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Teaching metacognitive regulation of reading comprehension in an on-line environment

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TEACHING METACOGNITIVE REGULATION OF READING COMPREHENSION IN AN ON-LINE ENVIRONMENT

Abstract

This paper examines how to teach Cognitive Self-Regulation. Approaches to enhancing Metacognition are discussed and a model for metacognitive regulation is presented. A strategy of reciprocal teaching is advocated for the development of metacognitive regulation of Reading Comprehension. An on-line annotation tool is proposed with a rationale for how learning supports, resources, and activities may be included.

Introduction

As e-learning and other flexible modes of course delivery increase in popularity, much of the responsibility for learning has been transferred back to learners themselves. This responsibility is to a certain extent inherent in the process – after all, "learning is not something that happens to students; it is something that happens by students" (Zimmerman, 1989, p. 21). However, to assume that students who arrive in tertiary environments from a form of learning characterized by a high level of external regulation, are then able to operate independently as learners in a hopeful one at best. Students are expected to be able to engage academic tasks such as reading relevant literature, teamwork, and problem solving but often there is little assistance in getting students able to do so in a self-directed way.

There is much literature concerning the nature of Self-Regulated learning; what it is, and how it comes about (Paris & Byrnes, 1989; Pintrich & Groot, 1990; Schunk & Zimmerman, 1994). Most approaches view Self-Regulation as a combination of affective and cognitive elements, where the internal states of Metacognition and Self-Concept are mediated through Self-Monitoring and Motivation, to develop Cognitive and Volitional Control Strategies (Zimmerman, 1989). If one is to examine the cognitive component of Self-Regulation a question becomes immediately apparent. How does one make students better self-regulators? We know that students who are self-regulating are metacognitively aware, engage in Self-Monitoring, and are able to develop regulatory strategies, but where should instruction be pitched? It is a 'chicken or egg' argument. Simply focusing on the strategic outcomes of self-regulation does not ensure their metacognitive use. Nor is Metacognition something that is immediately accessible, since it is a state, rather than a process. What follows is a discussion of the role of Metacognition in Self-Regulated Learning and a proposal for how it can be developed in the domain of Reading Comprehension through an on-line annotation tool that engages students in a variety of tasks informed by the strategy of reciprocal teaching. The ultimate aim is for students to move from a supported environment for course readings to an ability to do so independently. In order to achieve this however, the issue of how students can be 'made' metacognitive must be addressed.

The problem with Metacognition

Wilson (1999) argues that the term Metacognition can be used in 'vague, confusing, and often contradictory' ways and can be used to describe a range of disparate higher level cognitive skills. She goes on, however, to define Metacognition as "awareness individuals have of their thinking and their evaluation and regulation of their thinking". In this definition it is both a state and a process, with 3 functions:

- Metacognitive awareness – individuals' awareness of their learning process, knowledge about content knowledge, and knowledge about their own strategies
- Metacognitive evaluation – individuals' judgments of their capacities and limitations
- Metacognitive regulation – the conscious modification of thinking using cognitive resources.

From this perspective, Metacognition actually involves regulatory processes and is therefore not so different from Self Regulation itself. In fact it could be argued that evaluation is similar to self-monitoring, and regulation is the formation and application of strategies. Inevitably, discussions of Metacognition are tied in with discussions of the overt use of monitoring and strategy development, as that is how it is manifest:

Examples of general metacognitive awareness include evaluating the adequacy of relevant domain knowledge, selecting strategies that are situationally appropriate, and allocating cognitive resources to a degree that matches task demands. (Schraw, Dunkle, Bendixen, & DeBacker Roedel, 1995, p. 444).

This position is further reinforced by Jacobson (1998) who defines Metacognition both as "knowing the process by which one learns" (p. 3) and, in citing Borokowski, Carr, and Pressley (1987) as "the self-monitoring of, and conscious use of learning strategies" (p. 4).

