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ABSTRACT

A working model of self-regulated learning based on the literature was developed together with an inventory of 71 items designed to test the five dimensions of the model: metacognition, learning strategies, motivation, contextual sensitivity, and environmental utilization/control. A five-point Likert scale was used to rank the items. Subjects were 104 students (21 males and 83 females) who were enrolled in classes in the college of education at a medium-sized midwestern university; participation was voluntary. The student GPA (grade point average) was used as the measure of academic achievement, and the subjects' scores on the inventory and its subscales correlated significantly with GPA. A significant correlation between sex and total score was also found, with females outscoring males on total score and all of the subscales except metacognition. (It is suggested that this result may be due to the small number of males in the sample.) While not statistically significant, data on inventory scores and class (freshman, sophomore, junior, senior, graduate) indicate the possibility that students become increasingly self-regulated as learners over the course of the college experience. It is concluded that self-regulated learning is an important component in academic success and that it can be measured via a self-report instrument. It is suggested that this inventory could be used for diagnostic predetermination of the level of self-regulation present in a particular learner, information that could be used to advantage in designing instruction designed to counteract any deficiencies in self-regulatory skills. A copy of the model with its dimensions and subscales is appended. (18 references) (BBM)

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The Development and Evaluation of a Self-Regulated Learning Inventory and its Implications for Instructor-Independent Instruction

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The Development and Evaluation of a Self-Regulated Learning Inventory and its Implications for Instructor-Independent Instruction

Few would argue with the claim that the ideal learner/student/scholar is organized, autonomous, self-motivated, self-monitoring, self-instructing, in short, behaves in ways designed to maximize the efficiency and productivity of the learning process. We would like our classrooms to be filled with such learners. Unfortunately, they rarely are. Our students, all too frequently, are underprepared and/or unmotivated with respect to productive academic performance. Given present day cultural and economic conditions, the consequences of academic underachievement can be disastrous, both for the individual and our society as a whole (National Commission on Excellence in Education, 1983; Jones & Idol, 1990).

Not surprisingly, a general call has gone out to the educational community to find ways of improving student performance. Such improvement will require changes on a variety of fronts. Current emphases on changing our curriculum, standards of achievement, and educational choice surely represent important steps in the right direction. However, equal attention must be paid to factors more or less directly under the learner's control. Too great an emphasis on the role of external conditions and factors tends to suggest that student performance is, in large measure, determined by forces outside of the learner's control; that good students are the products of education rather than the producers of educational outcomes. Such a view lacks balance and may be seriously misleading. Why are some students successful despite less than optimal educational conditions? The reasons are surely complex. One set of factors that are likely to prove significant involves what has come to be called **self-regulated learning** (Borkowski, et. al., 1990; Zimmerman, 1990).

The self-regulated learning perspective is multi-faceted and draws on contemporary developments on several theoretical fronts. Nevertheless, according to Zimmerman (1990 , p.4), "a common conceptualization of these students has emerged as metacognitively, motivationally and behaviorally active participants in their own learning." In other words, self-regulated learning is purposive, goal oriented and involves behaviors designed to maximize academic performance. While all students, barring those who are totally tuned out, are probably active in the manner just described, self- regulated learners appear to be both more keenly aware of the relation between specific behaviors and academic success and more likely to systematically and appropriately employ such behaviors. Perhaps most importantly, self-regulated learners are successful learners (Zimmerman & Pons, 1986). It follows that understanding the behaviors and processes that underlie self-regulated learning represents an important goal for educational researchers.

Contemporary approaches to self-regulated learning (although not limited to) are presently dominated by two main theoretical frameworks: Social learning/cognitive theory and information processing theory. Zimmerman and Pons (1986), for example, working out of the former, have defined self- regulated learners in terms of fourteen dimensions which span a spectrum from cognitive to behavioral to social factors.

