Cognitive Engagement Style, Self-Regulated Learning and Cooperative Learning

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Abstract

This paper examines the theory of cognitive engagement styles put forth by Corno and Mandinach (1983). Self-regulated learning, a construct central to this theory, is explored in connection with three related styles of cognitive engagement: recipience, task focus, and resource management.

The concept of cognitive engagement styles has a number of important implications for learning and teaching and these ideas are considered within the context of cooperative learning. Cooperative task and incentive structures are examined as two aspects of cooperative learning which impact on the cognitive processes that students might employ during learning. The concepts of cognitive modifiability and self-efficacy are then discussed in relation to concepts of motivation, academic achievement, and their influence on the use of self-regulated learning strategies. Although much of the research on self-regulated learning has been conducted with children, the literature on adult education is cited to provide evidence which would support the idea that the Corno/Mandinach (1983) theory of cognitive engagement styles is not only viable but is a desirable approach to use when examining the learning processes employed adults. The role of computers as vehicles for studying the learning process, specifically the concept of self-regulated learning, is also explored.

The paper concludes by presenting a general model of what might be considered to be the essential features of a well articulated theory and a criticism of the Corn and Mandinach model is presented within this context.

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1. Learning as a Cognitive Process

For many years educational practice has been influenced by psychology research. Behaviourism, modelled after the work of Watson and later B. F. Skinner, rose in prominence during the sixities and seventies, but was soon eclipsed by the social learning theories of Bandura. Today social learning theories are closely interwoven with a cognitive perspective of learning. Long (1990) is just one of many educators who has suggested that learning is predominantly a cognitive process; such learning, he believes, is influenced by a number of factors, including the state of the learner, existing or prior knowledge, and the attitudes and beliefs held by the learner toward the source, content, topic, and mode of presentation. The understanding that learning involves the activation of specific cognitive processes has led practitioners and researchers to explore the concept of cognitive engagement. It has been suggested that students can develop facilitative or debilitative styles of engagement (Marx and Walsh, 1988). Self-regulated learning is, by definition, a facilitative style of cognitive engagement.

2. Self-Regulated Learning: The Concept

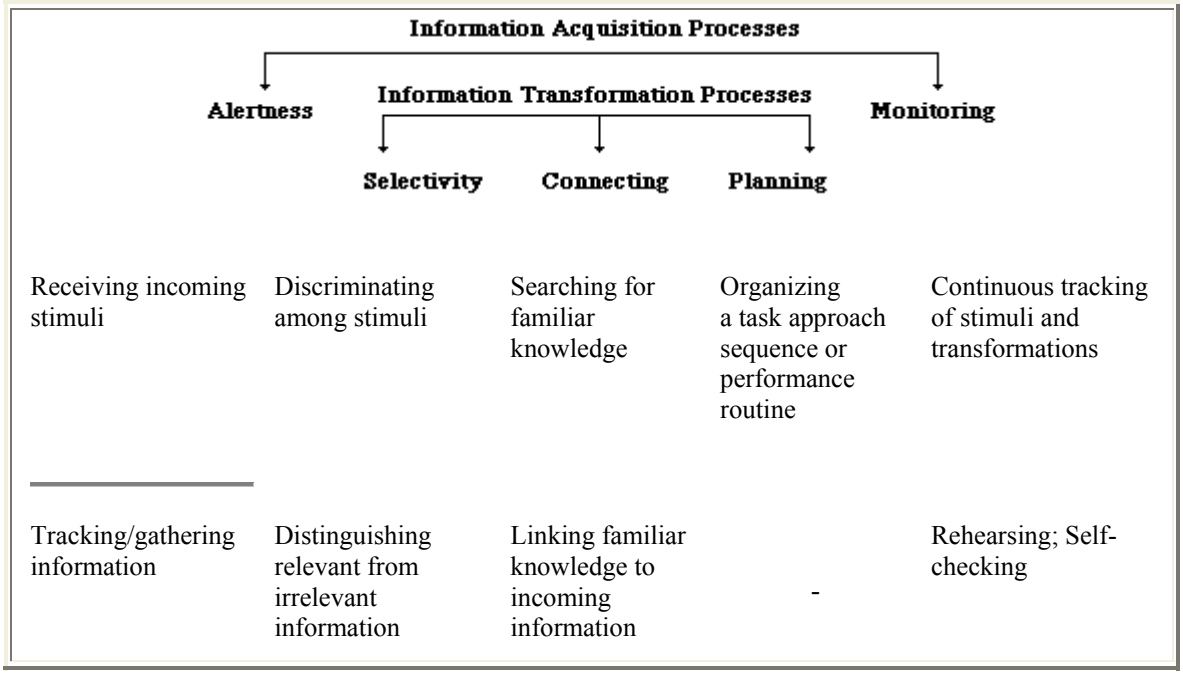
Self-regulated learning is an effort to deepen and manipulate the associative network in a particular area (which is not necessarily limited to academic content), and to monitor and improve that deepening process. (Corno and Mandinach, 1983, p. 95.)

Self-regulated learning refers to the deliberate planning and monitoring of the cognitive and affective processes that are involved in the successful completion of academic tasks (Corno and Mandinach, 1983; Corno, 1986). Corno and Mandinach (1983) have suggested that for some learners these metacognitive processes of planning and monitoring may be so well developed that at times they appear to occur automatically.

3. Components of Self-Regulation

3.1 Acquisition and Transformation Processes

Five components are viewed by Corno and Mandinach, (1983, p. 94) as necessary and sufficient to define self-regulated learning. As can be seen from Figure 1, the five components are organized into two categories: the information acquisition processes that include alertness (receiving and tracking information), and monitoring; and the transformational processes of selectivity, connectivity, and planning.



Acquisition processes bound and control the transformational processes of selectivity, connecting new information to that available in memory, and planning use of specific performance routines.

Figure 1. Five Components of Self-Regulated Learning, from Corno and Mandinach, 1983.

> Self-regulated learning, which represents the highest form of cognitive engagement, is epitomized by the task appropriate use of information acquisition and transformation skills, but metacognitive control processes are also an important component of this concept (Corno and Mandinach, 1983; Corno, 1986).

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The acquisition processes can be seen as metacognitive to the extent that they regulate the transformation processes. The transformation processes also have both metacognitive and cognitive aspects, for they can call forth other cognitive schemata that may be relevant to the task. Corno and Mandinach, 1983, p. 94.

