# CHAPTER 2  
THEORETICAL ORIENTATION AND REVIEW OF PAST STUDIES

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Introduction</td>
<td>41</td>
</tr>
<tr>
<td>2.2</td>
<td>Theoretical orientation related to thinking skills</td>
<td>41</td>
</tr>
<tr>
<td>2.2.1</td>
<td>Definition of thinking skills</td>
<td>41</td>
</tr>
<tr>
<td>2.2.2</td>
<td>Type of thinking skills</td>
<td>45</td>
</tr>
<tr>
<td>2.2.3</td>
<td>Definition of analytical thinking</td>
<td>50</td>
</tr>
<tr>
<td>2.2.4</td>
<td>Characteristics of analytical thinking</td>
<td>55</td>
</tr>
<tr>
<td>2.2.5</td>
<td>Importance of analytical thinking skills for preparing young generation</td>
<td>57</td>
</tr>
<tr>
<td>2.2.6</td>
<td>Teaching of thinking skills involves school administrators</td>
<td>59</td>
</tr>
<tr>
<td>2.2.7</td>
<td>Some common characteristics of analytical thinking lessons</td>
<td>59</td>
</tr>
<tr>
<td>2.2.8</td>
<td>Analytical thinking management practices of school administrators</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>(1) Analytical management policy</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>(2) Curriculum design and building</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>(3) Personnel development</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>(4) Learning materials and resources</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>(5) Learning management</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>(6) Learning measurement and evaluation</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>(7) Supervision, follow-up and report</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td>(8) Research for learning development</td>
<td>78</td>
</tr>
<tr>
<td>2.3</td>
<td>Review of the past studies</td>
<td>79</td>
</tr>
<tr>
<td>2.3.1</td>
<td>Introduction</td>
<td>79</td>
</tr>
<tr>
<td>2.3.2</td>
<td>Importance of review of the past studies</td>
<td>80</td>
</tr>
<tr>
<td>2.3.3</td>
<td>Past studies related to analytical thinking management practices</td>
<td>82</td>
</tr>
<tr>
<td>2.3.4</td>
<td>Summary</td>
<td>94</td>
</tr>
<tr>
<td>2.4</td>
<td>Uniqueness of the present study</td>
<td>96</td>
</tr>
<tr>
<td>References</td>
<td>98</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 2
THEORETICAL ORIENTATION AND REVIEW OF PAST STUDIES

2.1 INTRODUCTION

Education can be seen as the main way of developing individuals and society. The creation and use of knowledge depends on ability to think. Good thinking could be viewed as empowering for individuals and society. Perhaps most importantly in today's information age, thinking skills are viewed as crucial for educated persons to cope with a rapidly changing world. Many educators believe that specific knowledge will not be as important to tomorrow's workers and citizens as the ability to learn and make sense of new information (Gough, D., 1991)\(^1\).

School administrators have to recognize that teaching core subjects 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, applying knowledge to new situations, analyzing information, comprehending new ideas, communicating, collaborating, solving problems, and making decisions.” One important skill students need to have is ‘thinking skills’ (Salpeter, J., 2003)\(^2\).

For better understanding, the present chapter has summed up the scopes of documents and researches regarding the about thinking skills and analytical thinking as follow:

2.2 THEORETICAL ORIENTATION RELATED TO THINKING SKILLS

2.2.1 Definition of thinking skills

Thinking skills involve mental processes used in cognitive functions that enable people to make meaning from, and create with, information: solving problems, making decisions, critical thinking, planning and organizing job tasks, using a significant amount of memory, and finding, synthesizing and analyzing information. In the workplace, the various functions of thinking skills are applied to most tasks.

Bloom’s taxonomy of thinking skills identified various categories in the various thinking levels. (Bloom & Krathwohl, 1956)\(^3\)
Cognitive goal ------------------- Thinking cues

1 Knowledge ------------------------ Say what you know, or remember, describe, (knowing and remembering) repeat, define, identify, tell who, when, which, where, what

2 Comprehension ------------------ Describe in your own words, tell how you feel (interpreting and understanding) about it, what it means, explain, compare, relate

3 Application --------------------- How can you use it, where does it lead, apply (applying, making use of) what you know, use it to solve problems, demonstrate

4 Analysis ------------------------ What are the parts, the order, the reasons why, (taking apart, being critical) the causes/problems/solutions/consequences

5 Synthesis ----------------------- How might it be different, how else, what if, (connecting, being creative) suppose, put together, develop, improve, create your own

6 Evaluation ---------------------- How would you judge it, does it succeed, will it (judging and assessing) work, what would you prefer, why you think so

Nancy Skerritt (2003) defines thinking skills as cognitive processes that enable human beings to comprehend experiences and information, apply knowledge, express complex concepts, make decisions, criticize and revise unsuitable constructs, and solve problem. It is the habits of mind or thinking behaviours that start with a problem and ends in a solution. Thinking skills is a tool for adapting oneself to the physical and social environment in which he/she is in.

Ministry of education (2008) describes that thinking skill is the human ability or capacities for analytical, synthetic, constructive, critical and systematic thinking, leading to bodies of knowledge creation or information for judicious decision-making regarding oneself society and environment.

Robert Fisher (2010) states that thinking skills are the human capacity to think in conscious ways to achieve certain purposes. Such processes include remembering, questioning, forming concepts, planning, reasoning, imagining, solving problems, making decisions and judgements, translating thoughts into words and so on. A skill is commonly defined as a practical ability in doing something or succeeding in a task. Usually it refers to skills in particular contexts, such as being ‘good at cooking’ but they can also refer to general
areas of performance, such as having a logical mind, good memory, being creative and so on. A thinking skill is a practical ability to think in ways that are judged to be more or less effective or skilled. They are the habits of intelligent behaviour learned through practice, for example children can become better at giving reasons or asking questions the more they practice doing so.

Bob Kizlik (2012)\(^7\) states that thinking refers to the process of creating a structured series of connective transactions between items of perceived information. Think skills included critical thinking, creative thinking and analytical thinking. Critical thinking refers to reasonable, reflective thinking that is focused on deciding what to believe or do. Critical thinkers try to be aware of their own biases, to be objective and logical. Creative thinking refers to the ability to form new combinations of ideas to fulfill a need, or to get original or otherwise appropriate results by the criteria of the domain in question. Analyzing thinking involves the clarifying information by examining parts and relationships.

From the definition of thinking skills mentioned above, it can concluded that thinking skill is the human capacities to think in conscious ways to achieve certain purposes. It involves the mental process used in cognitive functions that enable people to make meaning from and create with a significant amount of memory, leading to bodies of knowledge creation or information for judicious decision-making and problem solving regarding oneself society and environment. Thinking skills includes creative, critical, and analytical thinking. These skills are activated when students of any age encounter unfamiliar problems, uncertainties, questions, or dilemmas. Successful applications of these skills result in explanations, decisions, performances, and products that are valid within the context of available knowledge and experience, and promote continued growth in higher order thinking, as well as other intellectual skills.

Some of the key definitions are provided in table 2.1. (King, F.J. et al, 2010)\(^8\)
<table>
<thead>
<tr>
<th>Terms</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>cognition</td>
<td>the &quot;mental operations involved in thinking; the biological/neurological processes of the brain that facilitate thought&quot;; “all of our mental processes, such as perception, memory, and judgment”</td>
</tr>
<tr>
<td>comprehension</td>
<td>the process by which individuals “construct meaning from incoming information”</td>
</tr>
<tr>
<td>creative thinking</td>
<td>generating and producing ideas through brainstorming, visualizing, associating relationships, making analogies, inventing, inferring, and generalizing</td>
</tr>
<tr>
<td>critical thinking</td>
<td>an attitude of suspended judgment, logical inquiry, problem solving, evaluative decision or action; skillful, responsible thinking that facilitates good judgment, relies upon criteria, is self-correcting and sensitive to context; skepticism, curiosity; questioning of beliefs, aims, definitions, conclusions, actions, appraisal of frameworks or sets of criteria by which judgments are made</td>
</tr>
<tr>
<td>graphic frame</td>
<td>an organizing pattern to visually represent relationships; serves as a medium for organizing new information and patterns of relationships (e.g., flowcharts, cartoons, symbols, diagrams, time lines, grids, graphs, concept maps, chains, towers, circles, pyramids, boxes)</td>
</tr>
<tr>
<td>higher order thinking</td>
<td>understanding of facts, concepts, principles, and procedures; analysis, synthesis, and evaluation</td>
</tr>
<tr>
<td>inquiry</td>
<td>investigating beliefs or forms of knowledge, taking care to consider the grounds that support them and the conclusions drawn from them</td>
</tr>
<tr>
<td>insight</td>
<td>“seeing” a correct solution; sudden coherency or change in perceptions, feeling, thought; the “aha” experience, from a state of not knowing to knowing</td>
</tr>
</tbody>
</table>
### TABLE 2.1 (Continued)

<table>
<thead>
<tr>
<th>Terms</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>metacognition</td>
<td>mental process of being aware of monitoring, supervising, organizing, and making executive decisions about one’s own thinking process; thinking about thinking, the use of information and strategies to solve problems; mind’s management system; ability of the mind to control its own processing of how we think.</td>
</tr>
<tr>
<td>problem solving</td>
<td>application of more than one rule/more than four concepts to solve problems to situations with multiple variables, multiple relationships; combines two or more rules to solve a problem</td>
</tr>
<tr>
<td>rational thinking</td>
<td>the interdependent skills of creative thinking, critical thinking, and problem solving</td>
</tr>
<tr>
<td>scaffolding</td>
<td>support and guidance gradually removed until one can work independently</td>
</tr>
<tr>
<td>schemata</td>
<td>systems of relationships between concepts; complex networks of related knowledge; cluster of knowledge associated with a type of problem; typical solution procedures</td>
</tr>
<tr>
<td>scripts</td>
<td>simple routines developed through repeated practice of elaborate reasoning procedures</td>
</tr>
<tr>
<td>transfer</td>
<td>“the ability to apply thinking skills taught separately to any subject”</td>
</tr>
</tbody>
</table>

#### 2.2.2 Types of thinking skills

Thinking skills can be classified into different types according to different educators.

Kagan Spencer (2003), in his article “The Information Processing Approach to Thinking” states that more and more people are employed in the information segment of the economy, and it is the fastest growing segment. In the information age, people have to live by generating, analyzing, categorizing, evaluating, and communicating information. An information processing approach to thinking skills aligns well with preparation of students for 21st century life.
The approach of information processing thinking skills can be divided into three types: understanding information, manipulating information, and generating information. In each of the three categories consisted of five specific skills. Therefore, 15 fundamental types of thinking skills are shown in table 2.2

**TABLE 2.2**

**FIFTEEN FUNDAMENTAL OF THINKING SKILLS**

<table>
<thead>
<tr>
<th>Thinking Skills</th>
<th>Fundamental of Thinking Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding Information</td>
<td>Recalling</td>
</tr>
<tr>
<td></td>
<td>Summarizing</td>
</tr>
<tr>
<td></td>
<td>Symbolizing</td>
</tr>
<tr>
<td></td>
<td>Categorizing</td>
</tr>
<tr>
<td></td>
<td>Role-Taking</td>
</tr>
<tr>
<td>Manipulating Information</td>
<td>Analyzing</td>
</tr>
<tr>
<td></td>
<td>Applying</td>
</tr>
<tr>
<td></td>
<td>Inducing</td>
</tr>
<tr>
<td></td>
<td>Deducting</td>
</tr>
<tr>
<td></td>
<td>Problem solving</td>
</tr>
<tr>
<td>Generating Information</td>
<td>Brainstorming</td>
</tr>
<tr>
<td></td>
<td>Synthesizing</td>
</tr>
<tr>
<td></td>
<td>Predicting</td>
</tr>
<tr>
<td></td>
<td>Evaluating</td>
</tr>
<tr>
<td></td>
<td>Questioning</td>
</tr>
</tbody>
</table>

Ministry of Education (2008)\(^{10}\) identified three important types of thinking skills for students to learn how to think more effectively as follow:

1. Creative thinking: This refers to the human ability regarding the invention or origination of any new things (a product, solution, artwork, literary work, etc.) that has value. New may refers to the individual creator or the society or domain within which novelty occurs.