A variety of research either specifically identified as focused on self-regulatory processes (Borkowski, Carr, Rellinger & Pressley, 1990; Pressley & Ghatala, 1990), or indirectly concerned with self-regulatory mechanisms (Baker 1989; Brown 1978; Glenberg, Wilkinson & Epstein, 1982; Justice & Weaver-McDougall, 1989; Leal 1987; Spring, 1985), has been conducted from an information processing orientation. The primary dimensions of interest for information processing theorists include metacognitive processes, learning strategies, and motivational factors related to self-attributions (the latter also being an ar.. of interest for social-cognitive theorists). Clearly, self- regulated learning is a multi-dimensional and complex phenomenon that transcends boundaries of interest that have separated researchers operating out of differing, and sometimes competing, theoretical orientations.

While our own research, at this juncture, has not been primarily theoretically motivated, we did find it necessary to impose an organizational structure on the various dimensions of self-regulated learning reported in the literature. We believe, in fact, that the model we have generated may be one of the more useful elements emerging out of our efforts. Our working model of self-regulated learning presently consists of five dimensions: **Metacognition, learning strategies, motivation, contextual sensitivity and environmental utilization/control** (see appendix A for our model and examples of our categorization scheme). In developing this model, we reasoned that the successful learner must both internally (we use the terms internal and external in a relative sense only since no absolute separation in the meaning of theses concepts as psychological constructs is possible) regulate, monitor, evaluate and modify, when necessary, the learning process, and be sensitive to and utilize or control contextual (external) factors such as course and instructor demands, where and when to study, who to go to for assistance, etc. Most of the various self-regulated strategies reported in the literature fall into one or another of the categories we have chosen. We argue, for example, that self-monitoring and self-evaluation are best construed as aspects of the metacognitive component of the learning process rather than as independent categories as in, for example, the scheme of Zimmerman and Pons (1986). The same reasoning can be applied to various categories of information processing reported in the literature (Pintrich, Smith & McKeachie, 1989; Weinstein, Zimmerman & Palmer, 1988) which we subsume under the broad notion of learning strategies (e.g., organizing and transforming, selecting main ideas, restating, etc.). Similar reasoning led us to subsume the interesting and important notion of epistemological beliefs (Shommer, 1990) under the general category of motivation.

Having devised a model of its components we felt was both economical and intuitively compelling, we set out to determine if self-regulated learning indeed played a vital role in successful academic performance. We chose to do this by employing a self-report inventory of our own design, composed of five subscales consistent with our model of self-regulated learning. We opted to develop such an instrument because (1) to our knowledge no instrument of its kind existed, and (2) because we believe that measuring the extent to which a learner is self-regulating has important implications for designing individualized instructional interventions not typically taken into account by instructional designers. In what follows, we first describe the development of our diagnostic tool and what it reveals about the nature of successful academic performance. We then go on to discuss potential technology based applications and implications of our work.

Development of the Self-Regulated Learning Inventory. Our first step in the creation of a self-regulated learning inventory involved the generation of an item pool. We decided to review the literature and to construct our items on the basis of findings that reported strong relationships between learner-generated activities and academic success. The result was a pool of approximately 100 items. We then reviewed and analyzed the items eliminating those that were too much alike and rewriting those that were either too complex or too vague. This left us with a pool of seventy-one items all of which were included in our first instrument. Although the items represented five subscales, we decided to present them randomly as a single test. A five-point Likert scale format was chosen as most appropriate for this type of instrument.

A pilot run was conducted to see if directions were clear and sufficient, how long it took to respond to the inventory and if the items as written were clear and comprehensible. As a result, a formal set of instructions was composed. It was determined that time to complete the inventory ranged from 20-30 minutes (see appendix B for sample items).

Subjects. Our subjects were all students enrolled in classes in the college of education at a medium size mid-Western University. Unfortunately, the majority of education majors continue to be female. Thus, our sample contains an imbalance in terms of males (21) and females (83); a weakness we are seeking to redress. Permission was granted to administer the inventory to intact classes by several instructors. Classes ranged in size from thirty to ten. In total, the inventory was responded to by 120 students. Only 104 cases were actually analyzed due to the failure of some students to properly report requested information and, in some cases, due to questionable patterns of responding such as circling the same number for every (or nearly every) item.

Procedure. The inventories were administered in every instance by either one or the other of the authors. Having obtained prior permission from class instructors, we passed out the inventories and read the prepared set of instructions. Although participation was entirely voluntary, no student refused to fill out the inventory.