3.2 Metacognitive Control Processes

Corno (1986) asserts that a number of volitional strategies described by Kuhl (1983, 1985), correspond to the control or metacognitive components of self-regulated learning. She suggests that these volitional or self-imposed processes are invoked by successful learners to protect themselves from internal and/or external distractions in the learning environment, thus maximizing the likelihood of goal accomplishment. According to Corno, Kuhl's theory suggests that these volitional strategies are subject to the influence of two motivational factors: first, is the perception of the task as one that is difficult to

complete; this perception can be influenced by competing interests, social and peer pressure, and state orientation ; second, motivation is influenced by the perception that task accomplishment is within the ability range of the learner. Corno describes the volitional or metacognitive strategies, as defined by Kuhl, to include the following:

- attention and encoding control: the ability to maintain task focus despite competing distractions;
- selective encoding: attending to the important features of the task;
- information processing control: the ability to allocate appropriate amounts of time and mental energy to the pertinent aspects of a task;
- motivation control: these strategies involve "self-reinforcement and self-imposed penance" (Corno, 1986) behaviours that are linked to the anticipation of potential consequences regarding task outcome;
- emotion control: self-talk strategies aimed at controlling performance anxiety; and
- environmental control: self-help strategies that are invoked for the purpose of assuring successful task completion.

A complete definition of self-regulated learning therefore includes not only the information acquisition and transformational processes; it must also encompass these volitional or metacognitive processes.

4. Related Styles of Cognitive Engagement

In addition to self-regulated learning Corno and Mandinach (1983) have identified three related styles of cognitive engagement. These include resource management, task focus, and recipience (Table 1). Various styles of cognitive engagement can be either facilitative or debilitative (Marx and Walsh, 1988). According to Corno and Mandinach (1983) the most debilitating of the four styles of cognitive engagement is that of recipience.

Table 1. Four styles of cognitive engagement, from Corno and Mandinach, 1983.

	Use of Transformation Processes	Use of Acquisition Processes
	Selectivity Connecting Low-level Planning	Alertness Monitoring High-level Planning
	High	**Low**
High	Self-Regulated Learning	Task Focus
Low	Resource Management	Recipience

4.1 Recipience

> Recipience...is less functional than either self-regulation or resource management for the long-term development of cognitive skill, since it exercises only some acquisition processes (such as rehearsals) that may come about during high level monitoring. Corno and Mandinach, 1983, p. 96

The recipient learner is one who engages in a passive approach to learning (Corno and Mandinach, 1983). Recipient learners are least likely to make use of metacognitive strategies or to engage in high level acquisition or transformational processes. These are the learners who are easily distracted by peers and other elements of the environment and who frequently are described by teachers as lacking motivation for school related tasks.

Some methods of instructional delivery have been identified by Corno and Mandinach (1983) as not only reinforcing recipient learning approaches, but actually interfering with the acquisition of self-regulation processes. Corno and Mandinach observed these short-circuiting instructional strategies being used by remedial teachers who were involved in a pilot study. Short-circuiting strategies included directing the learner's attention to specific information, and therefore away from more

detailed information, and using devices such as charts, diagrams, summaries, reviews, outlines, marginal notes, and advance organizers that reduce the need for learners to engage in the transformational processing of information (Corno and Mandinach, 1983). It seems that a high level of teacher-imposed structure is for some learners, inversely related to the attendant level of cognitive engagement. Corno and Mandinach suggest that the students would have been more likely to benefit from instruction had the teachers used a participant modelling method of instruction; such a method involves teacher explanations of the purpose for using particular strategies, as well as the explicit modelling of the strategies as examples of self-directed methods for transforming the lesson material. Corno and Mandinach suggest further that low achieving or low ability students are particularly likely to benefit from instruction in the use of these self-regulated learning strategies.

4.2 Task Focus

Task focused learning, exemplified by the successful implementation of test-taking skills and problem solving strategies, involves the predominant use of transformational, rather than information acquisition cognitive processes (Corno and Mandinach, 1983). Linn and Corno (Corno and Mandinach, 1983) suggest that particular cognitive transformations such as careful attention to specific detail, comparative analysis of prominent characteristics, and the ability to isolate relevant from irrelevant information, are typical strategies used by task focused learners. Some methods of instructional delivery have been suggested by Corno and Mandinach as promoting a task focused approach to learning. Such approaches are characterized by guided practice, the use of analogies, models, and taxonomies as systems for organizing information. Corno and Mandinach found that the task focus approach to learning was used more frequently by males than females when solving spatial and technical problems; this they have hypothesized as one explanation for gender-related differences in performance on spatial, mathematical, and scientific problem solving tasks.

4.3 Resource Management

The typical learner who utilizes strategies of resource management is one who relies heavily on assistance from others such as peers for the purpose of deliberately avoiding the extended mental effort that is necessary for the transformational processing of information (Corno and Mandinach, 1983). It has been suggested by Corno and Mandinach that the social character of some learning environments, typified by cooperative and small group task structures, may promote dependence on resource management skills by providing increased opportunities for learners to obtain assistance from others on difficult tasks. That some students might rely exclusively on a resource management approach to learning tasks should be cause for concern among educators, particularly in light of the recent thrust toward cooperative learning.

5. Cognitive Engagement in Cooperative Learning

The discussion of cognitive engagement styles leads us to a number of important questions. For what types of skills are particular styles of engagement most appropriate? If one learning objective is to promote self-regulated learning, then we must consider whether cooperative or small group learning might be the most appropriate instructional method by which to accomplish such a goal. Does cooperative learning provide sufficient opportunity for students who are overly reliant on recipient or resource management strategies to engage in transformational cognitive processes? Can a resource management approach to learning actually be detrimental to the development of self-regulated learning processes? These are important questions for consideration in light of the recent educational trends in British Columbia toward more cooperatively structured learning environments.

A number of researchers have investigated the cognitive and non-cognitive benefits of cooperative goal structures. Johnson and Johnson (1974) investigated the comparative effects of cooperative, competitive, and individualistic goal structures. Relative to achievement, a number of studies were cited that support a preference for competitive goal structures when the activities are related to

simple drill and practice such as spelling and vocabulary drills; several other studies were cited in which a preference for cooperative goal structures was appropriate for improving group productivity and problem solving abilities (Johnson and Johnson, 1974). When non-cognitive benefits of the three goal structures were examined, cooperative learning methods were clearly superior to competitive methods (Johnson and Johnson, 1974; Slavin, 1983).