2. Critical thinking: This refers to the human ability to determine the value of an
argument, set of beliefs, claim or issue. It is usually employs logical reasoning and empirical
evidence to reach a conclusion and ultimately seeks to move away from personal biases.

(3) Analytical thinking: This refers to the human ability to solve the problem
quickly and effectively.

Robert Fisher (2010)\textsuperscript{11} identified five types thinking skills as follow:

(1) Information processing thinking skill: This refers to the ability of finding out
relevant information, organizing information and representing or communicating information.

(2) Reasoning thinking skill: This refers to the ability of giving reasons, making
inferences or deductions and arguing or explaining a point of view.

(3) Enquiring thinking skill: This refers to the ability of asking questions, planning
research or study and engaging in enquiry or process of finding out.

(4) Creative thinking skill: This refers to the ability to generating ideas, imagining
or hypothesizing and designing innovative solutions.

(5) Evaluating thinking skill: This refers to the ability to developing evaluation
criteria, applying evaluation criteria and judging the value of information and ideas.

Robert Kizlik (2012)\textsuperscript{12} illustrates that thinking skills refers to the process of creating
a structured series of connective transactions between items of perceived information. It can
be classified into three types of thinking skills as follow:

(1) Critical thinking: this refers to reasonable, reflective thinking that is focused on
deciding what to believe or do. Critical thinkers try to be aware of their own biases, to be
objective and logical. Critical thinking uses the specific dispositions and skills such as
analyzing arguments carefully, seeing other points of view and reaching sound conclusions.

(2) Creative thinking: This refers to the ability to form new combinations of ideas to
fulfill a need, or to get original or otherwise appropriate results by the criteria of the domain in
question.

(3) Analyzing skills: This refers to core thinking that involve clarifying information
by examining parts and relationships i.e. identifying attributes and components, determining
characteristics or the parts of something, identifying relationships and patterns, identifying
main ideas and identifying errors.
Bob Kizlik. (2012) explained that thinking skills are relatively specific cognitive operations that can be considered the “building blocks” of thinking. The following (1) have a sound basis in the research and theoretical literature, (2) are important for students to be able to do, and (3) can be taught and reinforced in school.

**Focusing skills** - attending to selected pieces of information and ignoring others.
- Defining problems: clarifying needs, discrepancies, or puzzling situations.
- Setting goals: establishing direction and purpose.

**Information gathering skills** - bringing to consciousness the relative data needed for cognitive processing.
- Observing: obtaining information through one or more senses.
- Formulating questions: seeing new information through inquiry.

**Remembering skills** - storing and retrieving information.
- Encoding: storing information in long-term memory.
- Recalling: retrieving information from long-term memory.

**Organizing skills** - arranging information so it can be used more effectively.
- Comparing: noting similarities and differences between or among entities.
- Classifying: grouping and labeling entities on the basis of their attributes.
- Ordering: sequencing entities according to a giver criterion.
- Representing: changing the form, but not the substance of information.

**Analyzing skills** - clarifying existing information by examining parts and relationships.
- Identifying attributes and components: determining characteristics or the parts of something.
- Identifying relationships and patterns: recognizing ways elements are related.
- Identifying main ideas: identifying the central element; for example the hierarchy of key ideas in a message or line of reasoning.
- Identifying errors: recognizing logical fallacies and other mistakes and, where possible, correcting them.

**Generating skills** - producing new information, meaning or ideas.
- Inferring: going beyond available information to identify what may reasonably be true.
- Predicting: anticipating next events, or the outcome of a situation.
- Elaborating: explaining by adding details, examples, or other relevant information.

**Integrating skills** - connecting and combining information.
- Summarizing: combining information efficiently into a cohesive statement.
- Restructuring: changing existing knowledge structures to incorporate new information.

**Evaluation skills** - assessing the reasonableness and quality of ideas.
- Establishing criteria: setting standards for making judgments.
- Verifying: confirming the accuracy of claims.

In conclusion, thinking skills can be classified into three types i.e. critical thinking, creative think, and analytical thinking.

(1) **Creative thinking** is a mental process of combining parts in such a way as to constitute a pattern or structure that unique and did not exist before. It involves the thinking that generates something new or different from the current exists and well or better than previous ideas. It is generative and divergent in nature. Creativity involves divergent and convergent thinking to produce new ideas by combining, changing and reapplying. Divergent means thinking that starts from a common point and moves outward into a variety of perspective. Divergent thinking with creativity can be appointed in four characteristics: fluency, flexibility, originality and elaboration. There are four abilities included in creative thinking:

- Fluency: This is the ability to produce great number of ideas or problem solutions in a short period of time.
- Flexibility: This is the ability to simultaneously propose a variety of approaches to a specific problem.
- Originality: This is the ability to produce new, original ideas.
- Elaboration: This is the ability to systematize and organize the details of an idea which can be describes and carry it out.
(2) **Critical thinking** is an incredibly important skill. It is an important element of all professional fields and academic disciplines. Critical thinking skills can be defined as way of thinking that assesses the worth and validity of something in existing. It involves carefully analysis, synthesis, judgement or evaluation the evidence or information by observation, experiences, reflection, statistics, machine, explaining, reasoning or communication. It is the thinking which process careful acquisition and interpretation information around a common point-out attempt to bring thoughts from different directions to reach a well-justified or common conclusion. There are five abilities included in critical thinking:

- Critical thinking skills related to consequence: This is the ability to criticize the consequence that might happen as a result of catastrophic event.
- Distinguishing facts: This is the ability to distinguish between fact and opinion
- Criticize the unsure situation: This is the ability to criticize the unsure situation.
- Making decision: This is the ability to make a decision or select the best choice.
- Criticize the things as being same or difference: This is the ability to criticize the two or more things as being same or difference.

(3) **Analytical thinking** refers to core thinking that involve clarifying information by examining parts and relationships i.e. identifying attributes and components, determining characteristics or the parts of something, identifying relationship and patterns, identifying main ideas and identifying errors.

In the present study, the analytical thinking skill was discussed and studied for its management practice of primary school administrators. The details about the analytical thinking skills are as follow:

### 2.2.3 Definition of analytical thinking

Everyday living is a series of decisions and choices that always revolve around what everyone wants, need or do and it can be difficult to separate the two. Analytical thinking is a critical component of visual thinking that gives one the ability to solve problems quickly and effectively. It involves a methodical step-by-step approach to thinking that allows you to break down complex problems into single and manageable components. (Visual Thinking Magic Association, 2011)
Richard, J. (1999) defined analytical thinking as the ability to visualize, articulate, and solve both complex and uncomplicated problems and concepts and make decisions that are based on available information. Such skills include demonstration of the ability to apply logical thinking to gathering and analyzing information, designing and testing solutions to problems, and formulating plans. Thinking analytically is a skill like carpentry or driving a car. It can be taught, it can be learned, and it can improve with practice. But like many other skills, such as riding a bike, it is not learned by sitting in a classroom and being told how to do it. Analysts learn by doing. To test for analytical skills one might be asked to look for inconsistencies in an advertisement, put a series of events in the proper order, or critically read an essay. Usually standardized tests and interviews include an analytical section that requires the examiner to use their logic to pick apart a problem and come up with a solution. Although there is no question that analytical skills are essential, other skills are equally required as well. For instance in systems analysis the systems analyst should focus on four sets of analytical skills: systems thinking, organizational knowledge, problem identification, and problem analyzing and solving. The ability to think analytically is crucial to being successful and fulfilling one’s purpose.

Visual Thinking Magic (2009) states that analytical thinking involves the process of gathering relevant information and identifying key issues related to the information. This type of thinking also requires comparing sets of data from different sources; identifying possible cause and effect patterns, and drawing appropriate conclusions from these datasets in order to arrive at appropriate solutions.

Analytical thinking can be broken down into three main steps:

(a) Gather information: For this step, one must gather all the necessary information that will be required for problem solving. It is needed to obtain more or higher quality information in order to collect all the relevant data to arrive at an appropriate solution. Gathering information requires the appropriate questions which enable to make more effective decisions about the problems. However, one also needs to consider the relevance of sources and the means by which he/she will gather this information.
(b) Identify issues and problems: When it comes to analytical thinking, it’s important to develop the ability to recognize underlying issues or problems based on trends, associations and cause-effect relationships between datasets.

(c) Organize information: Once all relevant information has been collected successfully, it is needed to organize and integrate all the pieces in a way that will provide the insights and ideas that can be used to draw appropriate conclusions. This in turn will lay down the foundations for potential solutions to the facing problem.

Analytical thinking is very much integrated into the visual thinking framework. It’s a part of the problem solving process which will utilize as work visually towards acquiring the necessary insights that will help to achieve the goals and objectives.

Wikipedia Encyclopedia (2011)\(^\text{17}\) defines analytical skill is the ability to visualize, articulate, and solve both complex and uncomplicated problems and concepts and make decisions that are based on available information. Such skills include demonstration of the ability to apply logical thinking to gathering and analyzing information, designing and testing solutions to problems, and formulating plans. For instance in systems of analytical thinking skills, four sets of thinking should be focused: organizational knowledge, problem identification, problem analyzing and solving.

Karen (2011)\(^\text{18}\) states that the ability to think analytically is crucial to being successful and fulfilling everyone’s purpose. In his view, the analytical thinking is based on the deductive thinking. The deductive thinking is the act of reasoning which move from a whole to its part, from the general to the particular, from the universal to individual, from broader generalizations to specific observation, and from general theories to specific instance.

Napoleon Hill (2011)\(^\text{19}\) advised that accurate thinking is based on two types of reasoning:

(1) **Induction:** This is the act of reasoning from a part to a whole, from the particular to the general, from the individual to the universal. It is based on experience and experimentation and draws conclusions from them.
(2) **Deduction:** In this act of reasoning specific conclusions are based on general logical assumptions. As Napoleon Hill says: to be an accurate thinker, one must take two important steps:

- Separate facts from opinions, fictions, and unproved hypotheses.
- Separate facts into two categories: important and unimportant.

According to the Work Related Competencies Organization (2011)\textsuperscript{20}, analytical thinking skills can be defined as the ability to analyze problems systematically, organize information, identify key factors and underlying concerns and generate solutions. It combines the ability to draw on one’s experience and knowledge to effectively solve problems through assembling facts by discerning and comparing before reaching a sound conclusion. There are two levels of analytical thinking:

(a) Distinguishes aspects of problems: Distinguishes important from unimportant aspect of an issue or a problem, making it possible to come to new decisions more quickly and decisively and discusses the problem and possible solutions with a supervisor, who would have the analytical thinking and judgment to respond.

