Strategic knowledge and strategic competence

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Strategy is a style of thinking,
a conscious and deliberate process,
an intensive implementation system,
the science of insuring future success
Pete Johnson

Introduction

Strategic knowledge has been placed in the center of the debate of today's pedagogy. First from the linguistic study of language, then from language studies and later from other scientific codes such as mathematics, social science, biology, etc. (being philosophy the involving meta-science), This modern path to teaching that revolves around the studies dealing with strategic knowledge respond to the need of condensing in their methodological proposals the mechanisms that act as bridges between cognitive development, the inquiries about the world and the systematic construction of the learners' knowledge that occur in classrooms and which are accompanied by those who use the techniques and technologies to learn, that is the teachers.

Strategies can act and develop simultaneously and fluently among the teachers, learners and society, and the social contexts. When considering its design, strategies do not constitute isolated instances they constitute a didactic. When considering the capacity to codify the experience of the world through language strategies constitute cognitive and socio-cultural knowledge.

This section discusses the theories that illuminate strategic knowledge and learning as informed by: 1) Information Processing Theory (Gagné, E. 1985); 2) The dimensions literacy (Kucer, 2005), and 3) Communicative Competence (Bachman, 1990).

Information Processing Theory

Information processing theory, which is cognitive in nature estimates that knowledge is represented in a variety of forms including propositions, productions and images (see Gagné, E. 1985:35-67). Information processing theory explains the human cognitive system as one consisting of long-term and short-term memory. Short-term memory processing and capacity are very limited. Long-term memory capacity is theoretically infinitive. Things that are current and those that are activated from the long-term memory are the inhabitants of short-term memory. There are certain ways, like strategies, in which the information can be received and remembered, in other words, included in the general cognitive system.

According to informational theory, long-term memory consists of three types of knowledge, which also constitute all the human activities:

• Declarative (factual) knowledge – our knowledge about the world, organized in schemas.

• Procedural knowledge – how to do things.

• Metacognitive – when and how to use procedures.

Declarative knowledge refers to the individual that learns or knows that 'something is the case;' it is information that can be stored and retrieved upon demand. For example: *Independence Day is on such date* or *2+2=4*.

Procedural knowledge on the other hand, requires steps and processes to arrive at an answer or to solve a problem. For example: for a learner to answer the question: How long did the war of independence take? He/she must resort to two pieces of information: *when did it begin? When did it end?* In workshops conducted by the author over half of the participants fail to respond the latter question. They attempt to guess instead of asking themselves something along the lines of "*Independence Day was on year X… and the last battle of independence took place in year Y, then the war of independence took n years.*"

Information processing theory has a say in comprehension in the area of mental processes that can be triggered for involving and engaging learners. For Collings (n.d): "According to the information processing theory, in order for the information to become a part of the person's world knowledge, it has to be actively processed by means of creating inferences. Inferences come from activated background knowledge." This process of *inferencing* can be stimulated by allowing learners to relate new knowledge to their life experiences or to other disciplines of study. On the other hand, assessment tasks can reinforce the meaningfulness and rele-

vance the content and of the tasks, by asking learners to reflect on their potential use or by stimulating creativity in which learners can explore diverse applications of the new knowledge.

Pushkin (2007:2) expands on the above concepts: "Learning is the outcome of learners thinking about knowledge. If one were to view this algebraically, learning could represent the sum of thinking and knowledge. The foundation for this relationship rests with the following proposal by Maloney (1994 in Pushkin, 2007:3). In order to be a successful problem solver, it is proposed that learners need four types of schema-specific knowledge:

- Declarative knowledge (basic arbitrary facts: e.g., Na is the symbol for Sodium).

- Procedural knowledge (algorithms: e.g., determining the velocity of a moving particle by taking the derivative of its displacement as a function of time).

- Situational knowledge (recognizing contexts in a problem: e.g., two concurrent forces are competing with each other rather than together).

- Strategic knowledge (choosing appropriate algorithms: e.g., using a Ksp expression to calculate a precipitate ion's concentration as opposed to using pH)."