A more recent meta-analysis by Johnson, Maruyama, Johnson, Nelson, and Skon (1981) reviewed 122 studies and compared the effectiveness of cooperation, cooperation with intergroup competition, interpersonal competition, and individualistic goal structures in promoting achievement and productivity. This study yielded results similar to those of Johnson and Johnson (1974) regarding the effectiveness of cooperative learning: cooperative methods were found to be more effective than both competitive and individualistic efforts in promoting achievement and productivity except for rote-decoding tasks.

Slavin (1983) points out that the Johnson and Johnson (1974) study has been criticized by Cotton and Cook (1982) for making broad claims in favour of cooperative learning methods, when a number of statistically significant contradictory interactions were reported in the study. He makes the observation that data in the Johnson and Johnson study, as well as all previous reviews, provide evidence to support the notion that various tasks and outcome measures were associated with different results; he therefore questions the usefulness of making broad claims in regard to the comparative effectiveness of cooperative methods. Slavin presents a significant criticism of the Johnson and Johnson study by noting that two thirds of the studies in their meta-analysis involved group productivity as a dependent measure while only one third used student achievement as a dependent measure; he suggests that this factor strongly influenced their findings since groups are inherently superior to individuals in problem solving activities. In support of his criticism, Slavin points to a number of studies which indicate that increased group productivity is more likely due to the sharing of answers among participants rather than to any unique feature of the group interaction per se. This conclusion is in keeping with the perspective of Corno and Mandinach (1983), that some students in group activities may be overly reliant on the resources of others within the group.

Also lacking in the Johnson and Johnson (1974) study but present in Slavin's (1983) analysis was any comprehensive description of the criteria used for including studies in their meta-analysis. Slavin appears to have taken great care in restricting his meta-analysis to studies of comparable merit. His meta-analysis excluded those studies which took place in laboratory settings (in contrast to the natural setting of a classroom), those that were of short duration (less than two weeks), and included only those studies in which achievement measures fairly assessed learning in both the experimental and control groups. Slavin further implies that the 1981 study by Johnson, Maruyama, Johnson, Nelson, and Skon is similarly flawed.

Although Slavin (1983) was mindful of the non-cognitive benefits of cooperative learning, he restricted his meta-analysis to those studies that used achievement alone, as a dependent measure, in an effort to address the problem of conflicting measures that was associated with previous studies. Forty-six studies were included in Slavin's meta-analysis. Twenty-nine (63%) of the studies were reported to support the notion that cooperative learning methods have a significantly positive effect on student achievement while 15 (33%) of the studies found no differences and only 2 (4%) found significantly higher achievement for a control group rather than a cooperative learning group. However Slavin (1983, p. 434) suggests that this finding „masks important differences between [the] studies¾.

In support of this argument Slavin (1983) identified two components of cooperative learning: cooperative task structures and cooperative incentive structures: he noted that cooperative task structures are those "situations in which two or more individuals are allowed, encouraged, or required to work together on some task, coordinating their efforts to complete the task" while a "cooperative incentive structure is one in which two or more individuals are rewarded based on their performance as a group" (Slavin, 1983, p. 431; p. 429). Table 2 illustrates the different incentive structures that are possible within the two task structures of group work and task specialization.

Table 2. An illustration of the different incentive structures that are possible within the two task structures of group work and task specialization.

INCENTIVE STRUCTURE	TASK STRUCTURE	
	GROUP STUDY	***TASK SPECIALIZATION***
INCENTIVE STRUCTURE 1	Group reward for a single group product (to which all members contribute)	Group reward for a single group product (to which all members contribute)
INCENTIVE STRUCTURE 2	Group reward is based on the average score of individual assessments	Group reward is based on the average score of individual assessments
INCENTIVE STRUCTURE 3	No group reward; individual reward only	No group reward; individual reward only

Slavin (1983) found that 27 (59%) of the studies used a cooperative task structure with group rewards for individual learning, and of these, 24 (89%) found positive effects on student achievement, and 3 (11%) found no differences. "In contrast, none of the nine studies of group study methods that did not use group rewards for individual learning found positive effects on student achievement" (Slavin, 1983, p. 438). Slavin also found that achievement was affected in the task specialization condition when group rewards were used, regardless of whether the rewards were assessed on the basis of individual or group performance. He concluded that the existence of a group goal which creates an interdependent performance relationship among the group members is critical to achievement. These findings were similar across both elementary and secondary grade levels. In two of the studies Slavin noted that this incentive structure had an impact on student achievement, even in the absence of a cooperative task structure. Slavin concluded that both individual accountability and group rewards were essential to positively influence achievement outcomes in cooperative learning groups. Slavin (1983, p. 442) further suggested that individual accountability in cooperative learning groups could be achieved either by "averaging individual learning performances" or by using task specialization.

In comparison with the Johnson and Johnson (1974) study, Slavin (1983) was able, through his meta-analysis, to provide greater insight into the concept of cooperative learning. His results demonstrate that cooperative learning methods have no effect on student achievement, that in fact, it is the nature of the incentive structure that impacts most significantly on achievement. Slavin therefore concluded that the theory on which cooperative learning is based should be one of incentive structures rather than task structures. He also indicates that because of the non-cognitive (social and emotional) benefits of cooperative learning methods that cooperative learning methods may be justified as long as student achievement is not adversely affected.

Slavin's (1983) findings support a critical point made by Corno and Mandinach (1983), that effective learning is more dependent on the means by which it is accomplished, rather than task accomplishment per se. While the self-regulated learner and the resource manager may both be successful in accomplishing the learning task, the cognitive processes that are engaged by each approach to learning are dramatically different. The resource management style of cognitive engagement makes limited use of the more complex transformational processes that are necessary for self-regulated learning. The interdependent relationship among members of cooperative learning groups is therefore critical to the Corno and Mandinach model of self-regulated learning and is similarly a necessary component of the incentive structures that influence cooperative learning.

Despite the fact that the exclusive reliance on resource management learning strategies could be viewed as inappropriate, Corno and Mandinach (1983) suggest that learning tasks which promote the use of such strategies may actually aid learners in developing perceptive and metacognitive skills. Research by Ellen Gagne (1982) is provided as evidence to support this claim. In her study of college students, Gagne found that high achieving, low ability students were differentiated from lower achieving, low ability peers by their reliance on resource management strategies. Although resource management learning strategies may have some benefits, Corno and Mandinach found that not all tasks are appropriate for the use of such a learning approach. In a study by Corno and Haertel (Corno and Mandinach, 1983) it was found that problem solving abilities were highly predictive of performance criteria for a group of system engineers,

and that a high correlation existed between these problem solving abilities and the use of task focus strategies. These findings provide evidence for a principle which Corno and Mandinach claim is essential to the concept of self-regulated learning, that cognitive flexibility in adapting one's style to the demands of the task is essential to self-regulated learning.