(b) Sees relationships and makes timely decisions: Breaks the issue or problem into smaller parts so as to recognize important facts and issues. Makes links and analyzes relationships among several parts of a situation. Anticipates obstacles and thinks ahead to the next steps. Notices and uses patterns or trends from similar experiences. Makes well-timed decisions to meet the needs of the situation.

Hay Group (2012)\textsuperscript{21} defines analytical thinking as the ability to think logically, break things down and recognize cause and effect. Analytical thinking is the understanding a situation by breaking it apart into smaller pieces, or tracing the implications of a situation in a step-by-step way. Analytical Thinking includes organizing the parts of a problem or situation in a systematic way; making systematic comparisons of different features or aspects; setting priorities on a rational basis; identifying time sequences, causal relationships or if-then relationships. Analytical Thinking uses a logical reasoning process to break down and work through a situation or problem to arrive at an outcome.
Hay Group offers the Hay Group’s score card for Analytical Thinking. The scoring summary is as follow: (Hay Group, 2012)

- Breaks down problems: Breaks problems into single lists of tasks or activities, without assigning values. Make a list of items with no particular order or set of priorities. (e.g. Breaks down tasks or problem into key parts, Makes lists of actions required and resources needed, Break down programmes of work so that they are digestible, and identifies key milestone). Takes apart problems into pieces, links together pieces with a single link, breaks down a problem into smaller parts, Make multiple links several potential causes of events, several consequences of actions or multiple-part chains of events.

- Recognize cause and effect: (Thinks through why something happened, Thinks about an application, Make clear, logic plans and structures coherent programme of work)

- Analyzes several possible causes for any given situation: Analyze relationships among several parts of a problem or situation, Anticipates obstacles and thinks ahead about next steps. (e.g. Considers multiple implications and performance data)

- Undertakes analysis of very complex problems: Uses several analytical technique to break apart complex problems into component parts, Uses several analytical technique to identify several solutions and weights the value of each (e.g. Tackles apparently intractable, complex or taxing situations by rigorous analysis, including consideration of longer-term effects and impacts, including those on students, staff, organizational atmosphere and groups outside the school)

From the discussion about analytical thinking mentioned above, it can concluded that analytical thinking is the human ability to separation a whole into its constituent parts or element parts order to study the parts and their relations. It is the ability to scrutinize and break down facts and thoughts into their strengths and weaknesses. It is the process of separating and distinguishing elements of a concept, idea, problem and issue in order to understand its essential nature and inner relationships. The analytical thinking is based on the deductive thinking. The deductive thinking is the act of reasoning which move from a whole to its part, from the general to the particular, from the universal to individual, from broader generalizations to specific observation, and from general theories to specific instance. It is
based on reasoning, experience, experimentation and draws conclusions from them. There are four abilities included in analytical thinking:

- **Analyzing relationship of the two things or more**: This is the ability to analyze the relationship between the two things or more.
- **Separation the whole into the parts**: This is the ability to separate the whole into the parts such as separate the parts of animal, trees and things.
- **Analyzing patterns or order**: This is the ability to analyze the pattern or order of the things.
- **Comparison of the things**: This is the ability to compare the things or all the being.

### 2.2.4 Characteristics of analytical thinking

There are general styles of behavior common to individuals, and understanding them maximizes the ability to achieve results with others. One such style is that of approaching the world with an analytical slant. Some of the typical characteristics of the analytical style include the following: (Ayman Amer, 2005)

- Deliberate. Controlled, logical
- Independent of others and non-aggressive
- One who weighs all alternatives, remaining steadfast in purpose
- Unemotional, business-like and persistent
- Disciplined, lets others take the social initiative

The characteristics of analytical person are as follow:

- Approach problems based on facts and logic rather than emotions
- See the performing best in highly organized situations where they have a handle on the whole picture, thus minimizing the risk of being wrong
- Tend to do well when the nature of the risk is problem-solving, especially when they are knowledgeable in the area of concern. Use the ability as problem-solvers or information holders as the basis for relationships and don’t easily take risks or trust others
- Probably approach other people with caution, not revealing the inner self until comfortable
Have a productive competence in working out a problem and getting the task completed correctly, as one of their key strengths as analytical people

- May also have some tendencies with bother their co-workers
- Are cold or uncommunicative, remaining aloof from interpersonal relationships
- Orientated more toward ideas and data than toward relationships or feelings, they tend to prefer study and contemplation to immediate action

- Like things to be rational and well organized
- Typically take an orderly, systematic approach to the task at hand on job
- Are likely to hesitate until the task is clear and then work at it persistently and conscientiously

- Like to collect many facts and opinions before making a decision
- Usually wait for others to come to them before they share their opinions
- People with analytical style are bothered by these situations in their interaction with other: When they don’t know all the answers, When they have to interrupt others, When they must deal with overly aggressive or critical people, When people invade their private space or get too close when speaking, When people do not have all of the facts or will not listen to reason, When someone’s behaviour is loud and obnoxious, When people are unfocused or don’t pay attention, and When people pass themselves off as something they are not.

Harrison and Bramson (1982)\(^{24}\) categorized analytical thinking style in this way:

- Synthesist: These people like to discover two or more things that no other people may appear to have little of or no relationship at all and find ways to fit them into a new, creative combination. Synthesis tends to be interested in conflict and also like change – often for their own sake and might accept technology upgrades easily. Synthesists tend to pride themselves on their ‘creativity’.

- Idealist. The idealist mode of thinking is used by people who like to take a broad view of things and tend to be future-oriented. They also think about goals and are interested in social values. Idealists are like Synthesis in their focus on values rather than facts. Idealists like to be seen by other people as useful, supportive, open and trustworthy.
When it comes to solving problems, Idealists are at their best in situations where the important things are values, judgment, feeling and emotions.

- **Pragmatist.** The motto of the Pragmatist is “Whatever works”. They excel at finding new ways of doing things with the materials that lie at hand. They are apt to be interested in formulating strategies and tactics for getting things done and they often like to be liked, approved of, or at least accepted. The pragmatist approach is flexible and adaptive.

- **Analyst.** The Analyst approaches problems in a careful, logical, methodical way, paying great attention to details. Analysts analyze and judge things within a broad framework that helps to explain and arrive at conclusions. Analysts want to be sure of things, to know what’s going to happen next. They take pride in their competence, in the sense of understanding all the facets of whatever the situation in which they happen to be.

- **Realist.** The Realist's motto is, ‘facts are facts.’ Realists firmly believe that any two intelligent people, properly equipped with eyes and other sense organs, will at once agree on the facts. Without agreement on the fact, Realist believes, things don’t get done. The Realist always wants to get things done by proceeding on the facts that are at hand, rather than by gathering ever more data as Analysts do.

It can be said that an analytical thinking orientation focuses the efforts to understand and design systems on the structure of the system. Understanding of the whole is sought based on understanding the parts of the system and how they are assembled to form the whole. Analytical thinkers tend to be logical and fact based. They prefer quantitative data and precision. People who have analytical thinking styles like to make logical and well thought-out decisions.

### 2.2.5 Importance of analytical thinking skills for preparing young generation

Because of the rapid growth in information technology, the number of knowledge in which everyone may be found has increased dramatically. Today, more than half of the global workforce employed in any kind of job and demand for good fundamental skills of thinking.

Since knowledge work is primarily intellectual rather than physical in nature, it requires people to gather, create, produce, evaluate, capture or analyze information.
Knowledge work primarily requires people who can communicate and who can think. In the present situation, people need to be able to locate, assess, and represent new information quickly. They need to be able to communicate this to others, and to be able to work productively in collaborations with others. They need to be adaptable, creative and innovative, and to be able to understand things at a 'systems' or big picture' level. Most importantly, they need to be able to think and learn for themselves.

Analytical thinking skills are the skills which most demanded by people around the world when assessing job candidates, according to organizational and people development consultancy. The firm was quoting from a global survey of managers and executives while drawing attention to the fact that students are usually taught to listen, rather than to question, and as a result are often lacking this vital skill.

Analytical thinking skills play an important role for preparing the young generation people of rapidly changing world. Teaching analytical thinking involves the creation of challenging learning experiences which call for high level thinking, such as the development of the thinking skills listed in the Basic education core Curriculum, A.D. 2008. It is stipulated that the curriculum should promote an enquiring mind and a capacity to think rationally which enable students to think analytically. Providing people in thinking skills is important for several reasons: (Kathleen Cotton, 1991)

(1) Analytical thinking is necessary for people to have in rapidly changing, technologically oriented world. Capacity for analytical thinking leads to creation bodies of knowledge or information for judicious decision-making. Analytical thinking help people to eliminate problems and obstacles, based on sound reasoning, moral principles and accurate information, appreciation of relationships and changes in various social situations. It is the ability to apply knowledge to prevent and solve problems and ability for judicious decision-making, bearing in mind possible negative effects on oneself, society and the environment.

(2) Instruction in thinking skills promotes intellectual growth and fosters academic achievement gains. Research supports that providing instruction in a variety of specific creative thinking, critical thinking and analytical thinking are found to promote intellectual growth and achievement gains. Many commercially available thinking skills instruction
programmes have been shown to bring about improvements in students’ performance on intelligence and achievement tests. Student performance has been shown to improve as a result of both direct teaching and inferential learning of thinking skills.

2.2.6 Teaching of thinking skills involves school administrators

Teaching of thinking skills involves school administrators in the following points: (Lesley A. B., 2003)

(1) Setting challenging tasks that encourage students to strive to think through a problem or issue which may have no single correct answer

(2) Planning for learning objectives, which encourage students to gain an understanding of the patterns of thinking and principle concepts

(3) Encouraging students to use and build on what they already know in order to make sense of new information

(4) Planning for students to ‘think together’ through collaborative talk

(5) Intervening, when necessary, by asking questions that support or extend pupils’ thinking

(6) Using the plenary to check learning against objectives and to debrief pupils on both their solutions to the task and their strategies for carrying it out

(7) Helping students to make connections between the thinking involved in the task and other contexts in order to encourage transfer of knowledge and skills.

2.2.7 Some common characteristics of analytical thinking lessons

Lesley A. B. (2003) suggested some common characteristics of analytical thinking lessons as follow:

(1) Challenging tasks should be prepared to encourage students to use prior knowledge and students should be asked to make connections between the thinking and learning from the task to build a bigger picture –transferring skills.
(2) A puzzle, 'mystery' or problem that provokes cognitive conflict, e.g. a felt need to examine and advance one's thinking.

(3) Students should be encouraged to have attention to the vocabulary and process of reasoning.

(4) Considerable discussion, especially with peers, to identify and resolve problems should be motivated by teachers for students.

(5) School administrators should encourage teachers give assistance to students when necessary. Teachers should give the students a chance to struggle.

(6) During the plenary and the debriefing there should be an opportunity for students to discuss the solutions and how the task was done.

(7) Co-operative work – tasks in groups with discussion should be encouraged.

(8) Opportunity to reflect upon the development of both group and individual thinking should be provide for students.

(9) Diagnostic and formative assessment is more common, listening and watching group work should be considered as important as marking.

2.2.8 Analytical thinking management practices of school administrators

Management is the act of coordinating the efforts of people in accordance with certain policies to accomplish desired goals and objectives using available resources efficiently and effectively i.e. human resources, financial resources, technological resources, and natural resources (wikipedia, 2012)\(^28\).

Management practices is the method or technique or process of doing something which is found to be the most effective and practical means in achieving goals and objectives while making the optimum use of the firm's resources (Business Dictionary, 2012)\(^29\).

