balanced or not. The study was conducted in 47 institutions of primary education selected from various socio-cultural districts in the Kayseri province. The written examination papers of 101 Turkish language teachers selected from the chosen schools have been collected. A total of 69 written examination papers were randomly selected from the written examination paper samples belonging to the sixth, seventh, and eighth grades and 603 questions were chosen for the analysis. It was found that the distribution of the written examination questions used in the cognitive domain sublevels is not balanced. It has been shown that the questions focus on the comprehension level and that they remain inadequate in the analysis, synthesis and evaluation levels.

McBain, Richard (2011) conducted a simple classroom research project to examine how high up in the scale of Blooms taxonomy students were able to reach to understand higher order thinking skills when studying critical thinking

questions. Two classes of senior high school students who had been studying in the same bilingual program for five years were compared by assessing their quality responses to a social studies project. The questions given were structured along the lines of the levels of Bloom's taxonomy from simple knowledge style questions to more complex evaluation types. The results showed that only 41.66% of students had a sound knowledge of the six levels of Blooms Taxonomy ranging from knowledge to evaluation. The remaining group 58.33% showed less understanding of the levels. This study clearly highlights the need for teachers to plan lessons with more accuracy and to know at which level to begin lessons with a view to improving student's higher order thinking skills.

Omar, N.; Haris; S. S; Hassan, R. et al (2011) proposed an automated analysis of exam questions in the computer programming domain to determine the appropriate category of questions based on Bloom's Taxonomy. In this work, a rule-based approach was adopted in classifying the question items into their corresponding Bloom's cognitive level. The test items were a collection of examination questions in Programming subjects obtained from the Faculty of Technology and Information Science, Universiti Kebangsaan Malaysia (UKM). The training set consists of 70 examination questions and the test data set comprises of 30 questions. Only written final examination question were taken for test items. All the questions were manually categorized by a group of subject matter experts in programming domain. The system classified each question automatically to their corresponding verbs from the Taxonomy with the assistance of the developed rules. In order to determine the category of questions, it excluded difficulty level of each

question as a measuring factor. Findings indicate that the rules may successfully assist in the identification of the Bloom's taxonomy category correctly in the exam questions.

Shahzad, Saqib; Badshah, Syed Naeem; Muhammad, Hussain & Ramzan, S. M. (2011) analyzed the S.S.C Biology Question Papers conducted by Board of Intermediate and Secondary Education (BISE) Bannu, Pakistan of 5 years (2005-2009) using Bloom's Taxonomy. The study found that Comprehension level questions were most frequent, followed by Evaluation, Knowledge, Analysis and Synthesis respectively. No questions came from Application level. They concluded that SSC Biology question papers mostly covered more lower level skills (68.28%) than higher level skills (31.72%).

Tarman, Bulent & Kuran, Burcin (2011) conducted an examination of the Cognitive level of questions in 6^{th} and 7^{th} grade Social Studies textbooks based on Bloom's Taxonomy. The aim of this study was to find out whether high-order cognitive domain skills were reflected in the pre-reading and assessment questions in Social Studies textbooks, and if so, to what extent. It was found that the 6th grade prep questions were at a low level (84.2%), open-ended assessment questions were at a high level (70.2%), and the multiple-choice assessment questions were at a low level (85%). The 7th grade prep questions were low level at 71.3%, open-ended assessment questions were high level at 66.6%, and 93.05% of multiple-choice questions were low-level questions. According to the results of the study, questions

were not distributed in a balanced way in accordance with Bloom's taxonomy because there were more low level questions than high level questions.

Tanalol, Fattah, Sulong & Mamat (2012) implemented Bloom's Taxonomy concept as a guideline in designing examination question papers in Mining exam questions. Here, the difficulty level of each question was determined from the criteria of keywords found in the question. A knowledge based approach and text mining technique was used to identify and extract information and keywords from textual content in the exam paper. Besides using the prototype system developed, an illustration of the overall analysis for level of difficulty of examination question paper was obtained. The outcomes from the system can be used as a guideline by the academician (exam question designer) to design/revise the exam paper according to requirements.

Naomee, Iffat and Tithi, U.M (2013) tried to find out the reflection of Bloom's taxonomy on the learning outcomes of secondary social science curriculum of Bangladesh. Its objectives were to categorize the learning outcomes of secondary social science curriculum according to the Bloom's taxonomy and to analyze the reflection of Bloom's taxonomy on the learning outcomes of secondary social science curriculum. Data was collected by analyzing curriculum document using table of specification and interviewing curriculum specialists using interview schedule. The findings of the study revealed uneven application of the domains indicated by Benjamin Bloom and lack of consistency of the curriculum.

Shah, Kazim Sayed; Rani, Rabia; Mahmood, Rashid & Irm, Rana (2013) investigated the cognitive levels of examination questions with reference to Blooms's Taxonomy at Graduate level in Pakistan. 10 years (2001-10) previous English papers of Punjab University for Graduate students consisting of 541 questions were used as sample. The findings show that comprehension level is given the greatest prominence, which is followed by knowledge. Synthesis and evaluation levels are given lesser prominence while application and analysis are given least prominence.

Edussuriya, D.H; Marambe, K & Abeysekara, Y (2014) conducted an analysis of Forensic Medicine questions in the undergraduate medical curriculum of the University of Peradeniya, Sri Lanka with a view to determining the cognitive level of the essay and structured essay type questions. Essay and structured essay type questions of the first four years of the MBBS program from the year 2006 to 2012 were categorized according to the Bloom's Taxonomy. The study revealed that majority of questions were knowledge based while a considerable number were of the comprehension and application types. The proportion of questions of the synthesis and analysis were less while there was a moderate number of the evaluation type of questions. Observations made between the years revealed that there was a tendency for a decrease in the proportion of knowledge-based questions from the 1st year to the 4th years with an increase in the proportion of synthesis type of questions.

Lucas, Dippenaar & Du Toit (2014) analysed, assessed and compared the summative assessment opportunities of two third year level modules in

Biochemistry and Zoology. The questions posed in summative assessment opportunities were classified in terms of the cognitive levels identified by Bloom and the brain quadrants identified by Herrmann. Approximately 50% of the questions in the Biochemistry papers fell into the first two lower order Bloom's Taxonomy levels, whilst the remaining fell into levels 3 and 4, with no questions in the last levels of Bloom's Taxonomy. The questions posed in all of the Zoology papers covered mostly the first two cognitive levels of Bloom's Taxonomy with the highest percentage of all questions posed in all papers included in the first three levels. Correlation tests were done between student performances and the level of questions. No correlation exists between cognitive level and performance. Student achievement does not reflect the required understanding and ability to implement knowledge, or to engage with the subject matter at higher cognitive levels.

Ibtihal, R.A & Smadi, O. M (2015) evaluated the cognitive levels of the questions of Master Class textbook. A checklist based on Bloom's Taxonomy was the instrument used to categorize the cognitive levels of these questions. The results showed that the author of Master Class emphasized the cognitive level of Comprehension having 52% of the questions, while wrote only 3.7% and 6% of the questions on the cognitive levels of Knowledge and Application respectively. The results also indicated that about 40% of the textbook's questions emphasized higher-order thinking skills, which goes with the requirements of the revised curriculum.

Dhuha, A and Omar, N (2015) proposed a new method to classify exam questions automatically according to the cognitive levels of Bloom's

Taxonomy by implementing a combination strategy based on voting algorithm that combines three machine learning classifiers. In this work, several classifiers were taken into consideration. The classifiers were Support Vector Machine (SVM), Naïve Bayes (NB), and k-Nearest Neighbour (k-NN) that were used to classify the question with or without feature selection methods, namely Chi-Square, Mutual Information and Odd Ratio. Then a combination algorithm was used to integrate the overall strength of the three classifiers (SVM, NB, and k-NN). The classification model achieved highest result through the combination strategy by applying Mutual Information, which proved to be promising and comparable to other similar models. These experiments aimed to efficiently integrate different feature selection methods and classification algorithms to synthesize a classification procedure more accurately.

Dunham, B.; Yapa, G. & Yu, E. (2015) proposed Bloom's Taxonomy as a tool to assess the level of complexity of assessment tasks in statistics. Through the "Blooming" of statistics examination, that is, locating its constituent parts on Bloom's taxonomy, the difficulty level of an examination paper in statistics can be pseudo-objectively assessed, via both its Bloom's Index and the proportion of marks allocated to higher order cognitive skills. Six examination question papers from an introductory course in statistics were Bloomed post-hoc and it was found that the percentage of questions from LOCS were 36.7%, 36.6%, 32.7%, 37.1%, 29.0% and 18.2%. The percentage of questions from HOCS were 63.3%, 63.4%, 67.3%, 62.9%, 71.0% and 81.8%.

Ebadi, Saman & Shahbazian, Faranak (2015) investigated the cognitive level of first and second grade Iranian high-school final exam questions based on Blooms's Taxonomy of Educational Objectives. Content analysis of questions revealed that all the items of first and second grades were at the first three levels of the taxonomy which was mostly the lower order of thinking. Moreover, there was no difference between first and second grade questions with regard to cognitive levels of Bloom's taxonomy.

Festo, Kayima (2016) developed a question taxonomy framework to guide chemistry teachers in formulating good questions. The framework was developed on the basis of several question taxonomies including Bloom's Taxonomy. It provides question formulation hints and question examples for the nature of questions that can occur in the classrooms. The type of questions and the nature of uestioning are closely linked with the method of instruction the teacher uses. The framework is perceived to provide support to ensure that the teacher takes a step to think about and work on formulating those questions that will support students' understanding.

Mehmood, Tariq; Iqbal, Muhammad; Abdullah & Farooq, Muhammad (2016) analyzed the question papers of Physics at secondary level of the Boards of Intermediate and Secondary Education of Pakistan in the light of Bloom's Taxonomy(revised). It was a descriptive study and primarily based on analysis of documents. The question papers of Physics in the previous 5 years of annual examinations (2010-2014) were analyzed. The objective parts of these papers

touched only the two lower levels. The same were also found in the subjective parts of these papers where majority of the questions were from the two lower levels and only a slight portion was based on application level.

Rezaee, Marziyeh & Golshan, Mohammad (2016) tried to find out the cognitive levels of the nation-wide English final exams which were administered to third grade high school students and second grade high school students in Iran. For this purpose, the items of English final exams which were administered to third grade and second grade high school students were analyzed and codified based on the cognitive levels of Bloom's taxonomy of educational objectives. The results of this study showed third and second grade high school English final exams mostly assessed lower level learning, especially knowledge and comprehension. Moreover, no item of these tests was related to the three highest levels of learning objectives of Bloom's Taxonomy.

Koksal, Dincay & Ulum, Omer Gokhan (2018) conducted an analysis of exam questions for general English courses at Turkish universities to determine to what extent these question papers cover the lower and higher order cognitive levels of Bloom's taxonomy. The procedure of the study was based on descriptive content analysis design which describes the occurrence of the steps covered in both high and low order cognitive levels of Bloom's Taxonomy. In other words, the cognitive levels of Bloom's Taxonomy were employed while categorizing the exam questions utilized at university level. Question stems based on each cognitive steps and key words referring to the cognitive levels of Bloom's Taxonomy were employed to

diagnose which levels of thinking order were included in the overall analyzed exam questions. It was found that the exam questions include only knowledge and comprehension levels of Bloom's taxonomy. The percentage of knowledge level contained in the exam questions is 81.7% while it is 18.3% for the comprehension level. It was also clear that even between the percentages of knowledge and comprehension levels, there was a high gap.

2.3 Overview

The related literature is reviewed from both India and abroad in which the investigator studied 50 related literature. Majority of the researches on Bloom's Taxonomy have been conducted abroad. Very few researches done in India have been found and none in the state of Mizoram. Out of the 50 literature reviewed, only 6 studies conducted in India were found which covered the period from 1992 to 2018, that is within a span of 26 years.

The investigator reviewed 44 studies which were conducted abroad in countries like USA, UK, Australia, Canada, Turkey, Iran, Malaysia, South Africa, Pakistan, Sri Lanka, Bangladesh and others, which were conducted from the year 1997 to 2018, covering a span of 21 years.

Many of the related literature reviewed in this chapter were conducted in Science stream. In fact, 31 studies were reviewed from Science stream. Out of these, 14 studies belonged to the Physical Science stream covering subjects like

Mathematics, Physics, Chemistry, Statistics, etc; 5 studies were conducted in Life Science covering subjects like Biology, Zoology, Biochemistry, etc; 10 studies were conducted in Engineering and Computer Science stream; and 2 studies were conducted in Medical/Nursing Education. There were only 19 studies conducted in Arts and Humanities, out of which 8 were in Social Science; 8 in English literature/language; and 3 in Teacher Education. This reveals that more studies need to be conducted in the area of Education, Humanities and Social Science.

In the 50 reviews analysed, 30 were concerned with analysis of questions according to the cognitive levels of Bloom's taxonomy and 28 studies found that the majority of the questions analysed belonged to the Lower Order Cognitive Skills and very few from Higher Order Cognitive Skills. 4 studies were conducted on finding out the cognitive skill level of students; 4 studies were concerned with training teachers on setting HOCS questions; and 12 studies were concerned with developing a framework for the automatic classification of exam questions as per the cogntive levels of Bloom‟s Taxonomy, that is, the blooming of examination question papers.

In the 6 studies conducted in India, Singh (1992); Agrawal, Tewari et al (2006); and Sreekanth (2007) conducted studies on high school examination question papers in different parts of India and found that majority of the questions concentrated on knowledge and comprehension levels. Narayanan & Adithan (2015) analysed the end - semester question papers in Engineering courses and found that questions based on HOTS are more in some courses while less in some others.

Choudhary & Raikwal (2014) and Dhainje, Chatur et al (2018) conducted studies in the computer programming domain where they developed a framework for the automatic classification of exam questions as per the cogntive levels of Bloom's Taxonomy.

From the review of related literature, it is clearly seen that very few researches have been conducted in India on question paper setting and analysis of questions as per the cognitive levels of Bloom's Taxonomy. The present study is the first of its kind in the state of Mizoram, and the investigator hopes that the present study on question paper setting using the cognitive domain of Bloom's Taxonomy will be useful to know at what level we are teaching and examining our students. It will help us to understand where the cognitive levels of teachers and students are functioning at present and where we have yet to go. The findings of this study will, hopefully, pave the way to work out good training programmes for teachers with new and improved teaching and assessment techniques.

CHAPTER III

METHODOLOGY AND PROCEDURE

3.0 Introduction:

The word Methodology is derived from the Greek word *'Meta Logos'* meaning 'the way along which'. In simple terms, it means *'a system of methods and principles for doing something'* (Cobuild, 1987). A methodology assumes that there is a logical order that the researcher needs to follow in order to achieve a certain pre-determined result (eg; knowledge, insight, design, intervention, change). Defining and defending the logic of this logical order is what methodology is all about (Pennick, 2009)

Methodology is simply the means by which we collect and analyze data. How we arrive at the results is just as important as the results itself. The importance is associated with not only the validity of the research itself but also the means by which others can replicate what we've done in the research (Pittman, 2018). Any investigation should be structured so that the conclusion is close to the reality. Selection of research methodology is an essential pre-requisite before taking up a research project, so that the conclusion serves the purpose for which the project is undertaken (Bagchi, 1977).

The present chapter deals with the method of study i.e. procedure and design of the study, population and sample, description of tools used, the procedure for data collection and statistical techniques used. For the convenience of presentation, this chapter has been divided into the following sub-heads:

3.1 Method of Study:

Keeping in view the nature of various objectives of the study, the investigation used both Quantitative and Qualitative methods. For instance, Descriptive Survey method, which comes under Quantitative Research, was employed to study two objectives:- to find out the cognitive level of Higher Secondary, Collegiate and University students in terms of the Cognitive domain of

Bloom's Taxonomy (Objective 3) and to study teachers' understanding of Bloom's Taxonomy and its implications in question-paper setting (Objective 4). At the same time, Experiment method was employed to study the impact of training of teachers in Bloom's Taxonomy on their question-paper setting (Objective 5). Here, the researcher conducted a Pre-test Post-test experiment on teachers with the help of the supervisor.

The present study also employed Qualitative Research in the form of Content Analysis Method to analyze selected question papers in Education at Higher Secondary, Collegiate and University levels in terms of the Cognitive domain of Bloom's Taxonomy (Objective 1) and to study the progression of question paper setting from the lower to the higher level cognitive objectives in Education at Higher Secondary, Collegiate and University levels (Objective 2).

3.2 Population and Sample of the Study:

A) Population: As the primary data relating to the various objectives of the study have been collected from the samples drawn from two communities of people, namely, students and teachers of Education subject of higher secondary, college and university, this study relates to the following two populations to which the result of the study will be applicable.

i) Population 1: All Class XII, Vth Semester B.A Education and Ist and IIIrd Semester M.A students studying Education subject in different Higher Secondary Schools,

Colleges and Universities in Mizoram constituted the population of students for this study.

ii) Population 2: All Higher Secondary, College and University teachers teaching Education subject in different Higher Secondary Schools, Colleges and Universities in Mizoram constituted the population of the teachers for this study.

Table 3.1.

Population of teachers and students of Education subject in Mizoram during the academic session 2016-2017

Institution	Population of Teachers	Population of Students
Higher Secondary	204	5149 (Class XII Education)
College	87	525 (V^{th} Semester B.A Education Core)
University	18	90 (I^{st} & III^{rd} Semester M.A Education)

Source: Mizoram Board of School Education Annual Report 2016 – 2017; Directorate of Higher and Technical Education & Directorate of School Education, Govt. of Mizoram; Dept. of Examinations, Mizoram University.

B) Sample of the Study:

i) Sample of Students: The sample for the study relating to finding out the cognitive level of students in terms of Bloom's Taxonomy consisted of 776 students - 380 consisted of Class XII students reading Education in various Higher Secondary schools in Aizawl; 310 students of V^{th} Semester BA (Education Core) studying in

various Degree Colleges of Aizawl; and 86 students studying MA (Education) in Mizoram University and ICFAI University. 258 of the sampled students were male and 518 were female.

ii) Sample of Teachers: The sample for the study relating to teachers' understanding of Bloom's Taxonomy of Educational Objectives and its implications in question paper setting consisted of 163 teachers teaching Education subject in different Higher Secondary schools, Colleges and Universities in Mizoram. Out of these, 76 teachers were from Higher Secondary schools, 70 from Colleges and 17 teachers from Universities. 37 of the respondents were male and 126 were female.

The sample for studying the impact of training of teachers in Bloom's Taxonomy on question paper setting consisted of 30 teachers, 14 males and 16 females, who participated in the Orientation Course for teachers organized by the Human Resource Development Centre, Mizoram University during 19 October to 15 November 2016. 27 of the participants were College teachers and 3 of them were University teachers.

C) Sampling Technique: Since the study was related to only Education students and teachers of Higher Secondary, Collegiate and University levels, Stratified Random Sampling technique was employed for collection of samples for the study.

3.3 Distribution of Sample:

The sample of the present study consists of 776 students reading Education subject in Class XII, Vth Semester B.A (Education Core) and M.A (Education) in various Higher Secondary Schools, Colleges and Universities in Mizoram; 163 teachers of the Department of Education teaching in various Higher Secondary schools, Colleges and Universities in Mizoram; and 30 teachers who attended the Orientation Course Programme organized by Mizoram University.

For the Higher Secondary School sample, the investigator collected data from 8 Higher Secondary Schools in Aizawl offering Education subject viz., Gov't JL Higher Secondary School, Gov't KM Higher Secondary School, Gov't Mizo Higher Secondary School, Gov't Central Higher Secondary School, Gov't Chaltlang Higher Secondary School, Gov't Mamawii Higher Secondary School, Gov't Republic Higher Secondary School, and Synod Higher Secondary School.

For the College sample, data was obtained from 8 Colleges in Aizawl offering B.A Education Core Course viz., Pachhunga University College, Gov't Aizawl College, Gov't Hrangbana College, Gov't Johnson College, Gov't T. Romana College, Gov't Aizawl West College, Gov't Aizawl North College and Gov't J.Thankima College.

The sample for University students was collected from the M.A (Education) students of Department of Education, Mizoram University and ICFAI University. A more detailed view of the samples for the present study are shown in Table 3.1

Table 3.2

Sample of Students

Sl. No.	Level	Total Number	Male	Female	Urban	Rural
1	Higher Secondary School (Class XII)	380	142	238	193	187
2	College (V^{th} Sem.B.A)	310	101	209	140	170
3	University (M.A I^{st} & III^{rd} Sem)	86	15	71	39	47
Grand Total		**776**	**258**	**518**	**372**	**404**

Table 3.3

Sample of Teachers

Sl. No	Category of Respondents	Total Number	Male	Female	Working in Aizawl	Working outside Aizawl
1	Higher Secondary School Teachers	76	19	57	58	18
2	College Teachers	70	13	57	55	15
3	University Teachers	17	5	12	17	-
	Grand Total	**163**	**37**	**126**	**130**	**33**

Table 3.4

Sample of Teachers for Pre-test / Post-test Experiment

Gender	Nos.	Institution Level	Nos.	Stream	Nos.	Place of Work	Nos.	Degree	Nos.
M	14	**PG**	3	**Arts**	25	**Mizoram**	9	**Master Degree**	13
								M. Phil	12
F	16	**UG**	27	**Science**	5	**Outside Mizoram**	21	**Ph. D**	5
TOTAL - 30									

3.4 Tools of Data Collection:

As research on Bloom's Taxonomy and its implications in question-paper setting is very few, there is not much literature relating to the present study. There were no standardized tools available for conducting the tests. Therefore, the investigator, with the help of the supervisor, prepared the five tools used in this study, following appropriate procedures for formation of tools and also consulting a number of related literature for guidance. The following tools were developed by the researcher for collection of required data.

3.4.1. Bloom's Taxonomy Coding Scheme: Bloom's Taxonomy Coding Scheme was developed to analyze question papers in Education of Class XII Board

Examination, B.A and M.A End Semester Examinations as well as to study the progression of question paper setting from the lower to higher level cognitive objectives, The Coding Scheme basically comprises of the six cognitive levels given by Bloom, viz., Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation. Key words or verbs for each level was compiled to be used as a guide for structuring or framing questions and tasks. The Coding Scheme plays a pivotal role for achieving all the objectives of the present study.

3.4.2. Cognitive Level Test: Cognitive Level Test to find out the cognitive level of students in terms of the Cognitive domain of Bloom's Taxonomy was developed by the investigator where students were asked to set 5 questions of difficulty levels ranging from 1 to 5, from two topics in Educational Psychology course. They had to set 10 questions in all, 5 questions for each of the two topics.

3.4.3. Opinionnaire for Teachers: Opinionnaire to study teachers' understanding of Bloom's Taxonomy and its implications in question-paper setting was constructed which consisted of 22 statements or questions with 3 choices for each question to be simply ticked by the respondent. The Opinionnaire was divided into three sections namely 1) Awareness of teachers regarding Bloom's Taxonomy, 2) Application of Bloom's Taxonomy in teaching-learning and evaluation and 3) Attitude of teachers towards Bloom's Taxonomy.

3.4.4. Pre-test/Post-test Experiment: A schedule was constructed for both the Pre-Test and Post-Test Experiment to study the impact of training of teachers in Bloom's

Taxonomy on their question-paper setting. Both the Pre-test and Post-test schedules consisted of 12 items – a combination of questions and test exercises. Intervention in the form of a detailed lecture with power point presentation on Bloom's Taxonomy was conducted after the Pre-test.

3.5. Procedures of Data Collection:

Regarding Objectives 1 and 2, the researcher collected old question papers in Education of five consecutive years, i.e., 2011 to 2015. These old question papers covered Class XII Education Board Examination Question papers of Mizoram Board of School Education; B.A Education End Semester question papers of Mizoram University, and M.A Education End Semester question papers of Education Department, Mizoram University. These question papers were analyzed in accordance with Bloom's Taxonomy Coding Scheme developed by the researcher.

In order to obtain data for Objective 3, the researcher visited 8 Higher Secondary schools, 8 Colleges and 2 Universities in Aizawl. Prior permission was taken from the Head of the Institutions and the researcher personally visited the said Institutions and conducted the tests. After giving a brief introduction and purpose of the study, the tests were distributed to the students. Clear instructions were given on how to answer the test items. The researcher developed a Cognitive Level Test where students were asked to set 10 questions of various difficulty levels. They were provided with reading materials on two topics from Educational Psychology course namely 1) Individual Difference and 2) Mental Health and Hygiene. They were

asked to set 5 questions for each of the two topics in order to find out at what cognitive level of Bloom's Taxonomy they are functioning.

For Objective 4, the investigator collected data from three sets of Education teachers from all over Mizoram. The investigator personally visited as many of the teachers as possible and distributed the questionnaire to them. The teachers working outside Aizawl were contacted through phone and e-mail.

To collect data for Objective 5, a Pre-test/Post-test experiment was conducted on the teachers attending the Orientation Course programme organized by Mizoram University during 19 October to 15 November 2016. Prior permission was taken from the Director of Human Resource Development Centre, Mizoram University and the requested number of classes were given to the investigator for data collection. Pre-test was conducted on 26 October 2016 where a questionnaire was answered by the participants followed by Intervention in the form of a lecture on the importance and usefulness of the Cognitive levels of Bloom's Taxonomy in question-paper setting. Post-test was again conducted after interval of a few days, on 5 November 2016. The participants were given a questionnaire to determine whether there was improvement in their performance as compared to the Pre-test.

3.6. Sources of Data:

The study has used both primary and secondary sources of data for the attainment of its objectives.

Primary data relating to the cognitive level of students in terms of the Cognitive domain of Bloom's Taxonomy (Objective 3), teachers' understanding of Bloom's Taxonomy and its implications in question-paper setting (Objective 4), and impact of training of teachers in Bloom's Taxonomy on their question-paper setting (Objective 5) were personally collected by visiting Higher Secondary Schools, Colleges and Universities in Aizawl.

Secondary data relating to analysis of question papers in Education at Higher Secondary, Collegiate and University levels in terms of the Cognitive domain of Bloom's Taxonomy (Objective 1), and progression of question paper setting from the lower to higher level cognitive objectives in Education at Higher Secondary, Collegiate and University levels (Objective 2) were collected from Examination Cell of Mizoram Board of School Education and Mizoram University respectively. These data relate to old examination question papers of Education subject of HSSLC Board Examination, B.A End Semester Examination and M.A End Semester Examination for five consecutive years, i.e., 2011 to 2015.

3.7. Development of Tools:

Since very little research has been undertaken in the area of the present study, there is very few related literature available, especially in India. Most of the related works have been conducted abroad. Also no standardized tools for collecting data relating to the objective of the study were available. Therefore, the investigator, after consulting the relevant/related literature and having a series of

discussions with the supervisor, prepared the draft for each of the following five tools and distributed the same to various experts for comments and suggestions. Based on their suggestions, some items were added, some were modified and the final draft of these tools were prepared. A brief description of these tools are given as under:-

3.7.1. Bloom's Taxonomy Coding Scheme: The Coding Scheme for the Cognitive domain of Bloom's Taxonomy was developed after consulting the related works of 15 researchers downloaded from the internet. The investigator thoroughly studied the related literature and developed the Coding Scheme based on these works. For each of the six cognitive levels given by Bloom, viz., Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation, key words were compiled which are meant to be used as guides for framing or constructing questions, lesson plans, learning activities and tasks, to develop the levels of cognitive thinking of students. This Coding Scheme was used for analysis of Education question papers of Class XII, B.A and M.A. At the same time, it was used as a basis for the construction of other tools used in this study as well as for analysis of most of the data collected for the present study.

3.7.2. Cognitive Level Test: Cognitive Level Test was developed by the investigator to find out the cognitive level of students in terms of the Cognitive domain of Bloom's Taxonomy. This test was designed on the basis of similar tests conducted previously by other researchers in different parts of the world (Prasetyo, 2010 & McBain. 2011). In this test, the students were provided reading materials on two topics from Educational Psychology, namely Individual Difference and Mental Health and Hygiene; and a response sheet for setting 5 questions each from these two topics. The students were

asked to read the passages and then frame 5 questions of different difficulty levels for each of the two topics. The investigator clearly explained that they had to assign ratings from 1 to 5 in terms of increasing difficulty order of questions framed. These questions were then analyzed in terms of Bloom's Taxonomy Coding Scheme to find out at which cognitive level the students are functioning.

3.7.3 Opinionnaire: Opinionnaire for Teachers was developed by the investigator with the help of the supervisor to study teachers' understanding of Bloom's Taxonomy and its implications in question-paper setting. It consisted of 22 statements where three options were given for each statement and the respondent simply has to tick their choice of answer. It had three sections –

Section 1 - Awareness of teachers regarding Bloom's Taxonomy

Section 2 - Application of Bloom's Taxonomy in teaching-learning and evaluation

Section 3 - Attitude of teachers towards Bloom's Taxonomy

3.7.4 Pre-Test Post-Test Experiment: A schedule was developed by the investigator and the supervisor for conducting the Pre-Test and Post-Test Experiment comprising of a combination of questionnaires and exercises. Both the test schedules had 12 items each, where 4 questions were included only in the Pre-test, 4 questions were included only in the Post-test and there were 8 common questions in both the Pre-test and Post-test. The test schedules covered areas like purpose of formative and summative testing, awareness on classification of questions and difficulty level of

questions, construction and classification of key verbs for framing questions, arrangement of levels of students learning, setting of questions, etc. The Pre-test schedule was distributed to the sample which was then duly collected after completion. After this, intervention in the form of training on the use of Bloom's Taxonomy in setting of question papers was conducted by the investigator with the help of the supervisor. Post-test was conducted after an interval of one week. The details about the questions/statements included in the Pre-test and Post-test have been given in Table 3.4.

Table 3.5

Pre-Test Post-Test Questions

<table>
<tr><th colspan="3">QUESTIONS/STATEMENTS INCLUDED IN THE PRE -TEST POST TEST EXPERIMENT</th></tr>
<tr><th colspan="3">A. QUESTIONS/STATEMENTS INCLUDED ONLY IN THE PRE-TEST</th></tr>
<tr><th colspan="2">Questions/Statements</th><th>Remarks</th></tr>
<tr><td>1</td><td>Have you ever been appointed as a paper setter?</td><td rowspan="4">These questions/statements were included only in the pre- test to understand the experience and training of the participants in question paper setting. They were asked about their experience in question paper setting at college and university levels and the frequency of these appointments, the reference materials they used when setting question papers, whether they had attended any type of training on question setting and the quality and duration of such training, their opinion regarding the importance of conducting training on question setting and their knowledge/awareness of Bloom’s Taxonomy. Data gathered for these items have been used to explain the background experiences of the participants in the experiment.</td></tr>
<tr><td>2</td><td>Have you ever got any formal training in question paper setting?</td></tr>
<tr><td>3</td><td>In your opinion, how would you rate the importance of conducting training on question paper setting?</td></tr>
<tr><td>4</td><td>Have you ever come across Bloom’s Taxonomy of Educational Objectives?</td></tr>
</table>

B.	QUESTIONS/STATEMENTS INCLUDED ONLY IN THE POST-TEST	
Questions/Statements		**Remarks**
1	What was the quality of training on question paper setting provided in the last class?	These questions/statements were included only in the post- test to understand the view of the participants regarding the quality of training in question paper setting provided to them, their opinion on the importance of conducting training on question setting for college and university teachers, to evaluate their understanding of the cognitive levels of Bloom's Taxonomy, and their preference for questions at different levels of education. Data gathered for these items have been used to explain the learning experiences of the participants in the experiment.
2	In the background of brief training on question paper setting provided to you in the last class, how would you rate the importance of conducting such training for college and university teachers?	
3	Go through the following questions and write in front of each of these question the level to which it belongs to in terms of Bloom's taxonomy of educational objectives.	
4	In your opinion, what percentage of question at different stages of education should relate to the six categories suggested by Bloom' taxonomy.	

C.	COMMON QUESTIONS/STATEMENTS INCLUDED IN BOTH PRE-TEST AND POST TEST	
	Questions/Statements	**Remarks**
1	Do you think there is a need for conducting such training for teachers?	These questions/statements were included in both the pre-test and post-test in order to find out the impact of training on question paper setting using Bloom's Taxonomy. These common questions were used to compare the performance of the participants on various issues like need for formative and summative testing, classification of questions, arrangement of questions according to difficulty level, writing of verbs for setting questions, rating situations of student learning from lowest to highest level, and setting questions of different difficulty order. Data gathered for these items have been used to determine if there was improvement in the post-test performance as well as to determine the success of the intervention programme and the experiment.
2	Why do we conduct class tests/unit tests/term tests?	
3	Why do we conduct annual/semester exams?	
4	Describe the various classification of questions?	
5	Arrange the following types of questions in terms of their difficulty order by writing 1 in front of the most easiest and 6 in front of the most difficult.	
6	Write twenty (20) verbs like What, Define, explain etc. that are used in framing questions.	
7	The following table describes situations depicting six levels of students learning. You are expected to rate these levels from the lowest to highest level of students learning by writing 1 in front of a situation that is indicative of lowest level, and by writing 6 in front of the situation that depicts highest level of students' learning.	
8	Set 6 questions for end semester examination in the subject you teach and write the difficulty order in front of each question. (Write No.1 in front of the easiest question and No. 6 in front of the most difficult).	

3.8. Establishment of Reliability of Various Tools of Data Collection:

Since the tools used in this study were all constructed by the investigator with the help of the supervisor, the responses to different test items are not scored in the usual sense of the term and various items cannot be added up like scores. So the well known methods of establishing reliability cannot be used. To test the reliability of the tools, the investigator applied Test-Retest method on two of the tools, i.e., Cognitive Level Test and Opinionnaire for Teachers by administering the tests twice on a small sample for the teachers and the students and found them to be reliable.