6. Cognitive Modifiability in Self-Regulated Learning

Student ability, motivation, and quality of instruction have for many years been investigated as important variables related to student achievement. More recently there has been a growing interest in self-regulated learning as an important variable that interacts with achievement (Zimmerman, 1986). A study by Zimmerman and Pons (Zimmerman, 1986, p. 308), indicated that the use of metacognitive strategies was highly correlated with academic achievement. As well, motivational issues have been linked to self-regulated learning and academic achievement:

> The effective use of self-regulation strategies is theorized to enhance perceptions of self-control... and these self-perceptions are assumed to be the motivational basis for self-regulation during learning.
> Zimmerman, 1986, p. 308

Corno (1986) reports, that according to Gage (1977) many classroom researchers believe that motivation is a more readily influenced variable than general academic ability. Such views may reflect the notion that intelligence is a rather stable mental trait. The work of Feuerstein (1980) and others such as Schunk (1990) would suggest that cognitive abilities can be enhanced through learning.

> Advocates of the active-modification approach view the human organism as an open system that is receptive to change and modification. In this framework, modifiability is considered to be the basic condition of the human organism, and the individual's manifest level of performance at any given point in his [sic]

> development cannot be regarded as fixed or immutable, much less a reliable indicator of future performance. Feuerstein, 1980, p. 2

In support of this idea of cognitive modifiability, Corno (1983) cites the work of Lynn Gray (1982) who was able to demonstrate that the component processes of self-regulation could be acquired through training.

Like researchers and educators, students also differ in their views of ability; some view ability in a fixed or immutable way while others view ability in incremental way (Schunk, 1990). Regardless of the perspective that students have of their own capabilities, Schunk has suggested that the reason students persist on difficult tasks is due to a belief that effort enhances one's ability, a belief he suggests that begins to emerge around grade five or six and is generally understood by most children in the upper elementary grades. Schunk describes the differing conceptions of ability, and the role of attributions (factors such as ability, effort, task difficulty, and luck that students provide to explain the reasons for academic success and failure), in attempting to understand the relationship of perceived self-efficacy to self-regulated learning. He suggests that

> From an attributional perspective, students' self-efficacy and self-regulated learning can be tempered by their attributions. Students who attribute successes to their abilities and efforts are likely to feel efficacious about learning and engage in self-regulatory behaviours that further increase their skills.Schunk, 1990, p. 8.

Schunk (1990, p. 8) goes on to suggest that "self-regulated learning can be enhanced by providing students with attributional feedback that links their successes with their effort and abilities". Students are then able to learn that their abilities can be influenced by their efforts and it is this belief that is hypothesized to influence performance.

Schunk (1990) has conducted a number of studies to examine the relationship between attributional feedback and self-efficacy. A 1982 study that examined the

effects of periodic effort feedback on children learning subtraction skills was found to support the idea that children's beliefs about their learning capabilities can be influenced by such feedback. Another study in 1983 investigated the effects of ability and effort feedback on children learning subtraction skills. Three types of feedback were used: ability only, effort only, and ability plus effort. Children in the ability only condition were found to have demonstrated higher posttest self-efficacy and skill compared with children in the other two conditions (Schunk, 1990, p. 11). In a 1984 study Schunk investigated the effect of the sequence of attributional feedback on achievement outcomes with a group of children learning subtraction skills. The research was conducted over four sessions and examined four conditions of feedback: periodic ability only, effort only, ability only for the first two session followed by effort only during the last two sessions, and in the fourth condition this last sequence was reversed. Schunk hypothesized that for students who lacked skills, early effort feedback might be more believable, but that early ability feedback would enhance learning efficacy. Schunk (1990, p. 12) found that "providing ability feedback for early successes, regardless of whether it was continued or children later received effort feedback, raised their ability attributions, self-efficacy and skills, significantly more than did effort feedback for early successes". A study of similar design was conducted in 1986 by Schunk and Rice (1988) with children who presented with comprehension deficiencies. "Children who received ability feedback during the second half of the instructional program (ability/ability and effort/ability conditions) developed higher ability attributions and self-efficacy than subjects in the other conditions, but feedback sequence did not affect skill development" (Schunk, 1990, p. 12). Through these studies Schunk was able to conclude that "self-regulated learning can be affected by the practice of delivering attributional feedback" (Shunk, 1990, p. 13).

7. Self-Efficacy and Self-Regulated Learning

Schunk's (1988) definition of self-regulated learning includes cognitive processes such as attending to instruction, processing and integrating knowledge, and rehearsing information, as well as the beliefs that learners hold with respect to their capabilities for learning (self-efficacy). It is Schunk's view that self-efficacy, as a predictor of motivation and skill acquisition, can help to explain students'

self-regulated learning efforts (Schunk, 1988, p. 4). He has suggested that self-efficacy can influence students' choices about approaches to learning new or unfamiliar task, the intensity of effort that is applied to a task, and the degree of persistence that is directed toward a task.

Schunk (1988) has suggested that students' beliefs about their ability to perform learning tasks are influenced by perceptions relating to performance outcomes and attributions (perceived causes of success and failure) evidenced during the learning process. In his model (Figure 2) of self-efficacy and cognitive skill learning Schunk identifies these processes as efficacy cues. Students' perceptions of progress are said to be important in promoting efficacy (Schunk, 1988). As we have seen from Schunk's 1983 study of ability versus effort attributional feedback, ability attributions become increasingly important as the learning task progresses. Comparing one's performance with one's peers by observing their successful efforts is suggested as another method by which students develop self-efficacy. Schunk (1988) has suggested that although the most accurate self-evaluations are derived from comparisons with others who are similar in the ability or characteristic that is being evaluated, the comparisons can be predicated on a broad range of competencies or personal attributes that might include age, gender, and ethnic background. The source of the feedback (persuader credibility) about one's performance is also deemed by Schunk to be an important cue that contributes to self-efficacy.