Results. We first report on findings that relate to the technical properties of the inventory. Table 1 shows the results of an analysis of internal reliability of the inventory and its subscales. We are encouraged by these results, although by no

Table 1

Reliability Coefficients

	MCS	LSS	MOS	CSS	ECS
Alpha	.72	.77	.75	.59	.65

means satisfied. Data for the calculation of test-retest reliability were unavailable at the time of writing this report, hence we are unable to provide this information at this time.

An analysis of the correlation between each of the items on the inventory and student GPA, as well as a correlation of each subscale item with the total score for that subscale, was conducted. Three items failed to correlate significantly with either subscale total score or GPA and will have to be replaced.

Our only evidence with respect to validity at this point is indirect. That is, our items were constructed on the basis of findings in the literature related to the construct we set out to measure. An analysis of the correlation between scores on the inventory and GPA, our measure of academic achievement, revealed a significant correlation both for the inventory as a whole and for each of the subscales (see Table 2). This result corresponds to findings as reported in the supporting literature.

Table 2

GPA and Scores on the Inventory

	MCS	LSS	MOS	CSS	ECS	SRLTOT
Correlation	.46**	.46**	.45**	.29*	.40**	.56**

* p <.01, ** p <.001

As noted, we selected student GPA as our measure of academic achievement. We have already shown that scores on the inventory and its subscales correlate significantly with GPA. The largest correlation obtained was between GPA and total score (SRLITOT). We also obtained information for each subject on class (F,S, JR, SR, GRAD), age, sex and race. Analysis of these data revealed a significant correlation between sex and total score on the inventory. Table 3 shows the scores for males and females on the inventory and its subscales. It can be seen

Table 3

Sex X Inventory Score (mean scores)

	MCS	LSS	MOS	CSS	ECS	SRLTOT
MALE**	57.6	61	50.7	34.25	35.4	238.95
FEMALE*	57.49	66.4	54.3	36.44	38.01	252.95

** N= 83
* N= 21

that females outscore males on total score as well as all subscales except metacognition. While these differences are, in most instances, statistically significant, we hesitate in drawing a firm conclusion due to the small number of males in our sample.

The data for scores on the inventory and its subscales and class are presented in Table 4. While not statistically significant ($p<.10$), they do indicate the possibility of an interesting trend in student development; that is, that students become increasingly self-regulated as learners over the course of the college experience.

Table 4

Class X Inventory Score

	MCS		LSS		MOS		CSS		ECS		SRLTOT
	M	SD	M	SD	M	SD	M	SD	M	SD	M
SO	55.8	5.6	63.5	7.0	52.4	5.4	35.2	4.4	36.9	4.4	243.8
JR	57.8	7.3	67.2	7.5	53.7	6.7	36.8	3.6	37.8	5.2	253.4
SR	58.4	5.1	64.8	5.0	54.7	5.5	35.4	2.9	37.4	3.9	250.9
GR	61.0	7.3	65.3	11.1	54.5	6.6	38.5	5.8	39.5	1.7	258.8
Total Possible	85		90		75		50		55		355

Note: SO - N=31, JR - N=41, SR - N=27, GR - N=5.

Discussion. Our results lead us to conclude both that self-regulated learning is an important component in academic success and that it can be measured via a self-report instrument. The results of our analysis of the data indicate a substantial relationship exists between self-regulated learning and GPA. This result is in line with published research on self- regulated learning (Zimmerman & Pons, 1986, 1988; Zimmerman, 1990). The fact that total score showed the highest correlation with performance is in line with the work of Zimmerman & Pons (1988) who also found self-regulated learning could be treated as a single, overarching factor. Our results further suggest that successful students may become increasingly self- regulating over the course of the college experience. This finding, however, needs further exploration.

Our research, as well as the research of a number of others (Zimmerman, 1990) lends support to the claim that self-regulatory skills are important components of successful academic performance. The question is: what implications do such findings have for the design of instructor-independent facilitation of the learning process? Two elements appear to be essential to designing effective ways of facilitating the acquisition of complex cognitive skills: an understanding of the learner and the learning process, and properly anchored learning contexts, or practice environments. Our model of self-regulated learning, we think, provides a viable, comprehensive, and relatively unique basis for the former. Our inventory, which could be electronically administered, allows for diagnostic predetermination of the level of self-regulation present in a particular learner. Such information is likely to prove crucial for determining the degree to which a particular learner is ready to benefit from instructor-independent instruction. The fact that a given learner may be more or less able to self-regulate also suggests that a variety of instructional options must be developed to suit the needs of different types of learners. Specifically, it may be necessary, when self-regulatory skills are deficient, to develop instruction designed to counteract this deficiency. As to the problem of anchoring instruction, we believe that computer, particularly multi-media, based approaches offer the most viable and cost effective solutions.

