CHAPTER II

THEORETICAL OVERVIEW

2.1 Critical thinking skills: Theoretical importance
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THEORETICAL OVERVIEW

“By three methods we may learn wisdom: first, by reflection, which is noblest; second, by imitation, which is easiest; and third by experience, which is the bitterest” – Confucius.

Turning experience into learning is an important human activity; people recapture their experience, think about it, mull it over and evaluate it (Boud, Keogh & Walker, 1985). It is working with the experience that is important in learning. Reflection can occur before; during and after a lesson. Three key elements in reflective process are – returning to the experience; attending to the feeling and re-evaluating the experience.

The purpose of the study is to explore the effectiveness of using reflective thinking strategy of teaching on achievement in chemistry, metacognitive awareness, innovative attitude and fear of success. The study also tries to disclose the effectiveness of reflective thinking strategy of teaching among students with different levels of creativity. Studies (Boud & Miller, 1996; Boud et al. 1997; Fairelough, 1998) show that, there are much advantages in classrooms and in higher education by way of reflective practices; students learn to ask researchable
questions, identify varied resources, create realistic time lines, initiate, implement and bring closure to a learning activity, prepare students for their adult lives, help interacting actively with the content and concepts they are studying, make students active in planning and assessing learning process, increase self-confidence, identify personal strength, promote enthusiasm and motivation.

Cultivating students’ ability to think has been an important theme for redesigning and reforming traditional instructional learning systems (Jones & Idol, 1990; Tishman, Jay, & Perkins, 1993). Researches has identified various types of thinking, such as critical thinking, reflective thinking, reasoning, decision making, problem solving, metacognition, as the important capabilities of students that should be cultivated in both instructional and learning situations and everyday life (Tishman, et al. 1993). Reflection is the search for general principles or rules based on evidence gathered largely from memory. It is the search for possible answers, new questions, and evidence that supports the possible answers.

2.1 CRITICAL THINKING SKILLS: THEORETICAL IMPORTANCE
Within the context of learning environments, cognitive psychology provides a framework to understand and interpret how higher order processes such as critical thinking skills develop among students. Theories of cognitive development underscore the importance of learning environments that facilitate student progress in reaching advanced stages of intellectual growth, of which critical thinking skills are an integral component.

In theory, cognitive development requires movement through increasingly complex layers of differentiation and integration in the ways that individuals think, value, and behave (Anderson & Krathwohl, 2000). Cognitive psychology conceptualises progression from one stage of cognitive development to another as a way to measure the maturity, depth, and complexity of an individual’s thought process and intellectual growth.

Theories of cognitive development such as the Jean Piaget’s (1964) theory of human intellectual development (as cited in Goetz, Alexander & Ash, 1992) post a four stage model with ‘formal operational reasoning’ identified as the final stage of development. The formal operational stage is denoted by the ability to use abstract reason and deduction as well as employ
previous knowledge and experiences to less well-defined situations. Achieving advanced stages of intellectual development allows hypotheses presented in multiple contexts to be tested through a systematic process.

Other theories on cognitive development also use the progression through increasingly complex stages or periods to gauge one’s ability to think critically.

Advanced stages of intellectual development are marked by the ability to use a reflective process to integrate new knowledge learned from others into existing intellectual frameworks. More recently, Kitchener and King (as cited in Li, 2004) has developed a theory of reflective judgment that conceptualises cognitive growth as a series of seven stages related to what people know or believe and how they justify their knowledge claims and beliefs. At the final stage, individuals see knowledge in a constructive sense and acknowledge their own role and experiences in shaping their beliefs.

2.2 LEARNING THEORISTS’ ON REFLECTIVE THINKING

In exploring how reflective practice can support and aid learning it is helpful to acknowledge how we learn. The following points can be made about the process of learning. First and
foremost, learning is individual. All learners start from their own position of knowledge and have their own set of experiences to draw upon.

Secondly, learning is contextual. Students need to understand that the context in which they learn and operate affects how and what they understand.

Another key point is that learning is relational. In order to make sense and achieve a deep understanding of material and experiences students need to relate new information to existing knowledge and experiences. This is best achieved through a process of reflection. It is at this point that students can make use of feedback from tutors and peers. Engaging in a dialogue with others helps students to make sense of what they know. Relating the feedback given by others to their current understanding helps students to think about what and how they are learning.

