

Theories on Reflective Research Methodology

This approach to learning from reflection was advanced by theorists who were invested in ways adults and professionals learn and develop their expertise in their fields. Scholarly works of theorists: Donald Schön (1983), David Kolb (1985), and Gibbs (1988) have focused on exploring the ways adults learn, and especially in the different ways that professionals learn and develop their expertise on their fields of practice. According to Kolb's model, the ideal learning process engages all four of these modes in cyclical fashion: definite experience, observation and reflection, formation of abstract concepts and generalizations, testing (application) of implications of concepts in new situations. In order for learning to be effective, all four of these approaches must be incorporated. David Kolb has extended his original work to explore the different ways in which individuals learn.

Observations from experience are central to Reflective Research process and Graham Gibbs (1988) Reflective Research ideas coincide much with that of Dewey on "learning by doing."

Reflective Research method as part of one's professional practice enables a practitioner in the field to examine his or her professional activities, approach, or methodology for continuous improvements in the advancement of his or her professional expertise. This approach encompasses the application of critical, reflective, and reflexive evaluations of the values and theories that guide one's practice of profession. Quoting, [Somekh & Zeichner \(2009, p.5\)](#), Millwood (chap. 3) noted that:

Action research, as a proposition, has discursive power because it embodies a collision of terms. In generating research knowledge and improving social action at the same time, action research challenges the normative values of two distinct ways of being – that of the scholar and the activist ([Somekh & Zeichner 2009, p.5](#))

Richard Sagor (2000) of the Institute for the Study of Inquiry in Education notes that "action research is a disciplined process of inquiry conducted *by* and *for* those taking the action. The primary reason for engaging in action research is to assist the "actor in improving and/or refining his or her actions" (chap. 1, p. 1). The reflective method used in this study has a semblance to the methodological approach applied by Richard Millwood (2014, chap. 3) for his dissertation, where he had taken into account his collections of work in his field of educational design from where he drew a greater outcome such as his creation a highly comprehensive Learning Theory dubbed as the "Holistic Approach to Technology Enhanced Learning (HoTEL)" that 25 Learning Theorists mapping out their respective world views or paradigms, along with the key concepts and under which scientific discipline each of them are categorized.

Millwood's work study takes into account the past decade of action research outcomes and scholarly endeavors as data for the reflective research process. The data collection in this study provides visual constructs or models drawn from the yearly summary of the analytical, critical, and reflective thinking and metacognitive (thinking about thinking) processes that this Researcher engaged in. Another work that is so much of an inspiration to the Reflective Research Methodology for this study is that of Stynes, Murphy, McNamara & O'Hara (2018) who designed and employed a Reflection-On-Action Rubric to show how the aspects of their own research may fit into a self-appraisal framework, with its four elements roach "in a continual cyclical process that engage, question and hopefully develop a critical response" (p. 163).

Stynes, Murphy, McNamara & O'Hara's approach to Reflective Research inspires a vision for creative and innovative action research approach that clearly guides a Researcher away from swerving into the direction of self-serving bias. The authors proposed the rubric for constant reflections during the theorizing process, or during the research action and writing phases, or upon full completion of the research activity. Their reflection-on-action rubric (see Figure __ , p.____) was developed from three scholarly works:

1. Schön's (1983) reflective research model for practitioners;
2. Moon's (2006) model that advances the thought that is reflective, performs a role in learning and in informing action, as well as in theory building (Moon, p. 45); and from,
3. Wellington's (2016) "assertions that researchers' systematic, critical and self-critical inquiry contributes to the advancement of knowledge" (Stynes, Murphy, McNamara & O'Hara, 2018, p. 159).