For becoming a competent learner a collection of facts, theories, events and objects related to a subject (declarative knowledge) would not suffice. Whereas a set of procedures and steps for doing things (procedural knowledge) will encourage the learner's higher order thinking. And for the learner to progress towards critical thinking a combination of strategic knowledge and situational knowledge would be required, that is, recognizing contexts of use an application and choosing the appropriate algorithms (understood as procedures, processes or set of rules).

The above has implications for instructional settings that should be prepared for both content and delivery; meaning that learners need to find reasons to attend to what is being taught. As Collings (2007) states that the preparation for the information processing at schools should be a very important activity. Such preparation is closely related to the following cognitive processes:

Connecting to prior knowledge or building it up. Prior knowledge traditionally includes historical (e.g., knowledge about an author and his époque, literary theory) and modern (socio-cultural context of the modern and immediate reality) information.

Motivation. In order for the information to be successfully stored in the long-term memory, the reader has to be genuinely interested in it. The teacher's task is to try and evoke emotional attitude of the students towards the text before reading.

Information processing theories help us understand that the content of the classroom tasks benefit from being purposeful, from showing a clear sense of direction and from being as contextualized as possible. The learner does not necessarily enter motivated to a 'surprise' topic or activity; motivation is also cognitive, that is, derived from the tasks proposed. The more meaningful the topic, that is connected to prior knowledge and of potential use, the better the disposition to learn it. Socio-cultural and historical relationships can be very motivating, whereas motivation in its turn might evoke the interest to seeking for more information.

Information processing theories also highlight that in delivering the information it is important to show the relevance of the topic or task to the learner. The motivational aspect is closely connected with the goal of the particular learning activity. The task of the teacher is to help students learn to formulate the goals, most beneficial for their personal development, making the task motivation intrinsic and as personal as possible. Personal relevance also greatly contributes to a better positioning of the information in the long-term memory.

Dimensions of Literacy

Another theory that had an influence on this volume is that of Stephen Kucer (2005:5) who proposes a conceptual base for literacy with four dimensions: a) a linguistic dimension which focuses on the text, b) a cognitive dimension which focuses on mind processes, c) a socio-cultural dimension that focuses on the individual as a member of a group, and d) a developmental dimension which focuses on the growth of the individual as reader and writer.

As for the *linguistic* dimension Kucer considers the functions that language serves, and the various text-types used in social life. When discussing this dimension he takes a discourse perspective rather than a perspective on the systems of language. Nonetheless, Kucer clarifies that understanding orthographic, syntactic, morphological and semantic aspects of language are important for instruction.

As for the *cognitive* dimension of literacy Kucer assigns an important role to psycholinguistic aspects like memory and perception, the nature and role of background knowledge on reading comprehension, and cognitive interrelationships between reading and writing. For this author intertextuality, for example, refers to the connections readers and writers make among various texts. I agree that

relating texts from diverse disciplines or environments is of great importance to readers. The more connected the discourses the more familiar these will be to learners.

As for the *sociocultural* dimension Kucer (2005:170) understands literacy as sets of social practices. For critical responsive activities "seek to analyze and critique issues of power and perspective that weave their way through any text and any response". Literacy practices involve identity, self-expression and self-representation in which learners need to be given the opportunity to build a theory of the world and later to be able to transform it.

As for the developmental dimension Kucer (2005:170) illustrates how children learn to 'maneuver and orchestrate the various dimensions of language with diverse degree of control, flexibility on several contexts'. Fluent readers and writers do not mature overnight. They can master the word when they connect it to self, to other texts and to the world. These connections contribute to literacy development.

To complete the above discussion I propose adding a dimension to literacy: *The visual dimension* of literacy, which would be situated within the realm of information processing. And I propose it to be considered an important aspect of strategic knowledge. Stokes (2001) affirms that visual literacy is the ability to interpret images as well as to generate images for communicating ideas and concepts. This author provides this brilliant example:

> [...] During a rehearsal of Debussy's La Mer, Toscanini found himself unable to describe the effect he hoped to achieve from a particular passage. After a moment's thought, he took a silk handkerchief from his pocket and tossed it high into the air. The orchestra, mesmerized, watched the slow, graceful descent of the silken square. Toscanini smiled with satisfaction as it finally settled on the floor. "There," he said, "play it like that". (Fadiman, 1985:548 cited by Stokes, 2000)

Educational literature suggests that using visuals in teaching results in a greater degree of learning. It recommends instruction that incorporates varying degrees of visual components to stimulate interest in using visual enhancements in teaching and to promote the development of learners' visual skills in combination with their development of verbal, reading, and mathematical skills.