There are several reasons why we believe videodisc technology and multimedia offers a viable solution path to instructional interventions of the kind we have in mind. As noted, a general theme in contemporary instructional psychology is that effective instruction must be contextually grounded, or "situated" (Brown, Collins & Duguid, 1989; Cognition and technology group at Vanderbilt, 1990). From this perspective, instruction, ideally, would take place within real-world settings resembling as much as possible the actual contexts in which the skills to be learned would be applied. Practically speaking, however, such an approach is difficult, perhaps impossible, to effect on a grand scale. To make matters worse, such a strategy presents additional difficulties for instruction in skills considered not part of the standard curriculum. Videodisc technology, however, lends itself to a reasonable compromise. At the very least it should be possible to create problem contexts that resemble closely real-world situations for students to ground their learning experiences in. In terms of our own aims, it should be possible to recreate the context of academic tasks faced by students in real classrooms by using videodisc technology to lend a sense of reality to instruction aimed at promoting self-regulatory skills. At the same time, since these would be true-to-life simulations, students would have the opportunity to try out various strategies without the pain of a failed exam or course. Furthermore, since metacognition is vital to self-regulated learning, a computer-based approach allowing for use of the instructional program as a temporary self-reflective "executive" that prompts (thereby increasing awareness), monitors and evaluates performance, appears a potent method for the building of this crucial component of skilled learning.

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Appendix A
Dimensions of Self-Regulated Learning
A Working Model

A. Metacognition

Definitions

1. Regulation of cognition
   a. Planning/deciding
   b. Monitoring
   c. Evaluation/checking
2. Knowledge about cognition
   a. Knowing **what** to do
   b. Knowing **how** to do
   c. Knowing **when** to do
   d. Knowing **where** to do
3. Self-reflective awareness

Types

1. Metacomprehension
   a. Text processing
   b. Listening skills
2. Metamemory
   a. General strategy knowledge
   b. Metamemory acquisition procedures
   c. Specific strategy knowledge

B. Learning Strategies

Definitions

1. Plans organized to facilitate successful learning
2. Skills specific to achieving learning goals
3. Procedures that accomplish academic goals

Types

1. Text processing strategies
   a. Underlining main ideas
   b. Summarization
   c. Using imagery
2. Lecture/discussion processes
   a. Notetaking
   b. Graphic representation
   c. Recasting

C. Motivation

Definitions

1. Awareness of the relationship between effort and outcome
2. Sense of mastery/competence
3. Desire to learn

Types

1. Causal attributions
2. Locus of control
3. Self-efficacy
4. Epistemological Beliefs

D. Contextual awareness/sensitivity

Definitions

1. Ability to gauge task demands
2. Ability to balance task demands with personal resources
3. Ability to judge the relationship between learning task and assessment