Critical Thinking Theory

Critical Thinking Theory is a necessary component of validating Mental Models. In their article, "A Theory of Critical Thinking," Cognitive Technologies, Inc. (n.d.), provided an excellent and practical definition of Critical Thinking as a skill being:

"exemplified by asking *questions* about *alternative possibilities* in order to reliably achieve some *objective*. Asking and answering questions is a skill of dialogue. Alternative possibilities are represented by mental models. A process of questioning mental models is (or should be) adopted because of its reliability for achieving the purposes of the participants within the available time (Cognitive Technologies, Inc., n.d., para. 1)

Cognitive Technologies, Inc. (para. 2) explained how Critical Thinking Theory is multifaceted, multi-dimensional, forming a three-layers structure from: 1) inner mental coherent rationalizations (Mental Model Theory) to 2) "intersubjective dialogue," and, 3) to correspondence with external reality (Reliability). Critical Thinking necessitates a

process of both Inner Dialogue with self (Reflective Thinking) and an External Dialogue (conversations with others to gather their perspectives and validate one’s own world views) – a principle or concept that is required in the Ladder of Inference as framework for learning.

The article, further noted that the Theory of Critical Thinking utilizes and fuses research on at least three categories of topics, adapting knowledge drawn from various scholars or authors and their outlined topics are presented below in Fig. 6 Table 2: Classification of Topics of Research in Critical Thinking Theory:

3 Topics in Critical Thinking Theory	Adapted from the Works of:
1. Theories of reasoning according to which people represent information about a problem or situation by means of mental models of alternative possibilities, evaluate the models in the light of relevant background knowledge, update the models by adding new information as it becomes available, revise models to resolve internal inconsistencies, and draw conclusions by inspecting the surviving possibilities.	(adapted from Johnson-Laird, 1983; Johnson-Laird & Byrne, 1991)
2. Theories of critical discussion in which a proponent must defend a claim against challenges of various kinds by an opponent or critic	(adapted from Rescher, 1977; Walton & Krabbe, 1995; van Eemeren & Grootendorst, 1992; Walton, 1998).
3. Theories of the cognitive mechanisms and processes involved in belief formation and decision making, which vary in their reliability or their association with proficient performance in a domain	(adapted from Simon, 1997; Gigerenzer & Selten, 2001; Ericsson & Smith, 1991; Klein et al., 1993; Payne, Bettman, & Johnson, 1993).

Fig. 6 Table 2: Classification of Topics of Research in Critical Thinking Theory

Refractive Thinking

The power of Reflective Research Methodology can be best appreciated from an understanding of the value of Critical Thinking that augments the process of Reflective Thinking. Critical Thinking requires the use of cognitive skills in order to achieve well-informed decision making about a question or problem with the end in mind of achieving desirable outcomes. *Reflective thinking* involves thinking processes aimed at developing judgments or conclusions about one’s understanding, perceptions, perspectives, and beliefs formed from his or her experiences of the world and examining them carefully against existing facts and knowledge (Dewey, 1933). Refractive Thinking on another hand, encourages a bolder path for researchers and suggests an expanded approach to Critical and Reflective Thinking. Since this study is highly conceptual and in essence attempts to theorize and examine the link between instruction and communication, the task requires a more analytical, critical, reflective, and refractive thinking approach in examining personally developed Mental Models.

Authors like Pagano and Roselle (2006, 2009) consider refraction as transformative knowledge that confirms the use of critical thinking and problem solving. Refractive Thinking paves the way toward taking in of knowledge and processing of ideas, thoughts, and information beyond the traditional boundaries of critical thinking and reflections. For Cheryl Lentz (2011), Refractive Thinking is about “moving beyond conventional thinking and wisdom to see the world not as it is, but as the world could be; underlying the important forces and dynamics that are needed to create and sustain innovation and social change (Lentz, 2011, Abstract).

With Refractive Thinking, one takes a leap of courage to challenge existing and commonly accepted thoughts, world views, approaches, and methods of doing things. With Refractive Thinking, the knowledge developed from careful critical and reflective analysis are meaningfully utilized, projected, and expressed to provoke new ways of thinking, to create, innovate, in ways more visible, useful, and valuable to societal change. Given these definitions and concepts, a dynamic trio of these three types of thinking is illustrated below (Fig. 3 Refractive Thinking Model):