Some of the strategies put forward refer to several forms of graphics for instruction and for enhancing understanding. Visual organizers that incorporate illustrations and text to depict patterns of concepts and ideas serve as organizational frameworks to promote thinking and learning (Tarquin & Walker, 1997 cited by

Stokes, 2000). They may also assist learners in relating ideas to prior knowledge, subordinate ideas, and information from various sources. For example, Venn diagrams may prove useful in analyzing similarities and differences between two or more concepts and frameworks for webbing that encourage thought regarding the whole and its parts are examples of visual organizers. Visual frameworks may link prior knowledge with what the learner wants to know and with what the learner has learned; the framework can be expanded to address what the learner still wants to learn, serving as a catalyst for further study or research. Feature analysis frameworks use a grid design to represent the relationships of concepts within a category. So far the information processing theory has been presented along with the dimensions of literacy. The next section deals with communicative competence which is a complex construct which discussion hopes to shed light on thought processes.

Communicative Competence

Taking into consideration that the development of communicative competence is one type of learning, which mediates to acquire other types of learning- it is here proposed that the levels of communicative competence attained by an individual are directly related to the type of knowledge required. In Table No.1, and reading from top to bottom the arrows point an upward movement towards language proficiency. An analogy with traffic lights is proposed: The bottom part in red represents a reader/writer/listener/speaker in standby. The middle part in yellow represents her on the 'go' and the top part in green represents the movement towards the destination of competence.

The linguistic competence involving phonological, orthographic, lexical, syntactic and semantic components constitute the formal component of language. It is related to declarative knowledge (knowing that something is the case, i.e., knowing the rules of language). Attaining this competence would constitute a primary step on the road to competence. It is then argued that classroom practices cannot stop at proposing tasks focused solely on an intratextual level or on literal text type.

Moving up from the linguistic competence we can find *the* A*nalytical Competence* -involving the identification of the gist of a text, distinguishing between main and secondary ideas, and the rhetoric, organization. The language user deals with the functional component of language, that is to say what is being communicated to who and what for. *The* A*nalytical competence* is related to procedural knowledge (knowing how a text is structured). Attaining this competence would constitute half way on the road to competence. It is then argued that classroom practices that stop at the intratextual level or on inferential text type still fall short of comprehension or understanding.

In the same upward direction *sociolinguistic competence* can be found. It refers to the ability to interpret the social meaning of the choice of linguistic varieties and to use language with the appropriate social meaning for the communication situation.

Table No. 1. **Levels of communicative competence**

	COMPETENCE	LEVELS	TEXT TYPE	TYPE OF KNOWLEDGE REQUIRED
C O M U N I C A T I V E C O M P E T E N C E	**TEXTUAL**	**EXTRATEXTUAL**	**CRITICAL**	**CRITICAL**
	PRAGMATIC (Application of world knowledge, knowledge of linguistic context and schematic knowledge)	**INTERTEXTUAL**	**INFERENTIAL** (To derive as a conclusion from facts or premises)	**THINKING** **=** **STRATEGIC** (implies higher order thinking) **+** **SITUATIONAL** (implies higher order thinking)
	SOCIOLINGUISTIC (Ability to interpret the social meaning of the choice of linguistic varieties and to use language with the appropriate social meaning for the communication situation)			
	ANALYTICAL (Determine what the text is about, identify main and secondary ideas, enumerate the major parts of the text)			**PROCEDURAL** (implies middle cognitive demand)
L I N G U I T I C	**SEMANTIC** (Processing of propositions) **SYNTACTIC** (Processing of phrases and clauses) **LEXICAL** (Processing of word meaning) **MORPHOLOGICAL** (Parsing of words) *ORTHOGRAPHIC* *(Processing of graphic representation)* *PHONOLOGICAL* (processing of acoustic input) ↑	**INTRATEXTUAL** (Refers to the connections readers and writers make within the text) ↑	**LITERAL** What is actually stated in text ↑	**DECLARATIVE** (Implies lower cognitive demand) ↑