In the present study, management practices refers to the method or technique or process of coordinating the efforts of school members in accordance with certain policies to accomplish desired goals and objectives on analytical thinking of students using available resources efficiently and effectively:
In order to manage the analytical thinking of students, Ministry of Education (2008) stipulated eight aspects of analytical thinking management practices as follow:

1. Analytical thinking management policy
2. Curriculum design and building
3. Personnel development
4. Learning materials and resources support
5. Learning management
6. Learning measurement and evaluation
7. Supervision, follow-up and report
8. Research for learning development

(1) Analytical thinking management policy

Analytical thinking management policy refers to the administrative process which encourages analytical thinking skills of students. The administrators have to formulate the policy with co-operation of students, teachers, parents, communities and educational personnel in order to improve the analytical thinking of students.

The analytical thinking management policies can be done as follow:

- School should formulate the policies according to the goals of Basic Education Core Curriculum, 2008 which aims at the full development of students in thinking skills (analytical thinking).

- School should formulate the policies in order to encourage students to have reflective thinking, such as:
  - Provide enough wait-time for students to reflect when responding to inquiries.
  - Provide emotionally supportive environments in the classroom encouraging reevaluation of conclusions.
  - Prompt reviews of the learning situation, what is known, what is not yet known, and what has been learned.
  - Provide authentic tasks involving ill-structured data to encourage reflective thinking during learning activities.
• Prompt students’ reflection by asking questions that seek reasons and evidence.

• Provide some explanations to guide students’ thought processes during explorations.

• Provide a less-structured learning environment that prompts students to explore what they think is important.

• Provide social-learning environments such as those inherent in peer-group works and small group activities to allow students to see other points of view.

• Provide reflective journal to write down students’ positions, give reasons to support what they think, show awareness of opposing positions and the weaknesses of their own positions.

♦ School should formulate the policies incorporated to learning environment to help students develop their ability to reflect on their own learning. For example:

• School administrators should model meta-cognitive and self-explanation strategies on specific problems to help students build an integrated understanding of the process of reflection.

• Study guides or advance organizer should be integrated into classroom materials to prompt students to reflect on their learning.

• Questioning strategies should be used to prompt reflective thinking, specifically getting students to respond to why, how, and what specific decisions are made.

• Social learning environments should exist that prompt collaborative work with peers, teachers, and experts.

• Learning experiences should be designed to include advice from instructors and co-learners.

• Classroom activities should be relevant to real-world situations and provide integrated experiences.

• Classroom experiences should involve enjoyable, concrete, and physical learning activities whenever possible to ensure proper attention to the unique cognitive, affective, and psychomotor domain development of students.
School should formulate the policies incorporated to prompts and scaffolding suggestions to promote reflective thinking by:

- Structure lesson plans to support reflective thinking.
- Provide lesson components that prompt inquiry and curiosity.
- Provide resources and hand-on activities to prompt exploration.
- Provide reflective thinking activities that prompt students to think about what they have done, what they learned, and what they still need to do.
- Provide reflection activity worksheets for each lesson plan to prompt students to think about what they know, what they learned, and what they need to know as they progress through their exploration.

(2) Curriculum design and building

**Curriculum design and building** refers to the curriculum stipulates learning standards for learners development on analytical thinking skills. Educational institutions have to create additional subjects to form a new learning unit, or variety of intensive course for learners to select those to satisfy their inclination, interest, needs, and individual difference. Curriculum should focuses on learning for quality of development, basic thinking skills. Emphasis should lay on well balanced integration in analytical thinking in every subject. Students should have enough time to participate in development activities and others for improving their analytical thinking.

Curriculum design and building should create effective learning process for development of analytical thinking of students. Discussion should be promoted for students to share their opinions to others. Discussions are best done in a circle rather than the typical classroom setting which is designed for a lecture. Teachers should prepare a topic or open ended questions so as to facilitate discussion. Discussion, and not lecture, is the important thing when teaching analytical thinking. The topic can be part of a previous reading assignment, a current event or any number of things. Students should be explained that whomever is holding the heart has everyone's total focus, and is the only one who should be talking. Everyone else is to listen with their full non-judgmental focus on the person with the heart. Also explain that they have the right to pass by simply passing the heart to the next child, and there is no right or wrong answers, so no one is corrected, judged or criticized for
their answers. If the students are not use to discussions, they might be reluctant to participate. So it is wise to break the ice by beginning with very simple questions. Once they are comfortable that they will not be put down for their answers, they will be eager to contribute (Ministry of Education, 2008).

As the discussion begins, an open ended question is asked, and the heart is given to someone in the circle. The teacher is a facilitator in these discussions, and participates on an equal level with the students. If one person begins to dominate the discussion, facilitator can say something like that is interesting, but it is time to pass the heart so others have time to participate.

Before starting a new question, allow the heart to pass around the circle once with no one responding so as to be sure everyone has finished discussing the question asked. Then it is time to ask another open ended question. If the answers begin taking the discussion in a new direction, it is often a good idea to allow this, because it can lead to some unexpected answers that the children are curious about. But this is a judgement call that facilitators must decide in each situation.

(3) Personnel development

Personnel development refers to the process of refinement and development of professional instructors. Personnel development aims at creating academic leadership and competency of teachers in conducting the classroom for encouragement of the analytical thinking skills of students.

Personnel development is most important in the education supervision. The main target of the personnel development is to develop the learning of the students to a high efficacy, and the responsible person is the teacher. As the world is ever evolving, together with new technologies and knowledge, therefore, the everyday experience of the teacher is not sufficient to keep him up-date-date with proficiency. Therefore, it is essential to develop the teachers constantly and continuously until the end of their professions.

About the proficiency in developing the personnel, Humphries (cited in Glickman, and others. 2001) studied about the new ways of implementing the curriculum from 36 schools in Georgia, United States, from 1980-1981. He indicated that the co-operation in the
personnel development planning from parties would result in the successfulness of the programme. Moreover, it was found that there were personnel, who were developed proficiently i.e. school administrator and supervisor. They have to co-operate in the planning and arrange diverse experience training which vary according to the character of the teachers. They have to let every teacher really partake in the programme operation and conjoin the training activity with the general personnel development. School administrators should focus on the demonstration, advice on the operation and the use of feedback data, give a chance for the teachers to exchange knowledge, and experience, and let them assist each other. Teachers can choose the purposes and the activities in the training.

Mohlman (cited Vachara Laoriendee, 1998)\textsuperscript{33} studied the comparison of three formats in developing the personnel. First format is to present the content, knowledge, and skill. This is also demonstrating, practice, and give feedback information. Second format is to present the knowledge and skill, then demonstrate and practice. The feedback information will be done through the peer observation. Third format is to present the knowledge and skill, then practice. After that, get the feed back information, and get the advice from trainer coaching. It was found that the most effective groups are from the second format with the peer observation.

Glickman, and others (2001)\textsuperscript{34} indicated about the details of the personnel development as follows:

(i) Give fundamental service to each teacher;

(ii) Format of activities, and methods in developing the personnel;

(iii) Prepare to develop the personnel with following details:

- Mentoring programs is to help the programme participants in the personal development, by experienced teachers with special talents who are entrusted to give recommendation to the new teachers, with an intention to assist and advise continuously, and personally.

- Skill-development programmes are comprised of many operational meetings for many months. Participant is given assistance and advice during the training. The teacher can adapt these skills to the teaching.
Teacher centers is a place where teachers can meet and discuss about the learning and teaching, develop their teaching skills, and make innovation planning, or compile and create learning-teaching media.

Teacher institutes are where a group of teachers co-operate in learning and practice their experience intensely in a specific case, or specific skill, or about a complex subject for consecutive days, or weeks.

Collegial support groups is done by teachers of the same school cooperate in solving school problems, or try to use new innovations in the teaching, and try to help each other.

Network can be done through the cooperation of teachers from various schools. They can exchange information, and interchange understanding and successes. Some schools may use the computer network, and some through other means of communications. Meetings are done once in a while.

Teacher leadership can be done by the teachers assisting in preparing the leaders and assist other teachers in playing the roles of a leader, such as to present the training, or act as an expert, or lead in the teaching, etc. Teachers acting as a leader, do not only assist other teachers, but also get some experience in developing their professional themselves.

Teacher as writer becomes more popular to the teachers, because they can express themselves or reflect their knowledge about the students, the teaching, and about their progression. This writing may in articles or exchange opinions with colleagues. Official articles will be printed in various educational journals.

Individually planned staff development is done by teachers stipulating their own objectives and goals in their development. This will be done with the planning, operation according to various activities, and evaluation.

Partnership is a cooperation of schools that planned and operate some programmes. This cooperation may be done with some universities, or firms. Whereby, each unit is equivalent with same rights. They share responsibilities and cooperate in the performance; and they also share benefits. This may includes all the programmes proposed earlier.
Personnel development preparation

In the personnel development preparation through the teacher training, the supervisor or the related persons should bear six aspects in mind: (Glickman, and others. 2001).

(i) Invite the resource person: The supervisor must tell the resource persons clearly what he should talk about, what he should do, what activities he should join, and what roles he should play.

(ii) Check all the facilities: Make sure that the training will go smoothly with enough supplies and equipment for the activities such as the microphone, the recorder, and the slide projectors, etc. Moreover, reserved equipment must also be prepared.

(iii) Prepare the foods and designate details, such as the coffee breaks; advice about the toilet is, as well as the proceeding schedules in the training for the trainees.

(iv) Check the room status: Check the facilities, and adjust the room temperature.

(v) Test the equipment: The supervisor should check the use of the equipment with the resource persons to see that they in suitable and working condition. He should also prepare the papers and other necessary materials for the trainees.

(vi) Evaluate the meeting: The trainee will fill in the evaluation form after the training to show their opinion about the topic of the train. This information is to be adapted and improved for the next meeting.

It can be concluded that the personnel development is very important for the teachers in improving the teaching to the proficiency on analytical thinking. It must go in accordance with the need and the teachers' level of competency. A successful personnel development must have a long-term planning. There will be minor group operations, feedback information, demonstrations, and the partaking of the leader in various activities. There also is a consideration of the character of the persons to partake in the activities.

(4) Learning materials and resources support

Learning materials and resources support refers to the supporting which focus on promoting learners analytical thinking skills. The learning materials and resources must
encourage the students to be self taught as well as to motivate skillful search for new knowledge.

Learning materials and resources serve as tools for promoting and supporting management of the learning process for developing analytical thinking, enabling learners to efficiently acquire knowledge, skills, processes and characteristics as prescribed in the curriculum standards. There are several kinds of learning materials and resources, i.e., natural media, print media, technological media and various local learning networks. With a view to making judicious choices of learning materials and resources, attention should be paid to their suitability to the learners’ different developmental levels and paces of learning. For provision of leaning materials and resources, learners and teachers can produce and develop materials and resources themselves or make judicious choices from among the various materials and resources of quality around them, as well as improve the chosen media as appropriate. These media can be utilized in the learning process, enabling learners to learn through appropriate communication. Educational institutions should provide sufficient learning materials and resources to ensure proper learning by learners. Ministry of Education (2012)\(^36\) advised the school administrators to provide materials and resources for developing analytical thinking as follow:

(i) Provide learning sources, learning material centres, learning information systems and efficient learning networks both in schools and communities for the purposes of study, research and exchange of learning experiences among educational institutions, local areas, communities and the world community;

(ii) Provide and procure learning materials and resources for study and research by learners to whom additional knowledge is given, and utilize duly adjusted locally available materials as learning materials and resources;

(iii) Choose and utilize learning materials and resources of high quality, which are suitable, diversified and consistent with the learning methods, the intrinsic nature of the learning contents and individual differences among learners;

(iv) Evaluate quality of the learning materials and resources selected for use on a systematic basis;
(v) Study, explore and conduct research for development of learning materials and resources that are appropriate to the learners’ learning process; and

(vi) Periodically and continuously supervise, monitor and assess the quality and efficiency of the learning media and their application.