3.9. Establishment of Validity of Various Tools of Data Collection:

As the questionnaires and tests were constructed to obtain data from different stakeholders on different issues related to question paper setting in terms of the Cognitive domain of Bloom's Taxonomy, a single overall index of validity for these tools cannot be established. To ensure the validity of these tools, standard procedures and principles were followed while framing the tests and questionnaires. It was ensured that the items in the tests and questionnaires cover a significant aspect of the investigation. Content Validity was also established by distributing the tools to a number of experts for a deeper study.

3.10. Administration and Scoring Process:

As a preliminary step, a draft of the different tools to be used for the study was made and distributed to experts with a request to make comments and necessary modifications. Based on their suggestions, some items were modified, some were cancelled and others were added. The modified tools were then administered to the selected sample of students and teachers for data collection.

Coding Scheme for Bloom's Taxonomy was constructed after consulting the works of 15 researchers downloaded from the Internet. The investigator compiled Coding Scheme based on these different works and distributed it to several experts for necessary modifications. The modified Coding Scheme was then used as a tool for analyzing the Education question papers of Class XII, B.A and M.A (Board and End Semester Examinations) of five consecutive years, i.e., 2011-2015. The question papers were analyzed based on the Coding Scheme and each question was categorized into different levels of the Cognitive Domain – Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation. Cognitive Level Test was administered to the same set of 776 students of Class XII, B.A and M.A. The test consisted of two sets where the students had to set 5 questions of different difficulty levels from two topics in Educational Psychology provided to them.

Opinionnaire for Teachers consisting of 22 questions was administered on 163 teachers to study their awareness regarding the importance of Cognitive domain of Bloom's Taxonomy on question paper setting. The 163 sample

consisted of 76 Higher Secondary School Education Teachers, 70 Under Graduate Education Teachers and 17 Post Graduate Education Teachers. The respondents were requested to put a tick mark on the answer of their choice provided against each statement.

Pre-Test/Post-Test Experiment was administered on 30 teachers to study the impact of training of teachers in Bloom's Taxonomy on their question-paper setting. Both the Pre-test and Post-test schedule consisted of 12 items each which are a combination of questionnaires and test exercises.

All the tools of data collection were administered on the selected sample of students and teachers. The respondents were asked to answer sincerely and the filled-in copies were then collected for analysis. Scoring in terms of frequency distribution was done and the percentages were worked out for each questionnaire/test according to the nature of the statement.

The final forms of the tools of data collection used for the present study has been given in Appendices 1, 2, 3, 4 and 5.

3.11. Statistical Techniques Applied for Analysis of Data:

Given the nature of data and the objectives of the study, Descriptive Statistics like frequency distribution, percentages and t-test for large correlated sample (Single Group Method) were applied for the analysis and interpretation of data.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

(Analysis & Progression of Question Papers)

4.0 Introduction

The present chapter deals with the analysis and interpretation of data collected for the purpose of achieving the objectives of the present study. The data obtained for the various objectives were collected personally by the investigator by visiting several institutions, and these were scored following standard scoring procedures. The scores were classified, tabulated and analyzed with the help of standard statistical techniques, keeping in view the objectives of the study and the findings were meaningfully interpreted.

This chapter is an attempt to analyze the data relating to three objectives:- 1) To analyze examination question papers in Education at Higher Secondary, Collegiate and University levels of five consecutive years (2011-2015) in terms of the Cognitive domain of Bloom's Taxonomy of Educational Objectives. 2) To study the progression of question paper setting from the lower to higher level cognitive objectives in Education at Higher Secondary, Collegiate and University levels. 3) To find out the cognitive levels of students of Higher secondary, Collegiate and University in terms of the cognitive levels of Bloom's Taxonomy. For the convenience of presentation, this chapter has been divided into the following sub-heads:-

4.1 Analysis of Examination Question Papers in Education of Higher Secondary, Collegiate and University levels of five consecutive years i.e., 2011 to 2015 (Objective 1)

4.2 Progression of question-paper setting from the lower to higher level cognitive objectives in Education of Class XII, B.A and M.A (Objective 2)

4.3 Cognitive levels of students of Higher Secondary, Collegiate and University in terms of the cognitive levels of Bloom's Taxonomy
(Objective 3)

4.1 Analysis of Examination Question Papers in Education of Higher Secondary, Collegiate and University levels of five consecutive years i.e., 2011 to 2015 (Objective 1):

The HSSLC (Arts) Board Examination question papers in Education, B.A (Education) Final/End Semester Examination question papers and M.A (Education) End Semester question papers of five consecutive years, i.e., 2011-2015 were analyzed on the basis of Bloom's Taxonomy Coding Scheme developed by the investigator. These old question papers were collected from the Examination Cells of Mizoram Board of School Education (HSSLC) and Mizoram University (B.A and M.A) respectively. All the questions were carefully scrutinized and then categorized in their proper levels of the Cognitive domain of Bloom's Taxonomy. The major findings with regard to analysis of examination question papers in Education (Objective 1) are presented in the following paragraphs.

4.1.1. Analysis of Higher Secondary School Education Question Papers 2011-2015:

The Class XII Board Examination question papers of Education of five consecutive years, i.e., 2011-2015 were analyzed in terms of Bloom's Taxonomy Coding Scheme. All the questions were individually analyzed by the investigator on the basis of the Coding Scheme and then placed in their respective categories of the Cognitive levels of Bloom's Taxonomy. The findings in this regard are presented as follows:

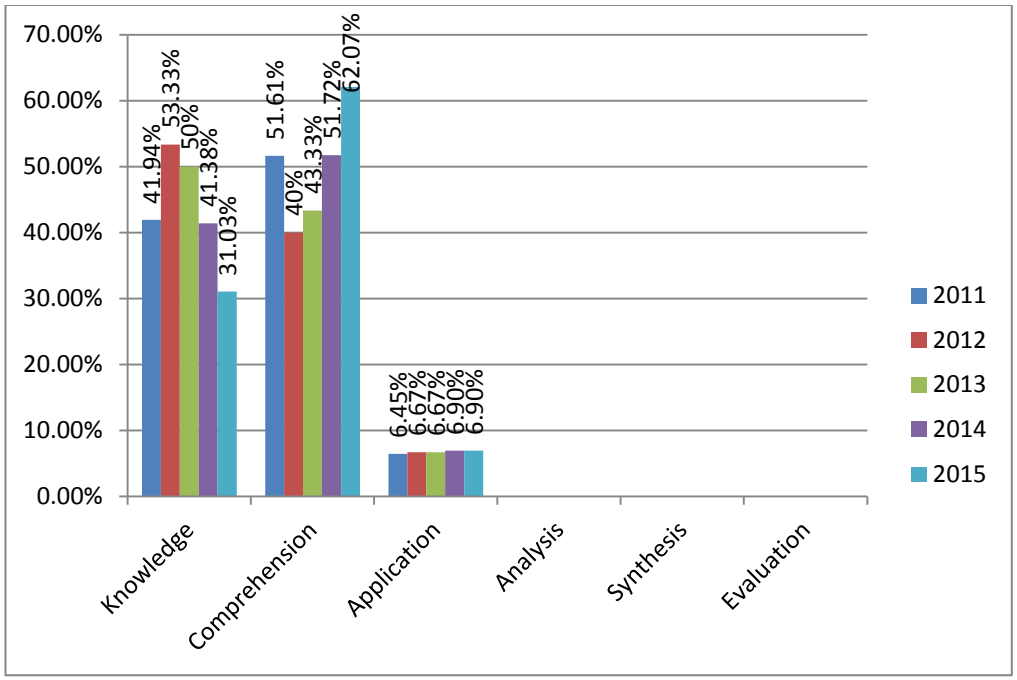
Table 4.1.1

Analysis of HSSLC Education Question Papers 2011-2015

Year	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
2011	41.94%	51.61%	6.45%	-	-	-
2012	53.33%	40%	6.67%	-	-	-
2013	50%	43.33%	6.67%	-	-	-
2014	41.38%	51.72%	6.90%	-	-	-
2015	31.03%	62.07%	6.90%	-	-	-
2011-2015	43.54%	49.74%	6.72%	-	-	-

Figure 4. 1

Consolidated Picture of Higher Secondary School (Class XII) Education Question Papers 2011-2015



In 2011, more than half of the question (51.61%) came from Comprehension domain, a large number from Knowledge domain (41.94%) and a small number (6.45%) from Application domain. All the questions came from these three domains only.

In 2012, majority of the questions (53.33%) were from Knowledge domain, followed by Comprehension domain (40%) and a small number (6.67%) from Application domain.

In 2013, half of the questions (50%) came from Knowledge domain, followed closely by Comprehension domain (43.33%) and Application domain (6.67%).

In 2014, more than half of the questions (51.72%) came from Comprehension domain, a large number (41.38%) from Knowledge domain, and a small number (6.90%) from Application domain.

In 2015, majority of the questions asked belonged to Comprehension (62.07%) which was followed by Knowledge (31.03%) and Application (6.90%).

The above Table 4.1.1 clearly indicates that in the HSSLC (Arts) Examination question papers in Education of five consecutive years, i.e., 2011-2015, majority of the questions were asked from the Lower Order Cognitive Objectives of Bloom's Taxonomy, namely Knowledge, Comprehension and Application. No questions were asked from the Higher Order Cognitive Objectives like Analysis, Synthesis and Evaluation. In fact, the highest number of questions came from Comprehension domain (49.74%), followed by Knowledge domain (43.45%) and a very small number from Application domain (6.72%).

Hence, we can conclude that the Higher Secondary School Board Examination Question Papers in Education of five consecutive years, i.e., 2011-2015 have covered only the Lower Order Cognitive Objectives of Bloom's Taxonomy.

Majority of the questions were directed towards testing the Knowledge and Comprehension skills of students. Though a small percentage of questions came from Application (6.72%), it was negligible. Thus, based on the findings of the present study, it may be sadly concluded that the HSSLC Education question papers of 2011-2015 have paid no attention to developing the Higher Order Cognitive Skills of students such as Analysis, Synthesis and Evaluation. This result may be due to defective curriculum, low quality of classroom instruction and interaction, ineffective assessment techniques, inadequate training of teachers, etc., and should be addressed and corrected promptly.

4.1.2. Analysis of B.A Education Question Papers 2011-2015:

Twelve papers offered in B.A Education course were selected for analysis for the present study. The name/title of these papers is given in Table 4.1.2. These B.A Education Final Examination/End Semester Question Papers were analyzed by the investigator on the basis of Bloom's Taxonomy Coding Scheme. Each question was individually analyzed and then categorized into the different cognitive levels of Bloom's Taxonomy. The findings in this regard are presented as follows:

Table 4.1.2

Analysis of B.A Education Question Papers 2011-2015

Name of Paper	Year	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
1. Psychological Foundations of Education (Paper I)	**2011**	17.65%	76.47%	-	5.88%	-	-
	2012	36.84%	57.9%	-	5.26%	-	-
	2013	38.89%	61.11%	-	-	-	-
	2014	38.89%	55.56%	-	5.55%	-	-
	2015	36.84%	57.9%	-	5.26%	-	-
2. Philosophical & Sociological Foundations of Education (Paper II)	**2011**	41.67%	41.67%	-	16.66%	-	-
	2012	35.29%	47.06%	-	17.65%	-	-
	2013	41.18%	52.94%	-	5.88%	-	-
	2014	35.29%	52.94%	-	11.77%	-	-
	2015	40%	40%	-	13.33%	-	6.67%
3. Development of Education in India (Paper III)	**2011**	33.33%	41.67%	-	16.67%	-	8.33%
	2012	-	80%	-	20%	-	-
	2013	40%	30%	-	30%	-	-
	2014	45.45%	45.45%	-	9.10%	-	-
	2015	-	80%	-	20%	-	-

4. Issues & Trends in Contemporary Indian Education (Paper IV)	**2011**	18.75%	56.25%	-	12.5%	-	12.5%
	2012	33.34%	53.33%	-	13.33%	-	-
	2013	33.33%	53.33%	-	6.67%	-	6.67%
	2014	18.75%	43.75%	-	18.75%	-	18.75%
	2015	28.57%	57.14%	-	14.29%	-	-
5. Research Methodology (Paper V)	**2011**	33.33%	55.56%	-	-	-	11.11%
	2012	18.18%	81.82%	-	-	-	-
	2013	15.38%	84.62%	-	-	-	-
	2014	23.53%	76.47%	-	-	-	-
	2015	22.22%	77.78%	-	-	-	-
6. Educational Evaluation (Paper VII)	**2011**	36.36%	63.64%	-	-	-	-
	2012	30%	60%	-	10%	-	-
	2013	21.43%	78.57%	-	-	-	-
	2014	42.86%	42.86%	-	14.28%	-	-
	2015	35.71%	64.29%	-	-	-	-

7.Educational Technology (Paper VIII A)	**2011**	38.46%	61.54%	-	-	-	-
	2012	27.27%	63.64%	9.09%	-	-	-
	2013	30%	50%	-	20%	-	-
	2014	37.5%	56.25%	-	6.25%	-	-
	2015	33.33%	66.67%	-	-	-	-
8.Educational Quidance and Counselling (Paper VIII B)	**2011**	40%	30%	10%	10%	-	10%
	2012	33.34%	50%	8.33%	8.33%	-	-
	2013	26.67%	53.33%	6.67%	13.33%	-	-
	2014	13.33%	66.67%	-	13.33%	-	6.67%
	2015	33.33%	40%	-	20%	-	6.67%
9. Curriculum Development (Paper IX)	**2011**	30%	70%	-	-	-	-
	2012	33.33%	66.67%	-	-	-	-
	2013	42.86%	50%	-	7.14%	-	-
	2014	33.33%	60%	-	6.67%	-	-
	2015	28.57%	42.86%	-	28.57%	-	-

10. Educational Planning & Management (Paper X)	**2011**	35.71%	64.29%	-	-	-	-
	2012	25%	66.67%	-	8.33%	-	-
	2013	25%	58.33%	-	16.67%	-	-
	2014	21.43%	71.43%	-	-	-	7.14%
	2015	16.66%	72.22%	-	5.56%	-	5.56%
11. Development of Educational Thought (Paper XI)	**2011**	23.08%	76.92%	-	-	-	-
	2012	7.14%	78.57%	-	14.29%	-	-
	2013	16.67%	66.66%	-	16.67%	-	-
	2014	21.42%	64.29%	-	14.29%	-	-
	2015	7.14%	64.28%	-	14.29%	-	14.29%
12. Special Education (Paper XII C)	**2011**	33.33%	66.67%	-	-	-	-
	2012	62.5%	31.25%	6.25%	-	-	-
	2013	42.86%	42.86%	14.28%	-	-	-
	2014	18.75%	50%	12.50%	18.75%	-	-
	2015	20%	60%	13.33%	6.67%	-	-

In Psychological Foundations of Education (Paper I), majority of the questions were asked from Comprehension domain (76.47% in 2011, 57.9% in 2012, 61.11% in 2013, 55.56% in 2014 and 57.9% in 2015), followed by Knowledge domain (17.65% in 2011, 36.84% in 2012, 38.89% in 2013 and 2014, and 36.84% in 2015). A small number of questions came from Analysis domain (5.88% in 2011, 5.26% in 2012, 5.55% in 2014 and 5.26% in 2015). There were no questions from Application, Synthesis and Evaluation domains.

In Philosophical & Sociological Foundations of Education (Paper II), about half of the questions belonged to the Comprehension domain (41.67% in 2011, 47.06% in 2012, 52.94% in 2013 and 2014, and 40% in 2015) followed by Knowledge domain (41.67% in 2011, 35.29% in 2012, 41.18% in 2013, 35.29% in 2014 and 40% in 2015). There was a slight increase in the number of questions from Analysis domain as compared to Paper 1 (16.66% in 2011, 17.65% in 2012, 5.88% in 2013, 11.77% in 2014 and 13.33% in 2015). A small number of questions (6.67% in 2015) were asked from Evaluation domain and there were no questions from Application and Synthesis domains.

In Development of Education in India (Paper III), a large number of questions came from Comprehension domain (41.67% in 2011, 80% in 2012, 30% in 2013, 45.45% in 2014 and 80% in 2015); followed by Knowledge domain (33.33% in 2011, 40% in 2013. 45.45% in 2014). A small number of questions were asked from Analysis domain (16.67% in 2011, 20% in 2012, 30% in 2013, 9.10% in 2014 and 20% in 2015) and Evaluation domain (8.33% in 2011). The percentage of

questions from Analysis level is higher in Paper III as compared to Paper I & II. However, there were no questions from Application and Synthesis domains.

In Issues & Trends in Contemporary Indian Education (Paper IV), more than half of the questions belonged to Comprehension domain (56.25% in 2011, 53.33% in 2012 and 2013, 43.75% in 2014 and 57.14% in 2015) followed by Knowledge domain questions (18.75% in 2011, 33.34% in 2012, 33.33% in 2013, 18.75% in 2014 and 28.57% in 2015). A number of questions were also asked from Analysis domain (12.5% in 2011, 13.33% in 2012, 6.67% in 2013, 18.75% in 2014 and 14.29% in 2015) and Evaluation domain (12.5% in 2011, 6.67% in 2013 and 18.75% in 2014). No questions were asked from Application and Synthesis domains. However, there is a slight increase in the percentage of questions from Evaluation domain as compared to other papers.

In Research Methodology (Paper V), most of the questions were asked from Comprehension domain (55.56% in 2011, 81.82% in 2012, 84.62% in 2013, 76.47% in 2014 and 77.78% in 2015) followed by Knowledge domain (33.33% in 2011, 18.18% in 2012, 15.38% in 2013, 23.53% in 2014 and 22.22% in 2015) and Evaluation domain (11.11% in 2011). In this paper, majority of the questions belong to the two lower cognitive domains, a negligible percentage (11.11%) from Evaluation domain and none from Application, Analysis and Synthesis.

In Educational Evaluation (Paper VII), a large number of questions belonged to Comprehension domain (63.64% in 2011, 60% in 2012, 78.57% in 2013,

42.86% in 2014 and 64.29% in 2015) followed by Knowledge domain questions (36.36% in 2011, 30% in 2012, 21.43% in 2013, 42.86% in 2014 and 35.71% in 2015). A small number of questions were asked from Analysis domain (10% in 2012 and 14.28% in 2014) and there were no questions belonging to Application, Synthesis and Evaluation domains.

In Educational Technology (Paper VIII A), majority of the questions came from Comprehension level (61.54% in 2011, 63.64% in 2012, 50% in 2013, 56.25% in 2014 and 66.67% in 2015) followed by questions from Knowledge level (38.46% in 2011, 27.27% in 2012, 30% in 2013, 37.5% in 2014 and 33.33% in 2015). A few questions were asked from Application level (9.09%) and Analysis level (20% in 2013, 6.25% in 2014 and 20% in 2015). There were no questions from Synthesis and Evaluation levels.

In Educational Guidance & Counseling (Paper VIII B), about half of the questions were asked from Comprehension (30% in 2011, 50% in 2012, 53.33% in 2013, 66.67% in 2014 and 40% in 2015) followed by questions from Knowledge level (40% in 2011, 33.34% in 2012, 26.67% in 2013, 13.33% in 2014 and 33.33% in 2015). In this paper, several questions were also asked from Application (10% in 2011, 8.33% in 2012 and 6.67% in 2013), Analysis (10% in 2011, 8.33% in 2012, 13.33% in 2013 and 2014 and 20% in 2015) and Evaluation (10% in 2011, 6.67% in 2014 and 2015). However, there were no questions set from Synthesis level.

In Curriculum Development (Paper IX), majority of the questions belonged to Comprehension (70% in 2011, 66.67% in 2012, 50% in 2013, 60% in

2014 and 42.86% in 2015) followed by Knowledge (30% in 2011, 33.33 in 2012, 42.86% in 2013, 33.33% in 2014 and 28.57% in 2015). A small number also came from Analysis (7.14% in 2013, 6.67% in 2014 and 28.57% in 2015). No questions came from Application, Synthesis and Evaluation domains.

In Educational Planning & Management (Paper X), most of the questions asked were from Comprehension (64.29% in 2011, 66.67% in 2012, 58.33% in 2013, 71.43% in 2014 and 72.22% in 2015) and Knowledge (35.71% in 2011, 25% in 2012 and 2013, 21.43% in 2014 and 16.66% in 2015). Several questions also came from Analysis (8.33% in 2012, 16.67% in 2013 and 5.56% in 2015) and a small number (7.14% in 2014 and 5.56% in 2015) from Evaluation domain. In this paper, there were no questions from Application and Synthesis levels.

In Development of Educational Thought (Paper XI), the largest number of questions belonged to Comprehension (76.92% in 2011, 78.57% in 2012, 66.66% in 2013, 64.29% in 2014 and 64.28% in 2015). This was followed by an almost equal amount of questions from Knowledge (23.08% in 2011, 7.14% in 2012, 16. 67% in 2013, 21.42% in 2014 and 7.14% in 2015) and Analysis (14.29% in 2012, 16.67% in 2013, 14.29% in 2014 and 2015) respectively. A small number (14.29% in 2015) also came from Evaluation but no questions came from Application and Synthesis levels.

In Special Education (Paper XII C), more than half of the questions came from Comprehension (66.67% in 2011, 31.25% in 2012, 42.86% in 2013, 50%

in 2014 and 60% in 2015). A large number of questions belonged to Knowledge (33.33% in 2011, 62.5% in 2012, 42.86% in 2013, 18.75% in 2014 and 20% in 2015). Several questions were also asked from Application (6.25% in 2012, 14.28% in 2013, 12.50% in 2015) and a small number from Analysis (18.75% in 2014 and 6.67% in 2015). There were no questions from the two highest cognitive levels namely, Synthesis and Evaluation domains.

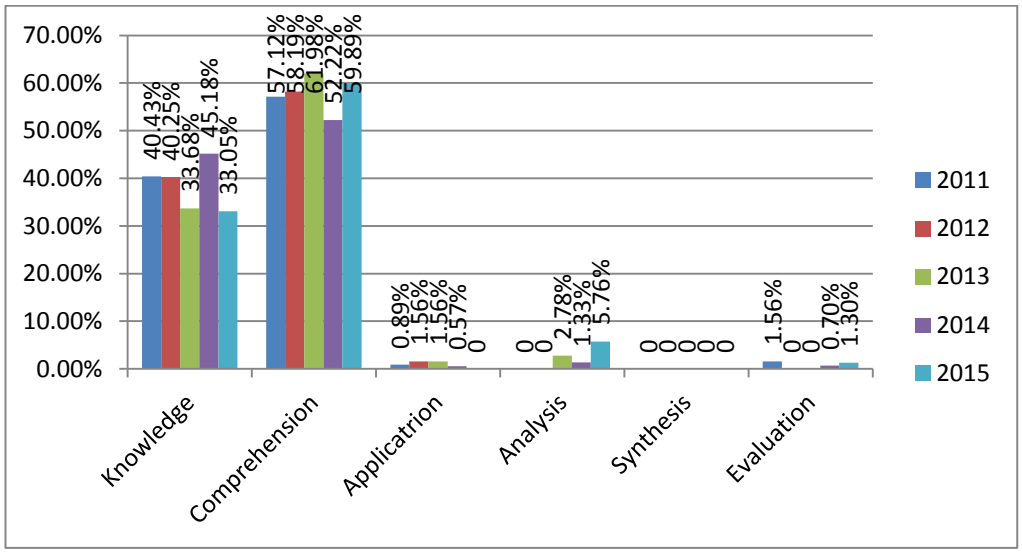
Table 4.1.3

Consolidated Analysis of B.A Education Question Papers 2011-2015

Year	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
2011	40.43%	57.12%	0.89%	-	-	1.56%
2012	40.25%	58.19%	1.56%	-	-	-
2013	33.68%	61.98%	1.56%	2.78%	-	-
2014	45.18%	52.22%	0.57%	1.33%	-	0.7%
2015	33.05%	59.89%	-	5.76%	-	1.3%
2011-2015	38.52%	57.88%	0.92%	1.97%	-	0.71%

Figure 4.2

Consolidated Picture of B.A Education Question Papers 2011-2015



The above Table 4.1.3 and Figure 4.2 shows the consolidated result of analysis of B.A Education question papers of five consecutive years, i.e., 2011 to 2015 in terms of Bloom's Taxonomy Coding Scheme. It clearly indicates that majority of the questions in the B.A Education question papers belonged to Comprehension domain (57.88%), followed by Knowledge domain (38.52%). There were a small percentage of questions from Analysis (1.97%), Application (0.92%) and Evaluation (0.71%) respectively. There were no questions from Synthesis level during these five years (2011 - 2015).

Hence, we can conclude that the B.A Education Final Examination/End Semester Examination question papers of 2011 to 2015 mostly concentrated on the two lower cognitive objectives, namely Comprehension and Knowledge. Although some questions were asked from the higher cognitive

objectives like Application, Analysis and Evaluation, they were very few. Synthesis level questions were completely absent. Thus, we may conclude that the B.A Education question papers of 2011-2015 have sadly neglected to test and develop the higher cognitive abilities of students like analytical, constructive and evaluative skills. The low quality of questions may be directly linked to poor curriculum package, low learning level of students, defective teaching-learning strategies, defective evaluation procedures and many more. It can be clearly seen that teachers need to improve the quality of their instruction and question-setting to a significantly higher standard.

4.1.3. Analysis of M.A Education Question Papers 2011-2015:

Fifteen papers of M.A Education course offered by Mizoram University were selected for analysis for the present study. M.A Education End Semester question papers from 2011-2015 were analyzed on the basis of Bloom's Taxonomy Coding Scheme where each question was individually analyzed and placed in their proper categories. The name of these 15 papers and the findings of the analysis are given below in Table 4.1.4

Table 4.1.4

Analysis of M.A Education Question Papers 2011-2015

Name of Paper	Year	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
1.Philosophical Foundations of Education (Paper I)	**2011**	29.42%	58.82%	-	11.76%	-	-
	2012	27.78%	61.11%	-	11.11%	-	-
	2013	31.25%	56.25%	-	12.50%		
	2014	35.29%	52.94%	-	11.77%	-	-
	2015	29.42%	47.05%	-	23.53%	-	-
2.Psychological Foundations of Education (Paper II)	**2011**	27.78%	50%	-	11.11%	-	11.11%
	2012	47.06%	47.06%	-	-	-	5.88%
	2013	37.50%	62.50%	-	-	-	-
	2014	25%	62.50%	-	12.50%	-	-
	2015	41.18%	52.94%	-	5.88%	-	-
3. Sociological Foundations of Education (Paper III)	**2011**	23.53%	47.06%	5.88%	23.53%	-	-
	2012	12.50%	81.25%	-	6.25%	-	-
	2013	18.75%	68.75%	-	12.50%	-	-
	2014	15.38%	61.54%	-	23.08%	-	-
	2015	33.33%	60%	-	-	-	6.67%

4. Research Methodology (Paper IV)	**2011**	31.58%	68.42%	-	-	-	-
	2012	33.33%	55.55%	5.56%	-	-	5.56%
	2013	25%	68.75%	-	-	-	6.25%
	2014	31.58%	57.89%	10.53%	-	-	-
	2015	20%	13.33%	46.67%	6.67%	-	13.33%
5. Curriculum Development (Paper V)	**2011**	29.42%	58.82%	5.88%	5.88%	-	-
	2012	13.33%	60%	-	26.67%	-	-
	2013	13.33%	46.67%	-	13.33%	-	26.67%
	2014	30.77%	61.54%	-	-	-	7.69%
	2015	27.78%	50%	-	-	-	22.22%
6.Teacher Education (Paper VI)	**2011**	42.86%	57.14%	-	-	-	-
	2012	33.33%	46.67%	-	20%	-	-
	2013	30.77%	69.23%	-	-	-	-
	2014	23.53%	70.59%	-	5.88%	-	-
	2015	25%	62.50%	-	-	-	12.50%

7. Educational Technology (Paper VII)	**2011**	11.76%	88.24%	-	-	-	-
	2012	21.43%	78.57%	-	-	-	-
	2013	14.28%	78.57%	-	7.15%	-	-
	2014	14.28%	71.44%	-	14.28%	-	-
	2015	16.67%	66.67%	-	8.33%	-	8.33%
8.Comparative Education (Paper VIII)	**2011**	28.57%	28.57%	-	28.57%	-	14.29%
	2012	33.33%	33.33%	-	16.67%	-	16.67%
	2013	15.38%	30.77%	-	46.16%	-	7.69%
	2014	21.43%	57.14%	-	21.43%	-	-
	2015	25%	43.75%	-	31.25%	-	-
9. Educational Testing & Evaluation (Paper IX)	**2011**	29.42%	70.58%	-	-	-	-
	2012	20%	66.66%	6.67%	6.67%	-	-
	2013	43.75%	50%	-	-	-	6.25%
	2014	25%	68.75%	-	6.25%	-	-
	2015	53.33%	46.67%	-	-	-	-

10.Educational Planning & Management (Paper X)	**2011**	29.42%	52.94%	-	5.88%	-	11.76%
	2012	35.29%	52.95%	-	11.76%	-	-
	2013	33.33%	33.33%	6.68%	13.33%	-	13.33%
	2014	40%	60%	-	-	-	-
	2015	50%	43.75%	-	-	-	6.25%
11.Higher Education (Paper XI)	**2011**	35.71%	28.57%	-	28.57%	-	7.15%
	2012	25%	62.50%	-	12.50%	-	-
	2013	40%	26.67%	-	26.67%	-	6.66%
	2014	33.33%	41.67%	-	25%	-	-
	2015	23.08%	61.54%	-	15.38%	-	-
12.Contemporary Issues in Education (Paper XII)	**2011**	50%	50%	-	-	-	-
	2012	38.46%	46.15%	-	15.39%	-	-
	2013	50%	37.50%	-	12.50%	-	-
	2014	22.22%	55.56%	-	11.11%	-	11.11%
	2015	16.67%	58.33%	-	8.33%	-	16.67%

13.Environmental Education (Paper XIII)	**2011**	37.50%	31.25%	-	25%	-	6.25%
	2012	21.43%	42.86%	21.43%	-	-	14.28%
	2013	37.50%	56.25%	-	6.25%	-	-
	2014	18.75%	43.75%	-	18.75%	-	18.75%
	2015	23.08%	61.54%	-	15.38%	-	-
14. Special Education (Paper XIV)	**2011**	22.22%	44.44%	-	16.67%	-	16.67%
	2012	35.29%	35.29%	5.88%	11.77%	-	11.77%
	2013	16.66%	55.56%	5.56%	5.56%	-	16.66%
	2014	38.88%	33.33%	5.56%	5.56%		16.67%
	2015	38.88%	44.44%	-	-	-	16.68%
15.Early Childhood Education (Paper XV)	**2011**	30.77%	30.77%	7.69%	30.77%	-	-
	2012	40%	33.34%	-	13.33%	-	13.33%
	2013	25%	41.67%	-	25%	-	8.33%
	2014	27.27%	18.18%	9.09%	9.09%	-	36.37%
	2015	28.57%	21.43%	-	35.71%	-	14.29%

In Philosophical Foundations of Education (Paper I), around half of the questions came from Comprehension level (58.82% in 2011, 61.11% in 2012, 56.25% in 2013, 52.94% in 2014 and 47.05% in 2015). This was followed by Knowledge level (29.42% in 2011, 27.78% in 2012, 31.25% in 2013, 35.29% in 2014 and 29.42% in 2015). A small number were also asked from Analysis level (11.76% in 2011, 11.11% in 2012, 12.50% in 2013, 11.77% in 2014 and 23.53% in 2015). There were no questions from Application, Synthesis and Evaluation domains.

In Psychological Foundations of Education (Paper II), the largest number of questions were set from Comprehension level (50% in 2011, 47.06% in 2012, 62.50% in 2013 and 2014 and 52.94% in 2015). This level was followed by Knowledge (27.78% in 2011, 47.06% in 2012, 37.50% in 2013, 25% in 2014 and 41.18% in 2015). There were several questions from Analysis level (11.11% in 2011, 12.50% in 2014 and 5.88% in 2015) and a negligible number (5.88% in 2011) from Evaluation level. In this paper, we see no questions set from Application and Synthesis levels.

In Sociological Foundations of Education (Paper III), majority of the questions belonged to Comprehension (47.06% in 2011, 81.25% in 2012, 68.75% in 2013, 61.54% in 2014 and 60% in 2015). Another large portion of questions were from Knowledge (23.53% in 2011, 12.50% in 2012, 18.75% in 2013, 15.38% in 2014 and 33.33% in 2015) followed by Analysis (23.53% in 2011, 6.25% in 2012, 12.50% in 2013 and 23.08% in 2014). A very small number also came from

Application (5.88%) and Evaluation (6.67%) but no questions were asked from Synthesis level.

In Research Methodology (Paper IV), majority of questions were asked from Comprehension level (68.42% in 2011, 55.55% in 2012, 68.75% in 2013, 57.89% in 2014 and 13.33% in 2015) followed by Knowledge level (31.58% in 2011, 33.33% in 2012, 25% in 2013, 31.58% in 2014 and 20% in 2015). A large number of questions were also set from Application level (5.56% in 2012, 10.53% in 2014, and 46.67% in 2015) and Evaluation level (5.56% in 2012, 6.25% in 2013 and 13.33% in 2015). A very small number (6.67%) was from Analysis level and no questions from Synthesis level.