R. Castillo (2010) adapted from: Kucer (2005), Pushkin (2007), and Bachman (1990:85)

Right above we find pragmatic competence which refers to the application of world knowledge; knowledge of linguistic context and schematic knowledge. The language user resorts to the other components –from phonological competence

to sociolinguistic competence in order to process an utterance (see discussion of the tern utterance in Montgomery B, and Baxter L, 1998:3).

Looking at the type of knowledge required that appears in the last column of Table1, and as stated before, I concur with Pushkin (2007) who contends that "situational knowledge plus strategic knowledge equals critical thinking for both imply higher order thinking. Situational knowledge refers to recognizing contexts in a problem: e.g., in language what to say to whom in accordance with the status of the interlocutors, the setting, the situation and the intention of communication. While "strategic knowledge refers to choosing appropriate algorithms: e.g., in language, using appropriate mechanism to organize ideas, or to synthesize them. Along those lines, for Skehan (1998:161-163) the more radical change in the models of communicative competence proposed so far was that of Bachman's (1990:85) for it assigns a central role to strategic competence. This subject is discussed in the next section.

There are key issues to address in reference to the attainment of communicative competence. The first problem we face when validating the levels and the descriptors of communicative competence is that teachers understand competence levels differently. A number of activities need to be designed in order to involve teachers in the process and to build a common understanding. These activities include studying the descriptors, sorting them in order of difficulty and comparing different sortings in pairs, etc. The result would be a proposal for the definition of the standard levels of 'good' command of language at the end of an educational cycle based on empirical data. It is then hoped that Table No.1 help teachers understand the levels of competence and the relationships with text types and types of knowledge required and facilitate the design of a scope and a sequence that gives account of what learners can do with language.

The second problem we face deals with the selection of oral or written texts. Course programs need to select and grade texts in which the text demands are in tune with the learner's cognitive development. In addition, these texts need represent different genres.

 The third problem we face deals with the selection of tasks learners will work on: a) seeking a combination of pedagogical tasks and real-life tasks; b) proposing tasks that have a purpose, a goal or an outcome; and c) finding tasks that are adequate to the learner needs and interests.

The fourth problem deals with the pedagogies that may allow information technologies assist in the understanding of the literacy world of contemporary learners. Although acknowledged this is a change that is slowly entering the world of school.

The fifth problem deals with testing, assessment and evaluation (TAE). First of all TAE have to reflect the teaching being carried out. In my observations as well as in the courses I have taught TAE is mostly concerned with the linguistic competence and there is little concern for the analytical competence and almost no concern for sociolinguistic or pragmatic competence. In the tests I examine regularly the most common items used were limited to the word or sentence level: organizing jumbled sentences, letter soups, cloze, or matching.

Testing ought not to stop at the decoding level. Characters, situations, setting, roles, communicative function, or speaker intention need to made part of those tests. It is here proposed that for teaching, testing, assessing and evaluating language there is a need to measure the learners in relation to processes, contents, and contexts of application. As an assessment agency proposes we need to ask these questions: "Are students well prepared for future challenges? Can they analyse, reason and communicate effectively? Do they have the capacity to continue learning throughout life?" (See homepage of : www.pisa.oecd.org).

Table 2. **Some test tasks proposed by P.I.S.A**

Processes : Forming a broad understanding; Retrieving information; developing an interpretation; Reflecting on content of text; Reflecting on form of text.
Contents : (knowledge and understanding): Continuous texts (narrative, expository, descriptive, argumentative/ persuasive, and injunctive/ instructive); Non-continuous texts (charts, graphs, diagrams, maps, forms, advertisements).
*Context of application (*situations/domains): Personal; Educational; Occupational, and Public.