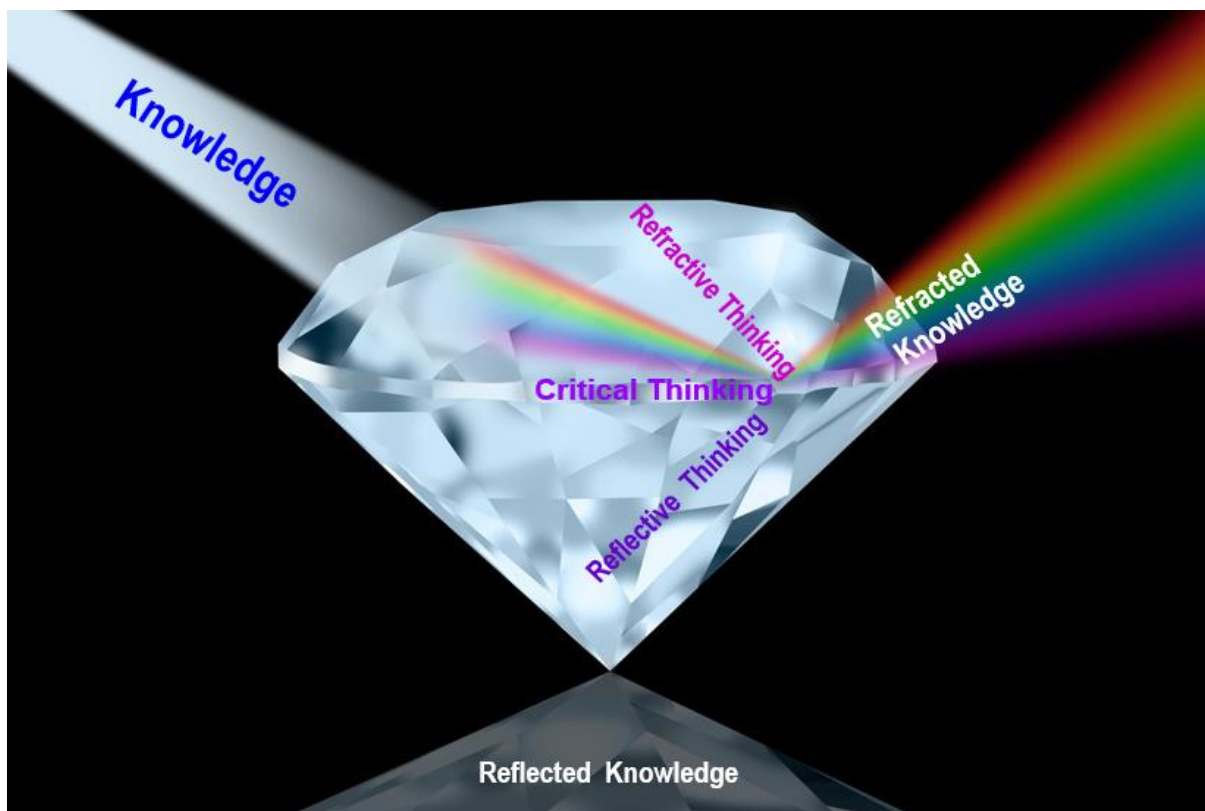


Image used with permission from Ron Bennett (2019)

This Refractive Learning Model envisages the process of knowledge made more visible through learner’s use of Critical, Reflective, and Refractive Thinking. The framework or Model is an extremely vital part of the study framework and truly enabled a balanced, non-biased, non-traditional reflective methodological approach.

An understanding of refraction may help in appreciating the value of the above framework. It must also be first that light normally travels in a straight direction through a single medium or object and this process is called transmission. In the transmission process, since the light simply goes through an object, there can neither be reflection or refraction. Refraction only occurs when light travels in a perpendicular manner.

Refraction in simpler terms is when light travels or passes through a transparent object or substance with optical density (i.e., water, glass, crystal, diamond) in a perpendicular manner and hits a surface of that is denser, the direction of the light bends and the components of the light are broken down making the colors of the light visible to the naked eye. When light is refracted, the colors are refracted at different angle, creating a spectrum of rainbow colors: Red, Orange, Yellow, Green, Violet, Indigo, and Blue (R.O.Y.G.B.I.V). White light is made up of several colors that are not visible to the naked eye and can only be seen when refracted, in which case, two forms of outcomes must be noted:

1. *Reflection* -- where the image of the object is reflected; and,
2. *Refraction* -- where the colors of light are projected outside of the object of object of its occurrence.