In producing, selecting and evaluating the quality of learning materials and resources utilized in educational institutions, regard should be given to their major principles, e.g., harmony with the curriculum, learning objectives, design of learning activities; provision of experiences to learners; accuracy and timeliness of contents that are not detrimental to national security or morality; proper use of language; and presentation models that are easily understood and interesting.

(5) Learning management

Learning management refers to the capacity to achieve learning outcomes in all learners and is based on the notion of “design with intent”. The application of learning management occurs through a series of capabilities which are organized using the learning management schematic. The learning management must be emphasized on thinking process, management and confronting real situations and the application of knowledge for preventing and solving problems; organizing activities to enable learning from actual experience; arranging practical exercises to enhance skills in doing, analytical thinking and satisfactory achievement, the thirst and continuous search for knowledge, inculcating skills for well balanced integration of all subjects.

Learning management is an important process for curriculum implementation. Basic Education Core Curriculum A.D. 2008 stipulates guidelines for learning management that education is based on the principle that all learners are capable of learning and self-development, and are regarded as being most important. Therefore, teachers, instructors and administrators must change their roles from guiding and knowledge transferring to helping, promoting and encouraging learners in acquiring knowledge from various media and learning centres. Teachers have to provide correct information to learners for use in creating their own knowledge.
Basic education curriculum management emphasizes training for intelligence and thinking process development which shall result in learners’ creative and critical thinking ability. Moreover management shall also focus on emotion control development by instilling awareness on own self value, understanding one self and others, building up capability to solve emotional conflicts appropriately and effectively.

There are variety of substance procedures and methodologies. Teachers must, periodically and continuously, focus their attention on individual learners’ total development i.e. body, intelligence, learning methodology, interest and ability. Therefore, different forms and methodologies must be applied in each level learning management, emphasizing actual teaching-learning situation, self learning, group learning, and learning from nature, from actual practice, and integrated learning. Researches must be integral parts of learning processes; similarly, learning academic subject must be integrated with moral issue.

Attempts shall be made to integrate the following procedures in teaching learning of all subjects i.e. management of environment preservation and development, thinking, and scientific analysis. Such integration of different subjects and learning procedures stipulate common goals, and learner centre focus. Integration may be within the same subject group or otherwise.

In the efforts to develop learners, enabling them attain various characteristics prescribed in the curriculum goals, attempts must be made by teachers to select appropriate learning processes. The learning management comprises of seven aspects as follow:

(i) Principles of learning management

The principles of learning management enabling the learners to attain knowledge and competencies for the standards required, major capacities and desirable characteristics as prescribed in the Basic Education Core Curriculum are: learners are most important; all are capable of learning and self-development; priority is given to learners’ benefits; the process of learning management must enable learners to develop themselves naturally to their highest potentiality; consideration must be given to differences among individuals and their brain development; and emphasis must be given to both knowledge and morality.
(ii) Learning process

For learning management through the learner-centred approach, learners will depend on a variety of learning processes that serve as tools for enabling them to achieve the curriculum goals. Among the essential learning processes for learners are: integrated learning process; knowledge-creating process; thinking process; social process; heuristic learning process; learning process from actual experience; process of actual practice; management process; research process; self-learning process; and process of developing characteristics.

There are different forms of integration.

• **Integration by one instructor**

  Individual teacher may link one theme or one subject concerned real life or stipulated subjects. Linkages between various subjects and learning procedures may also be undertaken e.g. reading, writing, calculating, critical thinking on certain issues, enabling learner to apply skills and learning procedures in acquiring knowledge about stipulated field.

• **Integration by two and more instructors**

  Two and more instructors jointly work out integration to teach one specific theme or subject, on parallel activities basis. For example, teaching about certain subject may be undertaken by one science teacher and one mathematics teacher, or one science teacher and one art teacher; one mathematics teacher about distance measurement by shadow measurement, the art teacher about technique of drawing shadowed picture.

• **Multi-disciplines integration**

  Subjects from different groups are integrated to replace normal learning management by each individual instructor teaching each subject or each subject group separately. For some topics such as environment, different teachers may jointly arrange learning processes together. Thai language teacher prepares Thai language learning about environment terms, science teacher works out scientific research on environment, social studies teacher assigns lessons or group activities about environment, health education teacher arranges activities pertaining to preserve healthy environment.

• **Integration by project learning approach**

  Learners and instructors jointly create a project for integrated teaching learning. The project will run continuously, as many hours of learning time for each subject
put together. Different subjects are combined to achieve common goals. This is learning teaching as a team. In the event it is necessary to emphasize skills for particular subject, learning management can be singled out, such as music camp, English language camp, art camp and so on.

The guidelines for learning management are as follow:

Learning management must respond to learners’ interest, taking into consideration development of analytical thinking. Each time-frame should not be too long to hold learners’ interest. Analytical thinking must be integrated with all subject groups. Emphasis must be placed on actual learning, actual practice, and learning enjoyment. Focus should be on promoting group work skills; integrating learning, project learning and application of themes with the aims to foster skills in thinking process, search for knowledge, own self creating body of knowledge, and creative production in order to exchange knowledge and skills with others.

Therefore, in the learning process, learners should be trained and receive further development for acquiring competence in these processes, which will facilitate their learning, enabling them to achieve the curriculum goals which emphasized on analytical thinking. Teachers are therefore required to study and understand various learning processes in order to be able to make judicious choices.

(iii) Designing learning management

Teachers are required to study the curriculum of the educational institution concerned in order to understand the learning standards, indicators, learners’ major capacities, desirable characteristics and learning contents suitable to the learners. The teachers then proceed to design learning management by choosing teaching methods and techniques, learning media/resources, and evaluation measures, so as to allow the learners to develop to their highest potentiality and thereby attain the established goals.

(iv) Roles of teachers

In regard to learning management enabling learners to attain the quality as prescribed in the curriculum goals, teachers should play the following roles.
Study and analyze individual learners, and then use the data obtained for planning learning management in order to stimulate and challenge the learners’ capacities;

Set the targets to be achieved by the learners in regard to knowledge, skills, process of conceptualization, principles, relationships as well as desirable characteristics;

Design and organize learning responsive to individual differences and different levels of brain development, so as to enable the learners to attain the goals of learning;

Provide an ambience and atmosphere conducive to learning, and provide necessary care and assistance enabling the learners to learn;

Prepare and utilize media that are suitable to the activities organized, and avail of local wisdom and appropriate technologies for teaching-learning activities;

Assess the learners’ progress through a variety of methods suitable to the intrinsic nature of the subjects and the learners’ developmental level;

Analyze assessment results for remedial and developmental measures for the learners’ benefit, as well as improve their own teaching-learning methods and activities;

Get involve with students to set the goals of learning, make plans and take responsibility on learning process;

Seek knowledge, make serious efforts to access learning resources, analyze and synthesize bodies of knowledge;

Interact with students, parents, other teachers and community, work and join in activities organized by school; and continuously assess and improve learning process.

(6) Learning measurement and evaluation

Learning measurement and evaluation refers to the procedures to be used by instructors for learner quality development. The outcomes of these two activities are data and information concerning learners’ development on analytical thinking skills, progress and achievement, as well as data useful for promoting learner’s full development potential on analytical thinking skills.

Learning assessment and evaluation must be based on two fundamental principles, i.e., evaluation for the purpose of developing the learners’ capacity and for
appraising their achievements. With a view to succeeding in developing the learners’ learning quality, learners must be strengthened and assessed by availing of the relevant indicators, so as to achieve the learning standards prescribed. Such evaluation also reflects the learners’ major capacities and their desirable characteristics, which are the main goals of measuring and evaluating the learning outcomes at all levels, i.e., classroom level, educational institution level, educational service area level, and national level. Therefore, learning assessment and evaluation is a process of enhancing the learners’ quality by using assessment results as data and information to show learners’ developmental progress and accomplishment. The data will also be useful for strengthening the learners, thus enabling them to learn to their highest potentiality.

Learning assessment and evaluation can be divided into four levels, i.e., classroom level, educational institution level, educational service area level and national level, details of which are as follow:

(i) **Classroom assessment**

Measurement and evaluation are part of the learning process. Teachers regularly and continuously measure and evaluate students’ performance in teaching-learning activities by using diverse assessment techniques, e.g., asking questions, observing, examining homework, assessing projects, tasks/assignments and portfolios, and using written tests, etc. Teachers should conduct evaluations themselves or provide learners with opportunities for self-evaluation, peer-to-peer evaluation, and evaluation by parents. Learners who do not succeed in meeting the standards prescribed in the indicators will need remedial measures for teaching and learning.

Classroom assessment is aimed at verifying whether and to what extent learners have achieved development and progress in learning through the provided teaching-learning activities, and determining what must be improved and which areas must be strengthened. Furthermore, evaluation also provides teachers with necessary data for improving their own performance, which must be in accord with the established learning standards and indicators.

(ii) **School assessment**

This evaluation is conducted by the educational institution in order to appraise the learners’ achievements on an annual/semester basis, based on assessment of
analytical thinking and learner development activities. The aim is also to obtain relevant information about whether education provided by the educational institution has enabled learners to reach their goals of learning, and what are the learners’ strengths. The learning outcomes can also be compared with national assessment criteria. School assessment will provide data and information for improving policy, curriculum, projects and teaching-learning methodology. Evaluation outcomes are also useful for preparation of each educational institution’s educational quality development plan in accord with the educational quality assurance guidelines, as well as reports on each educational institution’s achievement to its school board, the office of the educational service area, OBEC, parents and the community.

(iii) Local assessment

Evaluation is conducted in order to assess learners’ quality at educational service area level, based on the learning standards prescribed in the Basic Education Core Curriculum. It is aimed at obtaining basic information required for developing quality of education provided by the educational service area as mandated. Evaluation of the learners’ achievements can be conducted by availing of standard examination papers prepared and administrated by the educational service area or in cooperation with the parent agency. Besides, assessment results are also obtained from verification and review of the data obtained from evaluation at educational institution level in the educational service area.

(4) National test

Evaluation is conducted in order to assess learners’ quality at national level, based on the learning standards prescribed in the Basic Education Core Curriculum. The evaluation results will provide relevant data for comparing educational quality at different levels, which will be useful for planning in order to raise the quality of education provided. The data obtained will also support decision-making at national policy level. The data from evaluation at the various levels mentioned above will be useful to educational institutions for checking, reviewing and developing learners’ quality. It is incumbent upon the educational institutions to establish a system for providing necessary care and assistance, remedial measures, and encouragement and support in order to allow learners to develop themselves to their highest potentiality. Such development will be based on individual differences, depending on their particular problems and needs. The various groups include average achievers, the gifted and talented, under-achievers, those with disciplinary and behavioural
problems, those who refuse schooling, those with economic and social problems, and those with physical and intellectual disabilities, etc. The data obtained from the evaluation therefore will provide essential information to the educational institutions for providing timely assistance to learners, who are thus allowed to enjoy full development and learning achievement. Being responsible for educational provision, educational institutions are required to prepare relevant rules and regulations for measurement and evaluation of the learning outcomes, harmonious and in accord with the criteria and guidelines prescribed in the Basic Education Core Curriculum, thus providing a common and standard practice for all concerned. (Ministry of Education, 2008)\textsuperscript{37}

Criteria for Learning Assessment

- Judging learning outcomes

In judging the learning outcomes of various subject areas, analytical thinking and learner development activities, the teachers must base their judgement on development of individual learners. Teachers are required to regularly and continuously collect the learners’ data in all respects for each semester, as well as provide remedial measures, enabling learners to develop to their highest potentiality.