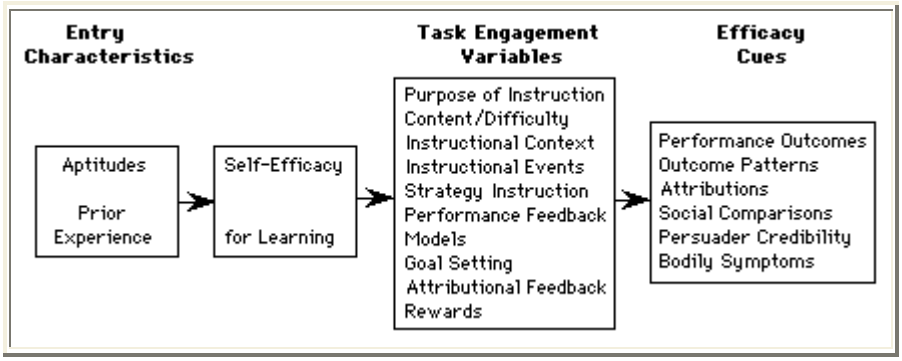

Figure 2. The hypothesized operation of self-efficacy during cognitive skill learning, from Schunk, 1988.

In Schunk's (1988) model, a number of task engagement features are also said to influence the learning process. These include the relevance of the task, the perceived difficulty of the learning material or instructional method, the learning strategies used by the students, the nature and timing of the feedback provided, the availability of coping peer models for comparison, the presence of proximal learning goals, and rewards that are linked to student performance.

These task engagement variable and efficacy cues in Schunk's (1988) model are further influenced by the aptitudes, personality characteristics, and priors experiences that students bring to a learning task; however, Schunk (1988, p. 6) makes an important observation when he notes the work of Collins (1982) who "found students of high and low mathematical self-efficacy within high, average, and low mathematical ability levels". It may be then, that there is not always a positive correlation between measures of self-efficacy and aptitude (Schunk, 1988). Schunk suggests that the usefulness of self-efficacy is in its ability to predict task effort and persistence, as well as skill acquisition, and that these factors can influence self-regulated learning.

The role of self-efficacy in influencing motivation is an important feature of self-regulated learning. If, as research suggests, cognitive processing abilities are correlated with achievement, and if such processes can be learned, even by lower ability students, and influenced by specific instructional methods, then, as educators and researchers we have an important responsibility to be cognizant of the role of self-regulated learning.

Much of the research on self-regulated learning has been conducted with children in research settings (Zimmerman, 1986) and research indicates that self-regulated learning correlates strongly with achievement in studies involving children. It is therefore important to consider the appropriateness of discussing the concept of self-regulated learning and the associated styles of cognitive engagement in relation to adult learning.

8. Self-Regulated Learning and Adult Learners

Long (1990) has suggested that there are a number competing views with regard to the nature of adult learners: first, there is the populist view, reflected by the adage that 'you can't teach an old dog new tricks'; this view implies that adult learners are less capable than younger learners; the traditional view sees the adult learner as a 'big child'; and lastly, the more recent trend, currently reflected in adult education literature, adheres to the view of adults as super learners. None of these views is particularly helpful in conceptualizing the adult learner.

Long (1990) suggests that it wasn't until about 1975 that researchers began to question the Piagetian assumption that all adults, by simple virtue of their chronological age, function at the more sophisticated stage of formal operations (abstract). Long cites the work of Chiapetta (1975) as one of the first of these studies, in which she reported that 53% of her sample of female school teachers failed to operate at the formal operations level. More recently, Corno and Haertel (Corno and Mandinach, 1983, p. 97) conducted a one year course in systems engineering for a large computer company and found that these adult learners demonstrated both resource management and task focus approaches to problem solving. In another study Ellen Gagne (1982) was able to differentiate high achieving-low ability college students from low achieving-low ability college students because the more successful students relied heavily on resource management skills (Corno and Mandinach, 1983, p. 97). These studies would tend to support Long's (1990) conclusion that there is a great deal of variability in the learning approaches and achievement levels among adults.

Key principles in adult teaching practice, as outlined by Brookfield (1986) provide a basis for suggesting that the concept of cognitive engagement styles is an appropriate way to study and promote the improvement of adult learning skills. Galbraith (1990, p. 6) outlines the six principles that Brookfield (1986) identified as necessary for effective teaching practice in adult education:

1. Participation is voluntary; adults engage in learning as a result of their own volition.
2. Effective practice is characterized by a respect among participants for each other's self worth.
3. Facilitation is collaborative.
4. Praxis is placed at the heart of effective facilitation; "learners and facilitators are involved in a continual process of activity, reflection upon activity, collaborative

analysis of activity, new activity, further reflection, and collaborative analysis, and so on" (Brookfield, 1986, p. 10).

5. Facilitation aims to foster in adults a spirit of critical reflection.
6. The aim of facilitation is the nurturing of self-directed, empowered adults.

Before proceeding with the argument that the concept of cognitive engagement styles is an appropriate way to understand and promote the improvement of adult learning, some clarification of terminology is necessary. The concept of volition, as expressed in Brookfield's (1986) first principle, is not be confused with Kuhl's (Corno, 1986) volitional strategies. Brookfield uses the term 'volitional' in much the same way that the term 'self-directed' is used to describe learners throughout adult education literature and as we will see, self-directed learning is not be equated with self-regulated learning.

Verduin and Clark (1991) point to Pratt's (1988) observation that self-directed learners may actively seek highly structured approaches to learning when selecting course work and that this would not make such students any less self-directed. It becomes clear from the descriptions of Brookfield and Pratt that the terms volition and self-directed are used to explain primary motivations for adults to engage in learning, perhaps as a way of diffentiating the independence of choice in adulthood from compulsory aspects of schooling required of children, whereas the term 'self-regulated' reflects the cognitive, metacognitive, and affective strategies that describe and explain the learning process. With these differences noted, the third, fourth, and fifth principles postulated by Brookfield clearly demonstrate a concern for cognitive processes in adult learning; critical reflection and analysis mirror the transformational processes of self-regulated learning in the Corno and Mandinach (1983) model. The fact that adult education practice places such a strong emphasis on the collaborative process and the suggestion that this instructional method may reinforce learning strategies that do not always promote the use of transformational processes, should be cause for reflection. Collaborative learning as a task structure, while not without value in terms of social and emotional gains, may not be the most appropriate or effective means for promoting self-regulation among adult learners in the absence of appropriate incentive structures.

9. Self-Regulated Learning and Media Research

The personal computer is the most recent technology in a long line of assistive devices to be introduced to education. Over the years much attention has been directed toward assessing the impact of these technologies on the learning process. This has resulted in a plethora of media comparison research studies and in many of these studies the focus was an attempt to demonstrate the instructional superiority of a given medium by suggesting that such learning was both more efficient and more effective than traditional instruction. More recently a different perspective has emerged that views technology as a platform for studying, understanding, and improving the learning process. This section begins with a closer examination of past media comparison research and concludes with an examination of some of the research that focuses on the use of computers as vehicles for studying the learning process.