An understanding of the principles and concepts how light travels in straight or perpendicular direction and how each direction creates different resulting impacts on the colors of the light will be discussed further in the summary or conclusion, implications and recommendations in Chapter V.

Systems Theory's Applicability to the Study of Instruction

Systems theory has been known for its holistic applicability to the studies of intrapersonal, interpersonal, intergroup, and human/nature interactions, especially in perception studies. Given its interdisciplinary characteristics and its functional applicability to the tasks of explaining or clarifying principles or concepts in all types of systems, Systems Theory provides a good framework for the study of the dynamic process of communication that occurs within the process of instruction.

For use within a specific area of study, systems theory as an approach carries both ontological (relations between the concepts and categories) and epistemological (ways of knowing; theory of knowledge) facets and is not restricted to either one. In the words of Alexander Laszlo and Stanley Krippner (1998):

As a field inquiry concerned with the holistic and integrative exploration of phenomena and events, systems theory pertains to both epistemological and ontological situations. But rather than constitute either an epistemology or an ontology, it is more reminiscent of the

Greek notion of gnosiology concerned with the holistic and integrative exploration of phenomena and events. There are aspects of the systems approach that are ontological and epistemological, as well as aspects that are at once both and should not be circumscribed to either (Laszlo and Krippner, 1998, p. 49).

Based on both its ontological and epistemological strengths, systems theory can be appropriately applied to instructional studies. Laszlo and Krippner (p. 49) highlight two of the multifaceted uses of systems theory as:

1. For the “study effectiveness of the technological design of an online classroom; and,
2. The “cybernetic feedback loop mechanism in the teaching and learning process.”

Mental Models Theory

Mental Models Theory within Systems Thinking has fueled the pursuit of this study. The Mental Models Theory fits well as one of major theoretical underpinning for this study since the representative data obtained from the reflective research consists of schematic representations (schemas) or mental models that were developed throughout the years of reflective practice. James Clear’s (2017) succinctly defines a mental model as:

... an explanation of how something works. It is a concept, framework, or worldview that you carry around in your mind to help you interpret the world and understand the relationship between things. Mental models are deeply held beliefs about how the world works. For example, supply and demand is a mental model that helps you understand how the economy works. Game theory is a mental model that helps you understand how relationships and trust work.

To understand the process of instruction, and to identify the link between instruction and communication require the presentations mental models or schemas. The proponents of Mental Models Theory define mental models as “psychological representations of real, hypothetical, or imaginary situations” which was first advanced by the American philosopher Charles Sanders Peirce in 1886 who postulated “human reasoning” as a process wherein:

humans examine the state of things asserted in the premises, forms a diagram of that state of things, perceives in the parts of the diagram relations not explicitly mentioned in the premises, satisfies itself by mental experiments upon the diagram that these relations would always

subsist, or at least would do so in a certain proportion of cases, and concludes their necessary, or probable, truth (Mental Models, n.d., p. 1 with reference to Peirce)

Scottish Psychologist Kenneth Craik in 1943 advanced a comparable notion that “the mind constructs “small-scale models” of reality that it uses to anticipate events, to reason, and to underlie explanation” which is akin to “Wittgenstein’s (1922) “picture” theory of the meaning of language, mental models have a structure that corresponds to the structure of what they represent” (Mental Models and Reasoning, p. 1). Furthermore, the proponents of Mental Models theory noted that:

Since Craik’s insight, cognitive scientists have argued that the mind constructs mental models as a result of perception, imagination and knowledge, and the comprehension of discourse. They study how children develop such models, how to design artifacts and computer systems for which it is easy to acquire a model, how a model of one domain may serve as analogy for another domain, and how models engender thoughts, inferences, and feelings (Mental Models and Reasoning, p. 1)