This apparently contradictory position of being a both a state and a process can be reconciled by acknowledging the dependence of metaknowledge upon domain dependent cognitive processes. In their research on metamemory, Nelson & Narens (1994) identify the relationship between the meta-level and the object-level of cognition through a reciprocal flow of control and monitoring. While the model itself is perhaps a little simplistic, it does give some hope to those floundering in the problem of how to enhance Metacognition in students. In Nelson and Narens' concept, one can view Metacognition as a kind of cognitive 'tamagochi'. in order to grow and become strong it must be fed and exercised. The process of monitoring nurtures Metacognition, likewise the activation of control processes exercises it.

It can be argued, then, that Metacognition is not something that can be tackled as a discrete entity – just as well, since it is quite inaccessible as such – but can be enhanced through engaging at the subordinate levels of self-monitoring and strategy development. Indeed, this is an implicit assumption made by many researchers who focus on the strategy and monitoring components of the self-regulatory model, with a view to developing Metacognition.

Teaching Metacognition

The reconciliation of Metacognition with its subordinate processes may provide assistance in identifying the means by which Self Regulation is developed, however, the question of how to teach Self-Regulation is still problematic. After all, it is something that comes from the student rather than being externally imposed (Brooks, 1997). This paradox is obviously untenable. For students to develop Cognitive Self-Regulation strategies, they need to engage in the process of Self-Monitoring and employ strategies to control their cognition. The question, then, is how best can on-line instructional approaches activate these processes and provide support for their development.

Here, the very concept of Self-Regulation becomes prone to the usual philosphical debates of learning theory. While it is inherently cognitive in nature, it can be viewed through various theoretical lenses such as Behaviourist, Phenomenological, Social Cognitive, Volitional, Vygotskian and Cognitive Constructivist theories (Zimmerman, 1989). Common to all of these is the acknowledgement of a specific set of conscious strategies that are employed and developed through a process of self-monitoring, whether this self-monitoring is identified in terms of Vygotskian inner speech or Behaviourist Self-Reinforcement.

Rather than argue from a single theoretical perspective, each approach offers a view as to how to firstly engage the self-monitoring crucial to Self-Regulation, and secondly assist students in the conscious formation of Self-Regulatory strategies. There is significant debate as to whether executive control strategies can be effectively taught directly, or whether they must be acquired indirectly over a long period of time. Nickerson (1988) sites opposing viewpoints. Gagne (1980) for example has argued that they can not be taught directly, while Greeno & Simon (1984) and Tuman and Rief (1980) are more open to the possibility. It is certainly true that those who are poor regulators aren't likely to be changed quickly; even when students know WHAT to do, it doesn't necessarily mean they'll do it. (Brooks, 1997). Therefore any approach to learning for Self-Regulation must adopt a multi-pronged approach. Lin (2001) advocates two basic approaches to supporting metacognitive development – strategy training and creating a supportive social environment. Within each, the focus can be domain specific (e.g. reading comprehension, writing skills, problem solving) and domain independent, dealing with knowledge of oneself as a learner.

The distinction between domain-specific and domain-independent functions is an important one. In questioning 'Does a General Monitoring Skill Exist?' Schraw et al (1995) conduct two experiments to determine whether self-monitoring is a domain-specific or a domain-general skill. Their findings leant 'qualified' support to self-monitoring as a domain-general activity, concluding "domain-general monitoring skills emerge late in development, are preceded by modularized monitoring skills, and emerge only after considerable effort has been devoted either implicitly or explicitly, to integrating monitoring skills across domains" p.442. Markman & Gentner (2001, pp. 223-224) concur, stating "even in the seemingly abstract domain of mathematics, cognitive performance is affected by domain content." They go on to

cite several studies that highlight the context-laden nature of cognition. The implication of this for any teaching model for Self-Regulation is that instruction need not be contextless, and indeed the abstraction of domain-specific Metacognition to a general awareness is an ideal but intangible goal, that must firstly be grounded within a specific domain.