The above sub-categories used to set the test tasks proposed by an examining body PISA may guide practitioners to propose solutions to the problems involved in the development of communicative competence. Hopefully an understanding of the issues presented in this chapter contributes to set goals, propose tasks and conduct an assessment that better reflect what learners can do with language, in the language and through language.

As a corollary it may be said that the pedagogy and didactics of language today faces the challenge of integrating, overlapping and processing the elements of

communicative competence and of proposing syllabi in which the textual level, the intratextual level and the extratextual level are permanently interwoven.

The next chapter examines the background, the theory and the research behind Strategic Knowledge which is in tune with the previous discussion on Information processing theory, the Dimensions of literacy, and Communicative Competence.

Strategic Competence

Yes, there are times when the gold medal only goes to the winner.
But not in the race of life, where the winners are those who
are superior not to others but to their former selves.
Robert Cooper

The theories here presented concur that there are different types of knowledge; that literacy has several dimensions; that communicative competence has several levels; and that learning and knowledge are mediated by language. These theories come to an understanding that learning requires sight, sound, symbols as well as abstraction, prediction and general thinking skills. Using language to communicate, to learn, to solve problems or to create constitutes a psycho-neurological as well as a social and cultural mechanism. In other words, you learn when you are able to understand, interpret, argue about or apply the meaning of a text. Learning the words implies transforming the meanings of the text with the voice of the learner. The act of learning also implies discovering meanings, debating and critiquing what the text says and it also implies proposing alternative interpretations. Therefore, you may say you have learnt when you understand the intentions, when you know how knowledge was obtained, when you know how to build your own idea or notion, and when you learn what works for you best to learn. The paper discusses the relationship between strategic knowledge and strategic competence, then, the Surface Approach to Learning and the Deep Approach to Learning are presented.

Connections between strategic knowledge ad and Strategic Competence.

Strategic knowledge refers to the procedures used in learning which serve as way of reaching a goal. Some of those procedures are conscious others are unconscious. Everyone has some degree of strategic knowledge that may be evidenced in spite of their incomplete knowledge in a certain field. By using diverse stimuli strategic knowledge may arise and allow learners to build a deep structure from a surface structure. Also, the learners' interactions with the stimuli may serve as

a framework and guide for understanding. Being able to use that knowledge to problem solving situations constitutes a *strategic competence*.

Bachman (1990:106) says: "I consider [strategic competence] more as a general ability, which enables an individual to make the most effective use of available abilities in carrying out a given task, whether that task be related to communicative language use or to non-verbal tasks such as creating a musical composition, painting, or solving mathematical equations." Correspondingly, strategies are goal-directed sequences of cognitive operations that lead from the student's comprehension of a question or instructions to the answer or other requested performance (Gagné, 1985:33).

When Bachman (1990:85 in Skehan, 1998: 161) discusses a communicative competence model, strategic competence "is no longer seen as compensatory, only activated when other competences are lacking. Instead, it is central to all communication. It achieves this by carrying out a mediating role between meaning intentions (the message which is to be conveyed), underlying competences, background knowledge, and context of situation. It carries out this role by: a) determining communicative goals, b) assessing communicative resources c) planning communication and d) executing this communication"

"…The most important factor, however, is that Bachman is redefining the relationship between competence and performance, since it has now dynamic qualities. This is shown in the figure below where the central mediating role of strategic competence between knowledge structures, language structures, and context of the situation can be seen clearly." Bachman (1990:85 in Skehan, 1998: 161).

Figure 1. **Components of communicative language ability in communicative language use** (Bachman 1990:85)
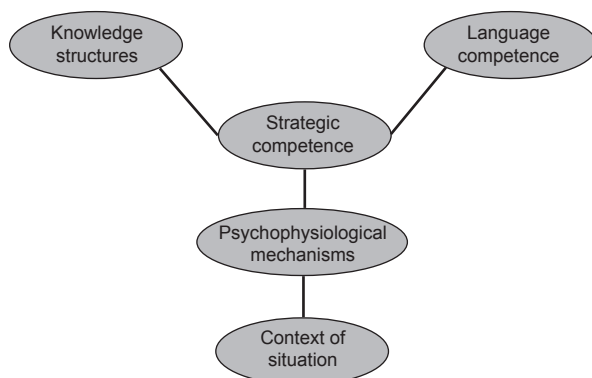
The above figure illustrates the thesis that strategic competence plays an important role in coordinating the contributions of other underlying competences during performance. Further research is needed to reveal actual processing; a case in point would be the study of the effects on performance of the application of stages like goal-setting, planning, execution and assessment (c.f., Cohen, A. D. & Olshtain, E. (1993:33). Another would be finding sound evidence of the contribution of linguistic, cognitive and sociocultural factors on performance. It is hoped that this paper encourages teacher-researchers to implement strategic knowledge and carefully study its role.