In the edited work of Walter Schaeken, Andr´e Vandierendonck, Walter Schroyens, and G´ery d’Ydewalle titled, “*The Mental Models Theory of Reasoning: Refinements and Extensions*” it can be well understood how mental models are best used when exploring relations among objects or concepts. A sample problem they presented was that of determining the relation between the glass and the napkin, where the “glass is to the right of the plate and the napkin is to the left of the plate. What is the relation between the glass and the napkin?” (Models in the Mind, n.d., p. 1). The editors ruled out that the use of mental models works better than the use of the mental rules theory and they noted that the motivation behind the mental models approach was the dissatisfaction with the ability of the former to provide “plausible explanation of systematic patterns in experimental results” (Models in the Mind, p. 1). The mental models approach allows the subjects to properly visualize the positions and relations of the objects in the given scenario and in so doing, one is attempting to:

...construct a model of the situation described by the assumptions. Subjects first imagine the glass to the right of the plate and then add the napkin to the left of the glass. Then they can simply “read off” the relation between glass and napkin from this model (Models in the Mind, p. 1).

Mental Models are tools for better thinking, espouses James Clear (p. 7).

Clear (p. 7, under the section “In Pursuit of Liquid Knowledge”) knowledge noted that in the academic arena, knowledge is being separated “into different silos—biology, economics, history, physics, philosophy. In the real world, information is rarely divided

into neatly defined categories” and quoting Charlie Munger (1994), “All the wisdom of the world is not to be found in one little academic department” (Clear, p. 7). Clear argues that:

World-class thinkers are often silo-free thinkers. They avoid looking at life through the lens of one subject. Instead, they develop “liquid knowledge” that flows easily from one topic to the next.

This is why it is important to not only learn new mental models, but to consider how they connect with one another. Creativity and innovation often arise at the intersection of ideas. By spotting the links between various mental models, you can identify solutions that most people overlook.

The correctness of Mental Models is deemed important for elaborations of one’s conceptual ideas as gauged against existing facts. A Mental Model could either be intricate or non-intricate theory or assumptions. Drawing on cognitive psychology for its explanation, Mental Models are representations of thoughts, are schemas that represent beliefs, perceptions, judgments, and actions, feelings, values, and ideas. Therefore, Senge (1994) advocates that for change to occur the real operative models must not remain hidden beneath the surface. Restructuring or redesigning of models is a means to improve and allow for change to occur. Although most of Senge’s thoughts focus on organizational change, the same principle may apply to any system such as the classroom system.

Raines (2009) notes that Senge’s theory falls within Systems thinking as it is a means to view the relations, links, or relationships between or among mechanisms, objects, things, or entities. Rather than view and analyze fragments and parts of how processes occur, systems approach allows for looking at things and processes as a whole. Systems theory is useful in identifying the elements and connections among major elements of a system (such as process flow, outcomes of the process, etc.).

The use of mental models allows for the determination of how an individual makes sense of the world, and most importantly how an individual takes action (Senge, 1990) as a result of his or her own thinking. However, since mental models are derived from one’s own reflective and reflexive thought process, it is only logical to expect that in academic undertakings, these mental models are highly suspects of Researcher’s bias. Those who use the Inference Ladder caution individuals of climbing the ladder too fast without careful examination of their beliefs and assumptions. In their work, “Dangers of Climbing the Ladder of Inference” Gelinas & James (2017) speak of the same necessary caution to heed in decision makings and in taking actions.

Mental Models, Reasoning, and Proving Logic

Philip Johnson-laird through his study of discourse shed light regarding the creation of mental models. Laird explained that individuals create mental models as they go through their thought processes (i.e., hearing a word). In this study, the mental models

or schematic representations were drawn from envisioning the process of instruction, and from understanding gained from conversations with others and from research. Mental models can be very simple or complicated (Communication Theory, n.d.). Studies have been conducted that led to revelations that not all logical facts can be proven mathematically or computationally.

According to Laird (2007), some three decades ago, psychologists thought that human reasoning depends on formal rules of inference similar to the logic in calculus. However, evidence refutes this thinking. The theory on the rules of inference was faced with challenges leading to an alternative stance: the view that logic is dependent on visualizing possibilities consistent with the foundation that starts from a world view, or insights, awareness or understanding of the world. Logical reasoning is dependent on a set of assertions, a recall, or a mixture of them. Individuals formulate or create mental models of any distinctive possibilities and draw inferences or conclusions from them. Reasoning is a replication of the world. Yet, our ability to use counterexamples to refute invalid inferences provides a foundation for rationality. On this account, reasoning is a simulation of the world magnified with one's knowledge and not merely a formalized reshuffling of the logical frames of sentences. Most importantly, not all mental models have to be proven true and correct through computational means.