Types

1. Cue sensitivity
2. Congruence assessment

E. Environment utilization/control

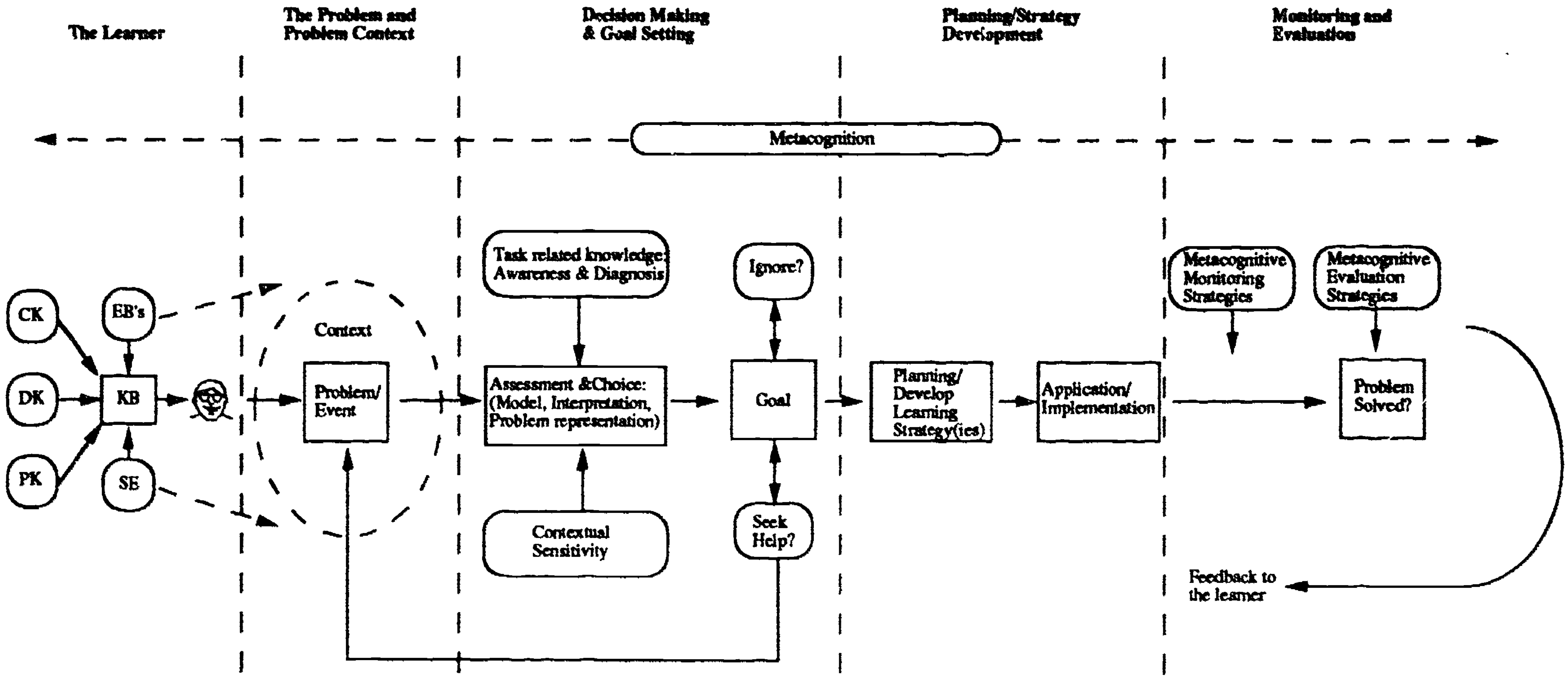
Definitions

1. Knowing where to find assistance
2. Planning and scheduling
3. Establishing a learning environment

Types

1. Help seeking
2. Goal setting
3. Staging

Appendix A (continued)
Self-Regulated Learning Model



Key:
CK=Conditional Knowledge
DK=Declarative Knowledge
PK=Procedural Knowledge
EB's=Epistemological Beliefs
SE=Self-Efficacy
KB=Knowledge Base

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Appendix B
Subscales of The Self-Regulated Learning Inventory with Sample Items

I. Metacognition Scale

1. After studying, I mentally review the material to get a sense of how much I have remembered.

2. When reading a text, or reviewing my notes, I periodically pause and ask myself: Am I understanding any of this?

II. Learning Strategy Scale

1. When preparing for an essay-type exam, I try to put the material I am studying into my own words.

2. When I need to remember a list of items or names, I actively recite or rehearse them until I can recall them from memory.

III. Motivation Scale

1. I prefer courses that are moderately challenging to easier ones.

2. If I have a good instructor, I do well. If I have a poor instructor, I do poorly. It's that simple.

IV. Contextual Awareness/Sensitivity Scale

1. The type and demands of a particular course have a lot to do with the kind and amount of studying I engage in

2. I try to determine what a particular instructor is looking for in terms of performance on the part of students and adapt my approach to the course accordingly.

V. Environment Utilization/Control Scale

1. When I study, I make sure I have enough time and a quiet place to go.

2. If I find I do not understand material covered in a text or in a course, I try to get help from someone who does.