Below is a proposed model for Metacognitive Self-Regulation. As can be seen, it is viewed in this model as a holistic internal state, integrating Self-Monitoring as well as the formation and activation of strategies. The model also accommodates the domain specific and domain independent nature of Self-Regulation, with the implicit assumption that domain independent Self-Regulation occurs only through the development of domain dependent skills, and through a further process of monitoring to generate general principles and strategies.

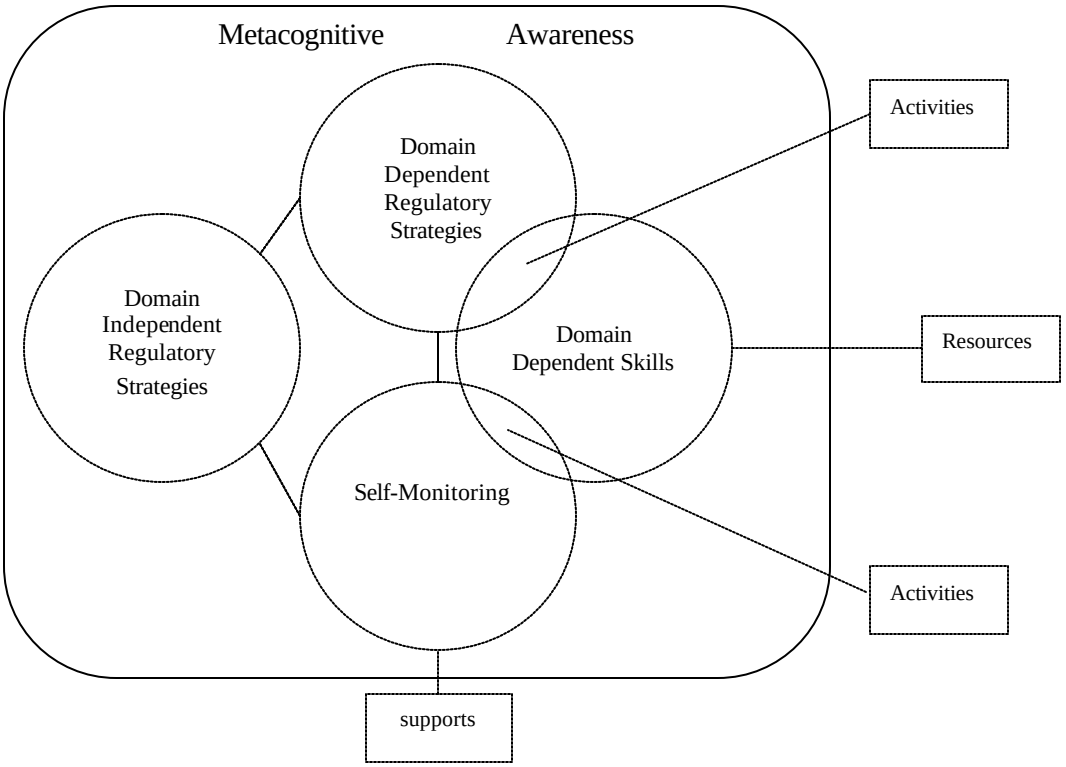

Figure 1 – A Model for Teaching Metacognitive Self-Regulation

The question remains however as to how a learning environment can promote these aspects. Oliver (1999) has argued that teaching can broadly be defined as the arrangement of supports, activities and resources to promote learning, and this has been integrated into the model. A previous paper (McMahon & Oliver, 2001) has proposed a number of examples of each as having the potential to provide the structure necessary for both cognitive and affective components of self-regulation. Resources such media rich content, and primary sources offering multiple perspectives can combine with supports such as on-line discussion, collaborative support, and modeling. These are framed by activities such as inquiry learning, problem solving and so on. What this paper advocates is a more focused approach than has been offered previously; one that directs itself specifically at the metacognitive awareness integral to Self Regulation, as well as an acknowledgement of its domain dependence.