9.1 Media Comparison Research

The pace of technological advancement has increased exponentially over the last forty years and such changes, accompanied by the transformational potentialities of technology, as well as curiosity about that which is new and innovative, are among the reasons for adopting and studying new technologies. Many researchers have been eager to investigate the comparative effects of media on learning and instructional processes. Comparative media research rose in prominence during the 1950s with the popularity of radio, and again in the 1960s with the arrival of 'educational' television; and the scenario was repeated during the 1970's and 1980's with the focus on computer-assisted instruction (Clark, 1983).

Clark and Salomon (1986) have examined a number of comparative media research studies, many published in the first and second editions of the Handbook of Research on Teaching. Too often in these studies, Clark and Salomon (1986) found internal consistency lacking. While a review of media research meta-analyses by Clark (1983) found that most studies showed positive learning effects for newer media over more conventional

media, upon closer examination of these studies he demonstrated how these effect sizes were substantially reduced when one instructor planned and presented both the conventional and experimental courses or when students who developed an increased familiarity with a new medium expended less effort on the task. When variables such as instructional context, curricular and task design, methods of presentation, learner characteristics, and novelty are controlled, Clark and Salomon (1986) agreed with a number of researchers such as Levie and Dickie (1973), Jamison et al. (1974), Schramm (1977), and Clark (1983), who have generally concluded that claims of instructional superiority for any singular medium are unwarranted. Salomon (1979) has suggested that the primary assumption of comparative media research is faulty: that various media forms will necessarily result in unique learning effects.

These findings of instructional media researchers are contrasted to those of mass media researchers who have concluded that various media produce important effect differences (Salomon, 1979). To understand this apparent contradiction an important distinction must be made between the learning process and the learning effects. While learning effects may not vary with the mode of delivery, the learning process itself is necessarily affected in different ways for different types of learners. Salomon (1979, p. 9) has suggested that,

> specific media attributes, when used as carriers of the critical information to be learned, call on different sets of mental skills and, by so doing, cater to different learners. It becomes justified to assume that no medium, not even specific medium attributes, is best for all learners.

Salomon (1979, p. 10) further suggests that,

> Since different modes of packaging information create different experiences...it would be of much greater promise to discover the areas in which media diverge and hence serve as means to different ends.

Clark and Salomon (1986) suggest that while there are some benefits to be gained, such as determining cost effectiveness, these types of comparative studies do little to extend our knowledge about the instructional effects of specific media attributes.

Clark and Salomon (1986, p. 464) observed that there as been an effort to differentiate the research about media from that of instructional technology and cite as evidence for this, the work of Tickton (1970) who produced the following definition of instructional technology as

> a systematic way of designing, and carrying out and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication and employing a combination of human and nonhuman resources to bring about more effective instruction.

Clark and Salomon (1986) have been cognizant of Tickton's (1970) comprehensive interpretation of instructional technology in making the distinction between research with media, in which technology is used as a vehicle for the delivery of instruction, and research on media, in which the generic variables of the media are examined. To compare adequately, the effects of two or more media the authors suggest that it is critical for non-media variables to be consistent across the media being examined. Clark and Salomon (1986, p. 465) point out that,

> learning from instruction is a much more complicated process that often involves interactions between specific tasks, particular learner traits, and various components of medium and method.

Decisions then, about how the processes of learning and teaching ought to proceed in new technological environments, must be considered not only in the context of the specific attributes of new media, but within the context of what we as educators know about learners, learning, and teaching.

> The mere use of technology to deliver instruction does not imply that the instruction is high in quality. That is, it is not necessarily effective or efficient. Using technology to enhance instruction means that some value is added to the instruction due to taking advantage of the characteristics of the technology.
> Florini, 1990, p. 383

The lack of conclusive evidence that might promote the benefits of a specific instructional medium, in addition to the shift in education from a behavioural to a cognitive orientation, have contributed to a fading emphasis on these kinds of media comparison studies (Clark and Salomon, 1986).

9.2 Self-regulated Learning and Computer-based Instruction

There are several characteristics of computer technology that make it a desirable vehicle for examining the concept of self-regulated learning. Computers make it possible to independently store data collected via interaction with the student thus providing the possibility for improved efficiency in data collection processes. This potentially reduces the opportunity for human

error and may add a degree of reliability (though not validity) to the data collection process. Computers also have the capability of monitoring and recording user interaction and/or progress and providing immediate feedback to the learner. This capability has both research and instructional benefits: first, profiles or transcripts of the step-by-step process of learner interaction with ideas or concepts can be stored and retrieved for later analysis; second, the immediate feedback that the learner receives allows a greater degree of learner control by providing individualized opportunities for review.

Mandinach (1984, 1987) is one researcher who has used the computer as a vehicle for studying the concept of self-regulated learning, although a number of others have studied various aspects of cognitive functioning in this environment. In her 1987 paper, Mandinach reported on two studies, one of which examined the role of strategic planning knowledge and self-regulation in learning an intellectual computer game. This study involved 48 volunteer junior high school students selected and grouped on the basis of their performance on a standardized achievement test and a battery of group-administered ability tests. A computer game that required "deliberate and efficient application of the strategic planning and logical reasoning processes that define self-regulated learning" (Mandinach, 1987, p 6) was used to assess performance variations during instructional and practice phases of the game. The study found that high ability students were more successful and displayed more self-regulated learning strategies than those who used alternative styles of engagement. Seventy-three percent of the students adopted and maintained a specific style (as defined by Corno and Mandinach, 1983) of cognitive engagement, while only 27% shifted to a different form of engagement throughout the sessions. Self-regulated learning was the most frequent (27%) and resource management was the least frequent (12%) form of cognitive engagement, but the latter was the style most

frequently used in combination with other styles. Next to students whose dominant style of engagement was self-regulated learning (SRL) were those students who used SRL in conjunction with a task focus approach. Those least successful at the game were those who used a combination of resource management and recipient engagement styles. Mandinach concluded that the high and low ability students displayed different patterns of cognitive engagement and that those who utilized SRL, task focus, and resource management forms of engagement were more successful in completing the game.

In a research project at the New Jersey Institute of Technology (NJIT), Hiltz (1990) and others conducted a major study between 1985 and 1987 that compared the instructional benefits of computer-mediated conferencing to face-to-face instruction and attempted to determine what variables might be associated with "especially good and especially poor outcomes in this new teaching and learning environment". Because of previous media comparison research findings the primary hypothesis was that

> There will be no significant differences in scores measuring mastery of material taught in the virtual and traditional classrooms.Hiltz, 1990, p. 144.