In Curriculum Development (Paper V), more than half of the questions belonged to Comprehension (58.82% in 2011, 60% in 2012, 46.67% in 2013, 61.54% in 2014 and 50% in 2015). This level was followed by Knowledge (29.42% in 2011, 13.33% in 2012 and 2013, 30.77% in 2014 and 27.78% in 2015), Evaluation (26.67% in 2013, 7.69% in 2014 and 22.22% in 2015), Analysis (5.88% in 2011, 26.67% in 2012 and 13.33% in 2014) and Application (5.88% in 2012) respectively. No questions came from Synthesis level.

In Teacher Education (Paper VI), majority of the questions belonged to Comprehension domain (57.14% in 2011, 46.67% in 2012, 69.23% in 2013, 70.59% in 2014 and 62.50% in 2015). Another large portion of questions came from Knowledge domain (42.86% in 2011, 33.33% in 2012, 30.77% in 2013, 23.53% in 2014 and 25% in 2015). Only a small percentage were from Analysis (20% in 2012

and 5.88% in 2014) and Evaluation (12.50% in 2015). There were no questions from Application and Synthesis.

In Educational Technology (Paper VII), the questions were asked mostly from Comprehension level (88.24% in 2011, 78.57% in 2012 and 2013, 71.44% in 2014 and 66.67% in 2015). A small number belonged to Knowledge level (11.76% in 2011, 21.43% in 2012, 14.28% in 2013 and 2014 and 16.67% in 2015) and an even lesser number from Analysis level (7.15% in 2013, 14.28% in 2014 and 8.33% in 2015). In this paper, the questions were concentrated in Comprehension, Knowledge and Analysis domains only.

In Comparative Education (VIII), the questions were quite evenly distributed between Comprehension level (28.57% in 2011, 33.33% in 2012, 30.77% in 2013, 57.14% in 2014 and 43.75% in 2015), Analysis level (28.57% in 2011, 16.67% in 2012, 46.16% in 2013, 21.43% in 2014 and 31.25% in 2015) and Knowledge level (28.57% in 2011, 33.33% in 2012, 15.38% in 2013, 21.43% in 2014 and 25% in 2015). A small number of questions were also set from Evaluation level (14.29% in 2011, 16.67% in 2012 and 7.69% in 2013) but no questions from Application and Synthesis levels.

In Educational Testing & Evaluation (Paper IX), majority of the questions belonged to Comprehension (70.58% in 2011, 66.66% in 2012, 50% in 2013, 68.75% in 2014 and 46.67% in 2015) followed by Knowledge (29.42% in 2011, 20% in 2012, 43.75% in 2013, 25% in 2014 and 53.33% in 2015) and then

Analysis (6.67% in 2012 and 6.25% in 2014). A very small number came from Application (6.67% in 2012) and Evaluation (6.25% in 2013) and none from Synthesis level.

In Educational Planning & Management (Paper X), about half of the questions belonged to Comprehension domain (52.94% in 2011, 52.95% in 2012, 33.33% in 2013, 60% in 2014 and 43.75% in 2015) followed closely by Knowledge domain (29.42% in 2011, 35.29% in 2012, 33.33% in 2013, 40% in 2014 and 50% in 2015). An almost equal number of questions came from Evaluation (11.76% in 2011, 13.33% in 2013 and 6.25% in 2015) and Analysis (5.88% in 2011, 11.76% in 2012 and 13.33% in 2013) and a very small number (6.68% in 2013) from Application. There was no question from Synthesis level.

In Higher Education (Paper XI), majority of the questions were set from Comprehension level (28.57% in 2011, 62.50% in 2012, 26.67% in 2013, 41.67% in 2014 and 61.54% in 2015) followed by Knowledge level (35.71% in 2011, 25% in 2012, 40% in 2013, 33.33% in 2014 and 23.08% in 2015) and Analysis level (28.57% in 2011, 12.50% in 2012, 26.67% in 2013, 25% in 2014 and 15.38% in 2015). A small percentage (7.15% in 2011 and 6.66% in 2013) were also asked from Evaluation level and none were set from Synthesis level.

In Contemporary Issues in Education (Paper XII), a little more than half of the questions came from Comprehension (50% in 2011, 46.15% in 2012, 37.50% in 2013, 55.56% in 2014 and 58.33% in 2015). A large number of the

questions were also set from Knowledge (50% in 2011, 38.46% in 2012, 50% in 2013, 22.22% in 2014 and 16.67% in 2015). Several questions belonged to Analysis (15.39% in 2012, 12.50% in 2013, 11.11% in 2014 and 8.33% in 2015) and a small number from Evaluation (11.11% in 2014 and 16.67% in 2015). There were no questions from Application and Synthesis levels.

In Environmental Education (Paper XIII), around half of the questions were asked from Comprehension level (31.25% in 2011, 42.86% in 2012, 56.25% in 2013, 43.75% in 2014 and 61.54% in 2015) followed by Knowledge level questions (37.50% in 2011, 21.43% in 2012, 37.50% in 2013, 18.75% in 2014 and 23.08% in 2015). A small number was also asked from Analysis (25% in 2011, 6.25% in 2013, 18.75% in 2014 and 15.38% in 2015) and Evaluation (6.25% in 2011, 14.28% in 2012 and 18.75% in 2014). A negligible percentage was also asked from Application level (21.43% in 2012) but none from Synthesis level.

In Special Education (Paper XIV), the number of questions were almost evenly distributed between Comprehension (44.44% in 2011, 35.29% in 2012, 55.56% in 2013, 33.33% in 2014 and 44.44% in 2015) and Knowledge (22.22% in 2011, 35.29% in 2012, 16.66% in 2013, 38.88% in 2014 and 2015). Several questions were also asked from Evaluation (16.67% in 2011, 11.77% in 2012, 16.66% in 2013, 16.67% in 2014 and 16.68% in 2015) and Analysis (16.67% in 2011, 11.77% in 2012, 5.56% in 2013 and 2014). A small number also came from Application (5.88% in 2012, 5.56% in 2013 and 2014) but Synthesis level questions were neglected entirely.

In Early Childhood Education (Paper XV), almost equal percentage of questions came from Knowledge domain (30.77% in 2011, 40% in 2012, 25% in 2013, 27.27% in 2014 and 28.57% in 2015) and Comprehension domain (30.77% in 2011, 33.34% in 2012, 41.67% in 2013, 18.18% in 2014 and 21.43% in 2015) followed closely by Analysis domain (30.77% in 2011, 13.33% in 2012, 25% in 2013, 9.09% in 2014 and 35.71% in 2015) and Evaluation (13.33% in 2012, 8.33% in 2013, 36.37% in 2014 and 14.29% in 2015). A very small number also came from Application level (7.69% in 2011 and 9.09% in 2014) with no questions from Synthesis level.

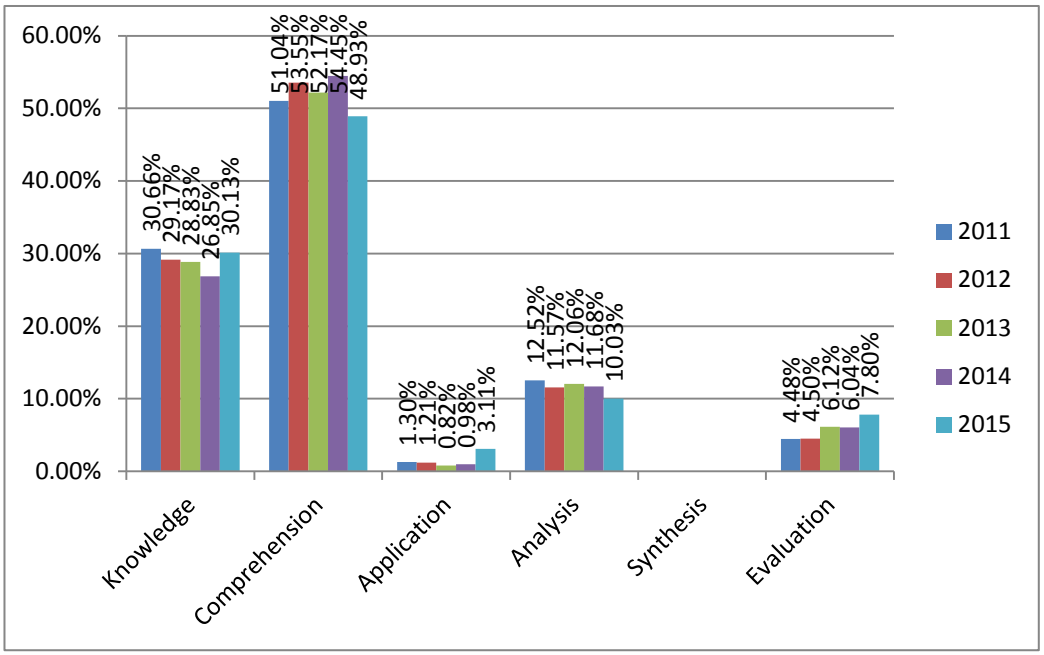
Table 4.1.5

Consolidated Analysis of M.A Education Question Papers 2011-2015

Year	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
2011	30.66%	51.04%	1.30%	12.52%	-	4.48%
2012	29.17%	53.55%	1.21%	11.57%	-	4.50%
2013	28.83%	52.17%	0.82%	12.06%	-	6.12%
2014	26.85%	54.45%	0.98%	11.68%	-	6.04%
2015	30.13%	48.93%	3.11%	10.03%	-	7.80%
2011-15	29.13%	52.03%	1.48%	11.57%	-	5.79%

Figure 4.3

Consolidated Picture of M.A Education Question Papers 2011-2015



The above Table 4.1.5 and Figure 4.3 clearly shows the consolidated result of M.A Education End Semester Examination question papers of five consecutive years, i.e., 2011 to 2015. It can be seen that majority of the questions (52.03%) belonged to Comprehension level, followed by Knowledge level (29.13%), Analysis level (11.57%), Evaluation level (5.79%) and Application level (1.48%). There were no questions from Synthesis level in any of the five years.

Thus, it can be concluded that majority of the questions in M.A Education examination papers concentrated on the two lower cognitive domains of Bloom's Taxonomy namely, Comprehension and Knowledge. Although several questions were asked from the higher cognitive levels, they were not of sufficient quantity, especially at the university level. Less questions covering Knowledge and

Comprehension skills and more questions from Application, Analysis, Synthesis and Evaluation domains need to be included in future in order to produce more quality students.

4.1.4. Consolidated Analysis of Higher Secondary, Collegiate and University Examination Question papers in Education of 2011 to 2015:

The consolidated analysis result of HSSLC, B.A and M.A Education question papers from 2011 to 2015 are given in the table below.

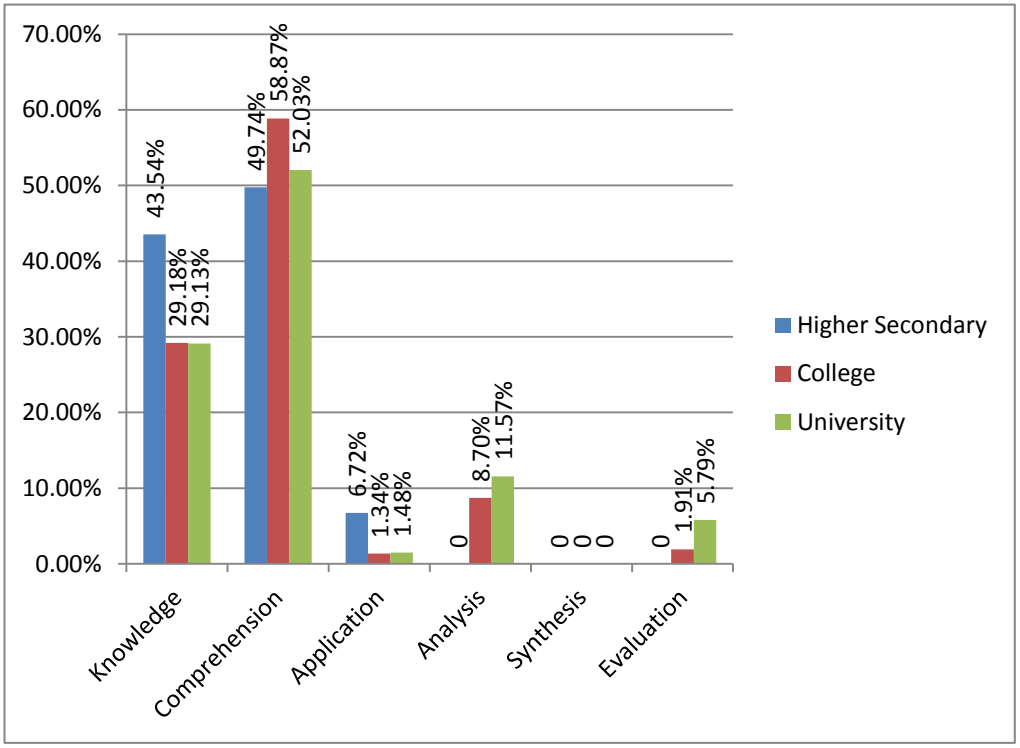
Table 4.1.6

Consolidated Analysis of HSSLC, B.A and M.A Education Examination Question Papers 2011-2015

Taxonomy Levels	Higher Secondary	College	University
Knowledge	43.54%	29.18%	29.13%
Comprehension	49.74%	58.87%	52.03%
Application	6.72%	1.34%	1.48%
Analysis	-	8.7%	11.57%
Synthesis	-	-	-
Evaluation	-	1.91%	5.79%
Total	**100%**	**100%**	**100%**

Figure 4.4

Consolidated Picture of Question Paper Analysis at Higher Secondary, Collegiate and University Levels 2011 to 2015



The above Table 4.1.6 and Figure 4.4 clearly indicates that Education question papers of Class XII, B.A and M.A final examination concentrated largely on testing the Comprehension skills of students (49.74% in Class XII, 57.88% in BA & 52.03% in MA). This was followed by Knowledge questions in all three stages/levels (43.54% in Class XII, 38.52% in BA & 29.13% in MA) and then by Application level questions (6.72% in Class XII, 0.92% in BA and 1.48% in M.A). The Higher Secondary School Education question papers concentrated solely on the three lower cognitive domains and no questions were asked from the three higher cognitive domains. The BA Education question papers concentrated largely on the three lower cognitive domains with a small percentage of questions coming from the higher three

domains. Likewise, the M.A Education papers also concentrated more on the three lower domains although there were more questions from the higher three domains compared to the Higher Secondary School and B.A Education question papers.

These findings clearly reveal that the quality of question papers in Education subject of Higher Secondary, Collegiate and University stages is quite low. All three stages have concentrated largely on testing the Knowledge and Comprehension skills of students. There has been very little effort to test and develop the higher cognitive skills of students. If this situation is not rectified promptly, we will produce more and more unemployable graduates and post-graduates. In order to produce useful and productive students, we must provide quality higher education. This can be achieved by adjusting our way of teaching and questioning towards higher order cognitive skills provided by Bloom's Taxonomy.

4.2 Progression of Question Paper Setting from the Lower to Higher level Cognitive objectives in Education at Higher Secondary, Collegiate and University levels (Objective 2)

Education final examination question papers of Class XII, B.A and M.A of five consecutive years, i.e., 2011 to 2015 were analyzed, categorized and tabulated on the basis of Bloom's Taxonomy Coding Scheme developed by the investigator. The results of this analysis clearly reveal the progression of question-paper setting from the lower to higher order cognitive objectives of Bloom's Taxonomy during the five years selected for analysis for the present study. The findings in this regard are presented as follows.

4.2.1 Progression of Question Paper Setting in Education at Higher Secondary level (Class-XII):-

The findings regarding progression of question paper setting in Education at Higher Secondary level (Class XII) are presented as follows:

Table 4.2.1

Progression of Higher Secondary School Education Question Papers 2011-2015

Overall Classification of Objectives	Level of Objectives in Cognitive Domain	Higher Secondary	
Lower level objectives	**Knowledge**	43.54%	**93.28%**
	Comprehension	49.74%	
Middle level objectives	**Application**	6.72%	**6.72%**
	Analysis	-	
Higher level objectives	**Synthesis**	-	**0%**
	Evaluation	-	

The above Table 4.2.1 shows the progression of questions from the lower to higher cognitive objectives in Higher Secondary schools. It can be clearly seen that from 2011 to 2015, majority of the questions concentrated on Knowledge and Comprehension domains, which are considered to be lower level objectives. A small number of questions were asked from Application domain, which comes under middle level objective. No questions were asked from the higher cognitive objectives in any of the five years.

The table clearly depicts that during 2011 to 2015, the percentage of questions from the lower cognitive objectives decreased and questions from the middle cognitive objectives increased as time progresses. By 2014 and 2015, questions from Knowledge level decreased considerably and questions from Comprehension and Application levels also increased. The percentage of lower cognitive questions (93.55%) in 2011 decreased slightly by 2015 (93.1%) and the percentage of middle cognitive questions in 2011 (6.45%) increased slightly by 2015 (6.90%).

From these findings, it can be concluded that with the passage of years, the percentage of questions in the lower domain have reduced and the percentage of questions in the middle domains have increased, although not to a considerable extent. There were no questions from the higher domains in any of the five years.

4.2.2. Progression of Question Paper Setting in Education at Collegiate Level:-

The findings regarding progression of question paper setting in Education at College level (B.A) are presented as follows:

Table 4.2.2

Progression of B.A Education Question Papers 2011-2015

Overall Classification of Objectives	Level of Objectives in Cognitive Domain	College	
Lower level objectives	**Knowledge**	29.18%	**88.05%**
	Comprehension	58.87%	
Middle level objectives	**Application**	1.34%	**10.04%**
	Analysis	8.7%	
Higher level objectives	**Synthesis**	-	**1.91%**
	Evaluation	1.91%	

The above Table 4.2.2 show the progression in question paper setting in Collegiate level during 2011 to 2015. They clearly reveal that majority of the questions concentrated on the lower level objectives, i.e., Knowledge and Comprehension. There were a small number of questions from the middle level objectives, which are Application and Analysis domains. No questions were asked from Synthesis and a very small number from Evaluation, which are the higher cognitive objectives.

The table clearly depicts that during 2011 to 2015, the percentage of questions from the lower cognitive objectives decreased and questions from the middle cognitive objectives increased year by year. The percentage of lower cognitive questions in 2011 (97.55%) decreased by 2015 (92.94%) and the percentage of middle cognitive questions in 2011 (0.89%) increased by 2015

(5.76%). However, the findings revealed that the percentage of questions from the higher cognitive objectives in 2011 (1.56%) declined slighty by 2015 (1.3%).

Based on these findings, we may conclude that with the passing of time, the percentage of questions in the lower domain have reduced and the percentage of questions in the middle domain have increased, although we do not see progression in the higher cognitive objectives. This needs to be addressed and corrected in the near future.

4.2.3 Progression of Question Paper setting in Education at University level:-

The findings regarding progression of question paper setting in Education at University level (M.A) are presented as follows:

Table 4.2.3

Progression of M.A Education Question Papers 2011-2015

Overall Classification of Objectives	Level of Objectives in Cognitive Domain	University	
Lower level objectives	**Knowledge**	29.13%	**81.16%**
	Comprehension	52.03%	
Middle level objectives	**Application**	1.48%	**13.05%**
	Analysis	11.57%	
Higher level objectives	**Synthesis**	-	**5.79%**
	Evaluation	5.79%	

The above Table 4.2.3 reveals the progression in question paper setting at University level during 2011 to 2015. They clearly reveal that majority of the questions concentrated on the lower level objectives, i.e., Knowledge and Comprehension. There were a number of questions from Application and Analysis domains which belong to the middle level objectives. No questions were asked from Synthesis and a small number from Evaluation, which are called the higher cognitive objectives.

The findings clearly depict that during 2011 to 2015, the percentage of questions from the lower cognitive objectives decreased and questions from the higher cognitive objectives increased year-wise. The percentage of lower cognitive questions in 2011(81.7%) decreased by 2015 (79.06%) and the percentage of higher cognitive questions in 2011 (4.48%) increased by 2015 (7.80%). However, the findings also revealed that the percentage of questions from the middle cognitive objectives in 2011 (13.82%) declined slighty by 2015 (13.14%), though not considerably.

Hence, we may conclude that over the five years, i.e., 2011 to 2015, the percentage of questions in the lower domain have reduced and the percentage of questions in the higher domain have increased. Though we do not see progression in the middle cognitive objectives, it remained more or less constant.

4.2.4 Consolidated Result of Progression of Question Setting at Higher Secondary, Collegiate and University levels of 2011 to 2015.

The progression of question paper setting in Education at Higher Secondary, College and University levels from 2011 to 2015 is presented as follows:

Table 4.2.4

Consolidated Result of Progression of Question Setting at Higher Secondary,

Collegiate and University Levels 2011 to 2015

Overall Classification of Objectives	Level of Objectives in Cognitive Domain	Stages of Education					
		Higher Secondary		College		University	
Lower level objectives	**Knowledge**	43.54%	**93.28%**	29.18%	**88.05%**	29.13%	**81.16%**
	Comprehension	49.74%		58.87%		52.03%	
Middle level objectives	**Application**	6.72%	**6.72%**	1.34%	**10.04%**	1.48%	**13.05%**
	Analysis	-		8.7%		11.57%	
Higher level objectives	**Synthesis**	-	**0%**	-	**1.91%**	-	**5.79%**
	Evaluation	-		1.91%		5.79%	

The above table and figure clearly show the trend in question – paper setting in Education at Higher Secondary, College and University levels during 2011 to 2015. At Higher Secondary level, 93.28% of the questions during 2011 to 2015 were from the first two levels of Bloom's Taxonomy, i.e., Knowledge and Comprehension, which are considered to be lower level objectives of the Cognitive domain of Bloom's Taxonomy. However, this percentage reduced to 88.05% at Collegiate level and 81.16% at University levels.

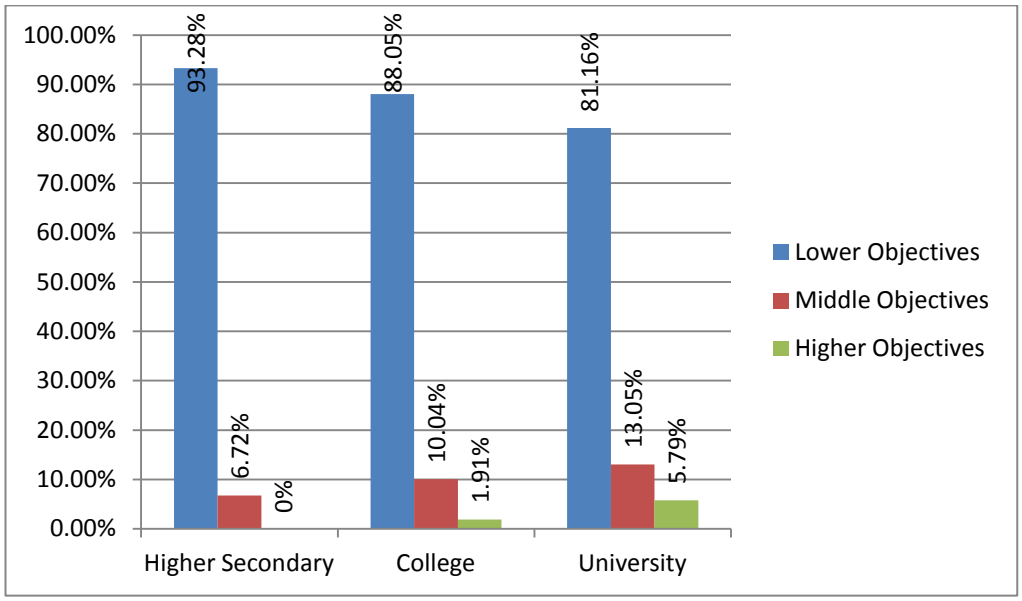
Analysis of the data in the same table depicts that 6.72% of the questions in Higher Secondary level came from the middle level objectives, i.e., Application and Analysis. This percentage increased to 10.04% at Collegiate level and 13.05 % at University level.

Further analysis of the data depicts that there were no questions relating to the two highest cognitive objectives, i.e., Synthesis and Evaluation, at Higher Secondary level during 2011 to 2015, whereas the percentage of such questions at Collegiate and University levels were 1.91% and 5.79 % respectively.

From these findings, it can be concluded that with the movement of students from lower to higher stages of education, the percentage of questions in the lower domain have reduced and the percentage of questions in the middle and higher domains have increased, although not to a desirable extent.

Fig 4.5

Consolidated Picture of Progression of Question Setting at Higher Secondary, Collegiate and University Levels 2011 to 2015



4.3 Cognitive Levels of Higher Secondary, Collegiate and University Students in terms of the Cognitive Domain of Bloom's Taxonomy (Objective 3):

The Cognitive Level Test was developed to find out the cognitive levels of Higher Secondary, College and University students in terms of the Cognitive domain of Bloom's Taxonomy of Educational Objectives. The sample consisted of 380 students of Class XII reading Education subject, 310 students of Vth Semester B.A Education Core, and 86 students of Ist and IIIrd Semester M.A Education. The sample students were asked to set 10 questions of different difficulty order from two topics in Educational Psychology provided to them. These topics were Individual Difference and Mental Health and Hygiene and students were

requested to set five questions from each of the topics belonging to different difficulty order. These questions were then analysed on the basis of Bloom's Taxonomy Coding Scheme. The findings on the Cognitive levels of the students are discussed below.

4.3.1 Cognitive Levels of Higher Secondary Students:

The findings regarding the Cognitive levels of Higher Secondary students are presented below:

Table 4.3.1

Result of Higher Secondary students on Cognitive Level Test

HIGHER SECONDARY (N=380)		
Taxonomy Level	**No. of Questions set by respondents**	
	N	**%**
Knowledge	2008	52.84
Comprehension	1429	37.61
Application	122	3.21
Analysis	163	4.29
Synthesis	-	-
Evaluation	78	2.05

The above Table 4.3.1 clearly indicates that the Cognitive levels of Higher Secondary students fall predominantly on the two lower Cognitive levels, i.e.,

Knowledge (52.84%) and Comprehension (37.61%) followed by Analysis (4.29), Application (3.21%) and Evaluation (2.05%) respectively No questions were set from Synthesis level. The combined score in the four higher cognitive levels (9.55%) reveal that the Higher Secondary students hardly use their higher cognitive abilities and that they have low creative and evaluative skills.

4.3.2 Cognitive Levels of College Students:

The findings with regard to the Cognitive levels of College students are presented in the table below:

Table 4.3.2

Result of College students on Cognitive Level Test

COLLEGE (N = 310)		
Taxonomy Level	**No. of Questions set by respondents**	
	N	**%**
Knowledge	1372	44.26
Comprehension	1200	38.71
Application	83	2.68
Analysis	302	9.74
Synthesis	-	-
Evaluation	143	4.61

The above Table 4.2.3 shows that the Cognitive levels of the College students are mostly concentrated in the two lower cognitive levels, i.e., Knowledge (44.26%) and Comprehension (38.71%) followed by Analysis (9.74%), Evaluation (4.61%) and Application (2.68%) respectively. No questions came from Synthesis level here also. The combined score for the four higher cognitive levels (17.03%) reveal that the College students rarely exercise their higher cognitive abilities. This is a clear indication that they have poor constructive and evaluative skills.

4.3.3 Cognitive Levels of University Students: The findings regarding the Cognitive levels of University students are presented as follows:

Table 4.3.3

Result of University students on Cognitive Level Test

University (N=86)		
Taxonomy Level	**No. of Questions set by respondents**	
	N	**%**
Knowledge	283	32.91
Comprehension	390	45.35
Application	42	4.88
Analysis	100	11.63
Synthesis	-	-
Evaluation	45	5.23

The above Table 4.3.3 indicates that the Cognitive levels of University students mostly come under the two lower cognitive levels, i.e., Comprehension (45.35%) and Knowledge (32.91%) followed by Analysis (11.63%) Evaluation (4.61%) and Application (2.68%) respectively. No set of questions came from Synthesis level in this sample either. The combined score in the four higher cognitive levels (21.74%) reveals that even the University students do not possess high applicative and evaluative skills.

4.3.4 Consolidated View of the Cognitive levels of Higher Secondary, College and University Students:

Consolidated findings of higher secondary, college and university students on Cognitive Level Test are given in the table below:

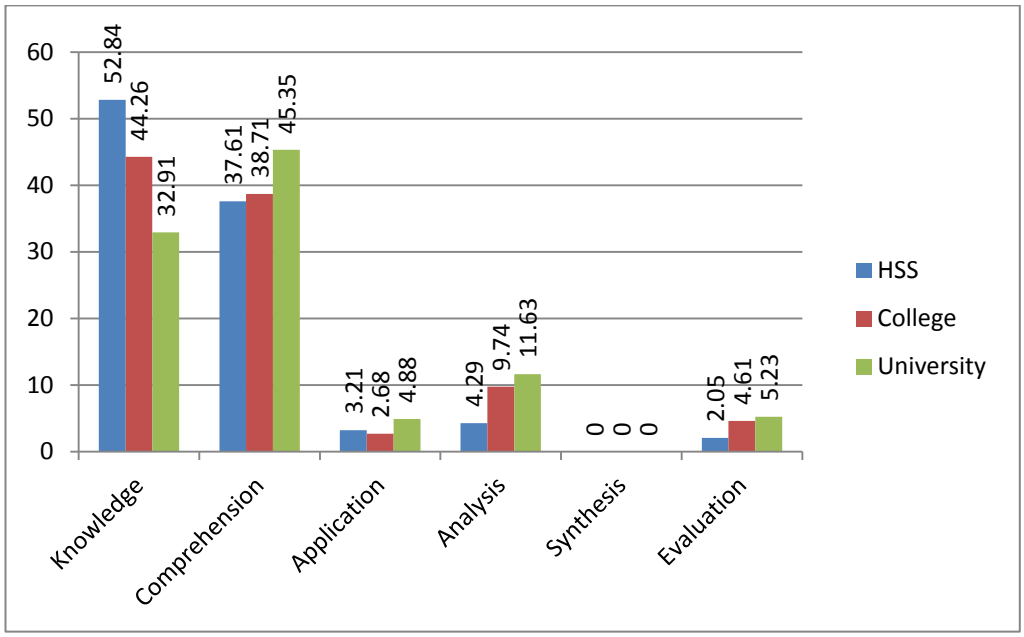
Table 4.3.4

Consolidated Result of Higher Secondary, College & University students on Cognitive Level Test

Bloom's Taxonomy Cognitive Levels	**Higher Secondary (N-380)**		**College (N–310)**		**Universiy (N–86)**	
	Percentage of questions set by respondents		**Percentage of questions set by respondents**		**Percentage of questions set by respondents**	
Knowledge	52.84	**90.45**	44.26	**82.97**	32.91	**78.26**
Comprehension	37.61		38.71		45.35	
Application	3.21	**7.5**	2.68	**12.42**	4.88	**16.51**
Analysis	4.29		9.74		11.63	
Synthesis	-	**2.05**	-	**4.61**	-	**5.23**
Evaluation	2.05		4.61		5.23	

Figure 4.6

Consolidated Picture of Higher Secondary, College & University students on Cognitive Level Test



The above table and figure gives a clear picture of the Cognitive levels of Higher Secondary, College and University students in terms of the Cognitive domain of Bloom's Taxonomy. It can be seen that these three sets of students mainly function at the two lower levels of the Cognitive domain. They all show poor application and evaluative abilities. However, the study reveals that the dominance of lower cognitive abilities slightly decrease as the students mature in age and progress to higher classes. Though Knowledge level dominates at the Higher Secondary stage, it decreases slightly at the College stage and by University stage, it is overtaken by Comprehension level. This shows that there is growth in the cognitive levels. It can also be seen that there is development of higher cognitive abilities like Application, Analysis and Evaluation at the University level, though not to a large extent. The absence of Synthesis level questions in all groups of students reveal that the development and promotion of the creative and constructive abilities of students is greatly neglected in our education system.

CHAPTER V

ANALYSIS AND INTERPRETATION OF DATA

(Understanding of Bloom's Taxonomy & Impact of Training of Teachers)

5.0 Introduction

This chapter is an attempt to analyse teachers' understanding of Bloom's Taxonomy and its implications in question-paper setting (Objective 5) and the impact of training of teachers in Bloom's Taxonomy on their question-paper setting (Objective 6). After collecting all the necessary data from the primary sources, the following analysis was done and interpretations were made on the basis of the analysis. For a meaningful and systematic presentation, this chapter has been divided into the following sections:

5.1 Teachers' understanding of Bloom's Taxonomy and its implications in question paper setting (Objective 5)

5.2 Impact of training of teachers in Bloom's Taxonomy on their question-paper setting (Objective 6)

5.1 Teachers' understanding of Bloom's Taxonomy and its implications in question paper setting(Objective 3):

Opinionnaire was constructed by the investigator to study teachers' understanding of Bloom's Taxonomy and its implications in question paper setting.

The questionnaire consisted of 22 statements with three choices for each question to be simply ticked by the respondent. It was divided into three sections –

Section 1 - Awareness of teachers regarding Bloom's Taxonomy (8 statements)

Section 2 - Application of Bloom's Taxonomy in teaching-learning and evaluation (7 statements)

Section 3 - Attitude of teachers towards Bloom's Taxonomy (7 statements)

The information of the respondents and the findings of the Opinionnaire are presented in the following paragraphs.

5.1.1 General Information of Respondents:

The information of the respondents are presented in the table below:

Table 5.1.1

General Information of Respondents for Opinnionaire

Sl. No	Category of Respondents	Total Number	Male	Female	Working in Aizawl	Working outside Aizawl
1	Higher Secondary School Teachers	76	19	57	58	18
2	College Teachers	70	13	57	55	15
3	University Teachers	17	5	12	17	-
	Grand Total	**163**	**37**	**126**	**130**	**33**

5.1.2 Findings on Awareness of teachers regarding Bloom's Taxonomy of Educational Objectives :

The section relating to Awareness of teachers about Bloom's Taxonomy of Educational Objectives had eight statements or questions and the findings are presented below:

1) Knowledge of Bloom's Taxonomy - 92.11% of the Higher Secondary teachers, 95.71% of College teachers and 100% of the University teachers replied that they had heard of Bloom's Taxonomy. A small percentage of Higher Secondary teachers (7.89%) and College teachers (4.29%) said they were not sure about the nature of Bloom's Taxonomy.