The Surface Approach to Learning and the Deep Approach to Learning.

In addition to problem solving and to communication, strategic knowledge is concerned with attempts to provide answers to the question: How do you want learners to approach the learning of a subject? How a teacher answers this question has a bearing on how the subject is taught, how assessment is carried out and what is expected of the learners. Along the lines of teaching, there are two related concepts that need to be presented and that underlie the discussion on how to approach learning. These terms are *the surface approach to learning* and *the deep approach to learning*. Specialists in some area would want their learners to build a series of schemas that allow them to integrate new knowledge to previous knowledge critically. Subject area specialists intend in their course syllabi and in their teaching that their learners build those schemas by means of practice, by the understanding of models or by using diverse knowledge organizers. In other words they would encourage a deep approach to learning in which learners would value and operate on the knowledge acquired.

By contrast, specialists would discourage a surface approach to learning in which learners value rote learning and in which, among other things, learners cannot distinguish between principles and examples. The power of assessment to determine students approach to learning has been recognized. Assessment methods which permit or even encourage surface approaches to be rewarded can be a strong influence on how students learn. For example, in reading, decoding exercises or eliciting literal information from a passage falls short of stimulating higher order thinking.

Work in other disciplines has found a clear correlation between a deep approach and the higher levels of learning outcome. There is some evidence that the same correlation exists in design learning. Entwhistle and Ramsden (in Lublin, 2003:11) have demonstrated the significance of looking at students' approaches to learning in relation to their orientation. The Approaches to Study Inventory (ASI) identifies three possible orientations:

1. Meaning orientation which correlates with a deep approach;

2. Reproducing orientation which correlates with a surface approach;

3. Achievement or strategic orientation, in which a student will be oriented primarily towards being successful, and will therefore readily adopt whichever learning strategy is most likely to gain success.

As a consequence it is suggested that teachers design and provide learning contexts which encourage 'achievement oriented' students to take deep approaches, and which reward their appropriate outcomes in assessment situations. Teachers need find ways to encourage learners to understand and apply deep approaches to their learning. On their part, Lublin J, (2003:2) cites Marton and Saljo (976) Marton, Hounsell and Entwistle (1997); Prosser and Trigwell (1998) and Biggs (1999) who put forward the thesis that:

> What the learner does has become more important for student learning than what the teacher does. This has led to the redefinition of teaching as the facilitation of student learning. One of the outcomes of this shift has also been the redefinition of course objectives in terms of learning outcomes rather than of teaching inputs. …One of the major concepts to emerge from this research was the idea that students can take different approaches to learning. It is suggested that good teaching can influence students to take a deep approach, while poor teaching in the widest sense can pressure students to take a surface approach. Biggs defines good teaching as the encouragement of a deep approach to learning.

On the other hand, Bradford (accessed 2007) discusses approaches to learning and study and its implications. This author cites Säljö and other researchers (such as Entwistle and Ramsden 1983 cited by Marton 1993) who suggest …

> The need to term a third approach that is the 'strategic' approach. This term describes students with an intention to achieve the highest grade possible through effective time management and organised study methods and an alertness of the assessment process. According to Entwistle, 'Interviews with students suggest that strategic students have two distinct focuses of concern -the academic content and the demands of the assessment system' (2000: 3). Furthermore, whereas the identification of 'deep' and 'surface' approaches originate from research which analysed the meaning gained from reading text, the 'strategic' approach' originates from research with reference to everyday situations; therefore it more appropriately describes an approach to studying (Morgan 1993).