The final point to acknowledge is that learning is developmental. Having made sense of new information and integrated it into an existing framework of understanding the student can then make informed choices about what to do next and how to develop their understanding.
In summing up, we can view reflection as having four main purposes. Reflection helps learners to – understand what they already know (individual) – identify what they need to know in order to advance understanding of the subject (contextual) – make sense of new information and feedback in the context of their own experience (relational) – guide choices for further learning (developmental).

Individuals often reflect on what they have done, but these are private and personal thoughts used to shape ideas. The main difference between this and formalised ‘reflective practice’ as a tool for supporting learning is that the student produces evidence of their reflection. This can be demonstrated in the form of a learning log, diary, personal development portfolio, critical incident journal or perhaps a video diary. Individuals engaged in this structured, evidence-based activity may be described as ‘reflective practitioners’.

2.2.1 DEWEY ON REFLECTIVE THINKING

Good reflective thinking is a more encompassing process, where by an individual becomes aware of his own knowledge and the gaps in his knowledge, assumptions and past experiences. Reflective thinking provides skills to mentally process learning
experiences, identify what they learned, modify their understanding based on new information and experiences and transfer their learning to new situations.

Reflective thinking has been explored and studied by many scholars from various fields of education, and one of the prominent personalities is John Dewey. Dewey considered that reflection involves an integration of attitudes and skills, in methods of inquiry that neither attitudes nor skills alone will suffice. The concept of ‘reflective thinking’ was introduced by John Dewey in his book ‘How We Think’. Dewey (1933) defined reflective thinking as ‘active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusion to which it leads’. He views it as ‘a specialised form of thinking that arises from a state of doubt, uncertainty or difficulty that the learner has experienced in their learning’. Although it is not strictly thinking about oneself, reflection here involves the learner as the object of reflection. He stated that ‘the function of reflective thinking is to transform a situation where there is experienced obscurity, doubt, conflict, disturbance of some sort, into a situation that is clear, coherent, settled, harmonious’.

Dewey’s Social Pragmatic View of Reflection
According to Dewey (1933), the role of reflection is to regulate the dialectic relationship between knowing and acting, and reflective thinking is a tool for problem resolution and operates through the progressive cycle of 'inquiry'. Dewey postulated five phases of reflective thinking: problem recognition; enumeration of possibilities of new actions or beliefs; evaluation of the possibilities through consulting memory, questioning, or experimenting; revision of possibilities; decision-making on next appropriate actions. These phases, varying in duration with the type of inquiry, can overlap in time.

Dewey (1933) specified three attitudes required for reflection:
1) Open-mindedness – tough interest and responsibility in facing consequences; ‘it includes an active desire to listen to more sides than one; to give heed to facts from whatever source they come; to give full attention to alternative possibilities; to recognise the possibility of error even in the beliefs that are dearest to us. 2) Whole Heartedness – strives to understand ones commitments and efforts to see situation from diverse perspectives; ‘it is having an absorbed interest in intellectual development, which creates an energy, enthusiasm and persistence in the holder of the attitude’. 3) Responsibility – to consider consequences of a
projected step; ‘it means to be willing to adopt these consequences when they follow reasonably from any position already taken... learners must ask for the meaning of what they learn, in the sense of what difference it makes to the rest of their beliefs and to their actions’. Dewey believed that these three attitudes need to be cultivated, as does the whole of reflective thinking.

Dewey again characterised reflection as comprising five phases. The phases need not necessarily occur in any particular order but should fit together to form the process of reflective thinking. The five phases are suggestions, problem, hypothesis, reasoning and testing.

Suggestions are the ideas or possibilities which spring to mind when one is initially confronted by a puzzling situation. The more suggestions available, greater is the need to suspend judgment and to consider each in an appropriate manner. Therefore, suggestions are an impetus for further inquiry.

Problem is the puzzle seen as a whole rather than as small or discrete entities on their own. It is seeing ‘the big picture’ and recognising the real cause for concern. It understands the
perplexity of a situation more precisely so that courses of action may be more fully thought through and intellectualised.

Hypothesis formation is when a suggestion is reconsidered in terms of what can be done with it or how it can be used. Acting on a working hypothesis involves making more observations, considering more information and seeing how the hypothesis stands up to tentative testing. In so doing, ‘the sense of the problem becomes more adequate and refined and the suggestion ceases to be a mere possibility, becoming a tested and, if possible, a measured probability’.