- Grading learning outcomes

In judging for the purpose of grading learning outcomes of each course, educational institutions can grade the level of learners’ learning outcomes or the quality level of their performance by using numerical, alphabetical, and percentage systems or a system that uses key words to indicate the standard attained. For assessment of reading, analytical thinking and writing, and desirable characteristics, the grading levels are: Excellent, Good Pass and Fail. For assessment of learner development activities, consideration must be given to the amount of time devoted, and the participation and achievement of learners in accord with the criteria prescribed by the educational institutions. The outcomes of the participation are graded as: Pass and Fail.

- Reporting on learning outcomes

Reporting on learning outcomes is a means of communicating to parents and learners the latter’s progress of achievement. Educational institutions are required to summarize the assessment outcomes and prepare written reports for submission for the
parents’ information on a periodical basis or at least once every semester. Reporting on learning outcomes can indicate quality level of learners’ performance, which reflects the standard of achievement for the various learning areas.

(7) Supervision, follow-up and report

Supervision, follow-up and report refers to the process established regarding the supervision, follow-up and report. There must be jointly responsible to produce learners whose qualifications meet standards and expectation of analytical thinking skills. The instructors must be given opportunities to co-operate, assist, encourage and support planning and implementation of plans to achieve high potential on analytical thinking of students. Supervision, follow-up and report are parts of quality assurance mechanism to meet analytical thinking standards.

Well-established mechanisms for supervision, follow-up and report, the performance and progress of students, classes, the school as a whole, and improvement programmes, are important features of many effective schools. These procedures may be formal or informal, but either way they contribute to a focus on teaching and learning and often play a part in raising expectations and in positive reinforcement.

Follow-up student’s performance: Frequent and systematic follow-up and evaluate the progress of students and classes by itself have little impact on achievement, but have been shown to be an important ingredient of the work of an effective school (Sizemore, 1985)\textsuperscript{38}. First, it is a mechanism for determining the extent to which the goals of the school are being realized. Second, it focuses the attention of staff, students and parents on these goals. Third, it informs planning, teaching methods and assessment. Fourth, it gives a clear message to students that teachers are interested in their progress. This last point relates to teachers giving feedback to students, which we discuss under “positive reinforcement”. Mortimore, et al, (1988)\textsuperscript{39} mentioned that the appropriate follow-up and evaluate not only to academic abilities but also to personal development on analytical thinking skills.

In conclusion, follow-up and evaluate is very importance for improving thinking ability. These procedures may be formal or informal, but either way they contribute to a focus on teaching and learning and often play a part in raising analytical thinking and in positive
(8) Research for learning development

Research for learning development refers to the requirement of research procedures consist of series of actions in respective order, namely problem analysis, establishment of plans to solve problems or to create development activities, implementation of plans, data collection, research output conclusion, report and utilization of research results. The result researches on analytical thinking skills will be used for development of analytical thinking potential of students.

Glickman and others (2001)10 propounded the stages of research for learning development as follows:

(i) Teachers evaluate the requirement of all the teachers by compiling all the fundamental data used for setting up the learning & teaching improvement purpose. In the technique for this stage of procedure, the teachers may use the information from various sources; such as the listening and observing, the official personal resume, interrogating medial men, inspect the opinion through free writing of the replies, check list and rank up the priorities, implement Delphi technique.

(ii) Teachers set brainstorming activities to decrease the supervising tasks. The topics of the brainstorming are: (a) what supervision formats should be used, and what would be the suitable amount suitable in assisting the teachers' teaching improvement? (b) What should the curriculum be developed (content, exercises, material and supplies), in the first and the following proceedings to assist the teachers in improving their teaching? (c) In what form should the additional knowledge (lecture, drill, demonstration, debates) be given to the teachers for implementation in the teaching improvement? (d) What form meeting and debates should be used to be suitable to the interchange of ideas about the teaching improvement?

(iii) Teachers set up activities concerning the procedure designation, to be in accordance with the stipulated objectives.

(iv) Teachers contemplate the proceeding in observing the progression of the operation according to the plan while being used in the classroom. Following implementation
may be used in the observation: (a) the measurement of the variable constancy in implementation may be used in the observation, (b) the measurement of the variable constancy in various aspects, the operational indicator, observing diagram, the classroom use, the partaking in the free lecture, the specific questionings, the educational critiques, and the specific condition observation.

(v) Teachers select the research design in accordance with the statistics used in the analysis of data. This research design may be implemented through the qualitative research, experimental research (i.e. true experimental research, quasi-experimental research, and pre-experimental research) and survey research.

It can be concluded that research for learning development is a dominant part in the effective development of analytical thinking. School administrators must realize that the research for learning development is focus on the teachers’ improvement. The research for learning development is like a tool in compiling the whole learning operation. It concerns to the direction of the learning & teaching improvement, the planning for analytical thinking development activities. It is clear that the research for learning development can help the teachers in reaching their teaching goals and the achievement of the educational institution.

2.3 REVIEW OF THE PAST STUDIES

2.3.1 Introduction

For the research work, it is necessary to review the work already done in the past. The review of literature thus becomes a link between the research proposed and the past studies. It tells the reader about aspects that have been already established or concluded by other authors, and also gives a chance to the reader to appreciate the evidence that has already been collected by previous research, and thus projects the current research work in the proper perspective. There is hardly any research project which is totally unrelated with research that has already taken place. Usually every individual research project only adds to the plethora of evidence on a particular issue. Unless the existing work, conclusions and controversies are properly brought about, most research work would not appear relevant, not will it appear important in the whole framework. Thus, review of literature is a very important aspect of any research both for planning the work as well as to show its relevance and significance.
2.3.2 Importance of review of the past studies

The review of the past studies is an important part in the research work. It provides the background and justification for the research undertaken. According to Bourner, T. (1996)\textsuperscript{41} there is good reasons for spending time and effort on a review of the literature before embarking on a research project. These reasons include:

1. To identify gaps in the literature
2. To avoid reinventing the wheel (at the very least this will save time and it can stop from making the same mistakes as others)
3. To carry on from where others have already reached (reviewing the field allows the researcher to build on the platform of existing knowledge and ideas)
4. To identify other people working in the same fields (a researcher network is a valuable resource)
5. To increase the breadth of knowledge of researcher’s subject area
6. To identify seminal works in researcher’s area
7. To provide the intellectual context for researcher’s work, enabling researcher to position the project relative to other work
8. To identify opposing views
9. To put the work into perspective
10. To demonstrate that the researcher can access previous work in an area
11. To identify information and ideas that may be relevant to research project
12. To identify methods that could be relevant to research project

As far as the literature review process goes, ultimately the goal for the researcher is to complete their review in the allocated time and to ensure they can maintain currency in their field of study for the duration of their research. (Bruce, 1990)\textsuperscript{42}

Leedy & Ormrod (2005)\textsuperscript{43} mentioned two critical considerations stem about the review of past studies:

1. Research must enhance the current understanding of a phenomenon, or contribute to enhance the body of knowledge.
2. Research must communicate what was discovered in the new study.

Knowing the current status of the body of knowledge in the given research field is an
essential first step for any research project.

An effective literature review accomplishes this step by:

(1) Helping the researcher to understand the existing body of knowledge including where excess research exists.

(2) Providing a solid theoretical foundation for the proposed study.

(3) Substantiating the presence of the research problem.

(4) Justifying the proposed study as one that contributes something new to the body of knowledge.

(5) Framing the valid research methodologies, approach, goals, and research questions for the proposed study.

Kumar, V. (2009)\(^4\) states that a large part of review of literature actually needs to be done even before the research project is formalized. This is essential to make sure that the researches are not repeating the work that someone has already done earlier. Sometimes, if the research has already been undertaken earlier, then it provides an option of modifying the work by adding a new perspective or altering some of the methods of research to obtain a perspective that will be different from earlier works and thus more valuable. Occasionally, the work may be exact repetition of the work done earlier, but with a different set of data or sources of facts, and purpose of the research may just be seen if the results are similar to earlier works.

A good researcher usually goes through a lot more literature than is actually incorporated in the paper. This is because different literature may have differing relevance for the current project and all of it may not worth reporting in the end, but in the initial phase, when the researcher is looking for all aspects of an issue that could be relevant one would like to extensively explore the literature and see if any relevant findings are already available. Some of the literature reviewed is directly relevant and hence used as a preface to explain the background of work. Then other reports may be relevant from the point of view of the project as they provide some clues to the puzzle by suggesting a hypothesis, which may be the subject matter of the research project.
It can be summarized that review of the related literature is necessary to show the available evidence to solve the problem adequately and thus the risk of duplication can also be avoided. It provides ideas, theories, explanations or hypotheses valuable in formulating the problem. It also suggests methods of research appropriate to the problem, to locate comparative data useful in the interpretation of results and to contribute to the general scholarship of the researcher. Review of literature is also important to highlight difference in opinions, contradictory findings or evidence, and the different explanations given for their conclusions and differences by different authors. Thus review of literature is a very important part of one’s research.

2.3.3 Past studies related to analytical thinking management practices

This chapter presents 10 past researches related to analytical thinking management practices which was already done in Thailand and in different countries as follow:

STUDY 1: A Study to Determine Whether the California Critical Thinking Skills Test will Discriminate between the Critical Thinking Skills of First Semester Students and Fourth Semester Students at a Two Year Community Technical College (Thomas F. Raykovich, 2000)\(^5\)

**Objectives of the study:** The objectives of the study were to determine if the California Critical Thinking Test will detect differences in critical thinking skills between first and fourth semester students enrolled in two year programming at Nicolet Area Technical College.

**Tool used in the study:** The California Critical Thinking Skills Test (CCTST) was used to be the tool of the study. Percentiles can be obtained for an overall critical thinking score, and/or for the following subscales: Analysis, Evaluation, Inference, Deduction, and Induction. The CCTST manual estimates the reliability to be at 0.78.

**Sample of the study:** The sample for this study consisted of 103 students enrolled in programming of substantial length (2 years, or 45 credits) at Nicolet Area Technical College. Of this sample, 53 were incoming (first semester) students, and 50 were students
preparing for graduation. The incoming students were taking general education courses and were administered the test instrument during class time under their instructors’ direction. The other group of students was chosen at random and was required to take the examination under the direction of the Nicolet College Assessment committee upon application for graduation.

**Technique used for analysis of data:** In an effort to determine if the California Critical Thinking Skills Test (CCTST) identified differences in critical thinking skills between first and fourth semester program students attending Nicolet Area Technical College, a causal-comparative study was conducted. The study was conducted comparing matriculating Nicolet College students and students preparing for graduation. Data taken from the California Critical Thinking Skills Test was statistically analyzed and the index of choice used to find the significance of the difference between the means of the two samples was the t-test for independent samples.