Enhancing Metacognitive Self-Regulation through Self-Monitoring and Strategy Instruction

A number of general tenets are claimed within the literature for what characterizes effective environments for Metacognition. Blakey and Spence (1990) cite Dirk's synthesis of much of the literature on Metacognition into the following features:

1. Connecting new information to former knowledge.
2. Selecting thinking strategies deliberately.

3. Planning, monitoring, and evaluating thinking processes. (Dirkes, 1985).

Each of these tenets aligns closely to the model proposed above. Connecting new information with former knowledge is primarily driven by the context of learning, and within a framework of skills inherent in a specific task. Thus it is integral to Domain-specific Skills. The second involves the actual development of use of regulatory strategies applied to a task. Planning, evaluating and monitoring, however, define the internal processing used to support the acquisition of domain specific skills and inform the application of regulatory strategies. These can collectively be considered as Self-Monitoring as they all foreground the reflective process that informs the creation and revision of plans through an evaluative feedback loop.

In developing an approach to instruction, then, three questions need to be answered for an environment to promote Self-Regulation:

- What types of resources are necessary to assist in the creation of domain specific skills?
- What activities have the user engaging in regulatory strategies and reflective practices within a specific domain?
- What supports are required to activate the monitoring required to ensure such skills and regulatory strategies become directed by the learner rather than by the nature of the environment itself?

The first two questions are predominantly influenced by the outcomes defined for a specific course or unit of instruction. Such outcomes can be lower order in nature, based around content acquisition, or higher order, as is the case for most university tasks. Examples of these are skills such as reading comprehension, research, and collaborative skills. These skills are inherently grounded within content and the academic context in which they are applied. The metacognitive aspect comes from the ability to apply a domain specific skill such as problem solving across different types and examples.

The third, therefore, involves the internalization of the learning towards more general self-directed practice. It is in providing such supports that differing theories abound. There are many general guidelines for framing activities, supports and resources for Metacognition. Grabinger (1996) for example cites the following strategies:

- Students should be asked to identify consciously what they "know" as opposed to "what they don't know."
- Students should keep journals or logs in which they reflect on their learning processes, thinking about what works and what doesn't.
- Students should manage their own time and resources, including estimating time requirements, organising materials and scheduling the procedures necessary to complete an activity.
- Students must participate in guided self-evaluation through individual conferences and checklists to help them focus on the thinking process.

Another set of suggestions are as follows:

- Identifying "what you know" and "what you don't know".
- Talking about thinking
- Keeping a thinking journal
- Planning and Self-Regulation
- Debriefing the thinking process
- Self-evaluation (Blakey & Spence, 1990)

If one is to interrogate such strategies, one can see that the can come from many sources, and are identified at the levels of resource and activity as much as learner support. Ultimately, self-monitoring is requires and evaluating one's performance against those goals through an evaluative feedback loop. Such feedback can come from many places including the teacher, other students, and the activities and resources themselves.

An approach to developing Metacognitive Self-Regulation through Reciprocal Teaching Strategies for Reading Comprehension

Since it has been argued that Metacognition is initially domain dependant, then an approach to teaching must initially be tied to a set of relevant skills. There are obviously many skills relevant to the domain of academic study, such as problem solving, research, teamwork, and so on. On particular skill necessary for self-regulated learning is that of Reading Comprehension. Many units at ECU, for example require students to engage in reading journal articles and text chapters. The types of content in these are not always formally 'taught' – it is expected that the students will be able to engage in this process in an independent and self-regulated way.

Dole, Duffy, Roehler, & Pearson (1991) synthesized the research on Reading Comprehension to identify the following regulatory strategies that are inherent in the skill.

1. Determining Importance
2. Summarizing Information
3. Drawing Inferences
4. Generating Questions
5. Monitoring Comprehension

While at one level they involve defined activities, they are also general regulatory strategies that can be applied to any text within the skill of Reading Comprehension. The key, then, is now to identify the supports, activities, and resources necessary to promote the metacognitive use of these.