Final grades and student self-reports were used to evaluate student progress in both virtual classroom (VC) and face-to-face modes of instruction in courses that were one semester long. With the exception of the computer science courses in which the VC grades were significantly better, the findings at NJIT were consistent with earlier media studies in that no significant differences in achievement were found between the two conditions (Hiltz, 1990).

A number of other hypotheses were formulated at the onset of this study and are important to this discussion. A second hypothesis was that writing scores would improve for students in the VC mode. No detectable improvements in writing scores for either group were found. Hiltz (1990) noted that it was not known whether this result was due to the inadequacy of the holistic scoring methods used or whether a single semester was simply too short a period of time in which to expect measurable differences in writing to take place. Other explanations are also possible may have been considered by Hiltz in the original study but were not evidenced in this paper. These explanations include the possibility that the writing skills of these students were already adequately developed and the idea that practice without explicit instruction, does not lead to improvements in writing.

A third hypothesis was that VC students would perceive the VC to be superior to the traditional classroom (TC) on a number of dimensions including: convenient access to educational experiences (supported); increased participation in a course (supported); improved access to the professor (supported); improved ability to apply the material of the course in new contexts and express independent ideas related to the material (not supported; Hiltz (1990) notes that increased confidence in expressing ideas was most likely to occur in mixed-mode courses); an increased interest in the subject matter (findings were course dependent); improved ability to synthesize or see connections among diverse ideas and information (no significant overall differences; there was interaction between mode and course); computer comfort (supported); increased levels of communication and cooperation with other students (mixed findings that were course-dependent; the extent of collaborative learning was highest in mixed-mode courses).

A more interesting finding that related outcomes to student characteristics is relevant to the discussion of self-regulated

learning. In attempting to answer the question of which medium (virtual classroom versus face-to-face instruction) Hiltz (1990, p. 168) found that

> Results are superior for well-motivated and well-prepared students who have adequate access to the necessary equipment and who take advantage of the opportunities provided for increased interaction with their professor and with other students, and for active participation in a course. Students who lack the necessary basic skills or who begin with a negative attitude will do better in a traditionally delivered course.

These conclusions would tend to support the findings of a number of studies which indicated that higher achieving students make spontaneous use of self-regulated learning strategies and that use of these strategies is a characteristic that differentiates learners of higher and lower ability. Such strategies are seen by Corno and Mandinach (1983) as critical to the acquisition and enhancement of student motivation. When contrasted with media comparison research, the use of computer-based technologies as tools that support and enhance research and instruction would appear to result in more substantive hypotheses being developed that have far more consequential implications for improving individual learning.

10. Limitations of the Model for Self-Regulated Learning

The Corno/Mandinach (1983) conceptualization of cognitive engagement styles provides a useful model to extend our thinking about the ways in which individual learning might be improved. It represents an attempt to integrate theories of learning and motivation into a model that has significant implications for classroom practice.

The role of theory is to provide an explanation of a phenomenon (Littlejohn, 1989). Littlejohn has suggested that theories represent a set of inter-related concepts or patterns of inter-related similarities and he describes two generalizations that can be made about all theories: first, all theories are constructions; they are not facts; and secondly, a well constructed theory will do more than provide definitions of words and symbols; it will demonstrate how the various concepts are related. He suggests that a taxonomy, for example, provides the labels for these concepts but fails to demonstrate the ways in which the concepts are interconnected. The purpose of theory then, is to provide an explanation of how various concepts are related. In organizing existing knowledge, a theory must support the formulation of concepts and be able to suggest potential research questions (Poole, et al., 1986). According to Littlejohn, such explanations will answer the "why" question and provide explanations that identify regularities among the variables. A comprehensive theory should embody the dimensions of causality (cause and effect relationships), logical consistency of the elements, and practical necessity which represents how the elements or concepts are affected by external circumstance (Littlejohn, 1989).

Littlejohn (1989) provides a description of nine inter-related functions of theory that are summarized here. The first is to organize and summarize knowledge, to look for patterns and connections that provide a synthesis of the critical concepts. The second function of theory is to provide a focus for investigation. This focus provides details about significant elements, including variables or relationships within the theory, and in so doing, responds to the question of what will be examined in the theory. The third function of theory is to provide a clarification of the concepts. The fourth function of theory is to guide researchers in their observation by suggesting what is to be examined and how it may be viewed. Theories also provide researchers with a predictive element that enables them to examine the outcomes and effects of the data being analyzed. This predictive component of theory is important because theory frequently influences practice in the field. A theory that neglects this component can be of little practical consequence because without the ability to observe the theory in action, it cannot be examined critically. The sixth component of theory relates to its heuristic value and its ability to guide other researchers in the field. Bales' Interaction Process Analysis, a method for examining the relationships within a small group, is an

example of a method based on heuristically grounded theory that has provided a foundation for other researchers to extend our knowledge about the interactions among members of small groups. The seventh component of theory relates to its communication function whereby a platform is provided for discussion, debate, and criticism of the theory. The eighth function of theory is control. Littlejohn (1989) suggests that while much theory is descriptive in nature, the goal of many theories is to develop performance norms. These norms provide a basis for researchers to evaluate important questions about human behaviour. The ninth and final function of theory relates to its generative potential to challenge extant understandings and raise new questions with regard to underlying assumptions.

Littlejohn (1989) has suggested that theories develop in three fundamentally different ways:

- our knowledge and understanding of a phenomenon can be developed with increasing clarity and precision
- our knowledge can be expanded or extended; and
- our knowledge can be revolutionized through new conceptualization of the phenomenon

Theories necessarily represent an abstraction of the underlying processes. Similarly, an inherent attribute of any paradigm representing theory, is that it further simplifies the nature of the relationships within the theory it is held to represent. It is therefore critical to any theory that these relationships be made explicit.

If we examine the Corno/Mandinach (1983) model of cognitive engagement styles within the context of these essential attributes of theory, a number of questions arise. The focus of the Corno/Mandinach model is to provide a delineation of the various processes of cognitive engagement that can be invoked by students and advocated by teachers for the purpose of improving learning; it also illustrates those processes that might be deleterious to learning. The model further details the relationships among these processes which may promote specific patterns of cognitive engagement, but it does so in such a way that the relationships among these element are sometimes unclear. Two factors contribute to this problem. First, the descriptions are expansive in nature and while this is helpful in considering the broad implications among varied patterns

of engagement, more specific examples might improve our understanding and facilitate application of the model to practice. For example, in information acquisition, two elements are identified: alertness and monitoring. The descriptors for alertness include receiving incoming stimuli and tracking/gathering information. The model would benefit from greater clarity which might include the use of descriptors in conjunction with specific examples to illustrate the authors' interpretation of these elements. Descriptors of alertness might include statements of agreement, and repeating or restating information in one's own words, both of which illustrate the learner's alertness to incoming information. These descriptors could be accompanied by specific examples like those below:

Statement of Agreement:

I agree with Mary's comments regarding the negative effects of socialization in schools.