2) Three Domains of Bloom's Taxonomy - 92.11% of the Higher Secondary teachers, 95.71% of the College teachers and 100% of the University teachers replied that they knew about the three domains of Bloom's Taxonomy. A small percentage of Higher Secondary (7.89%) and College teachers (4.29%) said they were not sure about the classification of the domains.

3) Six Cognitive Levels of Bloom's Taxonomy - 75% of the Higher Secondary teachers replied that they knew about the six Cognitive levels of Bloom's Taxonomy, 7.89% said they were not aware of it, and 17.11% said they were not sure about it.

77.14% of the College teachers replied that they knew about the six Cognitive levels of Bloom's Taxonomy, 10% said they were not aware of it, and 12.86% said they were not sure about it.

All the University teachers (100%) replied that they knew about the six Cognitive levels of Bloom's Taxonomy.

4) Knowledge of objectives to be achieved in each cognitive level with expected learning outcomes – 72.37% of the Higher Secondary teachers replied that they knew about the objectives to be achieved in each cognitive level of Bloom's Taxonomy with expected learning outcomes, 7.89% said they were not aware of it, and 19.74% said they were not sure about it.

74.29% of the College teachers replied that they knew about the objectives to be achieved in each cognitive level with expected learning outcomes, 10% said they were not aware of it, and 15.71% said they were not sure about it.

All the University teachers (100%) replied that they knew about the objectives to be achieved in each cognitive level of Bloom's Taxonomy with expected learning outcomes.

5) Uses of Bloom's Taxonomy in curriculum design/development – 47.37% of the Higher Secondary teachers replied that they were aware of the implications of Bloom's Taxonomy in curriculum design and development, 13.16% said they were not aware at all, and 39.47% said they were unsure about it.

57.14% of the College teachers replied that they were aware of the uses of Bloom's Taxonomy in curriculum design and development, 4.29% said they were not aware at all, and 38.57% said they were unsure about it.

94.12% of the University teachers replied that they knew about the uses of Bloom's Taxonomy in curriculum design and development and 5.88% said they were unsure about it.

6) Bloom's Taxonomy and Research work - 46.05% of the Higher Secondary teachers replied that they were aware of the uses of Bloom's Taxonomy in conducting research, 13.16% said they were not aware at all, and 40.79% said they were not sure about it.

64.29% of the College teachers replied that they were aware of the uses of Bloom's Taxonomy for conducting research, 17.14% said they were not aware at all, and 18.57% said they were not sure about the relation between Bloom's Taxonomy and research.

88.24% of the University teachers replied that they knew about the value of Bloom's Taxonomy in conducting research work and 11.76% said they were unsure about it.

7) Relevance of Bloom's Taxonomy in question paper setting and evaluation - 39.47% of Higher Secondary teachers stated their awareness about the relevance of Bloom's Taxonomy in question paper setting and evaluation, 13.16% said they had no knowledge about it and a 47.37% replied that they were not sure of the implications of Bloom's Taxonomy in question paper setting.

57.14% of the College teachers replied that they were aware of the implications of Bloom's Taxonomy in question paper setting, 17.14% said they were not aware at all, and 25.72% said they were not sure about the relation between Bloom's Taxonomy and research.

88.24% of the University teachers said they knew about the value of Bloom's Taxonomy in question setting and 11.76% said they were not sure about it.

8) Bloom's Taxonomy Key Verbs – 23.68% of Higher Secondary teachers responded that they were aware of the key verbs given by Bloom for framing questions, 36.84% replied that they had no idea about the key verbs and 39.48% said they were unsure.

40% of the College teachers stated that they were aware of the key verbs given by Bloom for framing questions, 28.57% replied that they had no idea about the key verbs and a 31.43% said they were not sure about any key verbs.

88.24% of the University teachers said they knew about the key verbs given by Bloom for framing questions, 5.88% replied they had no knowledge about the key verbs and a 5.88% said they were not sure about Bloom's Taxonomy key verbs.

Table 5.1.2

Findings on Awareness of teachers regarding Bloom's Taxonomy

Sl. No	Statement	Response Categories	HSS Teachers	College Teachers	University Teachers
1	Have you heard of 'Bloom's Taxonomy of Educational Objectives'?	Yes	70 (92.11%)	67 (95.71%)	17 (100%)
		No	Nil	Nil	Nil
		Not Sure	6 (7.89%)	3 (4.29%)	Nil
2	Are you aware that Bloom's Taxonomy classifies human thinking into different domains ?	Yes	70 (92.11%)	67 (95.71%)	17 (100%)
		No	Nil	Nil	Nil
		Not Sure	6 (7.89%)	3 (4.29%)	Nil
3	Do you know that Bloom classified the Cognitive domain into different levels?	Yes	57 (75%)	54 (77.14%)	17 (100%)
		No	6 (7.89%)	7 (10%)	Nil
		Not Sure	13 (17.11%)	9 (12.86%)	Nil
4	Are you aware that Bloom's Taxonomy provides objectives to be achieved in each level of the cognitive domain with expected learning outcomes?	Yes	55 (72.37%)	52 (74.29%)	16 (94.12%)
		No	6 (7.89%)	7 (10%)	Nil
		Not Sure	15 (19.74%)	11(15.71%)	1 (5.88%)

5	Are you aware that Bloom's Taxonomy can be used for designing/developing curriculum and learning activities?	Yes	36 (47.37%)	40 (57.14%)	16 (94.12%)
		No	10 (13.16%)	3 (4.29%)	Nil
		Not Sure	30 (39.47%)	27 (38.57%)	1 (5.88%)
6	Do you know that Bloom's Taxonomy can be used for conducting research?	Yes	35 (46.05%)	45 (64.29%)	15 (88.24%)
		No	10 (13.16%)	12 (17.14%)	Nil
		Not Sure	31 (40.79%)	13 (18.57%)	2 (11.76%)
7	Are you aware of the relevance of Bloom's Taxonomy in question paper setting and evaluation?	Yes	30 (39.47%)	40 (57.14%)	15 (88.24%)
		No	10 (13.16%)	12 (17.14%)	Nil
		Not Sure	36 (47.37%)	18 (25.72%)	2 (11.76%)
8	Do you know that Bloom developed key verbs for framing questions?	Yes	18 (23.68%)	28 (40%)	15 (88.24%)
		No	28 (36.84%)	20 (28.57%)	1 (5.88%)
		Not Sure	30 (39.48%)	22 (31.43%)	1 (5.88%)

5.1.3 Findings on Application of Bloom's Taxonomy in Teaching-learning and Evaluation:

The section relating to Application of Bloom's Taxonomy in teaching-learning and evaluation had seven statements or questions and the findings are presented as follows:

1) Application of Bloom's Taxonomy Cognitive objectives in teaching and evaluation – 47.37% of the Higher Secondary teachers replied that they had applied the cognitive objectives given by Bloom in their teaching and evaluation, 38.16% stated they did not and a 14.47% said they were unsure.

54.29% of the College teachers stated that they had applied the cognitive objectives given by Bloom in their teaching and evaluation, 31.43% stated they did not and 14.28% said they were unsure.

94.12% of the University teachers said they had applied the cognitive objectives given by Bloom in their teaching and evaluation, and 5.88% said they were unsure of applying Bloom's Taxonomy.

2) Application of Bloom's Taxonomy for planning instructional objectives - 44.74% of the Higher Secondary teachers replied that they had applied Bloom's Taxonomy for planning instructional objectives, 34.21% stated they did not and 21.05% said they were unsure.

45.72% of the College teachers stated that they had applied Bloom's Taxonomy for planning instructional objectives, 34.21% stated they did not and 21.05% said they were unsure.

88.24% of the University teachers said they had applied Bloom's Taxonomy for planning instructional objectives and 11.76% said they were unsure of applying Bloom's Taxonomy.

3) Application of Bloom's Taxonomy for planning student learning activities – 39.48% of Higher Secondary teachers stated that they had applied Bloom's Taxonomy for planning student learning activities, 23.68% said they had not and 36.84% were not sure of using Bloom's Taxonomy for planning learning activities.

42.86% of the College teachers replied that they had applied Bloom's Taxonomy for planning learning activities, 18.57% said they did not apply it and 38.57% were unsure of applying Bloom's Taxonomy for planning student learning.

94.12% of the University teachers said they had applied Bloom's Taxonomy for planning student learning and 5.88% said they were unsure of applying Bloom's Taxonomy for planning student learning activities.

4) Application of Bloom's Taxonomy for assessing students' abilities - 42.11% of Higher Secondary teachers stated that they had applied Bloom's Taxonomy for assessing students' abilities, 26.31% said they had not and 31.58% were not sure of using Bloom's Taxonomy for assessment of students' abilities.

42.86% of College teachers replied that they had used Bloom's Taxonomy for assessing students' abilities, 24.28% said they had not and 32.86% said they were not sure if they had used Bloom's Taxonomy for assessing students' abilities.

94.12% of the University teachers said they had applied Bloom's Taxonomy for assessing students' abilities and 5.88% said they were unsure of applying Bloom's Taxonomy for assessment of students' abilities.

5) Inclusion of higher cognitive questions - 84.21% of the Higher Secondary teachers stated that they set questions to test the higher cognitive skills of students, 6.58% said they did not set higher cognitive questions, and a few respondents 19.74% said they were not sure about setting higher cognitive questions.

75.71% of the College teachers replied that set questions from the higher cognitive levels, 8.57% said they did not and 15.72% said they were not sure about setting higher cognitive questions.

All the University teachers (100%) replied that they include questions to test the higher cognitive abilities of students.

6) Number of higher cognitive questions included – 15.79% of Higher Secondary teachers responded that they do not include any higher cognitive questions when setting question papers, 50% replied that they include at least one or two higher cognitive questions and 34.21% said they include more than two questions from the higher cognitive domains.

24.29% of the College teachers revealed that they do not include any higher cognitive questions, 50% said they include one or two questions and 25.71% said they set more than two higher cognitve questions.

41.18% of University teachers revealed that they include one or two questions from the higher cognitive objectives and 58.82% stated that they set more than two higher cognitive questions.

7) Application of Bloom's key verbs in question setting – 23.68% of Higher Secondary teachers revealed that they had applied Bloom's key verbs in question paper setting, 36.84% stated they had not used the key verbs for framing questions, and 39.48% said they were not sure if they had applied the key words for question setting.

40% of College teachers revealed that they had used the key verbs given by Bloom in framing questions, 28.57% said they had not used the key verbs for setting questions and 31.43% replied that they were unsure about using Bloom's key verbs in their question setting.

88.24% of the University teachers stated that they use Bloom's key verbs for framing questions and 11.76% were unsure about using Bloom's key verbs in their question paper setting.

Table 5.1.3

Findings on Application of Bloom's Taxonomy in teaching-learning and evaluation

Sl. No	Statement	Response Categories	HSS Teachers	College Teachers	University Teachers
1	Have you applied the cognitive objectives given by Bloom in your teaching and evaluation work?	Yes	36 (47.37%)	38 (54.29%)	16 (94.12%)
		No	29 (38.16%)	22 (31.43%)	Nil
		Not Sure	11 (14.47%)	10 (14.28%)	1 (5.88%)
2	Have you applied Bloom's Taxonomy for planning teaching or instructional objectives?	Yes	34 (44.74%)	32 (45.72%)	15 (88.24%)
		No	26 (34.21%)	20 (28.57%)	Nil
		Not Sure	16 (21.05%)	18 (25.71%)	2 (11.76%)
3	Have you applied Bloom's Taxonomy in planning student learning or learning activities?	Yes	30 (39.48%)	30 (42.86%)	16 (94.12%)
		No	18 (23.68%)	13 (18.57%)	Nil
		Not Sure	28 (36.84%)	27 (38.57%)	1 (5.88%)
4	Have you applied Bloom's Taxonomy for assessing students' abilities?	Yes	32 (42.11%)	30 (42.86%)	16 (94.12%)
		No	20 (26.31%)	17 (24.28%)	Nil
		Not Sure	24 (31.58%)	23 (32.86%)	1 (5.88%)
5	When you set exam questions, do you include questions to test the higher cognitive skills of students?	Yes	64 (84.21%)	53 (75.71%)	17 (100%)
		No	5 (6.58%)	6 (8.57%)	Nil
		Not Sure	7 (9.21%)	11 (15.72%)	Nil

6	How many questions from the higher cognitive objectives do you usually include ?	None	12 (15.79%)	17 (24.29%)	Nil
		One or Two	38 (50%)	35 (50%)	7 (41.18%)
		More than two	26 (34.21%)	18 (25.71%)	10 (58.82%)
7	Have you applied the key verbs for framing questions given by Bloom when setting question papers?	Yes	18 (23.68%)	28 (40%)	15 (88.24%)
		No	28 (36.84%)	20 (28.57%)	Nil
		Not Sure	30 (39.48%)	22 (31.43%)	2 (11.76%)

5.1.4 Findings on Attitude of teachers towards Bloom's Taxonomy:

The section relating to Attitude of teachers towards Bloom's Taxonomy in teaching-learning and evaluation had seven statements or questions and the findings are presented as follows:

1) Current standard of question paper setting – 15.79% of Higher Secondary teachers rated the current standard of question paper setting as poor, 51.32% rated it as satisfactory and 32.89% rated it as good.

Among the College teachers, 20% rated the standard of question setting as poor, 54.29% rated it as satisfactory and 25.71% rated it as good.

17.65% of University teachers rated the question setting standard as poor and 82.35% rated it as satisfactory.

2) Opinion on quality of questions – Of the Higher Secondary teachers, 23.68% revealed that they thought majority of the exam questions were testing only lower cognitive skills of students, 65.79% thought this was not the case, and 10.53% had no clear opinion on the matter.

Of the College teachers, 21.43% felt that majority of the questions test only lower cognitive abilities, 54.29% did not agree while 24.28% were not sure about the issue.

A small number of University teachers, i.e., 11.76% thought majority of the exam questions test only lower cognitive abilities of students while majority of them, i.e., 88.24% did not feel that way.

3) Opinion on inclusion of higher cognitive questions – 72.37% of Higher Secondary teachers thought more higher cognitive questions to test the critical thinking skills of students need to be included, 5.26% replied there was no need for inclusion of more higher cognitive questions while 22.37% were undecided on the matter.

75.71% of College teachers revealed that they favoured inclusion of more higher cognitive questions, 5.72% thought there was no need of including more higher cognitive questions while 18.57% were not sure about the matter.

Majority of University teachers, i.e., 88.24% felt the need for inclusion of more questions to test the higher cognitive skills of students, 5.88% did not agree and another 5.88% was not sure if more higher cognitive questions need to be included.

4) Need for better training program in teaching and evaluation techniques - Majority of Higher Secondary teachers (94.74%), College teachers (98.57%) and University teachers (94.12%) thought there was need for a better training program in teaching and evaluation techniques than currently available.

A very small number of Higher Secondary teachers (5.26%), College teachers (1.43%) and University teachers (5.88%) were unsure if a better training program was needed.

5) Opinion on setting questions in accordance with the cognitive levels of Bloom's Taxonomy - Majority of Higher Secondary teachers (94.73%), College teachers (94.28%) and all the University teachers (100%) thought setting questions in accordance with the Cognitive levels of Bloom's Taxonomy will enhance the quality of education.

A small percentage of Higher Secondary teachers (5.27%) and College teachers (5.72%) were not sure whether applying Bloom's Taxonomy in question setting will do much good to improve the quality of education.

6) Opinion regarding importance of knowledge of Bloom's Taxonomy for teachers – Majority of Higher Secondary teachers (84.21%), College teachers (94.28%) and all the University teachers (100%) thought knowledge of Bloom's Taxonomy will optimize the teaching and evaluation skills of teachers.

A small number of Higher Secondary teachers (15.79%) and College teachers (5.72%) were not sure whether knowledge of Bloom's Taxonomy will optimize the teaching and evaluation skills of teachers.

7) Opinion regarding application of Bloom's Taxonomy in education – A significant number of Higher Secondary teachers (63.16%), College teachers (72.86%) and University teachers (76.47%) felt that applying Bloom's Taxonomy in all aspects of education will improve the system considerably.

Quite a few number of Higher Secondary teachers (36.84%), College teachers (27.14%) and University teachers (23.53%) were not sure if application of Bloom's Taxonomy will really improve the education system.

\Table 5.1.4

Findings on Attitude of teachers regarding Bloom's Taxonomy

Sl. No	Statement	Response Categories	HSS Teachers	College Teachers	University Teachers
1	How would you rate the current standard of question paper setting prevailing in your school/college/ university?	Poor	12 (15.79%)	14 (20%)	3 (17.65%)
		Satisfactory	39 (51.32%)	38 (54.29%)	14 (82.35%)
		Good	25 (32.89%)	18 (25.71%)	Nil
2	Do you think majority of exam questions test only the lower cognitive abilities of students?	Yes	18 (23.68%)	15 (21.43%)	2 (11.76%)
		No	50 (65.79%)	38 (54.29%)	15 (88.24%)
		Not Sure	8 (10.53%)	17 (24.28%)	Nil
3	Do you think more higher cognitive questions testing the critical and abstract skills of students should be included?	Yes	55 (72.37%)	53 (75.71%)	15 (88.24%)
		No	4 (5.26%)	4 (5.72%)	1 (5.88%)
		Not Sure	17 (22.37%)	13 (18.57%)	1 (5.88%)
4	Do you think teachers need a better training program in teaching and evaluation techniques than currently available?	Yes	72 (94.74%)	69 (98.57%)	16 (94.12%)
		No	Nil	Nil	Nil
		Not Sure	4 (5.26%)	1 (1.43%)	1 (5.88%)
5	Do you think setting questions in accordance with the Cognitive levels of Bloom's Taxonomy will enhance the quality of education?	Yes	70 (94.73%)	66 (94.28%)	17 (100%)
		No	Nil	Nil	Nil
		Not Sure	6 (5.27%)	4 (5.72%)	Nil

6	Do you think knowledge of Bloom's Taxonomy will optimize the teaching and evaluation skills of teachers?	Yes	64 (84.21%)	66 (94.28%)	17 (100%)
		No	Nil	Nil	Nil
		Not Sure	12 (15.79%)	4 (5.72%)	Nil
7	Do you think applying Bloom's Taxonomy in all aspects of education will improve our educational system?	Yes	48 (63.16%)	51 (72.86%)	13 (76.47%)
		No	Nil	Nil	Nil
		Not Sure	28 (36.84%)	19 (27.14%)	4 (23.53%)

Hence we may conclude that the Education teachers of Higher Secondary, College and University levels are aware of the basic concepts of Bloom's Taxonomy of Educational Objectives and its implications in education. Regarding the relevance of Bloom's Taxonomy in question paper setting and evaluation and key verbs given by Bloom for framing questions, it was found that most of the university teachers had good knowledge, more than half of the college teachers also had good awareness but the awareness level of higher secondary teachers was low. It was found that the sampled teachers have applied Bloom's Taxonomy of Educational Objectives to their teaching-learning and evaluation work to some degree, but not extensively. They also have a good attitude towards Bloom's Taxonomy of Educational Objectives and thought that setting questions in accordance with the key verbs given by Bloom for each cognitive level will go a long way in enhancing the teaching and evaluation skills of teachers and thereby improving the quality of different aspects of education to a great extent.

5.2 Impact of training of teachers in Bloom's Taxonomy on their question-paper setting (Objective 5):

To study the impact of training of teachers in Bloom's Taxonomy on their question-paper setting, a *Pre-test Post-test* experiment was conducted on 30 teachers who participated in the Orientation Course programme organized by the UGC-Human Resource Development Centre, Mizoram University between 19th October and 15th November 2016. Pre-test was conducted on 26th October 2016 and Post-test was conducted after an interval of one week, i.e., on 5th November 2016. A brief explanation about the process and procedures adopted in the conduct of the said experiment is given as under.

5.2.1 Pre-test:- A Pre-test is a preliminary test administered to determine a student's baseline knowledge or preparedness for an educational experience or course of study. In the present study, Pre-test was conducted to find out the quality of question-paper setting of the participants. The Pre-test schedule consisted of 12 items relating to experience in question setting, purpose of formative and summative testing, awareness on classification of questions, assessment of level of students' learning, number and classification of verbs in writing questions, question paper setting, etc.

After necessary introductions and purpose of the study were stated, the Pre-test schedule was distributed to the participants and clear instructions were given on how to answer each item. After the questionnaires were completed, it was

collected for data analysis and tabulation. The investigator made sure that all the items in the questionnaire were answered by the participants.

5.2.2 Intervention:- In Pre-test Post-test experiment, the term Intervention means applying treatment or experimental manipulation to see if there are any changes in the targeted behaviour of the participants in the experiment.

After completion of the Pre-test, intervention was applied in the form of a training module on the use of Bloom's Taxonomy in setting of question papers. A detailed lecture on the concept and development of Bloom's Taxonomy of Educational Objectives; the three domains of Bloom's Taxonomy – Cognitive, Affective and Psychomotor; the Cognitive levels of Bloom's Taxonomy and its usefulness in teaching-learning, evaluation and curriculum design; concept of Higher Order, Middle Order and Lower Order Cognitive Objectives/Skills; how to use Bloom's Taxonomy in the classroom to promote the cognitive skills of students, how to use Bloom's Taxonomy to optimize teaching skills; how to frame or construct questions to test the different cognitive levels of students; what type of questions should dominate examination papers; key verbs provided by Bloom for framing questions for different cognitive levels; model questions to be set for each level of the Cognitive domain; expected teaching and learning outcomes provided by Bloom's Taxonomy, etc., were presented with the help of power-point. The three hour lecture/talk was followed by discussion and question-answer session. This intervention was conducted in order to study the impact of training of teachers on question-setting in terms of the Cognitive domain of Bloom's Taxonomy.

5.2.3 Post-test:- In the present study, after a gap of 9 days of administration of the aforesaid intervention, Post-test was conducted on 5th November 2016 to find out the impact of training of teachers in Bloom's Taxonomy on their question-paper setting. The Post-test schedule had 12 items relating to the need for training on question-setting, purpose of formative and summative testing, classification of questions, assessment of difficulty level of students learning, key verbs in writing questions, question-paper setting, writing of verbs for six levels of the Cognitive domain, classification of questions according to Bloom's Taxonomy, inclusion of different levels of questions at various stages of education, etc. After completion of the questionnaire, they were collected for data analysis and tabulation and it was ensured that every item in the test was answered.

In this experiment, 4 questions/statements were included only in the Pretest, 4 questions/statements were included only in the Posttest, and 8 questions/statements were included in both the Pretest and Posttest.

5.2.4 Demographic Profile of Respondents:- The demographic profile of the 30 participants of the experiment are given in the table below:

Table 5.2.1

Demographic Profile of Respondents for Pre-test & Post-test experiment

Gender	Nos.	Institution Level	Nos.	Stream	Nos.	Place of Work	Nos.	Degree	Nos.
M	14	**PG**	3	**Arts**	25	**Mizoram**	9	**Master Degree**	13
								M. Phil	12
F	16	**UG**	27	**Science**	5	**Outside Mizoram**	21	**Ph. D**	5
TOTAL - 30									

5.2.5 Outcomes of the Experiment:

The outcomes of the Pre-test Post-test Experiment are presented in detail under three sections as follows:-

A) Background Experience of Participants in the Experiment - The experience of the respondents in question-paper setting and evaluation are presented below:

i) Appointment as paper setter:

63.33% of the participants reported that they had not been appointed as paper setters and 36.67% replied that they had been appointed as paper setters previously. The main reason for this finding may be related to the fact that many of the participant teachers attending the Orientation Course programme were new recruits or junior teachers with only a few years of teaching experience.

Table 5.2.2

Appointment as Paper Setter

Sl. No.	Statement	Response	N	%
1	Have you ever been appointed as a paper setter?	Yes	11	36.67%
		No	19	63.33%

ii) Appointment as Paper Setter in Post Graduate Examination:

There were three Post Graduate teachers attending the Orientation Course programme and all of them reported that they had been appointed as paper setters in their own University, some said two to three times (33.33%) while others said four to five times (66.67%). However, none of them have ever been appointed as paper setters in other Universities.

At the same time, all of them had set questions for various class/unit/term tests, some said two to three times (33.33%) and others said more than five times (66.67%). While setting question papers, the respondents revealed that they refer to old question papers (100%), consultation with colleagues (66.67%) and consultation with senior faculty (33.33%).

Table 5.2.3

Appointment as Paper Setter in Post Graduate Examination

Sl. No.	Statement	Response	N	%
1	Have you ever been appointed as paper setter in P.G Exam in your own University?	Yes	3	100%
		No	Nil	-
		If yes, how many times? a) Only Once	-	-
		b) Two to three times	1	33.33%
		c) 4 to 5 times	2	66.67%
		d) More than 5 times	-	-
2	Have you ever been appointed as paper setter in P.G Exam in any other University?	Yes	Nil	-
		No	3	100%
3	Have you ever set question for class test/unit test/term test?	Yes	3	100%
		No	Nil	-
		If yes, how many times? a) Only once	-	-
		b) 2 to 3 times	1	33.33%
		c) 4 to 5 times	-	-
		d) More than 5 times	2	66.67%
4	While setting question paper, do you refer to the following? (You can tick more than one)	a) Old Question Papers	3	100%
		b) Question bank	-	-
		c) Consultation with colleagues	2	66.67%
		d) Consultation with senior faculty	1	33.33%

iii) Appointment as Paper Setter in Under Graduate Examination:

There were 27 Under Graduate teachers among the Orientation Course participants and 74.07% reported that they had not been appointed as paper setters in their own University while 25.93% replied that they had been appointed as paper setters in their own University, some two to three times (57.14%) and others four to five times (42.86%). Only one respondent (3.70%) had been appointed as paper setter in other Universities two to three times (3.70%).

At the same time, all the respondents reported that they had set questions for various class/unit/term tests more than five times (100%). While setting question papers, the respondents replied that they refer to old question papers (81.48%), question bank (29.63%), consultation with colleagues (51.85%) and consultation with senior faculty (25.93%).

Table 5.2.4

Appointment as Paper Setter in Under Graduate Examination

Sl. No.	Statement	Response	N	%
1	Have you ever been appointed as paper setter in U.G Exam in your own University?	Yes	7	25.93%
		No	20	74.07%
		If yes, how many times? a) Only once	-	-
		b) 2 to 3 times	4	57.14%
		c) 4 to 5 times	3	42.86%
		d) More than 5 times	-	-

2	Have you ever been appointed as paper setter in U.G Exam in any other University?	Yes	1	3.70%
		No	26	96.30%
		If yes, how many times? a) Only once	-	-
		b) 2 to 3 times	1	3.70%
		c) 4 to 5 times	-	-
		d) More than 5 times	-	-
3	Have you ever set question for class test/unit test/term test?	Yes	27	100%
		No	-	-
		If yes, how many times? a) Only once	-	-
		b) 2 to 3 times	-	-
		c) 4 to 5 times	-	-
		d) More than 5 times	27	100%
4	While setting question paper, do you refer to the following? (You can tick more than one)	a) Old question papers	22	81.48%
		b) Question bank	8	29.63%
		c) Consultation with Colleagues	14	51.85%
		d) Consultation with senior faculty	7	25.93%

iv) Training on Question Paper Setting:

96.67% of the participants reported that they have no formal training in question-paper setting. Only one participant (3.33%) replied that he/she received such training after joining the job in college, which was organised by Tripura University for 1 day. The respondent also mentioned that the quality of the training was good.

96.67% of the respondents declared that they believe training on question-setting is a necessity for teachers, and only one (3.33%) replied that there is no particular need for such a training.

66.67% of the respondents replied that conducting training on question paper setting was extremely important, while 23.33% felt that it was important and 10% felt it was moderately important to conduct training on question-paper setting.

76.67% of the respondents revealed that they had no idea/knowledge about Bloom's Taxonomy of Educational Objectives and only 23.33% replied that they had come across Bloom's Taxonomy, probably during their student days as these respondents had background in Education subject (M.A. Education / B. Ed / M. Ed).

Table 5.2.5

Experience of Training on Question-paper Setting

Sl. No.	Statement	Response	N	%
1	Have you got any formal training in question paper setting?	Yes	1	3.33%
		No	29	96.67%
		If yes, when? i) While pursuing degree	-	-
		ii) After joining the job in college	1	3.33%
		iii) Name of institution that conducted the training = Tripura University		
		iv) Duration of training = 1 Day		
		v) Quality of training = Good		
2	Do you think there is a need for conducting such training for teachers?	Yes	29	96.67%
		No	1	3.33%
3	How would you rate the importance of conducting training on question paper setting?	a) Extremely Important	20	66.67%
		b) Important	7	23.33%
		c) Moderately	3	10%
		d) Unnecessary	-	-
4	Have you ever come across Bloom's Taxonomy of Educational objectives?	Yes	7	23.33%
		No	23	76.67%

B) Impact of Intervention on teachers' opinions on various issues related to evaluation and question paper setting as per Bloom's Taxonomy:

In order to determine the impact of Intervention on the performance of the participants, a test of significance was conducted on 7 items which are common in both the Pre-test and Post–test. The t-test for Large Correlated Sample (Single Group Method) was applied by the researcher to find out whether there was significant difference between the Pre-test and Post-test scores of the participants. Null hypothesis was formulated stating that there is no significant difference between Pre-test and Post-test performance/scores. These 7 items selected for testing significance of difference include:-

i) Purpose of Formative Testing

ii) Purpose of Summative Testing

iii) Awareness on Classification of Questions

iv) Assessment of difficulty level of questions

v) Verbs Used in Writing of Questions

vi) Level of Students' Learning

vii) Question Paper Setting

The findings regarding the impact of intervention on the teachers are presented in Table 5.2.6 and a more detailed explanation of the findings for each of the 7 items is also provided.

Table 5.2.6

Significance of Difference between Pre-Test and Post-Test Scores On Various Issues Related to Question Paper Setting

Sl. No	Question	Score				Correlation	Df	t-value	Decision about Ho
		Pretest		Posttest					
		Mean	SD	Mean	SD				
i	Conduct of class/unit/term tests.	3.5	1.41	4	1.2	0.47	29	2.00 n.s	Accepted
ii	Conduct of annual/semester exams.	3.2	1.37	3.7	1.29	0.51	29	2.08 *	Rejected
iii	Classification of questions	0.8	0.96	1.87	0.97	0.63	29	7.13**	Rejected
iv	Arranging questions in terms of difficulty order from 1 to 6.	2.7	1.92	3.87	1.91	0.51	29	3.34**	Rejected
v	Writing verbs for framing questions	16.33	3.55	19	1.98	0.19	29	3.93**	Rejected
vi	Arranging six situations depicting level of students' learning from lowest to highest level of 1 to 6.	1.83	1.64	3.07	1.74	0.69	29	4.96**	Rejected
vii	Setting of 6 questions of different difficulty order of 1 to 6 for end semester exam	2.9	0.92	4.23	0.86	0.38	29	7.39**	Rejected

n.s= not significant, * Significant at .05 Level, ** Significant at .01 Level

i) Purpose of Formative Testing:

The respondents were asked to give five responses for the purpose of conducting class tests/unit tests/term tests, i.e., Formative Testing. The total score for the Pre-test was 105 and 120 for the Post-test. On the basis of the Pre-test and Post-test scores shown in the above Table 5.2.6, it can be seen that there is improvement in the Post-test. When t-test was applied to determine whether there was significant difference between the two results, it was found that the calculated t – value (2.00) was smaller than the table value of t at .05 level (2.04) and .01 level (2.76). Therefore, null hypothesis is accepted and we can conclude that there is no significant difference between the performances in the Pre-test and Post-test regarding the purpose of formative testing.

Some of the reasons for conducting class/unit/term tests (Formative Testing) given by the respondents are:

1. For formative evaluation.
2. To help students improve their knowledge and skills.
3. To test students' knowledge and understanding of subject matter.
4. To evaluate students' learning outcome and performance.
5. To engage students in the learning process.
6. To know the shortcomings and weaknesses of the students.
7. For continuous and comprehensive evaluation.
8. For providing remedial classes based on results.

ii) Purpose of Summative Testing:

The respondents were asked to write five points on the reasons for conducting annual/semester examinations. The total score for the Pre-test came to 96 and the total score for the Post-test was 111. Based on the scores shown in the above table 5.2.6, it can be declared that there is an improvement in the Post-test. In order to find out if the differences in the results were significant or not, t-test was applied and it was found that the calculated t-value (2.08) was higher than the table value of t at .05 level (2.04). Therefore, null hypothesis is rejected and we may conclude that the performance in the Post-test is significantly better than the Pre-test.

Some of the reasons for conducting annual/semester examinations (Summative Testing) given by the respondents are:

1. It is a requirement from the University.
2. For evaluation of students' abilities and promotion to the next higher class.
3. To judge students' intelligence and their grasp of subject matter.
4. To test students' level of knowledge and understanding.
5. To judge whether teaching-learning objectives have been achieved.
6. For evaluation of overall learning.
7. To evaluate the success or failure of overall teaching-learning process.
8. To evaluate whether students have mastered the subject matter or not.

iii) Awareness on Classification of Questions:

In the Pre-test, the respondents were asked whether they had ever come across any classification of questions and it was found that 46.67% had no idea about classification of questions. Therefore, these respondents did not answer the corresponding question asking them to give different classification of questions that they knew of. In the Post-test, they were able to give a number of classification of questions. In the Pre-test, only about half of the respondents (53.33%) answered the question while all of them answered it in the Post-test.