**Major findings:** The results of this study indicate the average mean test score of Nicolet College students enrolled in their fourth semester was significantly higher on the California Critical Thinking Skills Test (CCTST) than the mean test score earned by first semester Nicolet College students. Through additional research, it was found that on the five (CCTST) sub-scales, the total mean scores of fourth semester students were significantly higher than those of first semester students, with the exception of the Inference Sub-scale. It should be noted that although a statistically significant difference between the scores of first and fourth semester students was not found on the Inference sub-scale, this sub-scale did yield a higher mean score for the fourth semester students.

**STUDY 2:** The Development of the Enrichment Curriculum on the Critical Thinking Skills for Grade 6 Students of Basic Education Schools. (Ashara Chaywiwat, 2008)

**Objectives of the study:** The objective of this study was to develop the enrichment curriculum on critical thinking skills for grade 6 students of basic education schools. The critical thinking skills had 5 compositions i.e. problem, information, hypothesis, evaluation and conclusion.
Tool used in the study: The research tools were the enrichment curriculum, learning achievement tests and interview form.

Sample of the study: There were 26 students of Ban Thaluang School in the experimental group and 26 students of Ban Don Khawow School in the control group in the academic year of 2007 and these schools are under the Nakhon Ratchasima educational service area 7.

Technique used for analysis of data: This study was experimental research by design 4 processes of curriculum development were: (i) studying primary sources, (ii) forming the enrichment curriculum, (iii) experimenting the enrichment curriculum, and (iv) evaluating the enrichment curriculum. The data was analyzed by the use of mean (\( \bar{X} \)), percentage (%), standard deviation (S.D.) and t-test (dependent and independent sample).

Major findings: The results of the study are as follow:

(1) There was the significant difference between the posttest scores on the critical thinking skills for Grade 6 students belonging to experimental group and control group. The results reveal that posttest scores of the experimental group was statistically significantly higher than the control group after being taught.

(2) The critical thinking skills were found that students earned the highest score on evaluation skills followed by hypothesis, problem, information and conclusion.

(3) Evaluating the enrichment curriculum. The purpose of stage was to evaluate the effectiveness of the enrichment curriculum using standard criteria of E1 / E2 (80/80) equals 81.94 / 81.08.

STUDY 3 : Analysis-Promoted Administration of Secondary School in Bangkok (Jittikarn Supising, 2008)47

Objective of the study: The objectives of this research was to study the analysis-promoted administration in secondary school.

Tool used in the study: The five points Likert scale was used for data collection.
Sample of the study: The sample used in the study was 14 administrators and 92 teachers in secondary school, Bangkok, Thailand.

Technique used for analysis of data: Mean (\(\overline{X}\)), standard deviation (S.D.) and percentage (%) were used for analysis of data.

Major findings: The results of the study were as follow:

(1) Administrators and teachers gave the opinions that the analysis-promoted administration have been operated in the school at high level. It was found that all aspects of the analysis-promoted administration in the school were found at high level i.e. orientation, supervision, follow-up, evaluation, ambience/environment, and personnel development.

(2) Administrators viewed that the analysis-promoted administration have been operated in the school at high level. It was also found that all aspects of the analysis-promoted administration were found at high level i.e. orientation, supervision, follow-up, evaluation, ambience/environment, and resource support.

(3) Teachers viewed that the analysis-promoted administration have been operated in the school at high level. It was also found that all aspects of the analysis-promoted administration were found at high level i.e. orientation, supervision, follow-up, evaluation, ambience/environment, and personnel development.

STUDY 4: A Study of Analytical Thinking Management for the Pre-Primary Education of Private School in Bangkok Metropolitan (Wanwipa Mankong, 2008)

Objective of the study: The objective of this research is to study the current analytical thinking management for the pre-primary education of private school in Bangkok Metropolitan. Both a quantitative and a qualitative research design were used to carry out the study.

Tool used in the study: The survey questionnaires, in-depth interview and focus group discussion guidelines, teaching observation form concerning to analytical thinking management for the pre-primary education of private school in Bangkok Metropolitan were used as research instruments for the study.
Sample of the study: The samples obtained by stratified random sampling consisted of 30 administrators, 202 teachers and 19 parents.

Technique used for analysis of data: In order to fulfill the objectives of the study, quantitative data was analyzed applying descriptive statistics while qualitative data was analyzed by contents analysis.

Major findings: The research found that 90.15% of administrators explained that they made a plan for analytical thinking management in accordance with the policy of the Ministry of Education. They also relied on the strengths, weaknesses, opportunities, and threats analysis, experience of themselves and competitors. The 90.20% of administrators operated the plan by holding seminars to discuss lesson plan preparation. The parents wanted to acknowledge contents of every subject for the whole semester, and the contents had to show details about analytical thinking management. It was found that 55.00% of the administrators used integrated curricula. Most of teachers representing each of the large school, the medium school, and the small school agreed that they used various methods that met the needs and interests of the students.

The results indicated that most of the respondents used questioning, conversing and discussing techniques for teaching. The parents asserted that they were satisfied with their teaching methods, which efficiently please their students and got attention from them during learning sessions. In selection of learning media, all of the respondents selected material that matched the content of lessons and learning objectives. Most of teachers representing each of the large school, the medium school, and the small school agreed on the use of real materials for instruction. The research established that most of administrators see it very important that evaluation is conducted, by means of observation. All of the administrators opined that the schools should inform the result of assessment to parents, and agreed that use of the evaluation is beneficial to improvement of analytical thinking management. The parents suggested that the results of the evaluation should be advised immediately to parents after the evaluation process and that the schools should apply that information to the improvement of analytical thinking management.
The findings of the study as a whole suggested that analytical thinking management for the pre-primary education of private schools in Bangkok Metropolitan should rely on a consideration of child development and the context of both inside and outside of the schools. School activities should not contrast with the policy of the Ministry of Education. Moreover, both the teachers and the parents should share knowledge for developing students to achieve educational goals.

STUDY 5: Analytical Thinking Skills Development, Scientific Substance of Learning group for Grade 6 Elementary Education. (Sirikan Tanawutpornpinit, 2010)

Objectives of the study: The objectives of this study were:
(1) To develop instruction model of analytical thinking skills
(2) To compare the differences between pretest-posttest scores of analytical thinking skills
(3) To reflect learning activities of Grade 6 Elementary Education

Tool used in the study: The instruments for collecting data were the lesson plan of analytical thinking skills and analytical thinking skill test. The one group pretest-posttest design was used as the research design.

Sample of the study: 28 grade six students of Wattonyeod School (Thailand) were used to be the sample of the study.

Technique for analysis of data: The quantitative data were analyzed by frequency, percentage (%), mean (X̄), standard deviation (S.D.) and t-test for dependent sample. Content analysis was used for qualitative data.

Major findings: The results of this research revealed that the model of analytical thinking skills was developed 5 steps as follow:
(1) Review and transfer experience
(2) Inquiry
(3) Finding conclusion
(4) Discussion
(5) Knowledge distribution.
There was the significance between pretest-posttest scores on analytical thinking skills at 0.05 level. The posttest score was greater than pretest score on analytical thinking skills. For the students’ opinion towards learning activities, it was found that the students understand in science subject and analytical thinking skills, interested in active learning, variety of media, enjoy learning and could be used in real life situation.

STUDY 6: A Study of the Impact of School Development on Analytical Thinking Management (Somtawin Jampakaew, 2010)  

Objective of the study: The purpose of this research aims as follow:

1. To study the opinions of school teachers and school administrators about the impact of school development on analytical thinking management.

2. To compare the opinions of school teachers and school administrators about impact of school development on analytical thinking management.

Tool used in the study: The instrument used for data collection was the teacher and administrators narrative within professional discussion, and a critical reflective about impact of school development on analytical thinking management.

Sample of the study: The samples obtained by stratified random sampling consisted of 320 school teachers and 60 school administrators.

Technique of analysis of data: In order to fulfill the objectives of the study, the content analysis and percentage (%) was employed in the analyses of the data.

Major findings: It was found from the study as follow:

1. The thinking, action, and the development of school practices can be lead to more effective analytical thinking management in school.

2. The model of school-based management was impact on analytical thinking management. Therefore, the school teachers and school administrators should emphasis on four aspects of school development i.e. schools’ administration and management, teaching-learning activities, Personnel care taking and professional development, and community relations system.
(2.1) Schools' administration and management should emphasize on the plan for academic administration, budgeting, personnel administration, and general administration that provides students the utmost benefits. The administration is decentralized and involves stakeholders' participation in decision-making. Team-based work culture, knowledge construction and systemic problem-solving oriented should be encouraged. Administrators and schools’ committee should enable to be the role model for students, teachers, parents and community members. Quality assurance system should be available for inspection both by the assessors and by the community. Information technology system for the administration should available for the sections of academic administration, budgeting, personnel administration, and general administration. There should be the school’s plan or strategic plan for analytical thinking management.

(2.2) Teaching-learning activities should focus on learner-centered based i.e. up-to-date school’s curriculum which is in relevance to the need of the students, community, and society. Curriculum management should systemic and continuity. Learning activities should be varying, flexible, and suitable according to the nature and needs of students. Facilitation, follow up system, and supervision of teaching and learning quality should be emphasized and conducted regularly. There should be the effective use of teaching materials and technology. Both outside and inside database and learning resources should be available for teaching and learning. The assessment processes should be varying, appropriate, and in relevance to learning process and contents. Classroom research for analytical thinking development should be encouraged.

(2.3) Personnel care taking and professional development should be encouraged for personnel care taking and professional development for the benefits of students. Teacher professional development should be encouraged systemically and continuously.

(2.4) Community relations system should be provided for the opportunities for the stakeholders’ involvement in school administration and management. Parents’ and community’s involvement in school administration and management should be encouraged. Parents and community should participate in school’s activities continuously.
STUDY 7: The Development of Higher Order Thinking Skills Using WebQuest Instructional Activities for Undergraduate Students in Faculty of Education Mahasarakham University (Pachoen Kidrakarn, Suthipong Hogsuwan, Manit Asanok, and Hemarat Thanaputama, 2011)

Objectives of the study: The objectives of this study were:

1. To develop WebQuest-based instruction with an efficiency of 80/80, to examine an effectiveness index of the developed WebQuest-based instruction.

2. To compare the learning achievement, the analytical thinking abilities and the critical thinking of undergraduate students before and after studying WebQuest-based instruction on Classroom Applications of Educational Technology course.

3. To examine the attitude of undergraduate students toward WebQuest-based instruction.

Tool used in the study: The instruments used in this study were:

1. WebQuest-based instruction Entitle “0503 271 Classroom Applications of Educational Technology”

2. The learning achievement test with the discrimination between 0.27-0.89 and reliability as 0.84

3. The analytical thinking abilities test with the discrimination between 0.34-0.79 and reliability as 0.89

4. The critical thinking test with the difficulty between 0.33-0.84, the discrimination between 0.23-0.79 and reliability as 0.82

5. The attitudes of undergraduate students toward WebQuest-based instruction Test with the discrimination between 0.29-0.88 and reliability as 0.89.

Sample of the study: The sample used in this study consisted of 70 undergraduate students studying the bachelor’s degree in educational technology and communication major, Mahasarakham University, obtained using the cluster random sampling technique.
Technique used for analysis of data: The statistics used for analyzing the collected data were percentage, mean, and standard deviation; and t-test (Dependent Sample) were employed for testing hypotheses.