Authors like Entwistle, 1987; Biggs,1987 (in Lublin, 2003:10-11) also argue that the strategic or achieving approach is one which students are said to take when

they wish to achieve positive outcomes in terms of obtaining a pass or better in the subject. Students taking this approach:

• Intend to obtain high grades

• Organise their time and distribute their effort to greatest effect

• Ensure that the conditions and materials for studying are appropriate

• Use previous exam papers to predict questions

• Are alert to cues about marking schemes

This approach when allied to a deep approach to learning in the subject would seem likely to deliver both an intelligent engagement with the subject as well as success in the subject. While the focus of interest in the literature has been on deep and surface approaches a common view perceives strategic knowledge as how you approach studying a subject, but as it has been discussed, it concerns with how you learn in general. Nonetheless I propose that strategic approach deals with how to solve problems and it goes beyond academic content and study skills. The ability to transfer deep knowledge to a real life situation as well as to a test has to do with the understanding of principles and procedures relevant to a task or problem being undertaken.

I agree with Pushkin (2007) when he argues that classroom practices and materials may be taking away the complexity of concepts –perhaps in an effort to make learning manageable. These may be delivering a washed down version of problems and procedures that allow the application of formulas and rules, but those practices and materials may not contribute to the development of competencies and problem solving skills.

In his discussion on critical thinking and problem solving Pushkin (2007) makes a very strong case for strategic knowledge from a cognitive perspective:

> For Pushkin (2007) "When we talk about the relationship between thinking and knowledge there are parallel hierarchies. Declarative knowledge is the lowest level of knowledge and is parallel to lower-order thinking. Procedural knowledge is parallel to higher-order thinking. The combination of situational and strategic knowledge, conditional knowledge (Schoenfeld, 1978), is parallel to critical thinking.
>
> While it is relatively easy to distinguish lower-order from higher-order thinking, it is not as easy to distinguish higher-order from critical thinking. According to Lewis and Smith (1993: 136), "higher order thinking occurs when a person takes new information and information stored and interrelates and/or rearranges and extends this information to achieve a purpose or find

possible answers in perplexing situations". While the parallel to procedural knowledge is evident, there is no explicit connection to conditional knowledge; in other words, higher-order thinking does not necessarily take the context of "perplexing situations" into account, something critical thinking does. In physics problem solving, for example, students often take mathematical equations and derive them into new expressions towards solving multi-step problems. In chemistry problem solving, students can combine their knowledge of chemical formulas, molemass conversions, and chemical equations to solve problems that involve stoichiometry. However, the question remains as to how much opportunity students have to contextualize a chemistry or physics problem.

The shift needed consists in moving away from standard textbook examples and problems –and other traditional classroom practices- and give room to learners to construct knowledge. Then the curricula needs to expand the scope of learning opportunities offered. In other words, the content and tasks presented should expand the skills and strategies that could be utilized. Teachers should consider offering a broadminded view by proposing a syllabus in which there is a textual, intratextua, extratextual and critical appraisal of the topics. A syllabus which gives learners the opportunity to apply to diverse situations: world knowledge, knowledge of linguistic context and schematic knowledge. A syllabus which makes connections to various texts and that establishes relationships with other disciplines.

> Knowledge must be built in terms of depth and breadth. Thinking needs to be more than on a linear level; it must be broad, situated, and interconnected. Learners not only need to appreciate what knowledge is, but how we use it, when and where we use it, and why we use it. Scientific literacy should mean more than mere mental possession of a volume of knowledge; possession has little value if it is not used to its fullest application." (Pushkin, 2007:10)

As a conclusion it can be said that Strategic knowledge along with situational knowledge can be considered as constituents of critical thinking, a mode of cognition that is associated with problem solving. The test for critical thinkers are the new situations that challenge learners to recognize unique characteristics of a problem, characteristics that dictate which concepts are specifically relevant to solving the problem. A critical thinker should be able to make decisions based on the knowledge transformed, and explain the implications of the solution proposed. Our challenge as educators consists in creating learning opportunities that supports learners in the development of strategic competence.

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