The total score for the Pre-test was 24 and 56 for the Post-test. Based on these total scores and the fact that all the respondents were able to answer the question in the Post-test compared to 14 of them not being aware of any classification of questions in the Pre-test, we can state firmly that there has been improvement in the Post-test performance. When t-test was applied to find out if there was significant difference between the Pre-test and Post-test scores, it was found that the calculated t-value (7.13) was much higher than the table value of t at .05 level (2.04) and .01 level (2.76). Thus, null hypothesis is rejected and we can conclude that there is significant improvement in the performance of the respondents in the Post-test.

The above Table 5.2.6 shows that in the Pre-test, the mean score (0.8) is lower than the standard deviation (0.96). This is because only 14 respondents

answered in the Pre-test while all the 30 respondents answered the question in the Post-test.

Some of the various classification of questions given by the respondents are:

1. Objective, Short and Descriptive Type.
2. Very Easy, Easy, Moderately Easy, Difficult, Very Difficult Type.
3. Multiple choice, Short Answer and Long Answer Type.
4. Convergent and Divergent Type.
5. Memory, Understanding, Application and Reasoning Level Type.
6. Memory, Understanding and Reflective Type.
7. Lower, Middle and Higher Order Type.
8. Bloom's Taxonomy Level Question Type.

iv) Assessment of Difficulty Level of Questions:

Six questions belonging to the different Cognitive levels of Bloom's Taxonomy were given and the respondents were asked to give ratings for each question in terms of their difficulty order by giving 1 to the most easiest and 6 to the most difficult question. These questions related to testing of analytical capabilities of students; testing of understanding of acquired knowledge of students; testing of evaluation of a scheme/policy/theory/programme; testing of the knowledge of students; testing of ability to apply acquired knowledge in a new situation; and testing of ability to synthesize the existing knowledge to create something new and different.

For this test, the total Pre-test score was 81 and the total score for the Post-test came to 116. This result indicates that there has been improvement in the Post-test as compared to the Pre-test. When t-test was applied to determine whether there was a significant difference between the Pre-test and Post-test performances. It was found that the calculated t-value (3.34) was higher than the table value of t at .05 level (2.04) and .01 level (2.76). Thus, null hypothesis is rejected and we can conclude that there is significant difference between the Pre-test and Post-test and the intervention worked successfully.

v) Verbs Used in Writing of Questions:

This section is further divided into 2 sub-sections:

a) Number of Verbs suggested by the participants for framing questions.

b) Classification of Verbs suggested by the participants for framing questions.

a) Number of Verbs suggested by the participants for framing questions:

The respondents were asked to write 20 verbs used for framing questions and some examples were provided to them. In the Pre-test, the respondents gave 490 verbs and in the Post-test, they were able to give 570 verbs. This result indicates that there is improvement in the performance of the respondents in the Post-test with regard to writing of 20 verbs for framing of questions. It was found that when t-test was applied to determine whether the difference between the two tests were significant or not, the calculated t-value (3.93) was higher than the table value

of t at .05 level (2.04) and .01 level (2.76). Hence, null hypothesis is rejected and we can conclude that the performance of the respondents in writing 20 verbs was significantly better in the Post-test.

b) Classification of Verbs suggested by the participants:

In the earlier question, the respondents were asked to write 20 verbs for framing questions. These verbs were then analysed on the basis of Bloom's Taxonomy Coding Scheme and placed in their proper categories. The findings regarding the classification of verbs suggested by the respondents are given below in Table 5.2.7

In the Pre-test, 47.55% of the verbs suggested belonged to Knowledge domain and 25.51% belonged to Comprehension domain. Only a small number of verbs were suggested in Application (7.14%), Analysis (9.18%), Synthesis (2.86%) and Evaluation (7.76%) domains respectively. This finding indicates that majority of the verbs suggested in the Pre-test belonged to the two lower cognitive domains and a small number belonged to the other four higher cognitive domains.

In the Post-test, 33.33% of verbs suggested belonged to Knowledge domain and 22.98% belonged to Comprehension domain. The verbs suggested for the other cognitive domains such as Application (11.23%), Analysis (10.70%), Synthesis (10.53%) and Evaluation (11.23%) were not significantly large. However, in the Post-test, we see that there has been a slight decrease in Knowledge and

Comprehension verbs and a slight increase in the other four higher cognitive domains. Hence, we can conclude that there has been improvement in the Post-test with regard to number of verbs as well as classification of verb levels for the higher cognitive domains.

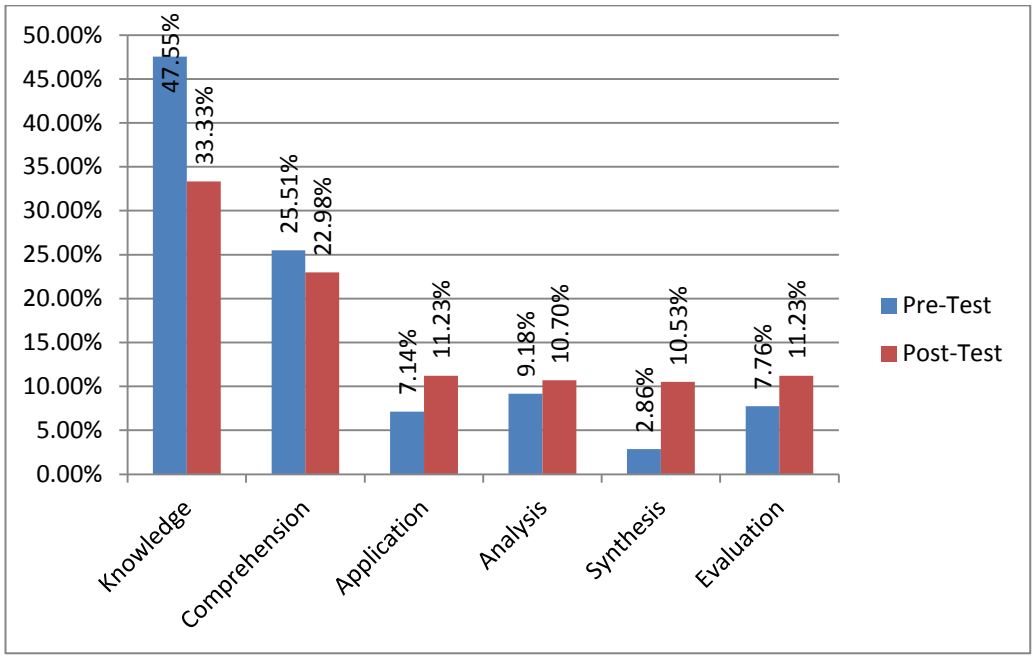
Table 5.2.7

Number of Verbs Suggested by Teachers for framing questions

Cognitive Domain	Pre-Test	Post-Test
	No. of verbs given by respondents (with %)	No. of verbs given by respondents (with %)
Knowledge level	233 (47.55%)	190 (33.33%)
Comprehension level	125 (25.51%)	131 (22.98%)
Application level	35 (7.14%)	64 (11.23%)
Analysis level	45 (9.18%)	61 (10.70%)
Synthesis level	14 (2.86%)	60 (10.53%)
Evaluation level	38 (7.76%)	64 (11.23%)
Total	**490**	**570**

Fig: 5.1

Classification of Verbs Suggested by Teachers



vi) Level of Students' Learning:

The respondents were asked to rate situations depicting six levels of students' learning based on the Cognitive domain of Bloom's Taxonomy. They were asked to give a rating from 1 to 6 depending on the situation indicative of the lowest level to the highest level of students' learning. These six levels depicted situations where students can generate new products, ideas, or ways of viewing things; students can justify a decision or a course of action; students can explain ideas or concepts; students can recall information; students can use the information in another familiar situation; and students can break information into parts to explore understandings.

In this test, the total score for the Pre-test was 55 and 92 for the Post-test. This indicates that there is improvement in the performance of the respondents in the Post-test. On applying t-test to determine whether there is significant difference between the Pre-test and Post-test, it was found that the calculated t-value (4.96) was greater than the table value of t at .05 level (2.04) and .01 level (2.76). Hence, null hypothesis is rejected and we can conclude that there is significant difference between the Pre-test and Post-test performances regarding understanding of the level of students' learning.

vii) Question Paper Setting:

The respondents were asked to set 6 questions of different difficulty order ranging from 1 to 6 for End Semester Examination in both the Pre-test and Post-test experiments. The questions were then analysed and categorised in terms of Bloom's Taxonomy Coding Scheme. The findings in this regard are provided in Table 5.2.6 and it clearly reveals the performance of the respondents in question-setting in the Pre-test and Post-test experiments.

The total score calculated for the Pre-test (87) is much lower than the total score for the Post-test (127). Therefore, it can be seen that there is improvement in question setting according to the six Cognitive levels of Bloom's Taxonomy in the Post-test. When t-test was applied to find out if there was significant difference between the two tests, it was found that the calculated t-value (7.39) is much greater than the table value of t at .05 level (2.04) and .01 level (2.76). Hence, null

hypothesis is rejected and we can conclude that the respondents showed significant improvement in question-paper setting according to the Cognitive levels of Bloom's Taxonomy in the Post-test.

C) View of participants on various issues related to the experiment:

The views or opinions of the participants on various issues related to the experiment on question paper setting as per Bloom's Taxonomy are provided in the following paragraphs:

i) Opinion of participants on the quality of Intervention and need of training on question paper setting:

53.33% of the respondents revealed that they found the quality of training on question-setting provided during the process of the experiment to be very good, 40% said it was good, and 6.67% found it to be of average quality.

All the respondents (100%) declared that there is a need for conducting training on question-paper setting for every teacher.

On the question regarding the importance of conducting training on question-paper setting for College and University teachers, 63.33% felt it was extremely important to conduct training on question paper setting, and 36.67% rated it to be important.

Table 5.2.8

Opinions of participants regarding Need of Training on Question-paper setting

Sl. No.	Statement	Response	N	%
1	What was the quality of training on question-paper setting provided to you in the last class?	a) Very Good	16	53.33%
		b) Good	12	40%
		c) Average	2	6.67%
		d) Poor	-	-
		e) Very Poor	-	-
2	Do you think there is a need for conducting such training for teachers?	Yes	30	100%
		No	-	
3	In the background of brief training on question setting provided in the last class, how would you rate the importance of conducting such training for College and University teachers?	a) Extremely Important	19	63.33%
		b) Important	11	36.67%
		c) Moderately Important	-	-
		d) Unnecessary	-	-

ii) Classification of Questions set according to the Cognitive Domain of Bloom's Taxonomy:

The respondents were given a set of six questions belonging to different Cognitive levels of Bloom's Taxonomy and they were asked to write down in which Bloom's Taxonomy level each of them belong. The questions provided in this test are given as under:-

1. Convert an unhealthy recipe for apple pie to a healthy recipe by replacing your choice of ingredients. Explain the health benefits of using the ingredients you chose vs. the original ones.

2. Identify which kinds of apples are best for baking a pie, and why?

3. Elaborate on the health benefits of eating apples versus oranges.

4. Do you feel that serving of Mid Day Meal to children in school improves their health and learning outcomes? Justify your answer.

5. List four ways of designing curriculum and explain which one is the most suitable for professional courses. Provide references to support your answer.

6. What are the health benefits of eating apples?

The findings regarding the understanding of classification of questions according to the Cognitive levels of Bloom's Taxonomy are presented in Table 5.2.9.

Table 5.2.9

Performance of respondents on Classification of Questions set according to the Cognitive Domain of Bloom's Taxonomy

Score	No.of respondents in each score level		Score Range	No. of respondents in each score range	
	N	%		N	%
1	2	6.67%	**1 - 3**	10	33.33%
2	3	10%			
3	5	16.66%			
4	12	40%	**4 - 6**	20	66.67%
5	6	20%			
6	2	6.67%			
Total	**30**	**100%**			

The above Table 5.2.9 shows the result for understanding of questions set according to the Cognitive levels of Bloom's Taxonomy. The result shows that 6.67% of the respondents got a low score of 1, 10% got a score of 2, 16.66% got a score of 3, 40% got a score of 4, 20% got a score of 5 and 6.67% got a perfect score

of 6 where they placed all the questions correctly in their proper category of the Cognitive levels of Bloom's Taxonomy.

This result indicates that since only a small group of the respondents (33.33%) were in the low score range of 1 – 3, and majority of the respondents (66.67%) were in the high score range of 4 – 6, we can conclude that the Intervention was successful and the respondents now have a good understanding of classification of questions set according to the Cognitive levels of Bloom's Taxonomy.

iii) Inclusion of Different Level of Questions from Bloom's Taxonomy at various stages of Education.

The respondents were asked to give their suggestions with regard to inclusion of different levels of questions from Bloom's Taxonomy at Elementary, Secondary, Collegiate and University levels of education. The detailed fndings are presented in Table 5.2.10.

At the Elementary stage, the respondents revealed their preference of questions in the following order: 1) Knowledge (70.36%) 2) Comprehension (16.61%) 3) Application (6.25%) 4) Evaluation (2.5%) 5) Analysis (2.32%) 6) Synthesis (1.96%). This order reveals that the respondents are leaning heavily towards inclusion of majority of questions from the two lower Cognitive domains and not favouring the inclusion of too many questions from the other four higher Cognitive levels at the elementary stage.

At the Secondary stage, the order of preference of questions revealed by the respondents were Comprehension (35.36%), Knowledge (29.65%), Application (18.39%), Analysis (8.75%), Synthesis (4.46%) and Evaluation (3.39%). This trend shows that the respondents are leaning heavily towards questions from the three lower Cognitive domains with more emphasis on developing or testing the Comprehension skills rather than Knowledge skills. They favour the inclusion of a number of questions from the higher three domains but not too many.

At the Collegiate stage, the preference of the respondents were quite scattered with the highest preference for Application (20.36%) followed by Analysis (18.04%), Evaluation (16.96%), Comprehension (15.54%), Synthesis (14.64%) and Knowledge (14.46%) respectively. This shows that the respondents favour inclusion of questions from all the domains in almost the same quantity, that is, they want the questions to be evenly distributed among all the domains while leaning slightly towards the higher domains.

At the University stage, the respondents showed very high preference for the higher Cognitive domains with Evaluation (28.21%) at the top spot, followed by Analysis (20.35%), Synthesis (19.29%), Application (14.29%), Comprehension (9.11%) and Knowledge (8.75%) respectively. This order of preference reveals that the respondents highly favour the inclusion of majority of the questions from the four higher Cognitive domains and very few questions from the two lower domains.

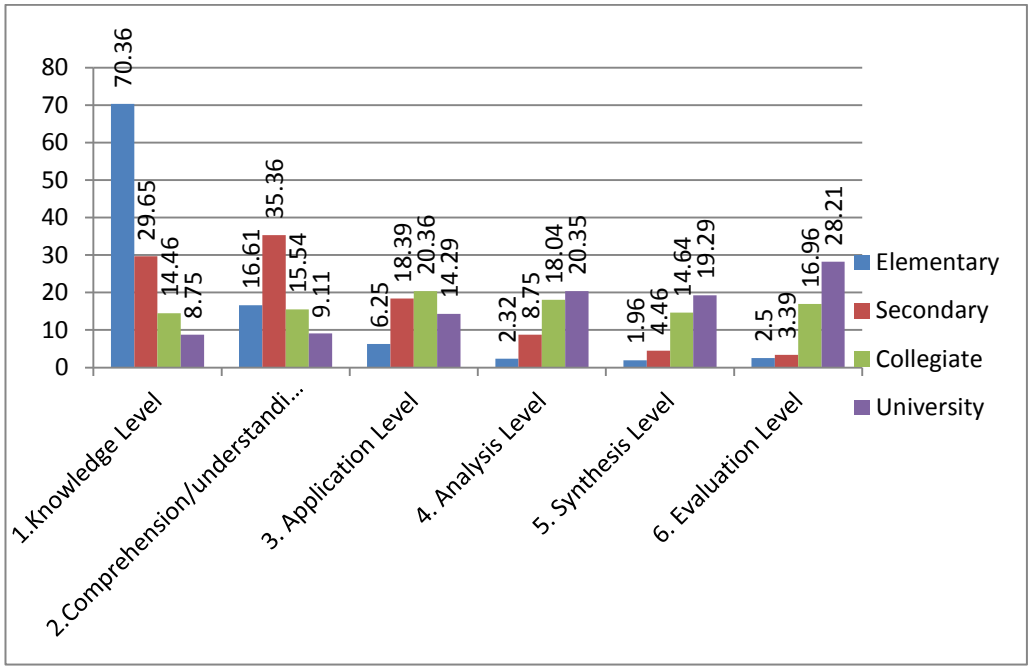
Table 5.2.10

Percentage of Questions preffered by teachers for different levels of Education

Categories of questions	Elementary	Secondary	Collegiate	University
Knowledge Level	70.36%	30%	14.46%	8.21%
Comprehension Level	16.61%	35.36%	15.18%	8.93%
Application Level	6.25%	18.75%	19.64%	14.29%
Analysis Level	2.32%	8.75%	18.04%	19.64%
Synthesis Level	1.96%	4.46%	14.62%	18.21%
Evaluation Level	2.5%	3.39%	16.96%	28.21%

Fig 5.2

Percentage of Questions preffered by teachers for different levels of Education



With this, we come to the end of the Pre-test Post-test experiment to study the impact of training of teachers on their question-paper setting according to the Cognitive domain of Bloom's Taxonomy. Through the results of analysis of various items of the test, we witnessed significant improvements in the performance of the respondents in all the major areas of the experiment. Therefore, we may conclude that the efforts taken to improve the quality of question-paper setting of College and University teachers in terms of the Cognitive levels of Bloom's Taxonomy was a success and that the teachers now have a good knowledge and understanding of the significance and impact of Bloom's Taxonomy of Educational Objectives on question paper setting and other teaching-learning issues related to this topic.

CHAPTER VI

MAJOR FINDINGS, SUGGESTIONS, RECOMMENDATIONS, DISCUSSIONS & CONCLUSIONS

6.0 Introduction

The present chapter deals with the major findings of the study, suggestions for improvement, recommendations for further research and discussions and conclusion. For the convenience of presentation, this chapter is divided into the following sub-heads:

6.1 Major Findings of the Study

6.2 Suggestions for Improvememt

6.3 Recommendations for Further Research

6.4 Discussions and Conclusion

6.1 Major Findings of the Study: The major findings of the present study are presented in the following sections:-

6.1.1 Findings relating to analysis of HSSLC, BA and MA Education Question Papers of five consecutive years i.e. 2011 – 2015 (Objective 1)

6.1.2 Findings relating to progression of question paper setting from the lower to higher level cognitive objectives in Education at Higher Secondary, Collegiate and University levels (Objective 2)

6.1.3 Findings relating to the cognitive levels of Higher Secondary, Collegiate and University Students in terms of the Cognitive Domain of Bloom's Taxonomy (Objective 3)

6.1.4 Findings with regard to teachers' understanding of Bloom's Taxonomy and its implications in question paper setting (Objective 4)

6.1.5 Findings relating to impact of training of teachers in Bloom's Taxonomy on their question paper setting (Objective 5)

6.1.1 Findings relating to analysis of HSSLC, BA and MA Education Board/End Semester Examination Question Papers of five consecutive years i.e. 2011 – 2015 (Objective 1) :

1) In the HSSLC (Arts) Board Examination question papers in Education of five consecutive years, i.e., 2011-2015, majority of the questions were asked from the Lower Order Cognitive Objectives of Bloom's Taxonomy, namely Knowledge, Comprehension and Application. No questions were asked from the Higher Order Cognitive Objectives like Analysis, Synthesis and Evaluation. In fact, the highest number of questions came from Comprehension domain (49.74%), followed by Knowledge domain (43.45%) and a very small number from Application domain (6.72%).

2) The analysis result of B.A Education End Semester question papers of five consecutive years, i.e., 2011 to 2015 indicates that majority of the questions in the B.A Education question papers belonged to Comprehension domain (57.88%), followed by Knowledge domain (38.52%). There were a small percentage of questions from Analysis (1.97%), Application (0.92%) and Evaluation (0.71%) respectively. There were no questions from Synthesis level during these five years.

3) In the M.A Education End Semester Examination question papers of five consecutive years, i.e., 2011 to 2015, it was found that majority of the questions belonged to Comprehension level (52.03%), followed by Knowledge level (29.13%), Analysis level (11.57%), Evaluation level (5.79%) and Application level (1.48%) respectively. There were no questions from Synthesis level in any of the five years.

4) From the Consolidated Analysis of Class XII, B.A and M.A final examination question papers of 2011 to 2015, it was revealed that the questions concentrated largely on testing the two lower cognitive domains, i.e., Comprehension and Knowledge respectively. The Higher Secondary school question papers concentrated mainly on the lower cognitive domains, with a very small percentage from Application domain and no questions from the higher cognitive domains. The B.A Education question papers concentrated largely on the two lower cognitive domains with a small percentage of questions coming from the higher domains. Likewise, the M.A Education question papers also concentrated more on the two lower domains although there were more questions from the higher domains compared to the Higher Secondary and B.A Education question papers.

6.1.2 Findings relating to Progression of question paper setting from the Lower to Higher level cognitive objectives in Education at Higher Secondary, Collegiate and University levels (Objective 2):

1) At the Higher Secondary stage, it was found that the lower cognitive questions dominated the HSSLC Board Examination question papers, with a small percentage of questions from the middle cognitive objectives and no questions from the higher cognitive objectives. During the five years of analysis, the percentage of lower cognitive questions in 2011 (93.55%) decreased slightly by 2015 (93.1%) and the percentage of middle cognitive questions in 2011 (6.45%) increased slightly by 2015 (6.90%).

From these findings, it can be concluded that with the passage of years, the percentage of questions in the lower domain have reduced and the percentage of questions in the middle domain have increased, although not to a considerable extent.

2) At the College stage, during 2011 to 2015, the percentage of lower cognitive questions in 2011 (97.55%) decreased by 2015 (92.94%) and the percentage of middle cognitive questions in 2011 (0.89%) increased by 2015 (5.76%). However, the findings revealed that the percentage of questions from the higher cognitive objectives in 2011 (1.56%) declined slighty by 2015 (1.3%).

Based on these findings, we may conclude that with the passing of time, the percentage of questions in the lower domain have reduced and the

percentage of questions in the middle domain have increased, although we did not see progression in the higher cognitive objectives.

3) At the University stage, it was seen that during 2011 to 2015, the percentage of lower cognitive questions in 2011 (81.7%) decreased by 2015 (79.06%) and the percentage of higher cognitive questions in 2011 (4.48%) increased by 2015 (7.80%). However, the findings also revealed that the percentage of questions from the middle cognitive objectives in 2011 (13.82%) declined slighty by 2015 (13.14%), though not significantly.

Hence, we may conclude that over the five years (2011 to 2015), the percentage of questions in the lower domain have reduced and the percentage of questions in the higher domain have increased. Though we did not see progression in the middle cognitive objectives, it remained more or less constant.

4) Consolidated Analysis of results indicate that at Higher Secondary level, 93.28% of the questions during 2011 to 2015 were from the first two levels of Bloom's Taxonomy, i.e., Knowledge and Comprehension, which are considered to be lower level objectives. However, this percentage reduced to 88.05% at Collegiate level and 81.16% at University levels.

Analysis of the data in the same table depicts that 6.72% of the questions in Higher Secondary level came from the middle level objectives, i.e., Application and Analysis. This percentage increased to 10.04% at Collegiate level

and 13.05 % at University level. Further analysis of the data depicts that there were no questions relating to the two highest cognitive objectives, i.e., Synthesis and Evaluation at Higher Secondary level during 2011 to 2015, whereas the percentage of such questions at Collegiate and University levels were 1.91% and 5.79 % respectively.

From these findings, it can be concluded that with the movement of students from lower to higher stages of education, the percentage of questions in the lower domain have reduced and the percentage of questions in the middle and higher domains have increased, although not to a desirable extent.

6.1.3 Findings regarding the cognitive levels of Higher Secondary, Collegiate and University Students in terms of the Cognitive Domain of Bloom's Taxonomy (Objective 3):

1) The cognitive levels of Higher Secondary students fall predominantly on the two lower cognitive levels, i.e., Knowledge (52.84%) and Comprehension (37.61%) followed by Analysis (4.29%), Application (3.21%) and Evaluation (2.05%) respectively. No questions were set from Synthesis level.

2) The cognitive levels of the College students are mostly concentrated in the two lower cognitive levels, i.e., Knowledge (44.26%) and Comprehension (38.71%) followed by Analysis (9.74%), Evaluation (4.61%) and Application (2.68%) respectively. No questions came from Synthesis level here also.

3) The cognitive levels of University students mostly come under the two lower cognitive levels, i.e., Comprehension (45.35%) and Knowledge (32.91%) followed by Analysis (11.63%) Evaluation (4.61%) and Application (2.68%) respectively. No set of questions came from Synthesis level in this sample either.

4) From the Consolidated results, it can be seen that these three sets of students mainly function at the two lower levels of the Cognitive domain. They all show poor application and evaluative abilities. However, the study reveals that the dominance of lower cognitive abilities slightly decrease as the students mature in age and progress to higher classes. Though Knowledge level dominates at the Higher Secondary stage, it decreases slightly at the College stage and by University stage, it is overtaken by Comprehension level. This shows that there is growth in the cognitive levels. It can also be seen that there is development of higher cognitive abilities like Application, Analysis and Evaluation at the University level, though not to a large degree. The absence of Synthesis level questions in all groups of students reveal that the development and promotion of the creative and constructive abilities of students is greatly neglected in our education system.

6.1.4 Findings with regard to teachers' understanding of Bloom's Taxonomy and its implications in question paper setting(Objective 4):

1) In the section relating to Awareness of Bloom's Taxonomy of Educational Objectives, which had 8 questionnaires, it was found that the Education teachers of

Higher Secondary, College and University levels were aware of the basic concepts of Bloom's Taxonomy and its implications in education. Regarding the relevance of Bloom's Taxonomy in question paper setting and evaluation and key verbs given by Bloom for framing questions, it was found that most of the University teachers had good knowledge, more than half of the College teachers also had good awareness but the awareness level of Higher Secondary teachers was low.

2) In the section relating to Application of Bloom's Taxonomy in teaching-learning and evaluation, which had 7 questionnaires, it was revealed that the Education teachers of Higher Secondary, College and University levels have applied Bloom's Taxonomy of Educational Objectives to their teaching-learning and evaluation work to some degree. Majority of the University teachers had applied it in their work to a large degree, and around half of the College and Higher Secondary teachers had also applied it in their teaching and evaluation work but not extensively. A significant number of the respondents gave negative or hesitant answers to the questions which reveals that many of them were not too familiar with the implications of Bloom's Taxonomy in teaching – learning and evaluation.

3) In the section relating to Attitude towards Bloom's Taxonomy, which had 7 questionnaires, it was found that majority of Higher Secondary, College and University teachers of Education have a good attitude towards Bloom's Taxonomy of Educational Objectives and thought that setting questions in accordance with the key verbs given by Bloom for each cognitive level will go a long way in enhancing the

teaching and evaluation skills of teachers and thereby improving the quality of different aspects of education to a great extent.

6.1.5 Findings relating to impact of training of teachers in Bloom's Taxonomy on their question paper setting (Objective 5):

1) 63.33% of the respondents reported that they have not been appointed as paper setters at College or University End Semester Examination levels and 36.67% replied that they had been appointed as paper setters. At the same time, all of them (100%) revealed that they had set questions for various class/unit/term tests in their own institutions.

2) There were three Post Graduate teachers attending the Orientation Course programme and all of them reported that they had been appointed as paper setters in their own University. However, none of them have ever been appointed as paper setters in other Universities.

3) There were 27 Under Graduate teachers among the Orientation Course participants and 74.07% reported that they had not been appointed as paper setters in their own University while 25.93% replied that they had been appointed as paper setters in their own University. Only one respondent (3.70%) had been appointed as paper setter in other Universities.

4) 96.67% of the respondents reported that they have no formal training in question-paper setting. Only one participant (3.33%) replied that he/she received such training after joining the job in college.

5) 96.67% of the respondents declared that they believe training on question-setting is a necessity for teachers, and only one (3.33%) replied that there is no particular need for such a training.

6) 66.67% of the respondents believed that conducting training on question paper setting was extremely important, while 23.33% felt that it was important and 10% felt it was moderately important to conduct training on question-paper setting.

7) 76.67% revealed that they had no idea/knowledge about Bloom's Taxonomy of Educational Objectives and only 23.33% replied that they had come across Bloom's Taxonomy.

8) In order to determine the impact of Intervention on the performance of the partipants, a test of significance was conducted on 7 items which are common in both the Pre-test and Post–test. Null hypothesis was formulated stating that there is no significant difference between Pre-test and Post-test performance/scores. A t-test for Large Correlated Sample (Single Group Method) was applied to test the null hypothesis and the findings are presented below:-

i) On the question regarding Purpose of Formative Testing, the total score in the Pre-test (105) was lower than the Post-test score (120). However, when t-test was applied to determine whether there was a significant difference between the two results, it was found that there was no significant difference between the performances in the Pre-test and Post-test and therefore, null hypothesis was accepted.

ii) On the question regarding Purpose of Summative Testing, it was found that the total score was higher in the Post-test (111) than the Pre-test (96). When t-test was applied, it was found that the performance in the Post-test was significant at .05 level and therefore, null hypothesis was rejected.

iii) On the question regarding Awareness of Classification of Questions, the total score for the Post-test (56) was more than the Pre-test (24). Based on these total scores and the fact that all the respondents were able to answer the question in the Post-test compared to 14 of them not being aware of any classification of questions in the Pre-test, we can state firmly that there has been improvement in the Post-test performance. When t-test was applied to find out if there was significant difference between the two results, it was found that there was significant improvement in the performance of the respondents in the Post-test.

iv) On the question regarding Assessment of Difficulty Level of Questions, it was revealed that the total Pre-test score was lower (81) than the Post-test score (116). This result indicates that there has been improvement in the Post-test

as compared to the Pre-test. On applying t-test to determine whether the difference was significant or not, it was found that there was significant difference between the Pre-test and Post-test and the Intervention worked successfully.

v) When the respondents were asked to write 20 verbs used for framing questions, they were able to write 490 verbs in the Pre-test and 570 verbs in the Post-test. This result indicates that there is improvement in the performance of the respondents in the Post-test and when t-test was applied, it was found that the performance in the Post-test was significantly better.

Regarding Classification of Verbs according to the Cognitive levels of Bloom's Taxonomy, it was found that majority of the verbs suggested in the Pre-test belonged to Knowledge domain (47.55%), Comprehension domain (25.51%), Application (7.14%), Analysis (9.18%), Synthesis (2.86%) and Evaluation (7.76%) domains respectively. In the Post-test, a significant number of verbs suggested belonged to Knowledge domain (33.33%), Comprehension domain (22.98%), Application (11.23%), Analysis (10.70%), Synthesis (10.53%) and Evaluation (11.23%) respectively. This result shows that there has been improvement in the Post-Test with regard to Number of Verbs as well as Classification of Verb Levels for the higher cognitive domains.

vi) A comparison of the Pre-test (55) and Post-test (92) scores revealed that there was improvement in the performance of the respondents in the Post-test regarding Understanding of the Level of Students' Learning.When t-test

was applied, it was found that that there was significant difference between the Pre-test and Post-test performances in favour of the latter, and null hypthesis was rejected.

vii) Regarding setting of questions according to the six Cognitive levels of Bloom's Taxonomy, the total score calculated for the Pre-test (87) was much lower than the total score for the Post-test (127). When t-test was applied to find out if there was significant difference between the two tests, it was revealed that the respondents showed significant improvement in question-paper setting according to the Cognitive levels of Bloom's Taxonomy in the Post-test. Hence, null hypothesis was rejected and it was concluded that the Intervention worked successfully.

9) 53.33% of the respondents reported that they found the quality of training on question-setting provided during the process of the experiment to be very good, 40% said it was good, and 6.67% found it to be of average quality.

10) All the respondents (100%) agreed that there is a need for conducting training on question-paper setting for every teacher. 63.33% felt it was extremely important to conduct training on question paper setting, and 36.67% rated it to be important.

11) In the Post-test, the respondents were given a set of questions belonging to different Cognitive levels of Bloom's Taxonomy and they were asked to write down the level in which each of them belong. The result showed that 6.67% got a low score of 1 and 10% got a score of 2 respectively. 16.66% of the respondents got a

score of 3, 40% got a score of 4, 20% got a score of 5 and only 6.67% got a perfect score of 6 where they placed all the questions correctly in their proper category of the Cognitive levels of Bloom's Taxonomy. Since only a small group of the respondents (33.33%) were in the low score range (1-3) and majority of the respondents (66.67%) were in the high score range (4-6), it was concluded that the respondents had a good understanding of classification of questions set according to the Cognitive levels of Bloom's Taxonomy after the training provided to them.

12) The respondents were also asked to give their suggestions with regard to inclusion of different levels of questions from Bloom's Taxonomy at Elementary, Secondary, Collegiate and University levels of education. At the Elementary stage, the respondents heavily favoured inclusion of majority of questions from the two lower Cognitive domains and not too many questions from the other four higher cognitive levels. At the Secondary stage, the respondents suggested more questions from the three lower Cognitive domains with emphasis on Comprehension domain and inclusion of several questions from the higher three domains. At the Collegiate stage, the respondents want the questions to be quite evenly distributed among all the domains while leaning slightly towards the higher domains. At the University stage, the respondents highly favour the inclusion of majority of the questions from the four higher Cognitive domains and very few questions from the two lower domains.