Palinscar & Brown (1984) propose a well known approach to teaching Reading Comprehension called Reciprocal Teaching. In this theory, there are three main components to supporting learning:

- dialogue between students and teacher, each taking a turn in the role of dialogue leader;
- "reciprocal" interactions where one person acts in response to the others;
- Structured dialogue using four strategies: questioning, summarizing, clarifying, predicting

Inherent in these components is the concept of dialogue and reciprocation. Learners take on the roles of teachers as well as students, and learning takes places through a process of discussion, and negotiation. It is this which provides the support necessary for self-monitoring to take place. What makes it pertinent to Metacognitive Self-Regulation is that it is an approach, which while initially structured, and teacher driven has the ultimate goal of moving from guided practice through the gradual release of responsibility to students' independent development and use of such strategies. (Duke & Pearson)

The activities of Questioning, Summarizing, Clarifying and Predicting can offer a gateway to the strategies inherent in reading comprehension. Obviously, however, it is not merely the practice of such strategies that will develop the self-regulatory use of them. Activities must also be grounded in self-monitoring activities and a feedback mechanism or support to mediate that self-monitoring.

Rosenshine & Meister (1994) ally Reciprocal teaching with three particular approaches to support: The Zone of Proximal Development (Vygotsky, 1978); Proleptic Teaching (Wertsch & Stone, 1979); and Scaffolding (Wood et al, 1976). All of these have their basis in Social Constructivist theory. Indeed, while Vygotsky never used the term scaffolding, his descriptions of interventions where 'new means of solving tasks' are made available through social discourse inform the approach. Proleptic teaching specifically has learners as 'apprentices' who 'as they become more experienced and capable of performing more complex aspects of the task … modeled … time and time again, they are ceded greater and greater responsibility until the become experts themselves' (Brown & Palinscar, 1989, p. 410). As the name suggests, scaffolding involves the provision of supports that are geared towards a student's particular capacities (within their Zone of Proximal Development) and are removed as the learner develops the ability to perform tasks independently. In this sense it has been argued that such approaches are similar to other forms of guided practice (e.g. Hunter, 1982; Good and Grouws, 1979) but in Reciprocal teaching emphasis is placed on encouraging students to provide instructional support for one another, instead of simply relying on the teacher as coach and mentor (Rosenshine & Meister, 1994). Scaffolds procedures include "reducing complexity to manageable amounts, marking critical features, and demonstrating solutions when the learner can recognize them" (Rosenshine & Meister, 1994). In summary, when embedded in the Instructional process of reciprocal teaching, learning is characterized as a process of emerging

expertise, that is adaptable and intentional, that comes about through scaffolding, where learners adopt modes that are highly interactive and reciprocal. (Dole et al., 1991, p. 256)

An On-Line Environment to Support the Development of Metacognitively Self-Regulated Reading Comprehension

In expanding on the model of Metacognitive Self-Regulation posited earlier, this paper proposes a design for a learning environment based upon the processes outlined in Figure 2.