Reasoning is when the linking of information, ideas and previous experiences allows one to expand on suggestions, hypotheses and tests, to extend the thinking about and knowledge of the subject. ‘Even when reasoning out the bearings of a supposition does not lead to its rejection, it develops the idea into a form in which it is more apt to the problem’.

Testing is the phase in which the hypothesised end result may be tested. In so doing, the consequences of the testing can be used to corroborate (or negate).

He emphasised the role of tools in the emergence of mind, especially language. In harmony with Dewey’s pragmatic social
behaviorism, communication and action in a social setting can facilitate reflective thinking. Summation of Dewey’s approach to reflective thinking can be well thought-out as a holistic way of making meaning which leads to the intellectual and moral growth of the individual by evaluating or interpreting a learning experience, especially problems felt in a situation.

**2.2.2 SCHÖN ON REFLECTIVE THINKING**

Schön (1987) creates the terms “reflection-in-action” and “reflecting-on-action”; the former refers to a practitioner’s thinking about a given phenomenon before him/her, and on the prior understandings which have been implicit in his/her behaviour while he/she carries out an experiment which serves to generate both a new understanding of the phenomenon and a change in the situation. The latter enables practitioners to spend time exploring why they acted as they did, and in so doing develop sets of questions and ideas about their activities and practice. We notice that the notion of reflection-on-action implies a reflexive form of thinking.

**Schön’s Communicative View of Reflection**

According to Schön reflection-on-action and reflection-in-action are essential factors for the development of professional
artistry, which refers to kinds of embodied skills practitioners demonstrate in problematic situations of practice. Whereas reflection-on-action refers to thinking back on the action already accomplished or pausing in the midst of an action to make a "stop-and-think". Reflection-in-action occurs while a practice is being undertaken and implies moment-by-moment "active experimentation". Besides, reflection-in-action is conceptually more complex, developmentally more mature, and functionally more significant than reflection-on-action. Based on his communicative views, Schön believed that the effectiveness of a practicum depends crucially on social interactions, especially reciprocally reflective dialogues between teacher and student who have to maintain communication which eventually leads to convergence of the interpretations of the concepts in question.

Schön's model of reflective practice consists of four central components: perceiving an indeterminate zone of practice precipitated by instability of a specific situation; framing the problem in terms of the particulars of the situation, analysing and criticising such an initial problem framing; reframing the problem in light of the inquirer's repertoire of domain-specific knowledge and previous experiences; generating moves for future actions leading to the new coherence of the situation. This
sequence of operations can be seen as an individual's attempt to converse with the situation in which he is embedded. Reflective conversation is a highly dynamic and dialectical cognitive enterprise. The inquirer shapes the situation, but in conversation with it, his idiosyncratic methods and appreciations are in turn shaped by the situation.

2.2.3 KOLB’S EXPERIENTIAL LEARNING THEORY

Kolb (1984) has constructed a model of experiential learning that comprises a full cycle of learning from experience. Reflection involves a dialogue between students and their peers, students and teachers, and students and work placement tutors, all of who can provide useful feedback necessary for reflection. To begin to reflect on their learning students need to be encouraged to make sense of new knowledge in relation to their existing understanding.

The learning cycle developed by Kolb (1984) is a useful and simple tool for illustrating to students the connection between reflection and improved learning:
The learning cycle

Concrete Experience

Active Experimentation

Reflective Observation

Abstract Conceptualisation
Learning from experience is most natural. However, that does not mean we learn from every experience. To learn from experience you have to reflect and inquire as to incident. For instance, you have to ask yourself; What happened? What can I learn from it? This means that learning from experience demands reflection, conceptualisation and generalisation and application to new situations.

2.2.4 VYGOTSKY ON REFLECTIVE THINKING

According to Vygotsky reflection can be understood as self-regulation, which is acquired by a process that involves first experiencing ‘other-regulation’ which occurs in the zone of proximal development where adult guidance or collaboration with more capable peers are available (Goetz et al.,1992).

Vygotsky’s socio-linguistic view of reflection
Through this special mode of social interaction, the form and content of self-regulation are gradually transferred from the more competent partner and internalised by the learner. The Vygotskian views also stress that sociolinguistic experience is indispensable for the emergence of metacognition and that inter subjectivity is a primary means for knowledge construction. The corollary is that modeling and verbal communication (including self-verbalisation) are strong facilitators for reflection. Vygotsky also advocated the thesis that reflection plays a mediating role by transforming meaningful experiences into learning which leads to development. Vygotsky, like Dewey, regarded language as the most potent cultural tool in achieving convergence of meaning and co-construction of knowledge during social interactions. Based on Vygotsky's theory of dialectical relationship between the intra and inter psychological transformation of one into another, high-order thinking like reflection is developed through consistent agent-world dynamic interactions.