6.2 Suggesstions for Improvement:

The following suggestions have been given for improvement of question paper setting in particular and the quality of education in general:

1) The study found that in all the question papers analysed, majority of the questions belonged to the Lower Order Cognitive Objectives, predominantly Comprehension, closely followed by Knowledge. Only a negligible number of questions were asked from the Higher Order Cognitive Domains. This finding clearly indicates the low quality of question paper setting in Education at Higher Secondary, Collegiate and University levels. More questions testing the higher cognitive abilities of students may be included in future, especially at the College and University stages.

2) Teachers need to be made aware of Bloom's Taxonomy and its relevance in the field of education, particularly in question paper setting. It may be made an integral part of the curriculum in teacher training programmes.

3) Teachers need to be informed of the importance of maintaining the correct balance between lower and higher order cognitive questions. Teachers cannot set an examination paper comprising of numerous Lower Order Cognitive Questions. Effective questions that include problem solving and complex thinking skills should be adequately included to stimulate students' mental activities.

4) Teacher Training Programmes/Workshops/Seminars on Question Paper Setting should be periodically conducted by the concerned authorities.

5) Teachers selected for setting of question papers should be given short training (one day) on Bloom's Taxonomy. If this is not possible, they should be provided with information regarding Bloom's Taxonomy Coding Scheme and be instructed to set questions accordingly.

6) The trend in question paper setting revealed by this study points to an inferior educational system. Remedial steps have to be taken in the areas of curriculum design, classroom teaching-learning methods, evaluation procedures and many others to redress this problem and improve the present system. If this trend continues, then the quality of education will deteriorate further and more unemployable graduates may be produced in future.

7) The study revealed that the Higher Secondary, Collegiate and University students have very poor application and synthesis skills. Therefore, teaching - learning methods and activities that will develop and promote the higher cognitive abilities of students need to be applied in the classroom.

8) Examinations should be conducted in such a way so as to minimize rote-learning and book learning as much as possible, and more emphasis be given on writing assignments, project reports, field works, seminar presentations, debates, etc which will help to develop the creative, critical and problem-solving skills of students.

Equal weightage should be given to written examination and practical work in the evaluation process.

9) Teachers should be made aware of clear/specific weightage of questions to be set from each cognitive level when setting examination question papers. The following weightage of questions for each cognitive level has been suggested by the investigator for future reference:

Higher Secondary stage : Knowledge - 20%, Comprehension - 30%, Application - 30 %, Analysis – 10%, Synthesis – 5% and Evaluation – 5%.

Collegiate stage : Knowledge - 10%, Comprehension - 20%, Application - 20 %, Analysis – 20%, Synthesis – 15% and Evaluation – 15%.

University stage : Knowledge - 5%, Comprehension - 10%, Application - 15 %, Analysis – 20%, Synthesis – 25% and Evaluation – 25%.

10) Teachers need to design their instructional objectives and student learning activities to encompass questions, topics and activities that will challenge students to think creatively, logically and critically.

11) Due to pressure to produce good examination results with high scoring students among educational institutions, teachers tend to feel hesitant and fearful of setting too many questions from the higher cognitive levels which result in majority of questions belonging to the lower cognitive levels. This has done more harm than

good and it is high time to remove this fear and hesitation among teachers and more questions from the higher cognitive levels need to be included in future.

12) Academic activities and programmes that promote and enhance personality and cognitive development may be periodically organised for the students right from elementary stage.

13) Periodical revision of syllabus, introduction of innovative teaching methodologies, new assessment techniques, new pattern of education, etc would go a long way in improving our education system.

14) Question banks comprising of model questions belonging to different cognitive levels should be developed by the proper authorities to be used as guides by teachers while framing or setting question papers.

15) Further research is needed in the area of materials development which focuses on higher order thinking skills which may incorporate exercises that encourage students to study more in-depth & use problem solving skills and critical thinking skills which are ranked high on Bloom's Taxonomy.

16) Innovative practices need to be introduced in the area of evaluation to ensure a method of assessment that provides a valid and reliable measure of student development. Formative and diagnostic evaluation, self and peer evaluation, multiple testing techniques, criterion-referenced testing, introduction of semester system and

grading at school level, open book examination, use of mechanical/electronic devices, computer adaptive testing, etc are some of the innovative methods which will go a long way in improving teaching-learning and evaluation.

6.3 Recommendations for Further Research:

Research work may be undertaken in the following related fields or areas:

1) Use of Bloom's Taxonomy for designing instructional objectives and learning activities.

2) Implications of Bloom's Taxonomy for developing and designing curriculum.

3) How to use Bloom's Taxonomy in the classroom for effective teaching and learning.

4) Analytical study of teaching-learning and evaluation methods at elementary and secondary stages of education in terms of the Cognitive Domain of Bloom's Taxonomy.

5) Innovative techniques and methods to promote higher cognitive abilities of students at various stages of education.

6) Cognitive abilities/levels of students of elementary and secondary schools in terms of the Cognitive Domain of Bloom's Taxonomy.

7) Affective Domain of Bloom's Taxonomy and its implications in social and emotional development of children.

8) Analysis of HSLC and HSSLC question papers of Mizoram Board of School Education in terms of the Cognitive Domain of Bloom's Taxonomy.

9) Analysis of question-setting trend at elementary and secondary stages of education in terms of the Cognitive Domain of Bloom's Taxonomy.

10) Analysis of question-setting trend at collegiate and university stages of education in terms of the Cognitive Domain of Bloom's Taxonomy.

11) Evaluation of various aspects of teacher training programmes of elementary, secondary and higher education levels in terms of Bloom's Taxonomy of Educational Objectives.

12) Evaluation of curriculum and textbooks of elementary, secondary and higher education levels in terms of Bloom's Taxonomy of Educational Objectives.

6.4 Discussions and Conclusion:

The study found that Education question papers of Class XII, B.A and M.A final examinations concentrated largely on testing the two lowest cognitive levels, i.e., Knowledge and Comprehension. In fact, Comprehension level questions dominated the examination question papers of all three stages of education during the five years of analysis and questions covering the higher cognitive domains were very few, especially at Higher Secondary level. However, an increase in the percentage of higher cognitive questions was observed as the levels became higher. This is commensurate with the findings of other researchers such as Karamustafaoglu, Sevim and Cepni (2003), Ali (2005), Riazi and Mosalanejad (2010) and Kocakaya and Gonen (2010) who also conducted similar studies in schools, colleges and universities and found that lower order cognitive questions were predominant in all the stages or levels of education, but the percentage of higher cognitive questions increased slightly at the University stage.

In the Class XII question papers analysed, it was found that all the questions belonged to the three lower order cognitive levels. Knowledge level questions dominated the examination question papers followed by Comprehension and a very small percentage from Application. No questions were asked from the three higher cognitive levels. Singh (1992), Agrawal, Tewari et al (2006), Sreekanth (2007), Ferranie (2008), Ayvaci and Turkdogan (2010), Tarman & Kuran (2011) Ebadi & Shahbazian (2015), Mehmood, Iqbal & Farooq (2016) and Rezaee &

Golshan (2016) also conducted analysis of High school/Secondary school examination question papers and found the same result.

In the Bachelor Degree and Master Degree question papers analysed, it was found that majority of the questions belonged to the three lower order cognitive levels, especially Comprehension level. Only a small percentage of questions were asked from the higher cognitive levels. This finding shares the same result as the research findings of Narayanan & Adithan (2015), Cepni (2003), Shah, Rani et al (2013), Edussuriya, Marambe & Abeysekara (2014), Lucas, Dippenaar & Du Toit (2014), Ibtihal & Smadi (2015) and Koksal & Ulum (2018). Among the 50 related literature reviewed, only Jones, Harland et al (2009) and Garekwe (2010) found different results where there were more higher cognitive questions.

These findings strongly imply that if majority of the examination questions at higher education level test mostly the lower cognitive skills of students, then the quality of question paper setting in Education is very low in terms of the Cognitive levels of Bloom's Taxonomy. This, in effect, points to an inferior curriculum, teaching-learning methods and assessment techniques. This finding is a serious cause for concern and needs to be addressed and rectified as soon as practicable. The existing higher education system needs a major overhaul in the areas of curriculum package, curriculum transaction, pedagogical methods, evaluation procedures and so on.

The study also revealed that the students of Higher Secondary, Collegiate and University stages mainly function at the two lower levels of the Cognitive domain. They all show poor application, synthesis and evaluative abilities. Studies conducted by Gierl (1997), Jackson (2000), Bennett & Kennedy (2001), McBain (2011) and Veeravagu, Muthusamy & Subrayan (2010) all reported that the cognitive responses of students belonged to the three lowest levels of Bloom's Taxonomy. However, it was found that the dominance of lower cognitive abilities slightly decrease as the students mature in age and progress to higher classes. Though Knowledge level dominates at the Higher Secondary stage, it decreases slightly at the College stage and by University stage, it is overtaken by Comprehension level. This shows that there is growth in the cognitive levels. It can also be seen that there is development of higher cognitive abilities like Application, Analysis and Evaluation at the University level, though not to a large extent. The absence of Synthesis level questions in all groups of students reveal that the development and promotion of the creative and constructive abilities of students is greatly neglected in our education system.

The study further revealed that the teachers of Higher Secondary, Collegiate and University stages also function at the three lower levels of the Cognitive domain. When the teachers were asked to set questions in the Pre-test, it was found that majority of the questions belonged to the lower cognitive levels. Similar tests were conducted by Sultana (1997), Khorsand (2009) and Hawks (2010) where they found that 70 – 80 % of the questions generated by the teachers were from the lower cognitive levels of Bloom's Taxonomy. The Post-test result showed

significant improvement in question-paper setting according to the Cognitive levels of Bloom's Taxonomy. This clearly indicates the need for training of teachers on question setting according to Bloom's Taxonomy as well as incorporating Bloom's Taxonomy into the classroom teaching – learning process in order to develop the higher order thinking skills of both teachers and students. Researchers such as Stabile (2001), Noble (2004), Crowe, Dirks & Wenderoth (2008), Ranganathan & Nygard (2010), Choudhary & Raikwal (2014), Festo (2016), Dhainje, Chatur et al (2018) and many more created a tool/framework to help teachers design their lessons and assessment techniques so as to improve the thinking skills of students and enhance their performance.

The present investigation clearly reveals that both the teachers and students are functioning at the lower cognitive levels of Bloom's Taxonomy of Educational Objectives. Teachers and students alike need to be given more awareness regarding the cognitive levels and how to develop these higher cognitive abilities. Teachers need to design their instructional objectives and teaching-learning activities in such a way as to promote and develop the reasoning, constructive and problem solving skills of students. They need to be made aware of the importance of developing and functioning at the higher cognitive levels, how to plan teaching objectives and learning activities to promote higher cognitive thinking, what innovative pedagogical techniques to apply in the classroom, how to frame questions to test and challenge the higher thinking skills of students, how to engage and nurture these higher cognitive abilities and so on. Rote memorization and bookish knowledge should be done away with as much as possible. Less dependence on

Lecture method and more emphasis on interactive methods like discussions, feedback, debates, etc will surely improve the teaching – learning process.

In order to produce useful graduates who can make useful contributions to the economy, we must provide quality higher education. Students should posses a number of cognitive skills such as an understanding of methodologies or ability in critical analysis. An important objective of education is to develop and promote the higher cognitive abilities of students such as abstract and logical thinking abilities, critical and analytical skills, evaluative and problem solving skills and many others. All higher educational institutions and Universities should enhance critical thinking skill amongst their students and should be held accountable to provide this when students are enrolled and pursuing a Degree programme. Active learning, which includes activities such as discussion, debates, role plays and cooperative learning encourages critical thinking and helps the students retain technical contents better. When active learning activities are employed, students have to use a deep level approach when learning course contents, which results in students using higher order thinking skills (Donavan, 2003). Bloom's Taxonomy will serve as an effective tool guiding the faculty to arouse the curiosity of learners in their subjects.

Bloom's Taxonomy is a highly valuable tool in the construction and assessment of question papers. It has been widely used by curriculum planners, administrators, researchers, and teachers at all levels of education. It is easily

understood and is considered a complete recipe which relates to all the four pillars of quality education and can help us in addressing the quality in any type and level of education. If we can gradually adjust our way of teaching and questioning towards higher order cognitive skills according to Bloom's Taxonomy and use it to help design examinations and analyze the results, it will greatly improve the quality of assessment in education.

Our present system of education which gives too much emphasis on rote memorization, theoretical and bookish learning, examination/marks oriented teaching-learning and evaluation, has done more harm than good to the quality of education as can be seen from the number of unemployed graduates in the state. Political leaders, administrators, academicians and teachers should gradually try to bring about changes in the standard and quality of higher education. In order to bring about positive and effective changes, an essential need is the development of reliable tools, methods and better training programmes for teachers and educational administrators that reinforce and assess new curriculum designs, new teaching-learning strategies, new learning styles and new evaluation techniques. Bloom's Taxonomy relates to all these different aspects of education and can be effectively applied to improve the quality of education.

APPENDICES

APPENDIX - I

Bloom's Taxonomy Coding Scheme

COGNITIVE LEVEL	KEY VERBS
Knowledge Level: Questions in this level should relate to testing of knowledge. Students should be able to remember or recall data or information.	define, know, label, list, match, name, recall, reproduce, select, state, how much is, how did, what is, write, tell, show, collect, quote, who, when, where, locate, find, what, why, omit, which, choose, how, spell, visualize, draw, read, record, view, point to, memorize, recite, repeat, write, tell, tick.
Comprehension Level: Questions in this level should relate to testing of understanding of acquired knowledge. Students should be able to understand the meaning of material and able to reproduce in own words, explain ideas and concepts.	comprehend, convert, distinguish, explain, give examples, paraphrase, rewrite, summarize, translate, what is the main idea of, describe, illustrate, illuminate, associate, differentiate, discuss, outline, restate, relate, rephrase, express, transform, confirm, , cite, make sense out of, state in own words, throw light on, trace, understand, report, enumerate, elaborate, rotate, articulate.
Application Level: Questions in this level should relate to testing of ability to apply acquired knowledge in new situations. Students should be able to use or apply a previously learned concept in a new situation.	apply, change, compute, demonstrate, manipulate, operate, predict, prepare, produce, solve, use, calculate, complete, classify, experiment, build, interview, make use of, organize, plan, utilize, model, interpret, act, administer, chart, contribute, control, extend, construct, implement, include, inform, instruct, operationalize, participate, preserve, project, provide, teach, transfer, give original examples, sketch, paint, dramatize, make, extrapolate, identify, suggest, tabulate.

Analysis Level: Questions in this level should relate to testing of analytical capabilities. Students should be able to break up material into different parts for an in-depth study, distinguish between different parts.	analyze, break down, deconstruct, discriminate, infer, separate, categorize, question, order, connect, arrange, divide, examine, investigate, advertise, discover, dissect, inspect, simplify, survey, take part in, test for, distinction, theme, relationship, function, motive, assumption, organize, correlate, focus, limit, recognize, subdivide, research, take apart, sort, debate, affect.
Synthesis Level: Questions in this level should relate to testing of ability to synthesize existing knowledge to create something new. Students should be able to put parts together to form a new whole, create or develop a new product or idea.	combine, compile, compose, create, devise, design, generate, modify, rearrange, reconstruct, reorganize, revise, develop, propose, hypothesize, invent, integrate, substitute, what if?, formulate, prepare, generalize, imagine, make up, originate, solution, suppose, original, improve, adapt, minimize, maximize, delete, theorize, happen, support, schematize, add, anticipate, collaborate, communicate, facilitate, incorporate, individualize, initiate, intervene, negotiate, progress, reinforce, restructure, validate, derive, roleplay, add to create.
Evaluation Level: Questions in this level should relate to testing of evaluation of theory, policy, etc. Students should be able to make judgement about the value of material or ideas, justify a statement or idea.	Appraise/apprise, compare and contrast, criticize/critique, defend, evaluate, justify, judge, rate, assess, recommend, rank, grade, test, measure, convince, verify, argue, prioritise, determine, award, dispute, mark, rule on, agree, opinion, criteria, prove, disprove, perceive, value, estimate, influence, deduct, consider, reframe, score, deduce, weigh, option, preferable/prefer, draw conclusions/conclude.

APPENDIX - II

Response Sheet for Testing the Cognitive Levels of Students using Bloom's Taxonomy of Educational Objectives in the Cognitive Domain
(Cognitive Level Test)

Name of Respondent:

Name of Institution:

Class : **Sex:** **Age:**

Permanent Address :

Instruction to Respondents:

Two topics from Educational Psychology namely, Individual Difference and Mental Health and Hygiene have been selected for this exercise. You will be provided with reading materials on these two topics. Read and study the passages slowly and carefully as you have to set five questions from each topic. Think of yourself as a teacher who is about to set questions for Final/Promotion Examination. You should set questions for different difficulty levels and write the difficulty level for each question. Assign ratings from 1 to 5 in terms of increasing difficulty order of questions set by you. The questions should have only one stem each.

SET I: Questions for Individual Difference

Q. No	Question	Difficulty Level

SET II: Questions for Mental Health & Hygiene

Q. No	Question	Difficulty Level

APPENDIX - III

Opinionnaire to study teachers' understanding of Bloom's Taxonomy and its implications in question paper setting

A. Personal Information of Respondent

1. Name_____
2. Gender_____
3. Name and address of the institution where working _____
   _____
4. Qualifications (M.A/M.Phil/Ph.D. Please Specify) _____
5. Total Teaching Experience: _____Years
   a) In School_____ Years
   b) In College_____ Years.
   c) In University_____ Years

B. Opinionnaire to study teachers' understanding of Bloom's Taxonomy. (Please tick one response which is most appropriate for you.)

SECTION I (Awareness regarding Bloom's Taxonomy)

1. Have you heard of 'Bloom's Taxonomy of Educational Objectives'?

i) Yes
ii) No
iii) Not Sure

2. Are you aware that Bloom's Taxonomy classifies human thinking into different domains?

i) Yes
ii) No
iii) Not Sure

3. **Do you know that Bloom's Taxonomy provides objectives to be achieved in each domain?**

i) Yes
ii) No
iii) Not Sure

4. **Are you aware that Bloom classified cognitive domain into different levels with expected learning outcomes for each level?**

i) Yes
ii) No
iii) Not Sure

5. **Are you aware that Bloom's Taxonomy can be used for designing/developing curriculum and learning activities?**

i) Yes
ii) No
iii) Not Sure

6. **Do you know that Bloom's Taxonomy can be used for conducting research?**

i) Yes
ii) No
iii) Not Sure

7. **Are you aware of the relevance of Bloom's Taxonomy in question paper setting and evaluation?**

i) Yes
ii) No
iii) Not sure

8. Do you know that Bloom developed key words/verbs to be used in question paper setting?

i) Yes
ii) No
iii) Not Sure

\SECTION II (Application of Bloom's Taxonomy in teaching-learning and evaluation)

1. **Have you applied the cognitive objectives given by Bloom in your teaching and evaluation work?**

i) Yes
ii) No
iii) Not Sure

2. Have you applied Bloom's Taxonomy for planning teaching or instructional objectives?

i) Yes
ii) No
iii) Not Sure

3. Have you applied Bloom's Taxonomy in planning student learning or learning activities?

i) Yes
ii) No
iii) Not Sure

4. Have you applied Bloom's Taxonomy for assessing students' abilities?

i) Yes
ii) No
iii) Not Sure

5. When you set exam questions, do you include questions to test the higher cognitive skills of students?

i) Yes
ii) No
iii) Not Sure

6. How many questions from the higher cognitive objectives do you usually include ?

i) None
ii) One or Two
iii) More than two

7. Have you applied the key verbs for framing questions given by Bloom when setting question papers?

i) Yes
ii) No
iii) Not Sure

SECTION III (Attitude towards Bloom's Taxonomy)

1. **How would you rate the current standard of question paper setting prevailing in your school/college/university?**

   i) Poor
   ii) Satisfactory
   iii) Good

2. Do you think majority of exam questions test mostly lower cognitive abilities of students?

i) Yes
ii) No
iii) Not Sure

3. Do you think more higher cognitive questions testing the critical and abstract skills of students should be included?

i) Yes
ii) No
iii) Not Sure

4. Do you think teachers need a better training programme in teaching and evaluation techniques?

i) Yes
ii) No
iii) Not Sure

5. Do you think setting questions in accordance with the cognitive levels of Bloom's Taxonomy will enhance the quality of education?

i) Yes
ii) No
iii) Not Sure

6. Do you think knowledge of Bloom's Taxonomy will optimize the teaching and evaluation skills of teachers?

i) Yes
ii) No
iii) Not Sure

7. Do you think applying Bloom's Taxonomy in all aspects of education will improve our educational system?

i) Yes
ii) No
iii) Not Sure

APPENDIX - IV

Pre-test Schedule for testing the understanding of teachers on question paper setting in the context of Bloom'sTaxonomy of Educational Objectives

A. Personal Information

1. Name_____
2. Gender_____ 3. Age _____
4. Name and address of the institution where working _____
_____
5. Contact Numbers: _____
6. Email ID:_____
4. Qualifications:
   a) Master Degree (M.A./M.Sc./M.Com./MBA/ M.Tech. Please Specify)_____
   b) Research Degree (M.Phil. or/and Ph.D. Please Specify_____
5. Subject being taught in college/university (PleaseSpecify):_____
6. Total Teaching Experience: _____Years
   d) In School_____ Years
   e) In College_____ Years.
   f) In University_____ Years

B. Pre-Test Questions

1. Have you ever been appointed as a paper setter? Yes/No

If yes, give details about the following

A. Appointment as a Paper Setter in P.G. Examination

i) Have you ever been appointed as a paper setter in P.G. Examination in your own University?

a) Yes
b) No
c) Not applicable as I am working in college

If yes, how many times:

a) Only Once
b) Two to Three Times
c) Four to Five Times
d) More than Five Times

ii) Have you ever been appointed as a paper setter in P.G. Examination in any other University?

a) Yes
b) No
c) Not applicable as I am working in college

If yes, how many times:

a) Only Once
b) Two to Three Times
c) Four to Five Times
d) More than Five Times

iii) Have you ever set questions for Class test/Unit Test/Term Test in P.G. Class?

a) Yes
b) No

If yes, how many times:

a) Only Once
b) Two to Three Times
c) Four to Five Times
d) More than Five Times

iv) While setting question paper do you refer to the followings? *(Note: You may tick more than one alternative)*

a) Old question papers
b) Question bank(s)
c) Consultation with Colleagues
d) Consultation with senior faculty
e) None of these

B. Appointment as Paper Setter in U.G. Examination

i) . Have you ever been appointed as a paper setter in U.G. Examination in your own University?

a) Yes
b) No

If yes, how many times:

a) Only Once
b) Two to Three Times
c) Four to Five Times
d) More than Five Time

ii) Have you ever been appointed as a paper setter in U.G. Examination in any other University?

a) Yes
b) No

If yes, how many times:

a) Only Once
b) Two to Three Times
c) Four to Five Times
d) More than Five Times

iii) Have you ever set questions for Class test/Unit Test/Term Test in U.G. Class?

a) Yes
b) No

If yes, how many times:

a) Only Once
b) Two to Three Times
c) Four to Five Times
d) More than Five Times

iv) While setting question paper do you refer to the followings? (*Note: You may tick more than one alternative)*

a) Old question papers
b) Question bank(s)
c) Consultation with colleagues
d) Consultation with senior faculty
e) None of these

2. Have you got any formal training in question paper setting? Yes/No

a) If yes, when (Please put a tick mark)

I. While pursuing: P.G/M.Phil./Ph.D. Program

II. After Joining the Job in: College/University

b) Who conducted this training? (Name of the institution)

_____

c) How long was the duration of such training? _____Day(s)

d) What was the quality of such training? Please tick the answer of your choice

Very Good/ Good/ Average/ Poor/Very Poor

3. Do you think there is a need for conducting such training for teachers?

a) Yes
b) No

4. In your opinion, how would you rate the importance of conducting training on question paper setting?

a) Extremely important

b) Important

c) Moderately important

d) Unnecessary

5. Why do we conduct class tests/unit tests/term tests?

1.
2.
3.
4.
5.

6. Why do we conduct annual/semester exams?

1.
2.
3.
4.
5.

7. Have you ever come across any classification of questions?

a) Yes
b) No

If yes, can you specify that classification?

Classification-1:

Classification-2:

Classification-3:

Classification-4:

Classification-5:

8. Have you ever come across Bloom's Taxonomy of Educational Objectives?

a) Yes
b) No

9. Arrange the following types of questions in terms of their difficulty order by writing 1 in front of the most easiest and 6 in front of the most difficult.

a) Question relating to testing of analytical capabilities of students. ( )

b) Question relating to testing of understanding of acquired knowledge of students. ( )

c) Question relating to testing of evaluation of a scheme/policy/theory/ programme. ( )

d) Question relating to testing of the knowledge of students. ( )

e) Question relating to testing of ability to apply acquired knowledge in new a situation. ( )

f) Question relating to testing of ability to synthesize the existing knowledge to create something new and different. ( )

10. Write twenty (20) verbs like What, Define, explain etc. that are used in framing questions.

1.	**11.**
2.	**12.**
3.	**13.**
4.	**14.**
5.	**15.**
6.	**16**
7.	**17.**
8.	**18.**
9.	**19.**
10.	**20.**

11. The following table describes situations depicting six levels of students learning. You are expected to rate these levels from the lowest to highest level of students learning by writing 1 in front of a situation that is indicative of lowest level, and by writing 6 in front of the situation that depicts highest level of students learning.

Situation	**Level of Students Learning**	**Your Ratings**
Situation-1	Students can generate new products, ideas, or ways of viewing things?	
Situation-2	Students can justify a decision or a course of action?	
Situation-3	Students can explain ideas or concepts?	
Situation-4	Students can recall information?	
Situation-5	Students can use the information in another familiar situation?	
Situation-6	Students can break information into parts to explore understandings and relationships?	

**** Rate from 1 to 6 in terms of progressive/increasing level of students' learning***

12. Set 6 questions for end semester examination in the subject you teach and write the difficulty order in front of each question. (Write No.1 in front of the easiest question and No. 6 in front of the most difficult).

Note: All of these six (6) questions should have only one stem each

Question No.	Question	Difficulty Level*
1		
2		
3		
4		
5		
6		

**** Assign ratings from 1 to 6 in terms of progressive/increasing difficulty order of questions set by you.***

(Note: For clarification of the items in the schedule, please refer to Methodology chapter, Table 3.4)

APPENDIX - V

Post-Test Schedule for testing the understanding of teachers on question paper setting in the context of Bloom's Taxonomy of Educational Objectives

C. Personal Information

1. Name_____
2. Gender_____ 3. Age_____
4. Name and address of the institution where working_____

_____

5. Contact Numbers: _____
6. Email ID:_____
4. Qualifications:

a) Master Degree (M.A./M.Sc./M.Com./MBA/ M.Tech. Please Specify)

_____

b) Research Degree (M.Phil. or/and Ph.D. Please Specify)

_____

5. Subject being taught in college/university (PleaseSpecify):_____

6. Total Teaching Experience: _____Years

g) In School_____ Years
h) In College_____ Years.
i) In University_____ Years

B. Post-Test Questions

1. What was the quality of training on question paper setting provided in the last class? (Please tick the answer of your choice)

Very Good/ Good/ Average/ Poor/Very Poor

2. Do you think there is a need for conducting such training for every teacher?

c) Yes
d) No

3. In the background of brief training on question paper setting provided to you in the last class, how would you rate the importance of conducting such training for college and university teachers?

a) Extremely important

b)Important

c) Moderately important

d) Unnecessary

4. Why do we conduct class tests/unit tests/term tests?

1.

2.

3.

4.

5.

5. Why do we conduct annual/semester exams?

1.

2.

3.

4.

5.

6. Describe the various classification of questions.

Classification-1:

Classification-2:

Classification-3:

Classification-4:

Classification-5:

7. Arrange the following types of questions in terms of their difficulty order by writing 1 in front of the most easiest and 6 in front of the most difficult.

a) Question relating to testing of analytical capabilities of students. ( )

b) Question relating to testing of understanding of acquired knowledge of students. ( )

c) Question relating to testing of evaluation of a scheme/policy/theory/ programme etc. ( )

d) Question relating to testing of the knowledge of students. ( )

e) Question relating to testing of ability to apply acquired knowledge in new a situation. ( )

f) Question relating to testing of ability to synthesize the existing knowledge to create something new and different. ( )

8. Write twenty (20) verbs like What, Define, explain etc. that are used in framing questions.

1.	**11.**
2.	**12.**
3.	**13.**
4.	**14.**
5.	**15.**
6.	**16**
7.	**17.**
8.	**18.**
9.	**19.**
10.	**20.**

9. The following table describes situations depicting six levels of students' learning. You are expected to rate these levels from the lowest to highest level of students learning by writing 1 in front of a situation that is indicative of lowest level, and by writing 6 in front of the situation that depicts highest level of students learning.

Situation	**Level of Students Learning**	**Your Ratings**
Situation-1	Students can generate new products, ideas, or ways of viewing things?	
Situation-2	Students can justify a decision or a course of action?	
Situation-3	Students can explain ideas or concepts?	
Situation-4	Students can recall information?	
Situation-5	Students can use the information in another familiar situation?	
Situation-6	Students can break information into parts to explore understandings and relationships?	

**** Rate from 1 to 6 in terms of progressive/increasing level of students' learning***

10. Set 6 questions for end semester examination in the subject you teach and write the difficulty order in front of each question. (Write No.1 in front of the easiest question and No. 6 in front of the most difficult).

Note: All of these six (6) questions should have only one stem each

Question No.	Question	Difficulty Level*
1		
2		
3		
4		
5		
6		

11. Go through the following questions and write in front of each of these question the level to which it belongs to in terms of Bloom's taxonomy of educational objectives.

Sl.No.	Question	Type of question in terms of Bloom's taxonomy
1.	Convert an "unhealthy" recipe for apple pie to a "healthy" recipe by replacing your choice of ingredients. Explain the health benefits of using the ingredients you chose vs. the original ones.	
2.	Identify which kinds of apples are best for baking a pie, and why?	
3.	Elaborate on the health benefits of eating apples versus oranges.	
4.	Do you feel that serving of MDM to children in school improves their health and learning outcomes? Justify your answer.	
5.	List four ways of designing curriculum and explain which one is the most suitable for professional courses. Provide references to support your answer.	
6.	What are the health benefits of eating apples?	

12. In your opinion, what percentage of question at different stages of education should relate to the six categories suggested by Bloom' taxonomy.

Categories of questions	Elementary	Secondary	Collegiate	University
1.Knowledge Level				
2.Comprehension Level				
3. Application Level				
4. Application Level				
5. Application Level				
6. Application Level				

(Note: For clarification of the items in the schedule, please refer to Methodology chapter, Table 3.4)

APPENDIX - VI

List of Higher Secondary Schools, Colleges and Universities visited for data collection.

I. Higher Secondary Schools :-

1. Gov't JL Higher Secondary School, Khatla, Aizawl.
2. Gov't KM Higher Secondary School, Dawrpui Vengthar, Aizawl.
3. Gov't Mizo Higher Secondary School, McDonald Hill, Aizawl.
4. Gov't Central Higher Secondary School, College Veng, Aizawl.
5. Gov't Chaltlang Higher Secondary School, Chaltlang, Aizawl.
6. Gov't Mamawii Higher Secondary School, Mission Veng, Aizawl.
7. Gov't Republic Higher Secondary School, Ramhlun South, Aizawl.
8. Synod Higher Secondary School, Mission Vengthlang, Aizawl.

II. Colleges :-

1. Pachhunga University College, College Veng, Aizawl.
2. Gov't Aizawl College, Sikulpuikawn, Aizawl.
3. Gov't Hrangbana College, Chanmari, Aizawl.
4. Gov't Johnson College, Khatla, Aizawl.
5. Gov't T. Romana College, Republic Vengthlang, Aizawl.
6. Gov't Aizawl West College, Dawrpui Vengthar, Aizawl.
7. Gov't Aizawl North College, Ramhlun North, Aizawl.
8. Gov't J.Thankima College, Bawngkawn, Aizawl.

III. Universities :-

1. Department of Education, Mizoram University, Tanhril, Aizawl.
2. Department of Education, ICFAI University, Durtlang North, Aizawl.

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CONTENTS

Analysis of BA Examination Question Papers in Education Using Bloom's Taxonomy of Educational Objectives

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Abstract

Planning, teaching and assessment stages are used to achieve educational aims, where assessment is the crucial stage in determining students' conceptual development. Written examination is a conventional yet universal tool to evaluate the student's performance in a subject area. Teachers tend to ask questions in the 'knowledge' category 80% to 90% of the time. If this trend continues, the quality of education will go down. A good and reasonable examination paper must consist of various difficulty levels to accommodate the different capabilities of students. If we can gradually adjust our way of teaching and questioning towards higher order cognitive skills, it will surely improve the quality of education. Using Bloom's Taxonomy to help design examinations and analyze the results could greatly improve the quality of assessment in education. Hence the need arises for conducting analysis of question papers from the perspective of the cognitive levels of Bloom's Taxonomy.

Key words: *Examination question papers, Bloom's taxonomy, Educational objectives*

Introduction:

One of the most important aims of education is to provide the best quality education so that students can develop to their maximum potential and make substantial contributions to the knowledge economy. The primary concern of evaluation is to bring about improvement in the teaching-learning process so that the learner develops his potential to the optimum level. In order to achieve this goal, regular and qualitative evaluation of various aspects of the educational system is needed. The four pillars of quality education, namely, 1) curriculum development & design, 2) classroom teaching-learning/curriculum transaction, 3) students' level of learning and learning styles, and

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4) evaluation/assessment of learning outcomes are closely interlinked. One aspect affects or determines the success of all the other aspects. If the curriculum package is of high quality, then classroom teaching-learning, students' level of learning and evaluation methods will also be of high quality and vice versa. Therefore, these four pillars of quality education need to be given due attention and focus by educational administrators, curriculum planners, teachers and other concerned personnel. Then only the aims and objectives of education will be successfully achieved and the quality of education will be greatly improved.