Restatement:

In Chapter 3 the author suggested that the use of written text had certain learning benefits over verbal interaction.

Each of the five major elements in the model of self-regulated learning would benefit from such elaboration. Related to this idea is a question regarding the nature of the relationship between the elements of self-regulated learning in Table 1 and the cognitive engagement styles illustrated in Figure 1. If we look at recipience (Table 1) for example, are some elements of alertness present and others absent or are all aspects of alertness present, but utilized minimally? What if levels of alertness are high, but monitoring processes are low? Is the implication still that acquisition processes are low, and if so, in comparison with what, are they considered to be low? These questions bring us to the second factor that contributes to a lack of clarity in understanding the relationship among the model's elements, and this might be described as a language problem. The

use of terms such as high and low levels of acquisition and/or monitoring is sometimes confusing. What constitutes high level monitoring? What is deemed to be low? The ambiguity of these terms becomes apparent in the following description of recipience:

> Recipience...is less functional than either self-regulation or resource management for the long-term development of cognitive skill, since it exercises only some acquisition processes (such as rehearsals) that may come about during high level monitoring. Corno and Mandinach, 1983, p. 96

Recipience is by definition a style of cognitive engagement that utilizes low levels of information acquisition and transformation, and one might infer that this would also include low levels of monitoring, yet the above description suggests that high level monitoring is possible. Is high level monitoring deemed to be high in comparison with lower levels of alertness or lower level of transformational processes? Could a learning situation exist whereby a student exhibits low levels of alertness, but high levels of monitoring? While it may be eventually possible to conceive of such a scenario, it is difficult at this time to imagine the conditions under which such an engagement style might exist. How might this apparent contradiction be explained? If recipience reflects a more passive approach to learning, one might conclude that alertness to incoming information could be higher than the accompanying levels of monitoring; that is, a student might passively follow instructions to locate specific information without thinking about why such information was important or why it would be important to search for the information in the first place. This kind of engagement might be typical of the student who simply wants to complete the task for the sake of saying it is finished. An alternative explanation for this apparent contradiction is that the authors are implying that the more cognitively complex monitoring of transformational processes (such as those involved in planning) should be described as low level monitoring because they are deeper, more elaborate processes. While there is a parallel example of this usage of high and low in reference to computer languages it is highly unlikely that this analogy would provide the basis for such usage by cognitive psychologists. It may be more likely that these terms have some prior foundation in theories of cognitive psychology

with which this writer is unfamiliar. Nonetheless, usage of the terms high and low is unclear and the model would benefit from more explicit descriptions of such terms.

Further questions arise from this example. Why is the task focus style of engagement excluded from above definition of recipience? By inference one can assume that recipience is the least desirable of the four styles of cognitive engagement, but this omission creates a mild degree of ambiguity. Was this a deliberate omission and if so, what might be the rationale? A further question: nowhere have the authors suggested that a recipient style might be appropriate under some learning conditions. This researcher would submit that tasks which require repetitive or rote learning, such as memorizing a piece of text or mathematical tables, might be highly appropriate to a recipient style of engagement. Such tasks, at least during the practice phase, require little in the way of transformational processing, and could be accomplished using relatively low levels of alertness and monitoring. The question remains as to whether such an interpretation would be considered appropriate in the authors' interpretation of the model.

Another question of significance relates to the possibility of a developmental relationship or continuum that might exist among the various styles of cognitive engagement. If such a continuum were to exist, what strategies might be helpful to practitioners in assisting students to move flexibly from one cognitive style to another and what types of learning tasks and conditions might be associated with these various strategies?

We have said that this model represents an attempt to integrate theories of learning and motivation into a model that has significant implications for classroom practice. But precisely how the concept of motivation fits within this model is not clear. In this researcher's thinking, motivation represents an internal state of the learner and while acknowledging that motivational states can be influenced by external factors (such as learning new cognitive strategies and thereby influencing learners' beliefs about their ability to accomplish a task), the model falls short of describing the possible reciprocal relationship between the various processes of cognitive engagement and motivational states. Many other

factors, such as the personality of the teacher, the task conditions, and environmental or internal distractions, also affect motivation . The model could benefit from a more elaborative description of the relationship between these motivational factors and the cognitive processes.

How we view ourselves as human beings is reflected in our perceptions, our behaviour, our relationships with others, and even in the ways that we as researchers construct our theories and paradigms. Language, communication, and learning are inherently social processes and it would be the claim of many theorists that our thinking is inextricably connected to this social nature of our beings. To what extent is human experience basically individual versus social? Whether it is important, or in fact even essential, to view the individual within the larger social context of the natural environment, is an ontological issue that should not escape our attention. The Corno/Mandinach model of cognitive engagement styles reflects a fundamentally individual view of cognition. If cognitive engagement is a critical feature of language and the communication process and if learning and communication are inherently social in nature, it is this researcher's opinion that the model does not adequately reflect this social component of learning.

A less trenchant, but nonetheless important criticism of the Corno/Mandinach model is that none of the illustrations reflect what the authors themselves consider to be an important element of the model, that the most desirable style of cognitive engagement is reflected in the individual who is able to flexibly adapt a cognitive style of engagement to the specific demands of a given task. This point is critical to understanding the concept of self-regulated learning, yet it is a point which might easily be overlooked since it is not depicted in Table 1 and it is given only brief mention in the two articles (Corno & Mandinach, 1983; Corno, 1986).

Despite these limitations, by examining the Corno/Mandinach (1983) model of cognitive engagement styles within the context of the essential attributes of theory, we can see that many of the criteria described by Littlejohn (1989) have been addressed. The model establishes relationships among the cognitive processes that are essential to learning and in so doing, creates new patterns that provide a focus for study. While these patterns might benefit from more

elaborative descriptions, they do aid researchers by suggesting a new perspective for examining individual learning. The Corno/Mandinach model is grounded in theories of learning and motivation that not only provide a platform for discussion, debate, and criticism, but have important implications for classroom practice. The greatest strength of this model may be in its ability to provide an insightful framework through which researchers and practitioners can observe, understand, and improve the learning process.

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