2.3 PRINCIPLES OF REFLECTIVE PRACTICE

Ghaye and Ghaye (1998) discuss on practice of teaching and how we reflect on it in different ways in order to improve our thinking about what we do. They present ten principles of
Theoretical Overview

reflective practice, which together provide a view of the teacher as a reflective practitioner and they are:

1. Reflective practice need to be understood as a discourse. A discourse can be understood as a set of meanings, statements, stories and so on which produce a particular version of events.

2. Reflective practice is fuelled and energised by experience. We have to reflect on our experiences and those things that it comprises.

3. Reflective practice is a process that involves a reflective turn – to look again at all our taken for granted values, professional understanding and practices.

4. Reflective practice is concerned with learning how to account ourselves – describe, explain and justify our teaching.

5. Reflective practice should be understood as a disposition to inquiry – we view our teaching and learning problematically, we question it, look into it systematically and continuously strive to learn from it.

6. Reflective practice is interest serving, when we reflect we engage in a process of knowledge creation. We are actually
doing something positive and constructive with the knowledge that we create.

7. Reflective practice is enacted by those who are critical thinkers. This can lead to personal and collective improvement through critical forms of reflective practice, central to being critical is the ability to ask probing and challenging questions about what we do.

8. Reflective practice is a way of decoding a symbolic landscape. Our everyday taken for granted teaching world of schools and classrooms are symbolic landscapes. The symbols await professional decoding; reflecting on practice helps us to discern the significance of this symbolism.

9. Reflective practice sits at the interface between notions of practice and theory. Reflection on practice links the theory and practice of teaching and linking the two is a creative process.

10. Reflective practice occupies a position within the broad landscape of postmodern way of knowing, namely social constructivism.

2.4 TECHNIQUES FACILITATING REFLECTIVE ACTIVITIES
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Techniques that allow learners to progress at a pace based on experience, knowledge, and interest, supports growth in reflective thinking. Some of the prominent methods that promote reflection are discussed below.

**Thinking Aloud**: A deliberate and systematic reflection that is visible or audible promotes teaching. Practitioners can induce reflection by pauses during teaching; to consider a remark or through care and effort to put observation into verbal thought.

**Discussions**: Creation of understanding by exchanging information, opinions, or experiences. The facilitator observes and encourages the group’s efforts without becoming directly involved. It can be done by encouraging group efforts through face to face or technological formats.

**Grouping Practices**: This helps in easy conduct of group discussion as well as small team activities. The facilitator’s role is to provide necessary background and directions, establish ground rules, present the assignment and facilitate the work of the group in meeting the activity objective. While the practitioners are working the facilitator’s should move quietly monitoring but not interrupting the group work. Facilitator should not interject their own ideas, opinions or information, but must
make the practitioners feel that the facilitator is supportive, attentive and available.

**Cooperative Learning:** Learning through collaboration fosters democratic processes in learning and improves relationships among diverse learners. Facilitator’s should establish purpose and rules, provide interesting and meaningful tasks, provide direction and monitor group interaction. Practitioners are expected to be self directed and apply leadership techniques with the purpose of completing a task in a collaborative setting.

**Think Pair Share:** Involves a three step co-operative structure. During the first step individuals think silently about a question posed by the teacher. Individuals pair up during the second step and exchange thoughts. In the third step the pairs share their responses with other pairs, other teams, or the entire group.

**Team Pair Solo:** Students do problems first as a team, then with a partner, and finally on their own. It is designed to motivate students to tackle and succeed at problems, which initially are beyond their ability. It is based on a simple notion of mediated learning. Students can do more things with the help (mediation) than they can do alone. By allowing them to work on problems, they could not do alone, first as a team and then with a partner,
they progress to a point they can do alone that which at first they could do only with help.

**Brain Storming:** Practitioners are to express all the ideas on a given topic within the time constraints. All answers are acceptable, the goal being quantity of ideas, uninhibited participation, and uncritical acceptance by team members. A recorder chosen prior to brainstorming activity writes down the ideas shared by all other members.

**Buzz Groups:** Buzz groups are informal, loosely structured, and small. They are used to break down larger groups into smaller teams, which make interaction of members less cumbersome. Buzz groups are generally practitioner run. Each team briefly address the problem at hand, records ideas, selects a designated reporter, then brings the team’s ideas back to the whole group for presentation.