Bloom's Taxonomy of Educational Objectives:

Bloom's Taxonomy of Educational Objectives is a classification of learning objectives within education proposed in 1956 by a committee of educators headed by Benjamin Bloom. The word **'taxonomy'** simply means **'classification of things arranged in a hierarchical order'**. Bloom's Taxonomy is a hierarchy of skills that reflects the growing complexity and ability to use higher order thinking skills. It divides educational objectives into three domains: **Cognitive *(knowing/head)*, Affective *(feeling/heart)*** and **Psychomotor (*doing/hands*).** Within the domains, learning at the higher levels is dependent on having attained prerequisite knowledge and skills at lower levels. The present study is limited to the Cognitive domain only.

The Cognitive Domain of Bloom's Taxonomy is a multi-tiered model of classifying thinking according to six cognitive levels of complexity, which are listed in order starting from the simplest behavior to the most complex. These levels are **knowledge, comprehension, application, analysis, synthesis and evaluation.** The categories can be thought of as degrees of difficulties, that is, the first ones must normally be mastered before the next ones can take place. A detailed look at the Cognitive Domain is given as follows.

1. **Knowledge**: Remember or Recall data or information.

Eg: What are the health benefits of eating apples?

Key Verbs: define, know, label, list, match, name, recall, recognize, reproduce, select, state, write, tell, show, collect, tabulate, quote, who, when, where, locate, find, what, why, omit, which, choose, how, spell, visualize, draw, read, record, view, point to, memorize, recite, repeat.

2. **Comprehension**: Grasp or Understand the meaning and interpretation of instructions and problems. State a problem in one's own words.

Eg: Elaborate on the health benefits of eating apples vs. oranges.

Key Verbs: comprehend, explain, give examples, paraphrase, rewrite, summarize, translate, what is the main idea of, describe, illustrate, associate, differentiate, distinguish, discuss, outline, restate, relate, rephrase, express, transform, confirm, suggest, make sense out of, state in own words, understand, report, enumerate, elaborate.

3. **Application**: Use a concept in a new situation or Applies what was learned in the classroom into novel situations to solve problems.

Eg: Identify which kinds of apples are best for baking a pie, and why?

Key Verbs: apply, change, compute, demonstrate, manipulate, operate, predict, prepare, produce, solve, use, calculate, complete, classify, experiment, build, interview, make use of, organize, plan, utilize, model, interpret, administer, chart, contribute, control, extend, construct, implement, include, inform, instruct, participate, preserve, project, provide, transfer, give original examples, sketch, paint, dramatize, make, extrapolate, identify.

4. **Analysis**: Separates material or concepts into component parts so that its organizational structure may be understood. Distinguishes between facts and inferences.

Eg: List four dishes made with apples and examine which ones have the highest health benefits. Provide references to support your statements.

Key Verbs: analyze, break down, diagrammatize, deconstruct, discriminate, infer, separate, categorize, question, order, connect, arrange, divide, examine, investigate, discover, dissect, inspect, simplify, survey, test for, distinction, theme, relationship, function, motive, inference, assumption, organize, correlate, focus, limit, subdivide, research, take apart, sort, debate, affect.

5. **Synthesis**: Builds a structure or pattern from diverse elements and Put parts together to form a whole, with emphasis on creating a new meaning or structure.

Eg: Convert an "unhealthy" recipe for apple pie to a "healthy" recipe by replacing your choice of ingredients. Explain the health benefits of using the ingredients you chose vs. the original ones.

Key Verbs: combine, compile, compose, create, convert, devise, design, generate, modify, rearrange, reconstruct, reorganize, revise, develop, propose, hypothesize, invent, integrate, substitute, what if?, formulate, prepare, generalize, imagine, make up, originate, solution, suppose, original, improve, adapt, minimize, maximize, delete, theorize, support, schematize, anticipate, collaborate, communicate, facilitate, incorporate, initiate, intervene, negotiate, progress, reinforce, restructure, validate, derive, add to create.

6. **Evaluation**: Make judgments about the value of ideas or materials.

Eg: Do you consider that serving apple pie for an after school snack for children is healthy? Justify your answer.

Key Verbs: appraise, compare, contrast, criticize, critique, defend, evaluate, justify, judge, rate, assess, recommend, rank, grade, test, measure, convince, verify, argue, prioritise, determine, dispute, measure, rule on, agree, opinion, criteria, prove, disprove, perceive, value, estimate, influence, deduct, consider, reframe, score, deduce, draw conclusions, apprise, weigh, option, preferable.

Rationale of the Study:

Bloom's Taxonomy is a valuable tool in the construction and assessment of question papers. Bloom created this taxonomy for categorizing level of abstraction of questions that commonly occur in educational settings. Evaluation is the crucial stage in determining whether students' conceptual development has reached Higher Order Cognitive Skills or not. Improving students' conceptual understanding depends on the question types asked in examinations by the teachers. A good assessment system will determine what and how students learn as well as what and how we teach. A good and reasonable examination paper must consist of various difficulty levels to accommodate the different capabilities of students. Whether or not the written examination is able to assess the student's ability very much depends on the questions presented in the examination paper.

In order to improve the quality of teaching, it is widely believed that one must set good/proper questions where appropriate attention is given to maintaining the correct balance between lower and higher order cognitive questions. The ability to reason effectively and to solve problems creatively are skills which must be acquired through appropriate instruction and training. Teachers can provide this type of instruction and training by using a blend of Higher and Lower order cognitive questions given in Bloom's Taxonomy in their assessments. The three lowest levels of abstraction in thinking are knowledge, comprehension and application. These are all exhibited at a very early age and continue throughout our lives. The higher order thinking skills are analysis, synthesis and evaluation. These emerge in late childhood and early adolescence and truly mark the beginning of serious consideration and contemplation. These levels have often been depicted as a stairway, leading many teachers to encourage their students to climb to a higher level of thought.

Bloom's Taxonomy provides a clear, concise representation of the alignment between standards and educational goals, objectives, products and activities. Bloom's Taxonomy has been widely used by curriculum planners, administrators, researchers, and teachers at all levels of education worldwide. It is easily understood and is

considered a complete recipe which relates to all the four pillars of quality education and can help us in addressing the quality in any type and level of education. Thus, the purpose of this paper is to analyse BA Education question papers under Mizoram University using Bloom's Taxonomy of Educational Objectives and to ascertain whether they meet the quality standards set by it.

Objectives of the Study:

The present study has the following objectives:

1. To analyze selected question papers in Education at the college level in terms of cognitive domain of Bloom's Taxonomy of Educational Objectives.
2. To study the progression of question paper setting from the lower to the higher level cognitive objectives in BA Education question papers for five consecutive years, i.e. 2011, 2012, 2013, 2014 and 2015.
3. To recommend suggestions for improvement in question paper setting.

Tools Used:

Bloom's Taxonomy Coding Scheme representing the six levels of learning objectives viz.: 1) knowledge 2) comprehension 3) application 4) analysis 5) synthesis and 6) evaluation, has been developed for classification of questions. This Coding Scheme was compiled from the works of 17 researchers who were working on different aspects of Bloom's Taxonomy.

Method of Analysis:

Document analysis method was used to analyze the BA Examination papers in Education of Mizoram University for five consecutive years (ie.2011-2015). The questions were analyzed using the aforementioned Coding Scheme and placed in their proper categories.

Findings and Discussions:

The data obtained were analyzed with the help of descriptive statistics (percentages) and the findings are presented in the following table.

Objective 1: *To analyze selected question papers of BA Education in terms of Cognitive Domain of Bloom's Taxonomy of Educational Objectives.*

In order to achieve this objective, BA Education question papers (excluding Statistics) of five consecutive years (2011-2015) were analysed using Bloom's Taxonomy Coding Scheme (also known as Bloom's Taxonomy Key Verbs). The findings in this regard are presented in the following table-1.

Table I : Consolidated View of Analysis of BA Edn Question Papers 2011-2015

Year	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
2011	39.47%	57.89%	0.88%	-	-	1.75%
2012	34.55%	61.82%	1.82%	1.82%	-	-
2013	36.79%	61.32%	1.89%	-	-	-
2014	46.79%	50.46%	0.64%	0.64%	0.64%	0.64%
2015	34.38%	59.38%	1.25%	3.75%	-	1.25%

Interpretation of Results/Discussion of Findings:

The above table shows the result of analysis of BA Education question papers from 2011 to 2015. It clearly indicates that most of the questions concentrated on Comprehension domain, followed closely by Knowledge domain. Some questions were asked from Application domain, but very few from the three domains under Higher Order Cognitive Skills, viz. Analysis, Synthesis and Evaluation. Hence, we can conclude that majority of the questions were from the Lower Order Cognitive Skills. Questions asked from the Higher Order Cognitive Skills were negligible.

The low quality of questions may be directly linked to poor curriculam package, low learning level of students, defective teaching-learning strategies and evaluation techniques. Teachers can improve the quality of their instruction and training by using a blend of Higher and Lower order cognitive questions. Using Bloom's Taxonomy to help design examination questions and analyze the results could greatly improve the quality of assessment in education.

Objective 2: *To study the progression of question paper setting from the lower to the higher level cognitive objectives.*

The above Table-1 clearly shows the trend in question paper setting in BA Education for the past five consecutive years, i.e. 2011 – 2015. It indicates that during the past five years, majority of the questions concentrated on Comprehension, Knowledge and Application domain respectively. Very few questions were asked from Analysis, Synthesis and Evaluation. Especially from 2011 to 2013, questions asked from the Higher Order Cognitive Skills were negligible (1.75% in 2011, 1.82% in 2012, none in 2013). But we see a slight improvement in 2014 (1.92%) and 2015 (5%), although the percentage is still quite low. This slight improvement may be attributed to the fact that Semester system was introduced from 2010 onwards with new curriculum, new teaching methods, new evaluation system, etc. The first batch of the semester system secured their bachelor degree in 2013.

Hence we can conclude that there has been a slight improvement in question paper setting in the past few years with the introduction of semester system. Efforts have been made to include more questions from Higher Order Cognitive Skills. But there is still a long way to go. With the introduction of CBCS in 2016, hopefully we will see more improvement in question paper setting in the near future.

Suggestions for Improvement

1. The study found that in all the question papers analysed, majority of the questions belonged to the Lower Order Cognitive Skills, predominantly comprehension, closely followed by knowledge. Only a negligible number of questions were asked from the Higher Order Cognitive Domains. This trend clearly indicates the low quality of our educational system. If this trend continues, then the quality of education will deteriorate further. Hence, remedial steps have to be taken in the areas of curriculum design, classroom teaching-learning, evaluation procedures, etc with immediate effect to redress this problem and improve the present system.
2. Teachers need to be made aware of Bloom's Taxonomy and its relevance in the field of education, particularly in question paper setting. It should be made an integral part of the curriculum in teacher training programmes.
3. Teachers need to be informed of the importance of maintaining the correct balance between lower and higher order cognitive questions. Teachers cannot set an examination paper comprising numerous Lower Order Cognitive Questions. Effective questions that include problem solving and complex thinking skills should be adequately included to stimulate students' mental activities.
4. Teacher Training Programmes/Workshops on Question Paper Setting should be periodically conducted by the concerned authorities.
5. Teachers selected for setting of question papers should be given short training (one day) on Bloom's Taxonomy. If this is not possible, they should be provided with information regarding Bloom's Taxonomy Coding Scheme and be instructed to set questions accordingly.

Conclusion

In order to produce useful graduates who can contribute to the knowledge-based global economy, we must provide quality higher education. This means producing graduates who are intuitive and creative, and who are able to use their cognitive skills when faced with problem solving tasks. Students should posses a number of cognitive skills such as an understanding of methodologies or ability in critical analysis. An essential need is the development of reliable tools and methods that reinforce and

assess new curriculum designs, new teaching-learning strategies, new learning styles, new evaluation techniques and so on. Bloom's Taxonomy relates to all these different aspects of education and can be effectively applied to improve the quality of education.

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"If you don't build your dream, someone else will hire you to help them build theirs."

Dhirubhai Ambani

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TITLE OF THESIS	:	ANALYSIS OF EXAMINATION QUESTION PAPERS IN EDUCATION USING THE COGNITIVE LEVELS OF BLOOM'S TAXONOMY OF EDUCATIONAL OBJECTIVES

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ANALYSIS OF EXAMINATION QUESTION PAPERS IN EDUCATION USING THE COGNITIVE LEVELS OF BLOOM'S TAXONOMY OF EDUCATIONAL OBJECTIVES

ABSTRACT

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Introduction

One of the most important aim of education is to provide the best quality education so as to produce useful graduates who can contribute to the knowledge-based global economy. This means producing graduates who are intuitive and creative, and who are able to use their cognitive skills when faced with critical problem solving tasks. The ability to reason effectively and to solve problems creatively are higher order cognitive skills which must be acquired through appropriate instruction and training. Teachers can provide this type of instruction and training by using a blend of higher, middle and lower order cognitive questions given in Bloom's Taxonomy.

Assessment is the crucial stage in determining whether students' conceptual development has reached higher order cognitive skills or not. Written examination is a conventional yet universal tool to evaluate the student's performance in a subject area. Whether or not the written examination is able to assess the student's ability very much depends on the questions presented in the examination paper. A good and reasonable examination paper must consist of various difficulty levels to accommodate the different capabilities of students. Improving students' conceptual understanding depends on the question types asked by the teachers, whether in the classroom or in examinations. The art of skilful questioning is a key to stimulate student's mental activities, thereby engaging students in higher-order thinking.

While questioning is identified as one of the most effective instructional strategies, research on questioning indicates that the use of questions by teachers is predominantly low level. Teachers tend to ask questions in the knowledge category 80% to 90% of the time (Azar, 2005). While these questions are not bad in themselves, using them all the time is not good practice. It is preferable to try to utilize higher order level of questions which require much more brain power and more extensive and elaborate answers.

The assumption exist that questions relating to application skills should start to dominate the higher academic levels in education, with a corresponding reduction in questions requiring retention skills. One must set good/proper questions where appropriate attention is given to maintaining the correct balance between lower, middle and higher order cognitive questions as given by Bloom's Taxonomy. All these have made the investigator curious to know the level of teaching–learning and evaluation existing in the higher educational institutions of Mizoram, and the following questions are raised in her mind:-

1) At what level of the Cognitve domain of Bloom's Taxonomy are the students of Higher Secondary, College and University stages functioning?

2) At what cognitive level are the students being taught and examined?

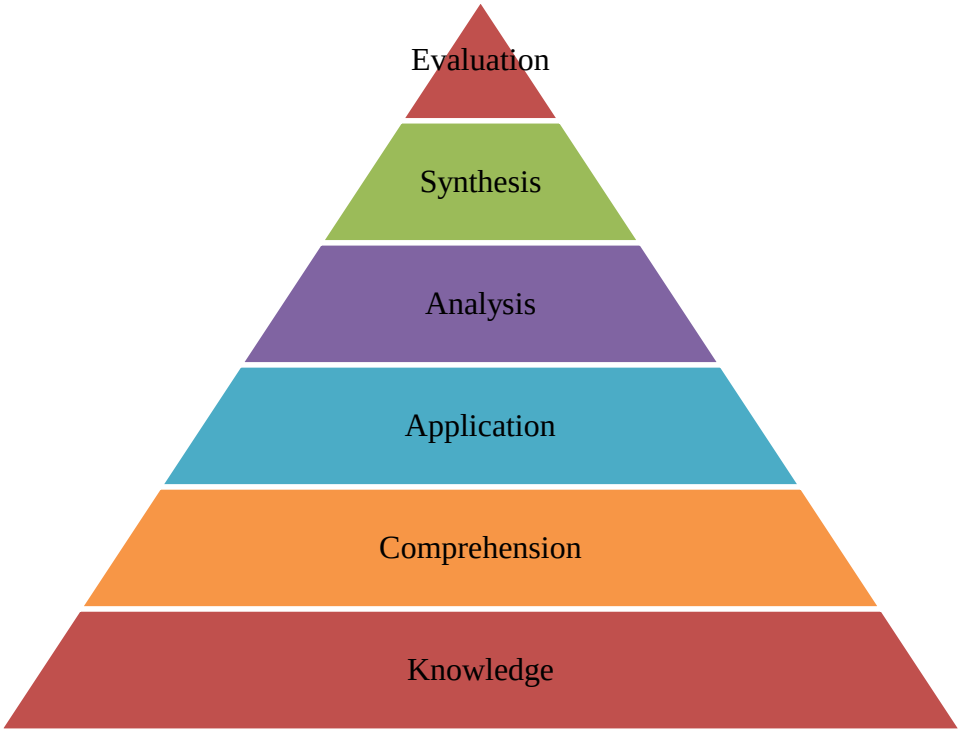
3) What is the prevailing standard of question paper setting in the higher educational institutions of Mizoram?

4) How can the standard of teaching-learning and question setting be improved towards higher order thinking?

5) How can Bloom's Taxonomy be applied to improve teaching-learning and evaluation methods of higher educational institutions in Mizoram?

In Bloom's Taxonomy of Educational Objectives, we are provided with six cognitive levels that begin with simple knowledge at the lowest level ranging all the way to evaluation at the highest level. These cognitive levels consist of Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation. These levels have often been depicted as a stairway, leading many teachers to encourage their students to climb to a higher level of thought. It is widely believed that if we can gradually adjust our way of teaching and questioning towards higher order cognitive skills given in Bloom's Taxonomy, it will not only improve the cognitive abilities of students but improve the overall quality of education. Bloom's Taxonomy is a valuable tool in the construction and assessment of question papers. Using Bloom's Taxonomy to help design examinations and analyze the results could greatly improve the quality of assessment in education. Hence the need arises for conducting analysis of question papers from the perspective of the cognitive levels of Bloom's Taxonomy.

Table I : Bloom's Taxonomy Cognitive Levels



Though there are some studies which have looked into the analysis of question papers using Bloom's Taxonomy in various parts of the world, none is there to throw light on the analysis of question papers in Mizoram. To get proper answers to the questions raised above and to fill a research gap, a study on question paper setting is conducted. By undertaking this study, the investigator hopes that the findings will lead us to know at what level we are examining our students. It will help us to understand where we are functioning at present and where we have yet to go. Knowledge of this result will, hopefully, pave the way to work out good training programmes for teachers with new and improved teaching and assessment techniques. Thus, the problem of the present study is stated as :

"Analysis of Examination Question Papers in Education using the Cognitive Levels of Bloom's Taxonomy of Educational Objectives".

Objectives of the study : –

The present study has the following objectives:

1. To analyze selected question papers in Education at Higher Secondary, Collegiate and University levels in terms of the Cognitive domain of Bloom's Taxonomy of Educational Objectives.

2. To study the progression of question paper setting from the lower to higher level cognitive objectives in Education at Higher Secondary, Collegiate and University levels.

3. To find out the cognitive level of students of Higher Secondary, Collegiate and University in terms of the Cognitive domain of Bloom's Taxonomy of Educational Objectives.

4. To study teachers' understanding of Bloom's Taxonomy of Educational Objectives and its implications in question paper setting.

5. To study the impact of training of teachers in Bloom's Taxonomy on their question paper setting.

Key Terms Used in the Study:-

1. **Analysis** : Analysis means the act of assessing, appraisal or evaluation of an object, person or things. In the present study, analysis refers to the assessment or evaluation of a student's achievement or performance on a selected course, i.e, Education.

2. **Cognitive** : Cognitive refers to the ability (or lack of) to think, learn and memorize; it is an expression of intellectual capacity pertaining to the mental processes of comprehension, judgment, memory, and reasoning. In the present study, cognitive will refer to the mental skills such as knowing, understanding, perceiving, memorizing, reasoning, judging, etc. that are used in the process of acquiring knowledge.

3. **Examination Question Papers** : It is an assessment tool for evaluating students' performance in a given subject area. Items of various difficulty levels are constructed to test the different cognitive capabilities of students. Question papers in this study will refer to Class XII Education Board Examination question papers, B.A Education and M.A Education End Semester Examination question papers of five consecutive years,i.e., 2011 – 2015.

4. **Taxonomy of Educational Objectives**: The word **'taxonomy'** simply means **'classification of things arranged in a hierarchical order'**. Taxonomy of

Educational Objectives, often called Bloom's Taxonomy, is a classification of the different objectives and skills that educators set for students (learning objectives). Bloom's Taxonomy divides educational objectives into three domains – Cognitive, Affective and Psychomotor. For the present study, Taxonomy of Educational Objectives will refer to Bloom's Educational Objectives in the Cognitive domain i.e. Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation.

5. **Lower Order, Middle Order and Higher Order Cognitive Objectives/Skills:** The six levels in the cognitive domain of Bloom's Taxonomy have been divided into three groups:

   i) Knowledge and Comprehension (Lower Order Cognitive Objectives)

   ii) Application and Analysis (Middle Order Cognitive Objectives)

   iii) Synthesis and Evaluation (Higher Order Cognitive Objectives)

Delimitations of the study:-

1) The study is delimited to analysis of Education question papers of HSSLC (Class XII) Board Examinations, B.A (Education) End Semester Examinations and M.A (Education) End Semester Examinations of five consecutive years, i.e., 2011, 2012, 2013, 2014 and 2015.

2) The study is delimited to Class XII students reading Education subject in Aizawl, Vth Semester B.A Education Core students studying in various Colleges in Aizawl,

and Ist and IIIrd Semester M.A Education students studying in the Department of Education, Mizoram University and ICFAI University in Aizawl.

3) The study is delimited to teachers teaching Education subject in various Higher Secondary schools, Colleges and two Universities in Mizoram.

Methodology :-

1. Method of study: Keeping in view the nature of various objectives of the study, the investigation used both Quantitative and Qualitative methods. For instance, Descriptive Survey method, which comes under Quantitative Research, was employed to study two objectives:- to find out the cognitive level of Higher Secondary, Collegiate and University students in terms of the Cognitive domain of Bloom's Taxonomy (Objective 3) and to study teachers' understanding of Bloom's Taxonomy and its implications in question-paper setting (Objective 4). At the same time, Experiment method was employed to study the impact of training of teachers in Bloom's Taxonomy on their question-paper setting (Objective 5).

The present study also employed Qualitative Research in the form of Content Analysis method to analyze selected question papers in Education at Higher Secondary, Collegiate and University levels in terms of the Cognitive domain of Bloom's Taxonomy (Objective 1) and to study the progression of question paper setting from the lower to the higher level cognitive objectives in Education at Higher Secondary, Collegiate and University levels (Objective 2).

2. Population : –

i) Population 1: All Class XII, Vth Semester B.A Education and Ist and IIIrd Semester M.A Education students studying Education subject in different Higher Secondary Schools, Colleges and Universities in Mizoram constituted the population of students for this study.

ii) Population 2: All Higher Secondary, College and University teachers teaching Education subject in different Higher Secondary Schools, Colleges and Universities in Mizoram constituted the population of the teachers for this study.

Table II : Population of Teachers and Students of Education subject in Mizoram during the academic session 2016-2017

Institution	Population of Teachers	Population of Students
Higher Secondary	204	5149 (Class XII Education)
College	87	525 (Vth Semester B.A Education Core)
University	18	90 (Ist & IIIrd Semester M.A Education)

3. Sample :–

i) Sample of Students: The sample for the study relating to finding out the Cognitive levels of students of Higher Secondary, Collegiate and University in terms of the Cognitive domain of Bloom's Taxonomy (Objective 3) consisted of 776 students - 380 Class XII students reading Education in various Higher Secondary schools in Aizawl; 310 students of Vth Semester B.A (Education Core)

studying in various degree Colleges of Aizawl; and 86 students studying Ist and IIIrd Semester M.A (Education) in Mizoram University and ICFAI University.

ii) Sample of Teachers: The sample for the study relating to teachers' understanding of Bloom's Taxonomy of Educational Objectives and its implications in question paper setting (Objective 4) consisted of 163 teachers teaching Education subject in different Higher Secondary schools, Colleges and Universities in Mizoram. Out of these, 76 teachers were from Higher Secondary schools, 70 from Colleges and 17 teachers from Universities.

The sample for studying the impact of training of teachers in Bloom's Taxonomy on question paper setting (Objective 5) consisted of 30 teachers who participated in the Orientation Course for teachers organized by the Human Resource Development Centre, Mizoram University during 19 October to 15 November 2016.

iii) Sampling Technique: Since the study was related to only Education students and teachers of Higher Secondary, Collegiate and University levels, Stratified Random Sampling technique was employed for collection of samples for the study.

4. Distribution of Sample :-

The sample of the present study consists of 776 students reading Education subject in various higher educational institutions in Aizawl. 380 samples were Class XII students, 310 samples were Vth Semester B.A (Education Core) students and 86 samples were M.A (Education) students. Out of these, 258 were male and 518 were female.

The sample of teachers consisted of 163 teachers of the Department of Education teaching in various Higher Secondary schools, Colleges and Universities in Mizoram; and 30 teachers who attended the Orientation Course programme organized by Mizoram University.

For the Higher Secondary school sample, the investigator collected data from 8 Higher Secondary Schools in Aizawl offering Education subject viz., Gov't JL Higher Secondary School, Gov't KM Higher Secondary School, Gov't Mizo Higher Secondary School, Gov't Central Higher Secondary School, Gov't Chaltlang Higher Secondary School, Gov't Mamawii Higher Secondary School, Gov't Republic Higher Secondary School, and Synod Higher Secondary School.

For the College sample, data was obtained from 8 Colleges in Aizawl offering B.A Education Core Course viz., Pachhunga University College, Gov't Aizawl College, Gov't Hrangbana College, Gov't Johnson College, Gov't T.Romana College, Gov't Aizawl West College, Gov't Aizawl North College and Gov't J. Thankima College.

The sample for University students was collected from the M.A (Education) students of Departments of Education, Mizoram University and ICFAI University. A more detailed view of the distribution of samples is presented in the tables below.

Table III : Distribution of Sample of Students

Sl. No.	Level	Total Number	Male	Female	Urban	Rural
1	Higher Secondary School (Class XII)	380	142	238	193	187
2	College (V^{th} Sem B.A)	310	101	209	140	170
3	University (M.A I^{st} & III^{rd} Sem)	86	15	71	39	47
Grand Total		**776**	**258**	**518**	**372**	**404**

Table IV : Distribution of Sample of Teachers for Opinionnaire

Sl. No	Category of Respondents	Total Number	Male	Female	Working in Aizawl	Working outside Aizawl
1	Higher Secondary School Teachers	76	19	57	58	18
2	College Teachers	70	13	57	55	15
3	University Teachers	17	5	12	17	-
	Grand Total	**163**	**37**	**126**	**130**	**33**

Table V : Distribution of Sample of Teachers for Pre-test / Post-test Experiment

Gender	Nos.	Institution Level	Nos.	Stream	Nos.	Place of Work	Nos.	Degree	Nos.
M	14	PG	3	Arts	25	Mizoram	9	Master Degree	13
								M. Phil	12
F	16	UG	27	Science	5	Outside Mizoram	21	Ph. D	5
TOTAL - 30									

5. Tools of Data Collection:

As research on Bloom's Taxonomy and its implications in question-paper setting is very few, there is not much literature relating to the present study. There were no standardized tools available for conducting the tests. Therefore, the investigator, with the help of the supervisor, prepared the tools used in this study, following appropriate procedures for formation of tools and also consulting a number of related literature for guidance. The following tools were developed by the researcher for collection of required data.

i) Bloom's Taxonomy Coding Scheme: Bloom's Taxonomy Coding Scheme was developed from the works of 15 other researchers in order to analyze question papers in Education of Class XII, B.A and M.A as well as to study the progression of question paper setting from the lower to higher level cognitive objectives, The Coding Scheme basically comprises of the six cognitive levels given by Bloom,

viz., Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation. Key words or verbs for each level was compiled to be used as a guide for structuring or framing questions and tasks. Question types to be set for each level with expected learning outcomes have also been given. The Coding Scheme plays a pivotal role for achieving all the objectives of the present study.

Table VI : Bloom's Taxonomy Coding Scheme

COGNITIVE LEVEL	KEY VERBS
Knowledge Level: Questions in this level should relate to testing of knowledge. Students should be able to remember or recall data or information.	define, know, label, list, match, name, recall, reproduce, select, state, how much is, how did, what is, write, tell, show, collect, quote, who, when, where, locate, find, what, why, omit, which, choose, how, spell, visualize, draw, read, record, view, point to, point out, memorize, recite, repeat, tick.
Comprehension Level: Questions in this level should relate to testing of understanding of acquired knowledge. Students should be able to understand the meaning of material and able to reproduce in own words, explain ideas and concepts.	comprehend, convert, distinguish, explain, give examples, paraphrase, rewrite, summarize, translate, what is the main idea of, describe, illustrate, illuminate, associate, differentiate, discuss, outline, restate, relate, rephrase, express, transform, confirm, , cite, make sense out of, state in own words, throw light on, trace, understand, report, enumerate, elaborate, rotate, articulate, elucidate.

Application Level: Questions in this level should relate to testing of ability to apply acquired knowledge in new situations. Students should be able to use or apply a previously learned concept in a new situation.	apply, change, compute, demonstrate, manipulate, operate, predict, prepare, produce, solve, use, calculate, complete, classify, experiment, build, interview, make use of, organize, plan, utilize, model, interpret, act, administer, chart, contribute, control, extend, construct, implement, include, inform, instruct, operationalize, participate, preserve, project, provide, teach, transfer, give original examples, sketch, paint, dramatize, make, extrapolate, identify, suggest, tabulate.
Analysis Level: Questions in this level should relate to testing of analytical capabilities. Students should be able to break up material into different parts for an in-depth study, distinguish between different parts.	analyze, break down, deconstruct, discriminate, infer, separate, categorize, question, order, connect, arrange, divide, examine, investigate, advertise, discover, dissect, inspect, simplify, survey, take part in, test for, distinction, theme, relationship, function, motive, assumption, organize, correlate, focus, limit, recognize, subdivide, research, take apart, sort, debate, affect, infer/inference.

Synthesis Level: Questions in this level should relate to testing of ability to synthesize existing knowledge to create something new. Students should be able to put parts together to form a new whole, create or develop a new product or idea.	combine, compile, compose, create, devise, design, generate, modify, rearrange, reconstruct, reorganize, revise, develop, propose, hypothesize, invent, integrate, substitute, what if?, formulate, generalize, imagine, make up, originate, solution, suppose, original, improve, adapt, minimize, maximize, delete, theorize, support, schematize, add, anticipate, collaborate, communicate, facilitate, incorporate, individualize, initiate, intervene, negotiate, progress, reinforce, restructure, validate, derive, roleplay, add to create.
Evaluation Level: Questions in this level should relate to testing of evaluation of theory, policy, etc. Students should be able to make judgement about the value of material or ideas, justify a statement or idea.	appraise/apprise, compare, contrast, criticize/critique, defend, evaluate, justify, judge, rate, assess, recommend, rank, grade, test, measure, convince, verify, argue, prioritise, determine, award, dispute, mark, rule on, agree, opinion, criteria, prove, disprove, perceive, value, estimate, influence, deduct, consider, reframe, score, deduce, weigh, option, preferable/prefer, draw conclusions/conclude.

ii) Cognitive Level Test: Cognitive Level Test to find out the cognitive level of students in terms of the Cognitive domain of Bloom's Taxonomy was developed by the investigator where students were asked to set 5 questions of different difficulty levels ranging from 1 to 5, from two topics in Educational Psychology course. They had to set 10 questions in all, 5 questions for each of the two topics. The questions set by the students were analysed on the basis of the Coding Scheme and then placed in their proper categories of Bloom's Cognitive levels.

iii) Opinionnaire: Opinionnaire to study teachers understanding of Bloom's Taxonomy and its implications in question-paper setting was constructed which consisted of 22 statements or questions with 3 choices for each question to be simply ticked by the respondent. It was divided into three sections namely 1) Awareness of teachers regarding Bloom's Taxonomy (8 statements), 2) Application of Bloom's Taxonomy in teaching-learning and evaluation (7 statements) and 3) Attitude of teachers towards Bloom's Taxonomy (7 statements).

iv) Pre-test/Post-test Experiment: A schedule was constructed for both the Pre-test and Post-test experiment to study the impact of training of teachers in Bloom's Taxonomy on their question-paper setting. Both the Pre-test and Post-test schedules consisted of 12 items, and these items are a combination of questionnaires and test exercises covering areas such as experience in question paper setting, need for training in question paper setting, purpose of formative and summative testing, awareness on classification of questions and difficulty level of questions, construction and classification of key verbs for framing questions, arrangement of levels of students learning, setting of questions of different difficulty orders for final examinations, etc. In this experiment, 4 questions were included only in the Pre-test, 4 only in the Post-test, and 8 in both the Pre-test and Post-test. The details about the questions included in the Pre-test and Post-test have been given in the table below.