The Ladder of Inference

A person's "beliefs might be founded on faulty selection or interpretation of data" notes Jonathan Levene (2016). Since mental models are developed through one's own reflexive thinking, the danger of self-bias can ever be present in the process. However, there are specific and potent ways to treat or address the risks of bias. As it has been well-recognized that Reflective Research brings self-improvement and professional development, the use of the ladder of inference may prove beneficial in combatting bias-filled inferences. Rotman School of Management (2012) recommends the Ladder of Inference as an Integrative Thinking Tools using a pool of data (comprising of information from research and experience). From this pool of data, select and interpret meaningful data as basis for making a conclusion or a decision for action or recommendation. This practical use of the Ladder of Inference is best fit to this study.

The Ladder of Inference, which is widely used within the systems thinking process, effectively helps eliminate outcomes that are based on personal biases alone. The Ladder of Inference was conceived by Argyris (1990) to help organizations (systems) in overcoming their challenges and consists of the following steps from down up to the top most level as illustrated in Fig. 4 below:



(Fig. 4 Ladder of Inference adapted from Argyris, 1990)

The Ladder of Inference is widely used to transform minds and develop the critical thinking and decision making skills of individuals. The use of the Ladder of Inference starts at the bottom of ladder of thinking, where there resides one's reality and experiences. From this pool of data are reality and facts. The *critical-reflective-refractive* thinker selects the best data, interprets, analyzes the data, apply assumptions, make conclusions, develop a stronger belief or mental model, and then takes the top most step: conclusion of action, as illustrated in Fig. 4 above.

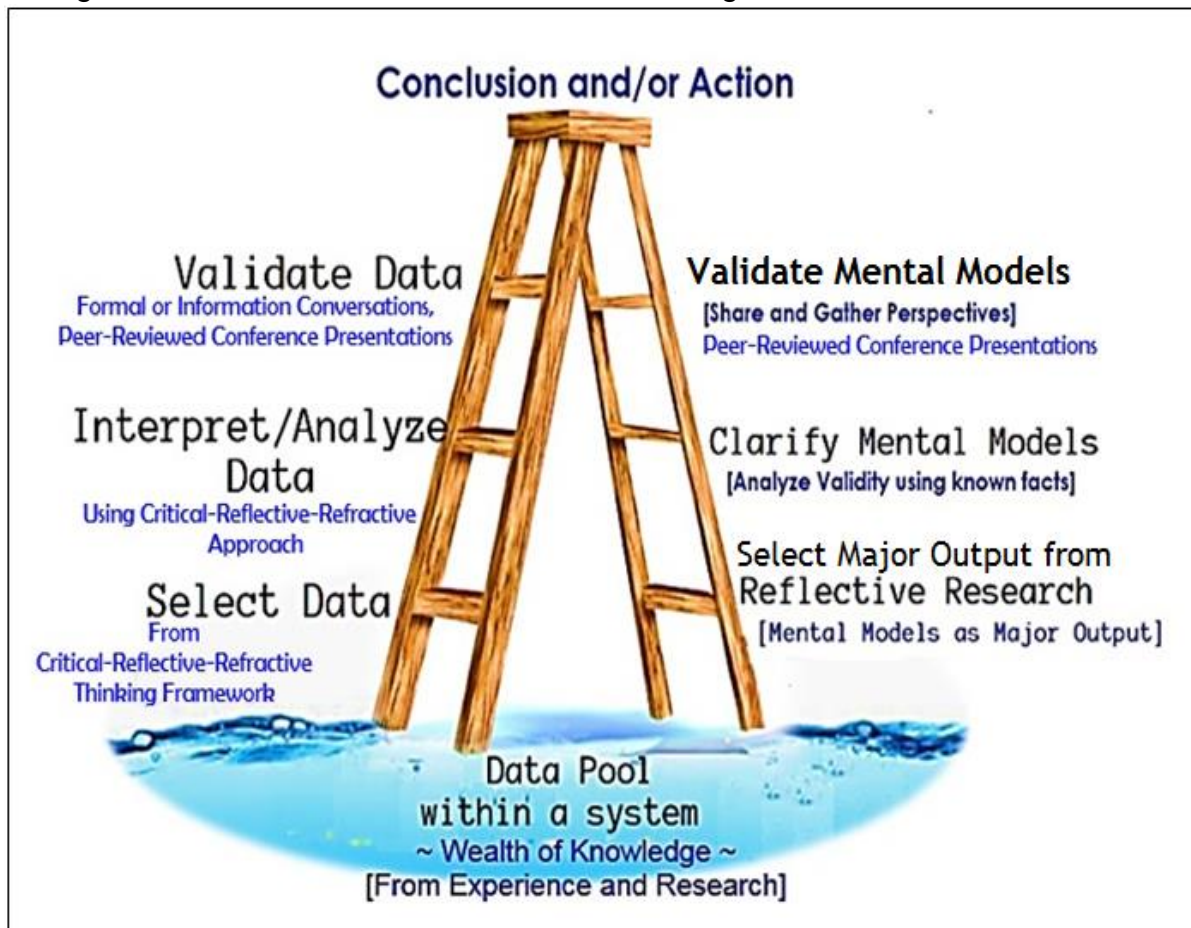
The Ladder of Inference can be used in any system and learning transformation approach, including the Reflective Research Methodology. By using the Ladder of Inference, individuals can check and counter-check their beliefs and mental models through a double-loop or triple loop approach (climbing up and going down the ladder of thinking) to review carefully reality and facts and select data from them, then examine and analyze one's own assumptions and beliefs before making decisions to taking actions. The Ladder of Inference is a step-by-step guide to reasoning, critical, evaluative, and reflective thinking process that is believed to be of help in arriving at a more accurate world view. Multiple versions of the Ladder of Inference abound proving how versatile and applicable it is to be used for organizational and personal development studies.