Major finding: The results of this study were: the developed WebQuest-based instruction had an efficiency of 81.25/80.38 which met the criterion 80/80, and had an effectiveness index of 0.6488 showing that the undergraduate students have had increase learning achievement as 64.88%. The undergraduate students have had the learning achievement, the analytical thinking abilities, and the critical thinking posttest mean scores higher than pretest mean scores with significant difference at the 0.01 level. The students’ attitude through WebQuest-based instruction mean score, as a whole and in each aspect, were at a high level.

STUDY 8: The Development of an Analysis Thinking Skills and Enduring Understanding of Seventh Grade Students Taught by Inquiry-Based Learning (Kannika Kaengkiri, 2012)

Objectives of the study: The objectives of this study were:

(1) To develop an instructional plan of the acidic and basic solutions through an inquiry-based learning approach to meet an effective learning criterion of 80/80

(2) To evaluate the analytical thinking ability and enduring understanding of students after the implementation of the inquiry-based learning approach

(3) To assess students’ opinions toward the inquiry-based learning approach.

Tool used in the study: Analytical thinking ability test and questionnaire to assess the students’ opinions towards the inquiry-based learning approach were used to be the tools of the study.

Sample of the study: 30 seventh grade students of Nongphowittaya School, Photharam, Ratchaburi were the sample of the study.

Technique used for analysis of data: Data were collected from a group of 30 seventh grade students of Nongphowittaya School, Photharam, Ratchaburi through a lesson plan as well as several analytical thinking ability test, enduring assessment forms and Questionnaire distribute in the classes. The statistical data analysis both descriptive (%,
Mean and standard deviation) and inferential (dependent t-test and content analysis) statistics were performed and a probability of 0.05 or less was considered as statistically significant.

**Major findings:** The results revealed that the effective instructional plan of the acidic and basic solutions was developed through the inquiry-based learning approach. The learning score E1/E2 was about 85.90/85.00 in which successfully meet the effective learning criterion. The scores indicating analytical thinking ability of the students after the implementation of the inquiry-based learning approach were significantly higher than those scores before the implementation the inquiry-based learning approach. High levels of all enduring understanding ability aspects were found in which the lesson explanation showed highest level of enduring understanding ability. Furthermore, students showed their highest level of agreement to the inquiry-based learning approach. The learning activities, learning environments, and the advantages from a learning lesson showed their agreement level ranged from the highest to the lowest level, respectively.

**STUDY 9:** A Study of Analytical Thinking management and its relation to Students’ Learning Achievement (Anderson, P.V., 2012)

**Objective of the study:** This study aims to find out the level of analytical thinking management of secondary school and to find out the relationship between analytical thinking management and students’ learning achievement.

**Tool used in the study:** The analytical thinking management questionnaire and students’ learning achievement test were used for gathering of data.

**Sample of the study:** The sample of the study was selected through the use of stratified random sampling techniques comprised of 250 secondary school teachers and the learning achievement data of their students.

**Technique of analysis of data:** In order to fulfill the objectives of the study, mean ($\bar{X}$), standard deviation (S.D.), t-test (independent) and Co-efficient Correlation was employed in the analyses of the data.
**Major findings**: It was found from the study that analytical thinking management was at moderate level. There was the significant difference between mean scores of analytical thinking management rated by secondary school teachers belong to different group of sex and qualification. The mean score of analytical thinking management rated by male teachers has smaller than that of the mean score of analytical thinking management rated by female teachers. Teachers belonging to higher group of educational qualification obtained higher mean scores on analytical thinking management than that of the teachers belonging to lower group of educational qualification. There was the significant positive relationship between the scores of analytical thinking management and students’ learning achievement.

**STUDY 10: A Study of the Effectiveness of Computer Assisted Instruction (CAI) for Enhancing of Thinking Skills of Primary School Students** (Banjamas Sriprasert, 2012)

**Objective of the study**: The purposes of the study were as follow:

1. To study the learning achievement of primary school students taught by CAI for enhancing of thinking skills
2. To study the students’ opinions pertaining to the CAI for enhancing of thinking skills of primary school students.
3. To compare the mean scores of the students’ opinions pertaining to the CAI for enhancing of thinking skills of primary school students with regards to students’ gender.

**Tool used in the study**: The researcher designated the following research tools:

1. The Computer Assisted Instruction (CAI) for enhancing of thinking skills of primary school students
2. The learning achievement test (pretest-posttest) on thinking skills of primary school students taught by CAI. There are three parts of the learning achievement test: (a) creative thinking, (b) critical thinking, and (c) analytical thinking.
3. The scale to evaluate the students’ opinions pertaining to the CAI for enhancing of thinking skills of primary school students
Sample of the study: The sample of the study was selected through the use of random sampling techniques comprised of 40 primary school students.

Technique for analysis of data: The data collected by the tools was analyzed according to the hypotheses. The following techniques of analysis of data and the statistical calculations were employed.

(1) In order to determine the level of learning achievement (pretest-posttest) of primary school students in thinking skills taught by CAI, mean (\( \bar{X} \)), standard deviation (S.D.) and percentage (%) were employed.

(2) To test the difference between the learning achievements (pretest-posttest) of primary school students in thinking skills taught by CAI, the t-test (dependent) was employed.

(3) To study the level of students’ opinions pertaining to CAI for enhancing of thinking skills, mean (\( \bar{X} \)) and standard deviation (S.D.) were employed.

(5) To compare the difference between the mean scores of students’ opinions pertaining to CAI for enhancing of thinking skills classified by student’s gender, t-test (independent) was employed.

2.3.4 Summary

The second chapter discussed about theoretical orientation and review of the past studies related to analytical thinking management practices.

Thinking skill is the human capacities to think in conscious ways to achieve certain purposes. It involves the mental process used in cognitive functions that enable people to make meaning from and create with a significant amount of memory, leading to bodies of knowledge creation or information for judicious decision-making and problem solving regarding oneself society and environment.

Thinking skills includes creative, critical, and analytical thinking. These skills are activated when students of any age encounter unfamiliar problems, uncertainties, questions, or dilemmas. Successful applications of these skills result in explanations, decisions, performances, and products that are valid within the context of available knowledge and experience, and promote continued growth in higher order thinking, as well as other intellectual skills.
Analytical thinking is the human ability to separation a whole into its constituent parts or element parts order to study the parts and their relations. It is the ability to scrutinize and break down facts and thoughts into their strengths and weaknesses. It is the process of separating and distinguishing elements of a concept, idea, problem and issue in order to understand its essential nature and inner relationships.

The analytical thinking is based on the deductive thinking. The deductive thinking is the act of reasoning which move from a whole to its part, from the general to the particular, from the universal to individual, from broader generalizations to specific observation, and from general theories to specific instance. It is based on reasoning, experience, experimentation and draws conclusions from them. There are four abilities included in analytical thinking: Analyzing relationship of the two things or more, Separation the whole into the parts, Analyzing patterns or order, and Comparison of the things.

Management practices is the method or technique or process of doing something which is found to be the most effective and practical means in achieving goals and objectives while making the optimum use of the firm’s resources.

In the present study, management practices refers to the method or technique or process of coordinating the efforts of school members in accordance with certain policies to accomplish desired goals and objectives on analytical thinking of students using eight aspects of resources efficiently and effectively:

In the operational definition, analytical management practices refers to the scores obtained from the scale which measures the analytical management practices of primary school administrators. Analytical thinking management practices scale comprise of eight aspects: (i) Analytical management policy, (ii) Curriculum design and building, (iii) Personnel development, (iv) Learning materials and resources support, (v) Learning management, (vi) Learning measurement and evaluation, (vii) Supervision, follow up, evaluation and report, and (viii) Research for learning development.

Ten past studies were reviewed in order to gain the information and ideas that relevant to the analytical management practices, objectives, tool, sample, and technique of analysis of data. It makes sure that the present research is not repeating the work that someone has already done earlier. After viewing the past researches, it can be concluded
that four past researches were experimental research (three in pre-experimental research and one quasi-experimental research). Three researches adopted the survey method; one study adopted quality type of research whereas the other two researches combined the qualitative method and quantitative method type of research. Most researches aimed to find out the difference between pretest and posttest scores of students on analytical thinking management practices whereas the other researches studied about the impact and relationship between thinking skills and students’ learning achievement.

Several tools used in the past studies i.e. the California Critical Thinking Skills Test (CCTST), enrichment on critical thinking skills, Analysis-Promoted Administration Scale, Analytical Thinking Management Scale/Questionnaire, Analytical Thinking ability Test, The WebQuest-based Instruction, CAI for enhancing thinking skills, Narrative, interview, and focus group. For quantitative research, Likert scale and questionnaire were used to measure Analysis-Promoted Administration and analytical thinking management.

Students, administrators, teachers, parents were used to be the sample of the study. Percentage (%), Mean (\(\bar{X}\)), standard deviation (S.D.) t-test (dependent), t-test (independent), correlation, and content analysis were used for analysis of data.

2.4 Uniqueness of the present study

After the review of ten past researches related to analytical thinking management, it can be seen the uniqueness of the present study as follow:

(1) The present investigation aims to find out the level of analytical thinking management practices of primary school administrators and compare the mean scores of analytical thinking management practices of primary school administrators belonging to different groups of sex, age, work experience, educational qualification, type of school, size of school, and area of school. Mean (\(\bar{X}\)), standard deviation (S.D.), t-test (independent) and ANOVA were used for analysis of data. Therefore, this research is a unique research or only one research which indicates the difference between mean scores of analytical thinking management practices rated by primary school administrators belonging to different groups sex, age, work experience, educational qualification, type of school, size of school, and area of school.
Analytical thinking management practices in the present study were divided into eight aspects: (i) Analytical management policy, (ii) Curriculum design and building, (iii) Personnel development, (iv) Learning materials and resources support, (v) Learning management, (vi) Learning measurement and evaluation, (vii) Supervision, follow up, evaluation and report, and (viii) Research for learning development.

The scale which measures analytical thinking management practices of primary school administrators were used in this study. This scale was constructed and standardized by the researcher and test for the item analysis (i.e. validity, discrimination, reliability).

Construct validity was used for establishment of validity of the scale. Item-Test Correlation was applied to the data obtained from 100 primary school administrators. The Pearson Product Moment was calculated for the $r_{xy}$ value from the total scores and the score of each item. t-test (independent) was used to test the discrimination index whereas test-retest method was used to prove the reliability of the scale.

After viewing the tools used in past and present research, one can says that the tool used in present research is unique tool which is not appearing in any research. This tool is the first construction and standardization. It cannot be seen this tool in the market before.

Sample of the past research was the primary school administrators in the Central part of Thailand. This is also the uniqueness of the present research.
REFERENCES


   [http://www.wednet.edu](http://www.wednet.edu)


   [http://www.adprimacom](http://www.adprimacom)

   [http://www.cala.fsu.edu](http://www.cala.fsu.edu)


    [http://www.adprimacom](http://www.adprimacom)

    [http://www.adprimacom](http://www.adprimacom)

    [http://www.analyticalthinkingmagic.com](http://www.analyticalthinkingmagic.com)

http://www.analyticalthinkingmagic.com

http://www.wikipedia.org

http://www.meaningfulexistence.com


http://www.haygroup.com

22. Ibid


http://www.thinkinghistory.co.uk

27. Ibid.

http://www.wikipedia.org

http://www.businessdictionary.com


31. Ibid.


35. Ibid.