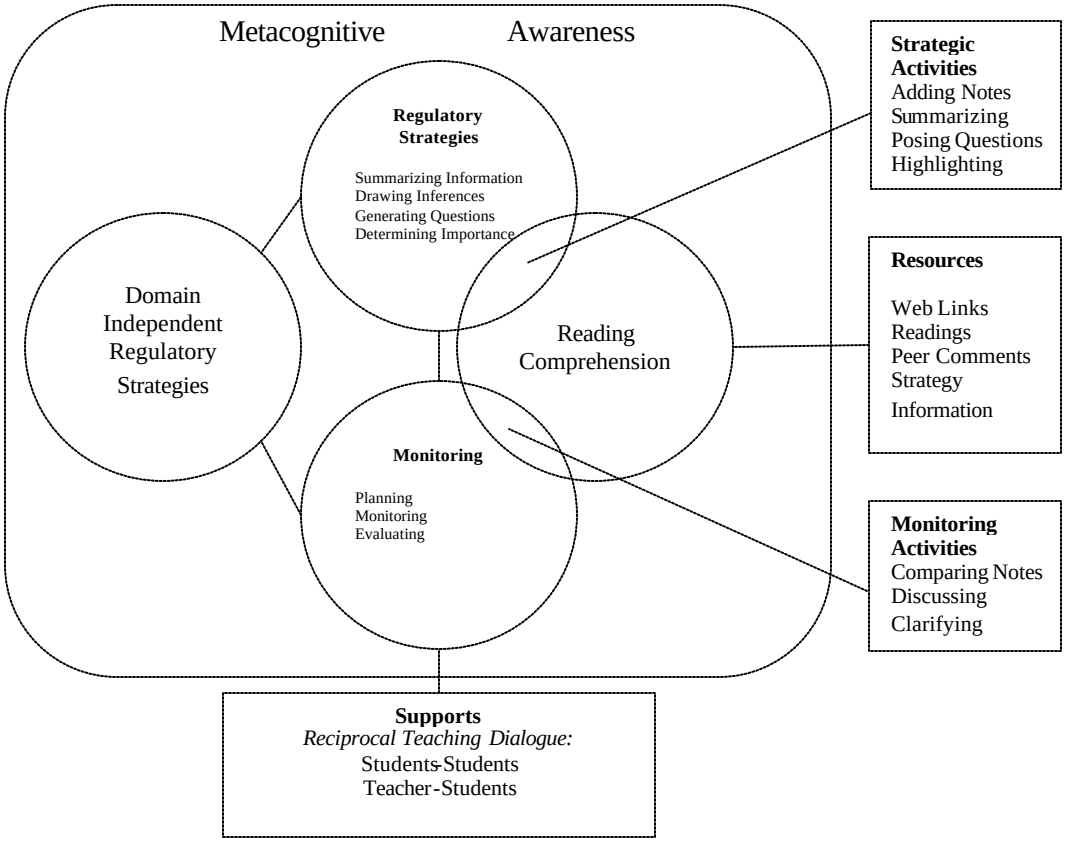

Figure 2 – an elaborated model as it applies to the domain of Reading Comprehension

MARK-UP is a web-based annotation tool to assist in the development of Metacognitive Self-Regulation for Reading Comprehension. It will provide the opportunity for students to engage in the regulatory strategies inherent in the task through activities of annotation, summarizing, posing questions, and highlighting. These will be framed around resources in the forms of reading content (articles in PDF form), web links, peer comments, and expository material provided by the teacher about effective reading strategies. Students will be able to annotate readings in the ways mentioned above, which are then stored in a database form which can be later accessed. To assist in the self-monitoring required, reflective activities will be embedded in the tool. Users, will, for example, be able to compare their own annotations, summaries, etc with others. They will also be able to seek clarification from teachers and other students through e-mail and discussion facilities. Support for this approach is found in the scaffolding inherent in reciprocal teaching, where appropriate strategies are initially modeled by an expert, and where students themselves provide guidance for each other, in a way where such supports are eventually faded to a point where learners are able to engage in these processes in a self-directed way (Nickerson, 1988).

It must be clarified that the tool itself is not a 'magic bullet' for Self-Regulation. Scaffolding is a process that is inherently dependent upon the quality of the interaction between the supports, resources, and activities in which the

learner engages. Care will need to be taken in the implementation of *MARK-UP* to ensure a deep level of monitoring takes place throughout its use. Also, in its current form, it will only be able to address the specific skill of academic reading comprehension. Nevertheless, the need for new approaches to making learners more independent in their use of strategies, and more aware:

There is a pressing need for more research on the question of what sorts of teaching/learning environments are conducing to the teaching/learning of thinking and what sorts are not. And it must be the priority of the educational system to develop conducive ones, or at least find ways to work around specific aspects of environments that are shown to inhibit thinking or the learning thereof. (Nickerson, 1988, p. 40)

MARK-UP is one attempt to address this need. Once completed in February 2003, it will be used as a tool to research how effectively Metacognitive Regulation can be stimulated within the common university task of engaging in academic literature.

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