Conceptual and Operational Framework

Combining the holistic power of Systems Theory, the flexibility of the Ladder of Inference, the agility of Mental Models, and the transformative strength of Refractive Thinking within the Reflective Research Methodology, a Dual Ladder of Inference is created as framework for this study. In this study, the selected data comprise of Mental Models which are the major output from the yearly Reflective Research, conducted as part of improving one's instructional practices. The Mental Models developed were drawn from visualizing the concepts and knowledge from experience as well as research

(reading or review of literatures, and conversations with colleagues). Assumptions and beliefs have been reviewed, vetted out, and counter-checked with the reality, facts, assumptions, beliefs, and perspectives of others.

The process of inference starts from the bottom of the ladder representing the Data Pool within the system, from where a Researcher gains a wealth of knowledge from experience and research. From the Data Pool, data is selected. Using Reflective Research Methodology with the integration of the Researcher's Critical, Reflective, Refractive (CRR) Thinking Model, a Dual Ladder of Inference is created with the Conceptual Framework on the left hand side ladder and the Operational Framework on the right hand side of the ladder, as illustrated in Fig. 5: Dual Ladder of Inference below:



(Fig. 5: Conceptual Framework: A Dual Ladder of Inference)

A multiple loop process in examining the Mental Models has been conveniently used in this study with the aid of the Dual Ladder of Ladder of Inference consisting of five major steps (from the bottom-up) as follows:

1. Accumulating a Data Pool (wealth of knowledge from experience and research).
2. Selection of Data from the pool of data accumulated from experience and research, which in this study, the schemas or Mental Models created in the process of Reflective Research. Any selected data from the Reflective Research process is subjected to critical-reflective-refractive thinking review.
3. Interpret and analyze data involved clarifying Mental Models through research and review of existing information, principles, models, and theories, applying critical, reflective, and refractive thinking.
4. To validate all personal assumptions, Mental Models were presented informally or formally (i.e., peer-reviewed paper presentations)
5. Conclusions are reached and embodied in the results of this study.

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