6. Sources of Data:

The study has used both primary and secondary sources of data for the attainment of its objectives.

i) Primary data relating to the Cognitive level of students in terms of the Cognitive domain of Bloom's Taxonomy (Objective 3) and teachers' understanding of Bloom's Taxonomy and its implications in question-paper setting (Objective 4) were personally collected by visiting 8 Higher Secondary Schools, 8 Colleges and 2 Universities in Aizawl; and to study the impact of training of teachers in Bloom's Taxonomy on their question-paper setting (Objective 5), Pre-test and Post-test experiment was jointly conducted by the investigator and the supervisor.

ii) Secondary data relating to Analysis of question papers in Education at Higher Secondary, Collegiate and University levels in terms of the Cognitive domain of Bloom's Taxonomy (Objective 1), and Progression of question paper setting from the Lower to Higher level cognitive objectives in Education at Higher Secondary, Collegiate and University levels (Objective 2) were collected from Examination Cell of Mizoram Board of School Education and Mizoram University respectively. These data relate to old examination question papers of Education subject of HSSLC Board Examination, B.A End Semester Examination and M.A End Semester Examination for five consecutive years, i.e., 2011 to 2015.

7. Statistical Techniques Applied for Analysis of Data:

Given the nature of data and the objectives of the study, Descriptive Statistics like frequency distribution, percentages and t-test for large correlated sample (Single Group Method) were applied for the analysis and interpretation of data.

Table VII: Pre-test/Post-test Questions

<table>
<tr><th colspan="3">QUESTIONS/STATEMENTS INCLUDED IN THE PRE -TEST POST-TEST EXPERIMENT</th></tr>
<tr><td colspan="3">A. QUESTIONS/STATEMENTS INCLUDED ONLY IN THE PRE-TEST</td></tr>
<tr><th colspan="2">Questions/Statements</th><th>Remarks</th></tr>
<tr><td>1</td><td>Have you ever been appointed as a paper setter?</td><td rowspan="4">These questions/statements were included only in the pre- test to understand the experience and training of the participants in question paper setting. They were asked about their experience in question paper setting at college and university levels and the frequency of these appointments, the reference materials they used when setting question papers, whether they had attended any type of training on question setting and the quality and duration of such training, their opinion regarding the importance of conducting training on question setting and their knowledge/awareness of Bloom’s Taxonomy. Data gathered for these items have been used to explain the background experiences of the participants in the experiment.</td></tr>
<tr><td>2</td><td>Have you ever got any formal training in question paper setting?</td></tr>
<tr><td>3</td><td>In your opinion, how would you rate the importance of conducting training on question paper setting?</td></tr>
<tr><td>4</td><td>Have you ever come across Bloom’s Taxonomy of Educational Objectives?</td></tr>
</table>

B.	QUESTIONS/STATEMENTS INCLUDED ONLY IN THE POST-TEST	
Questions/Statements		**Remarks**
1	What was the quality of training on question paper setting provided in the last class?	These questions/statements were included only in the post- test to understand the view of the participants regarding the quality of training in question paper setting provided to them, their opinion on the importance of conducting training on question setting for college and university teachers, to evaluate their understanding of the cognitive levels of Bloom's Taxonomy, and their preference for questions at different levels of education. Data gathered for these items have been used to explain the learning experiences of the participants in the experiment.
2	In the background of brief training on question paper setting provided to you in the last class, how would you rate the importance of conducting such training for college and university teachers?	
3	Go through the following questions and write in front of each of these question the level to which it belongs to in terms of Bloom's taxonomy of educational objectives.	
4	In your opinion, what percentage of question at different stages of education should relate to the six categories suggested by Bloom' taxonomy.	

C.	COMMON QUESTIONS/STATEMENTS INCLUDED IN BOTH PRE-TEST AND POST-TEST	
Questions/Statements		**Remarks**
1	Do you think there is a need for conducting such training for teachers?	These questions/statements were included in both the pre-test and post-test in order to find out the impact of training on question paper setting using Bloom's Taxonomy. These common questions were used to compare the performance of the participants on various issues like need for formative and summative testing, classification of questions, arrangement of questions according to difficulty level, writing of verbs for setting questions, rating situations of student learning from lowest to highest level, and setting questions of different difficulty order. Data gathered for these items have been used to determine if there was improvement in the post-test performance as well as to determine the success of the intervention programme and the experiment.
2	Why do we conduct class tests/unit tests/term tests?	
3	Why do we conduct annual/semester exams?	
4	Describe the various classification of questions?	
5	Arrange the following types of questions in terms of their difficulty order by writing 1 in front of the most easiest and 6 in front of the most difficult.	
6	Write twenty (20) verbs like What, Define, explain etc. that are used in framing questions.	
7	The following table describes situations depicting six levels of students learning. You are expected to rate these levels from the lowest to highest level of students learning by writing 1 in front of a situation that is indicative of lowest level, and by writing 6 in front of the situation that depicts highest level of students' learning.	
8	Set 6 questions for end semester examination in the subject you teach and write the difficulty order in front of each question. (Write No.1 in front of the easiest question and No. 6 in front of the most difficult).	

Major findings of the study:-

1. Findings relating to Analysis of HSSLC, BA and MA Education Question Papers of five consecutive years i.e. 2011 – 2015 (Objective 1) :-

1) HSSLC (Arts) Board Examination Education question papers of five consecutive years, i.e., 2011 to 2015, were analyzed on the basis of Bloom's Taxonomy Coding Scheme. Each question was individually analyzed and then categorized into the different cognitive levels of Bloom's Taxonomy. The study found that majority of the questions were asked from the lower cognitive objectives of Bloom's Taxonomy, namely Knowledge and Comprehension. A small number of questions were also asked from Application. No questions were asked from the higher cognitive objectives like Analysis, Synthesis and Evaluation. In fact, the highest number of questions came from Comprehension domain (49.74%), followed by Knowledge domain (43.45%) and a very small number from Application domain (6.72%).

2) Twelve papers/courses offered in B.A Education programme by Mizoram University were selected for analysis. B.A Education End Semester question papers of five consecutive years, i.e., 2011 to 2015 were analyzed on the basis of Bloom's Taxonomy Coding Scheme. The findings indicate that majority of the questions belonged to Comprehension domain (57.88%), followed by Knowledge domain (38.52%). There were a small percentage of questions from Analysis (1.97%), Application (0.92%) and Evaluation (0.71%) respectively. There were no questions from Synthesis level during these five years.

3) Fifteen papers/courses offered in M.A Education programme by Mizoram University were selected for analysis purpose. M.A Education End Semester question papers of five consecutive years, i.e., 2011 to 2015 were analyzed using Bloom's Taxonomy Coding Scheme. The findings revealed that majority of the questions belonged to Comprehension level (52.03%), followed by Knowledge level (29.13%), Analysis level (11.57%), Evaluation level (5.79%) and Application level (1.48%) respectively. There were no questions from Synthesis level in any of the five years.

4) From the consolidated analysis of Class XII, B.A and M.A final examination question papers of 2011 to 2015, it was revealed that the questions concentrated largely on testing the two lower cognitive domains, i.e., Comprehension and Knowledge respectively. The Higher Secondary school question papers concentrated mainly on the lower cognitive domains, with a very small percentage from Application domain and no questions from the higher cognitive domains. The BA Education question papers concentrated largely on the two lower cognitive domains with a small percentage of questions coming from the higher domains. Likewise, the M.A Education papers also concentrated more on the two lower domains although there were more questions from the higher domains compared to the Higher Secondary and B.A Education question papers.

Table VIII: Consolidated Analysis of HSSLC, B.A and M.A Education Examination Question Papers from 2011 to 2015

Taxonomy Levels	Higher Secondary	College	University
Knowledge	43.54%	29.18%	29.13%
Comprehension	49.74%	58.87%	52.03%
Application	6.72%	1.34%	1.48%
Analysis	-	8.7%	11.57%
Synthesis	-	-	-
Evaluation	-	1.91%	5.79%

2. Findings relating to progression of question paper setting from the lower to higher level cognitive objectives in Education at Higher Secondary, Collegiate and University levels (Objective 2) :-

1) At the Higher Secondary stage, it was found that the lower cognitive questions dominated the HSSLC Board Examination question papers, with a small percentage of questions from the middle cognitive objectives and no questions from the higher cognitive objectives. During the five years of analysis, the percentage of lower cognitive questions in 2011 (93.55%) decreased slightly by 2015 (93.1%) and the percentage of middle cognitive questions in 2011 (6.45%) increased slightly by 2015 (6.90%).

From these findings, it can be concluded that with the passage of years, the percentage of questions in the lower domain have reduced and the percentage of questions in the middle domain have increased, although not to a considerable extent.

2) At the College stage, during 2011 to 2015, the percentage of lower cognitive questions in 2011 (97.55%) decreased by 2015 (92.94%) and the percentage of middle cognitive questions in 2011 (0.89%) increased by 2015 (5.76%). However, the findings revealed that the percentage of questions from the higher cognitive objectives in 2011 (1.56%) declined slighty by 2015 (1.3%).

Based on these findings, we may conclude that with the passing of time, the percentage of questions in the lower domain have reduced and the percentage of questions in the middle domain have increased, although we did not see progression in the higher cognitive objectives.

3) At the University stage, it was seen that during 2011 to 2015, the percentage of lower cognitive questions in 2011 (81.7%) decreased by 2015 (79.06%) and the percentage of higher cognitive questions in 2011 (4.48%) increased by 2015 (7.80%). However, the findings also revealed that the percentage of questions from the middle cognitive objectives in 2011 (13.82%) declined slighty by 2015 (13.14%), though not significantly.

Hence, we may conclude that over the five years (2011 to 2015), the percentage of questions in the lower domain have reduced and the percentage of

questions in the higher domain have increased. Though we did not see progression in the middle cognitive objectives, it remained more or less constant.

4) Consolidated analysis of results indicate that at Higher Secondary level, 93.28% of the questions during 2011 to 2015 were from the first two levels of Bloom's Taxonomy, i.e., Knowledge and Comprehension, which are considered to be lower level objectives. However, this percentage reduced to 88.05% at collegiate level and 81.16% at university levels.

Analysis of the data in the same table depicts that 6.72% of the questions in Higher Secondary level came from the middle level objectives, i.e., Application and Analysis. This percentage increased to 10.04% at Collegiate level and 13.05 % at University level.

Further analysis of the data depicts that there were no questions relating to the two highest cognitive objectives, i.e., Synthesis and Evaluation at Higher Secondary level during 2011 to 2015, whereas the percentage of such questions at Collegiate and University levels were 1.91% and 5.79 % respectively.

From these findings, it can be concluded that with the movement of students from lower to higher stages of education, the percentage of questions in the lower domain have reduced and the percentage of questions in the middle and higher domains have increased, although not to a desirable extent.

Table IX: Consolidated View of Progression of HSSLC, B.A and M.A Education Examination

Question Papers from 2011 to 2015

Overall Classification of Objectives	Level of Objectives in Cognitive Domain	Stages of Education					
		Higher Secondary		College		University	
Lower level objectives	**Knowledge**	43.54%	**93.28%**	29.18%	**88.05%**	29.13%	**81.16%**
	Comprehension	49.74%		58.87%		52.03%	
Middle level objectives	**Application**	6.72%	**6.72%**	1.34%	**10.04%**	1.48%	**13.05%**
	Analysis	-		8.7%		11.57%	
Higher level objectives	**Synthesis**	-	**0%**	-	**1.91%**	-	**5.79%**
	Evaluation	-		1.91%		5.79%	

3. Findings regarding the Cognitive levels of Higher Secondary, Collegiate and University Students in terms of the Cognitive Domain of Bloom's Taxonomy (Objective 3) :-

1) The cognitive levels of Higher Secondary students fall predominantly on the two lower Cognitive levels, i.e., Knowledge (52.84%) and Comprehension (37.61%) followed by Analysis (4.29%), Application (3.21%) and Evaluation (2.05%) respectively. No questions were set from Synthesis level.

2) The cognitive levels of the College students are mostly concentrated in the two lower cognitive levels, i.e., Knowledge (44.26%) and Comprehension (38.71%) followed by Analysis (9.74%), Evaluation (4.61%) and Application (2.68%) respectively. No questions came from Synthesis level here also.

3) The cognitive levels of University students mostly come under the two lower cognitive levels, i.e., Comprehension (45.35%) and Knowledge (32.91%) followed by Analysis (11.63%) Evaluation (4.61%) and Application (2.68%) respectively. No set of questions came from Synthesis level in this sample either.

4) Consolidated analysis of results revealed that Knowledge level ability dominates at the Higher Secondary stage, which decreases slightly at the College stage and by University stage, it is overtaken by Comprehension level ability. Hence, we can conclude that the cognitive abilities of higher secondary, collegiate and university students mainly fall at the lower cognitive levels.

The same analysis also indicated that there is development of higher cognitive abilities like Application, Analysis and Evaluation, at the college and university stages, though not to a large degree. This shows that there is growth in the cognitive levels of students as they mature in age and progress to higher classes.

Table X: Consolidated Result of Higher Secondary, College & University students on Cognitive Level Test

Bloom's Taxonomy Cognitive Levels	**Higher Secondary (N-380)**		**College (N–310)**		**University (N–86)**	
	Percentage of questions set by respondents		**Percentage of questions set by respondents**		**Percentage of questions set by respondents**	
Knowledge	52.84%	**90.45**	44.26%	**82.97**	32.91%	**78.26**
Comprehension	37.61%		38.71%		45.35%	
Application	3.21%	**7.5**	2.68%	**12.24**	4.88%	**16.51**
Analysis	4.29%		9.74%		11.63%	
Synthesis	-	**2.05**	-	**4.61**	-	**5.23**
Evaluation	2.05%		4.61%		5.23%	

4. Findings with regard to teachers' understanding of Bloom's Taxonomy and its implications in question paper setting (Objective 4) :-

The Opinionnaire for testing teachers' understanding of Bloom's Taxonomy and its implications in question paper setting had three sections:-

Section 1 - Awareness of teachers regarding Bloom's Taxonomy (8 statements)

Section 2 - Application of Bloom's Taxonomy in teaching-learning and evaluation (7 statements)

Section 3 - Attitude of teachers towards Bloom's Taxonomy (7 statements)

The findings are presented in the following tables:

Table XI: Findings on Awareness of teachers regarding Bloom's Taxonomy

Sl. No	Statement	Response Categories	HSS Teachers	College Teachers	University Teachers
1	Have you heard of 'Bloom's Taxonomy of Educational Objectives'?	Yes	70 (92.11%)	67 (95.71%)	17 (100%)
		No	Nil	Nil	Nil
		Not Sure	6 (7.89%)	3 (4.29%)	Nil
2	Are you aware that Bloom's Taxonomy classifies human thinking into different domains ?	Yes	70 (92.11%)	67 (95.71%)	17 (100%)
		No	Nil	Nil	Nil
		Not Sure	6 (7.89%)	3 (4.29%)	Nil

3	Do you know that Bloom classified the Cognitive domain into different levels?	Yes	57 (75%)	54 (77.14%)	17 (100%)
		No	6 (7.89%)	7 (10%)	Nil
		Not Sure	13 (17.11%)	9 (12.86%)	Nil
4	Are you aware that Bloom's Taxonomy provides objectives to be achieved in each level of the cognitive domain with expected learning outcomes?	Yes	55 (72.37%)	52 (74.29%)	16 (94.12%)
		No	6 (7.89%)	7 (10%)	Nil
		Not Sure	15 (19.74%)	11(15.71%)	1 (5.88%)
5	Are you aware that Bloom's Taxonomy can be used for designing/developing curriculum and learning activities?	Yes	36 (47.37%)	40 (57.14%)	16 (94.12%)
		No	10 (13.16%)	3 (4.29%)	Nil
		Not Sure	30 (39.47%)	27 (38.57%)	1 (5.88%)
6	Do you know that Bloom's Taxonomy can be used for conducting research?	Yes	35 (46.05%)	45 (64.29%)	15 (88.24%)
		No	10 (13.16%)	12 (17.14%)	Nil
		Not Sure	31 (40.79%)	13 (18.57%)	2 (11.76%)
7	Are you aware of the relevance of Bloom's Taxonomy in question paper setting and evaluation?	Yes	30 (39.47%)	40 (57.14%)	15 (88.24%)
		No	10 (13.16%)	12 (17.14%)	Nil
		Not Sure	36 (47.37%)	18 (25.72%)	2 (11.76%)
8	Do you know that Bloom developed key verbs for framing questions?	Yes	18 (23.68%)	28 (40%)	15 (88.24%)
		No	28 (36.84%)	20 (28.57%)	1 (5.88%)
		Not Sure	30 (39.48%)	22 (31.43%)	1 (5.88%)

In the section relating to Awareness of Bloom's Taxonomy of Educational Objectives, it was found that the Education teachers of Higher Secondary, College and University levels were aware of the basic concepts of Bloom's Taxonomy and its implications in education. Regarding the relevance of Bloom's Taxonomy in question paper setting and evaluation and key verbs given by Bloom for framing questions, it was found that most of the University teachers had good knowledge, more than half of the College teachers also had good awareness but the awareness level of Higher Secondary teachers was low.

Table XII: Findings on Application of Bloom's Taxonomy in teaching-learning and evaluation

Sl. No	Statement	Response Categories	HSS Teachers	College Teachers	University Teachers
1	Have you applied the cognitive objectives given by Bloom in your teaching and evaluation work?	Yes	36 (47.37%)	38 (54.29%)	16 (94.12%)
		No	29 (38.16%)	22 (31.43%)	Nil
		Not Sure	11 (14.47%)	10 (14.28%)	1 (5.88%)
2	Have you applied Bloom's Taxonomy for planning teaching or instructional objectives?	Yes	34 (44.74%)	32 (45.72%)	15 (88.24%)
		No	26 (34.21%)	20 (28.57%)	Nil
		Not Sure	16 (21.05%)	18 (25.71%)	2 (11.76%)
3	Have you applied Bloom's Taxonomy in planning student learning or learning activities?	Yes	30 (39.48%)	30 (42.86%)	16 (94.12%)
		No	18 (23.68%)	13 (18.57%)	Nil
		Not Sure	28 (36.84%)	27 (38.57%)	1 (5.88%)

4	Have you applied Bloom's Taxonomy for assessing students' abilities?	Yes	32 (42.11%)	30 (42.86%)	16 (94.12%)
		No	20 (26.31%)	17 (24.28%)	Nil
		Not Sure	24 (31.58%)	23 (32.86%)	1 (5.88%)
5	When you set exam questions, do you include questions to test the higher cognitive skills of students?	Yes	64 (84.21%)	53 (75.71%)	17 (100%)
		No	5 (6.58%)	6 (8.57%)	Nil
		Not Sure	7 (9.21%)	11 (15.72%)	Nil
6	How many questions from the higher cognitive objectives do you usually include ?	None	12 (15.79%)	17 (24.29%)	Nil
		One or Two	38 (50%)	35 (50%)	7 (41.18%)
		More than two	26 (34.21%)	18 (25.71%)	10 (58.82%)
7	Have you applied the key verbs for framing questions given by Bloom when setting question papers?	Yes	18 (23.68%)	28 (40%)	15 (88.24%)
		No	28 (36.84%)	20 (28.57%)	Nil
		Not Sure	30 (39.48%)	22 (31.43%)	2 (11.76%)

In the section relating to Application of Bloom's Taxonomy in teaching-learning and evaluation, it was revealed that the Education teachers of Higher Secondary, College and University levels have applied Bloom's Taxonomy of Educational Objectives to their teaching-learning and evaluation work to some degree. Majority of the University teachers had applied it in their work to a large

degree, and around half of the College and Higher Secondary teachers had also applied it in their teaching and evaluation work but not extensively. A significant number of the respondents gave negative or hesitant answers to the questions which reveals that many of them were not too familiar with the implications of Bloom's Taxonomy in teaching – learning and evaluation.

Table XIII: Findings on Attitude of teachers regarding Bloom's Taxonomy

Sl. No	Statement	Response Categories	HSS Teachers	College Teachers	University Teachers
1	How would you rate the current standard of question paper setting prevailing in your school/college/ university?	Poor	12 (15.79%)	14 (20%)	3 (17.65%)
		Satisfactory	39 (51.32%)	38 (54.29%)	14 (82.35%)
		Good	25 (32.89%)	18 (25.71%)	Nil
2	Do you think majority of exam questions test only the lower cognitive abilities of students?	Yes	18 (23.68%)	15 (21.43%)	2 (11.76%)
		No	50 (65.79%)	38 (54.29%)	15 (88.24%)
		Not Sure	8 (10.53%)	17 (24.28%)	Nil
3	Do you think more higher cognitive questions testing the critical and abstract skills of students should be included?	Yes	55 (72.37%)	53 (75.71%)	15 (88.24%)
		No	4 (5.26%)	4 (5.72%)	1 (5.88%)
		Not Sure	17 (22.37%)	13 (18.57%)	1 (5.88%)
4	Do you think teachers need a better training program in teaching and evaluation techniques than currently available?	Yes	72 (94.74%)	69 (98.57%)	16 (94.12%)
		No	Nil	Nil	Nil
		Not Sure	4 (5.26%)	1 (1.43%)	1 (5.88%)

5	Do you think setting questions in accordance with the Cognitive levels of Bloom's Taxonomy will enhance the quality of education?	Yes	70 (94.73%)	66 (94.28%)	17 (100%)
		No	Nil	Nil	Nil
		Not Sure	6 (5.27%)	4 (5.72%)	Nil
6	Do you think knowledge of Bloom's Taxonomy will optimize the teaching and evaluation skills of teachers?	Yes	64 (84.21%)	66 (94.28%)	17 (100%)
		No	Nil	Nil	Nil
		Not Sure	12 (15.79%)	4 (5.72%)	Nil
7	Do you think applying Bloom's Taxonomy in all aspects of education will improve our educational system?	Yes	48 (63.16%)	51 (72.86%)	13 (76.47%)
		No	Nil	Nil	Nil
		Not Sure	28 (36.84%)	19 (27.14%)	4 (23.53%)

In the section relating to Attitude towards Bloom's Taxonomy, it was found that majority of Higher Secondary, Collegiate and University teachers have a good attitude towards Bloom's Taxonomy of Educational Objectives and thought that setting questions in accordance with the key verbs given by Bloom for each cognitive level will go a long way in enhancing the teaching and evaluating skills of teachers and thereby improving the quality of different aspects of education to a great extent.

5. Findings relating to impact of training of teachers in Bloom's Taxonomy on their question paper setting (Objective 5) :-

To study the impact of training of teachers in Bloom's Taxonomy on their question-paper setting, a Pre-test Post-test experiment was conducted on 30 teachers who participated in the Orientation Course programme organized by Human Resource Development Centre, Mizoram University between 19th October and 15th November 2016. Both the Pre-test and Post-test schedules consisted of 13 items which are a combunation of questionnaires and test exercises. The findings in this regard are presented as follows:

1) 63.33% of the respondents reported that they have not been appointed as paper setters at College or University End Semester Examination levels and 36.67% replied that they had been appointed as paper setters. At the same time, all of them (100%) revealed that they had set questions for various class/unit/term tests in their own institutions.

2) There were three Post Graduate teachers attending the Orientation Course programme and all of them reported that they had been appointed as paper setters in their own University. However, none of them have ever been appointed as paper setters in other Universities.

3) There were 27 Under Graduate teachers among the Orientation Course participants and 74.07% reported that they had not been appointed as paper setters in their own University while 25.93% replied that they had been appointed as paper

setters in their own University. Only one respondent (3.70%) had been appointed as paper setter in other Universities.

4) 96.67% of the respondents reported that they have no formal training in question-paper setting. Only one participant (3.33%) replied that he/she received such training after joining the job in college.

5) 96.67% of the respondents declared that they believe training on question-setting is a necessity for teachers, and only one (3.33%) replied that there is no particular need for such a training.

6) 66.67% of the respondents believed that conducting training on question paper setting was extremely important, while 23.33% felt that it was important and 10% felt it was moderately important to conduct training on question-paper setting.

7) 76.67% revealed that they had no idea/knowledge about Bloom's Taxonomy of Educational Objectives and only 23.33% replied that they had come across Bloom's Taxonomy.

8) In order to determine the impact of Intervention on the performance of the participants, a test of significance was conducted on 7 items which are common in both the Pre-test and Post–test. Null hypothesis was formulated stating that there is no significant difference between Pre-test and Post-test performance/scores. A t-test for Large Correlated Sample (Single Group Method) was applied to test the null hypothesis and the findings are presented below:-

Table XIV: Significance of Differences between Pre-test and Post-test Scores On Various Issues Relating to Question Paper Setting

Sl. No	Question	Score				Correlation	Df	t-value	Decision about Ho
		Pretest		Posttest					
		Mean	SD	Mean	SD				
i	Conduct of class/unit/term tests.	3.5	1.41	4	1.2	0.47	29	2.00 n.s	Accepted
ii	Conduct of annual/semester exams.	3.2	1.37	3.7	1.29	0.51	29	2.08 *	Rejected
iii	Classification of questions	0.8	0.96	1.87	0.97	0.63	29	7.13**	Rejected
iv	Arranging questions in terms of difficulty order from 1 to 6.	2.7	1.92	3.87	1.91	0.51	29	3.34**	Rejected
v	Writing verbs for framing questions	16.33	3.55	19	1.98	0.19	29	3.93**	Rejected
vi	Arranging six situations depicting level of students' learning from lowest to highest level of 1 to 6.	1.83	1.64	3.07	1.74	0.69	29	4.96**	Rejected
vii	Setting of 6 questions of different difficulty order of 1 to 6 for end semester exam	2.9	0.92	4.23	0.86	0.38	29	7.39**	Rejected

n.s= not significant, * Significant at .05 Level, ** Significant at .01 Level

9) 53.33% of the respondents reported that they found the quality of training on question-setting provided during the process of the experiment to be very good, 40% said it was good, and 6.67% found it to be of average quality.

10) All the respondents (100%) agreed that there is a need for conducting training on question-paper setting for every teacher. 63.33% felt it was extremely important to conduct training on question paper setting, and 36.67% rated it to be important.

11) In the Post-test, the respondents were given a set of questions belonging to different Cognitive levels of Bloom's Taxonomy and they were asked to write down the level in which each of them belong. The result showed that 6.67% got a low score of 1 and 10% got a score of 2 respectively. 16.66% of the respondents got a score of 3, 40% got a score of 4, 20% got a score of 5 and only 6.67% got a perfect score of 6 where they placed all the questions correctly in their proper category of the Cognitive levels of Bloom's Taxonomy. Since only a small group of the respondents (33.33%) were in the low score range (1-3) and majority of the respondents (66.67%) were in the high score range (4-6), it was concluded that the respondents had a good understanding of classification of questions set according to the Cognitive levels of Bloom's Taxonomy after the training provided to them.

12) The respondents were also asked to give their suggestions with regard to inclusion of different levels of questions from Bloom's Taxonomy at Elementary, Secondary, Collegiate and University levels of education. At the Elementary stage, the respondents heavily favoured inclusion of majority of questions from the two

lower Cognitive domains and not too many questions from the other four higher Cognitive levels. At the Secondary stage, the respondents suggested more questions from the three lower Cognitive domains with emphasis on Comprehension domain and inclusion of several questions from the higher three domains. At the Collegiate stage, the respondents want the questions to be quite evenly distributed among all the domains while leaning slightly towards the higher domains. At the University stage, the respondents highly favour the inclusion of majority of the questions from the four higher Cognitive domains and very few questions from the two lower domains.

Through the results of analysis of various items of the test, we witnessed significant improvement in the performance of the respondents in all the major areas of the experiment. Therefore, it may concluded that the efforts taken to improve the quality of question-paper setting of College and University teachers in terms of the Cognitive levels of Bloom's Taxonomy was a success and that the teachers now have a good knowledge and understanding of the significance and impact of Bloom's Taxonomy of Educational Objectives on question paper setting and other teaching-learning issues related to this topic.

Suggestions for improvement :- The following suggestions have been given for improvement of question paper setting in particular and the quality of education in general:

1) The study found that in all the question papers analysed, majority of the questions belonged to the Lower Order Cognitive Objectives, predominantly

Comprehension, closely followed by Knowledge. Only a negligible number of questions were asked from the Higher Order Cognitive Domains. This finding clearly indicates the low quality of question paper setting in Education at higher secondary, collegiate and university levels. More questions testing the higher cognitive abilities of students may be included in future, especially at the college and university stages.

2) Teachers need to be made aware of Bloom's Taxonomy and its relevance in the field of education, particularly in question paper setting. It may be made an integral part of the curriculum in teacher training programmes.

3) Teachers need to be informed of the importance of maintaining the correct balance between lower and higher order cognitive questions. Teachers cannot set an examination paper comprising of numerous Lower Order Cognitive Questions. Effective questions that include problem solving and complex thinking skills should be adequately included to stimulate students' mental activities.

4) Teacher Training Programmes/Workshops/Seminars on Question Paper Setting should be periodically conducted by the concerned authorities.

5) Teachers selected for setting of question papers should be given short training (one day) on Bloom's Taxonomy. If this is not possible, they should be provided with information regarding Bloom's Taxonomy Coding Scheme and be instructed to set questions accordingly.

6) The trend in question paper setting revealed by this study points to an inferior educational system. Remedial steps have to be taken in the areas of curriculum design, classroom teaching-learning, evaluation procedures and many others to redress this problem and improve the present system. If this trend continues, then the quality of education will deteriorate further and more unemployable graduates may be produced in future.

7) The study revealed that the higher secondary, collegiate and university students have very poor application and synthesis skills. Therefore, teaching - learning methods and activities that will develop and promote the higher cognitive abilities of students need to be applied in the classroom.

8) Examinations should be conducted in such a way so as to minimize rote-learning and book learning as much as possible, and more emphasis be given on writing assignments, project reports, seminar presentations, debates, etc which will help to develop the creative, critical and problem-solving skills of students. Equal weightage should be given to written examination and practical work in the evaluation process.

9) Teachers should be made aware of clear/specific weightage of questions to be set from each cognitive level when setting examination question papers. The following weightage of questions for each cognitive level has been suggested by the investigator for future reference:

Higher Secondary stage : Knowledge - 20%, Comprehension - 30%, Application - 30 %, Analysis – 10%, Synthesis – 5% and Evaluation – 5%.

Collegiate stage : Knowledge - 10%, Comprehension - 20%, Application - 20 %, Analysis – 20%, Synthesis – 15% and Evaluation – 15%.

University stage : Knowledge - 5%, Comprehension - 10%, Application - 15 %, Analysis – 20%, Synthesis – 25% and Evaluation – 25%.

10) Teachers need to design their instructional objectives and student learning activities to encompass questions, topics and activities that will challenge students to think creatively, logically and critically.

11) Due to pressure to produce good examination results with high scoring students among educational institutions, teachers tend to feel hesitant and fearful of setting too many questions from the higher cognitive levels which results in majority of questions belonging to the lower cognitive levels. This has done more harm than good and it is high time to remove this fear and hesitation among teachers and more questions from the higher cognitive levels need to be included in future.

12) Academic activities and programmes that promote and enhance personality and cognitive development may be periodically organised for the students right from elementary stage.

13) Periodical revision of syllabus, introduction of innovative teaching methodologies, new assessment techniques, new pattern of education,etc would go a long way in improving our education system.

14) Question banks comprising of model questions belonging to different cognitive levels should be developed by the proper authorities to be used as guides by teachers while framing or setting question papers.

15) Further research is needed in the area of materials development which focuses on higher order thinking skills which may incorporate exercises that encourage students to study more in-depth & use problem solving skills and critical thinking skills which are ranked high on Bloom's Taxonomy.

16) Innovative practices need to be introduced in the area of evaluation to ensure a method of assessment that provides a valid and reliable measure of student development. Formative and diagnostic evaluation, self and peer evaluation, multiple testing techniques, criterion-referenced testing, introduction of semester system and grading at school level, open book examination, use of mechanical/electronic devices, computer adaptive testing, etc are some of the innovative methods which will go a long way in improving teaching-learning and evaluation.

Recommendations for further research:-

1) Use of Bloom's Taxonomy for designing instructional objectives and learning activities.

2) Implications of Bloom's Taxonomy for developing and designing curriculum.

3) How to use Bloom's Taxonomy in the classroom for effective teaching and learning.

4) Analytical study of teaching-learning and evaluation methods at elementary and secondary stages of education in terms of the Cognitive Domain of Bloom's Taxonomy.

5) Innovative techniques and methods to promote higher cognitive abilities of students at various stages of education.

6) Cognitive abilities/levels of students of elementary and secondary schools in terms of the Cognitive Domain of Bloom's Taxonomy.

7) Affective Domain of Bloom's Taxonomy and its implications in social and emotional development of children.

8) Analysis of HSLC and HSSLC question papers of Mizoram Board of School Education in terms of the Cognitive Domain of Bloom's Taxonomy.

9) Analysis of question-setting trend at elementary and secondary stages of education in terms of the Cognitive Domain of Bloom's Taxonomy.

10) Analysis of question-setting trend at collegiate and university stages of education in terms of the Cognitive Domain of Bloom's Taxonomy.

11) Evaluation of various aspects of teacher training programmes of elementary, secondary and higher education levels in terms of Bloom's Taxonomy of Educational Objectives.

12) Evaluation of curriculum and textbooks of elementary, secondary and higher education levels in terms of Bloom's Taxonomy of Educational Objectives.

Conclusion:

Our present system of education which gives too much emphasis on rote memorization, theoretical and bookish learning, examination/marks oriented teaching-learning and evaluation, has done more harm than good to the quality of education as can be seen from the number of unemployed graduates in the state. Political leaders, administrators, academicians and teachers should gradually try to bring about changes in the standard and quality of higher education. In order to bring about positive and effective changes, an essential need is the development of reliable tools, methods and better training programmes for teachers and educational administrators that reinforce and assess new curriculum designs, new teaching-learning strategies, new learning styles and new evaluation techniques. Bloom's Taxonomy relates to all these different aspects of education and can be effectively applied to improve the quality of education. If we can gradually adjust our way of teaching and questioning towards higher order cognitive skills according to Bloom's Taxonomy and use it to help design examinations and analyze the results, it will greatly improve the quality of assessment in education.