**Role Playing:** This technique allows practitioners to think about and discuss the role of speaker or writer, audience or subject matter within a problem. This technique helps the facilitator gain insight into the feelings of the practitioners and helps discover what is important to them. Practitioners may be chosen or elect
to participate in a particular role. The scenario is set by the facilitator, but the dialogue should be developed spontaneously.

**Questioning:** Through effective questioning the facilitator may bring focus to an activity, cause group members to reflect on alternatives not otherwise discussed, promote identification of issues in more depth, control the direction or mood of practitioners, promote beliefs and values clarification and deepen insight of practitioners.

**Journaling:** It provides means of describing practice and of identifying and clarifying believes, perspectives, challenges and hopes for practice. It helps to make invisible thoughts visible. It is a way to put one’s thoughts on paper. Journaling is an important means for gathering information about events – actions, feelings and interpretations.

### 2.5 COGNITIVE VARIABLES

The present study selected achievement in chemistry and metacognitive awareness as the cognitive variables.

1. **Achievement**

An accomplishment, an attained level of expertise on performance of a task or an acquired base of knowledge (Sternberg, 2001). Achievement means to overcome obstacles,
to exercise power to strive to do something difficult as well and as quickly as possible Murray, 1938 (as cited in Sternberg, 2001).

2. Metacognition

Metacognition refers to our knowledge and awareness of our own cognitive processes and our ability to monitor and regulate them (Goetz et al., 1992). Metacognition is often simply defined as thinking about thinking or the cognition of cognition. It is the ability for one to control own thoughts. It includes thoughts about what we know or do not know and regulating how we came to know about learning. Metacognition refers to higher order thinking which involves active control over the cognitive processes.
2.6 AFFECTIVE VARIABLES

The present study selected innovative attitude and fear of success as the affective variables.

1. Innovative attitude

An attitude is a relatively stable organisation of beliefs, feelings and behaviour tendencies directed towards something or someone – the attitude object (Morris & Maisto, 2001). A learned (not inherited), stable (not volatile) and relatively enduring (not transitory) evaluation (positive or negative judgement) of a person, object or idea that can affect an individual’s behaviour. Innovative attitude refers to ones attitude of creativity, curiosity, initiative – innovative practices.

2. Fear of Success

Fear of success is the lack of belief in ones own ability to sustain progress, and accomplishments achieved in ones life. Fear that ones accomplishments can self-destruct at any time, no matter how much one achieve or accomplish. Fear of success is the belief that there are others who are better who will replace or displace one, if he or she do not maintain the performance record.
2.7 Creativity

Creativity is the ability to produce novel or socially valued ideas or objects ranging from philosophy to painting, from music to mousetraps (Mumford and Gustafson, 1988; Sternberg, 1996; as cited in Morris and Maisto, 2001). Creative people are problem finders as well as problem solvers (Getzels, 1975; Mackworth, 1965; as cited in Morris and Maisto, 2001). The more creative people are, the more they like to work on problems they have set for themselves.

Creativity is the process of producing something that is both original and valuable. The something could be a theory, a dance, a chemical, a process or procedure, or almost anything else.

CONCLUSION

A skeletal framework gives shape, support and form to any system that clings on to it. Likewise a theory is the essential mould that cast every educational strategy. The teachers who are said to be ‘incorrigible’ should have to reform their nature to understand the importance of theories in their teaching-learning environment.
This chapter of study has been that powerful to provide framework for the development of reflection and associated techniques within the context of education. It is not comprehensive in covering all the associated educational theory, but with anticipation there are some useful ideas that spark the thoughts to translate some of the ideas into practice. It is simple for traditionalists to close the eyes to reflective practice as a new trend and hope that the time will come when didactic teaching methods will again reign triumphant. Reflective practice is a realistic and achievable way of enhancing student learning while developing the types of knowledge, skills and abilities that are expected of in today’s society. It is also a way of ensuring that students gain the flexibility and imagination they need to continue to be lifelong learners.

The act of reflecting is one which causes us to make sense of what we have learned, why we learned it, and how that particular increment of learning took place. Moreover, reflection is about linking one increment of learning to the wider perspective of learning – heading towards seeing the bigger picture.
CHAPTER III

REVIEW OF RELATED LITERATURE

3.1 Reflective practices
3.2 Cognitive and Affective variables
3.3 Creativity