(1984), led to a new pedagogical optimism and renewed interest in training studies, and contributed at the same time to a decline in research in individual differences. The other trend is a growing interest in affective, motivational variables. It has become increasingly clear that there are close connections between metacognitive knowledge and beliefs and affective, volitional, and motivational variables.

More research on individual differences in metacogniton and executive control is needed. Although training studies are important and have great practical and theoretical value, they need a firmer empirical base of data concerning individual and developmental differences. There are still many unresolved questions concerning the relations between the three kinds of metacognition discerned. Furthermore, there are still a number of undiscovered areas of metacognitive knowledge and executive control. There is a need for a better theory of the developing individual differences and their interrelations so as to be able to produce better training programs.

See also: Affect, Emotions, and Learning; Cognition and Learning; Constructivism and Learning; Development, Learning, and Instruction; Expert Level of Understanding; Memory Development; Metacognitive Strategies, Teaching and Testing for; Problem-solving and Thinking, Development of Learning Skills in; Self-regulation in Learning; Transfer of Learning; Epistemology and Education

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Metacognitive Strategies, Teaching and Testing for

Metacognition is primarily concerned with those human reasoning processes that are necessary to solve problems for which no completely developed or automated procedures are available. Both knowledge of these processes and their control or regulation are typically subsumed in the concept of metacognition. This entry addresses a series of six questions related to teaching and assessing metacognition. These questions are:

(a) What aspects of metacognition should be taught?

(b) Who is likely to benefit from metacognitive instruction?

(c) What are the basic principles of metacognitive instruction?

(d) What is an appropriate amount of time for metacognitive instruction?

(e) What tasks should be used to teach metacognition?

(f) Where should metacognition be taught?

The answers to these questions are based primarily on the results of a series of related research studies (De Jong 1987, De Jong and Simons 1988, Simons

and De Jong in press; Simons 1989, Simons and Lodewijks 1987, Vermunt and Van Rijswijk 1988). Additional research studies are cited in support of answers to some of the questions. Several methodological issues are then discussed and a series of guidelines for future studies of metacognitive instruction is offered.

1. What Aspects of Metacognition Should Be Taught?

The selection of content to include in metacognitive instruction is not an easy task. Appropriate content can be chosen by examining the differences in metacognition of groups of students: high performing and low performing. Ideally, a diagnosis of the kinds of metacognitive processes not used by low-performing students would be made to corroborate this initial evidence obtained from the comparison.

A second source of content is the information contained in the theoretical and empirical literature. From this literature, three kinds of strategies and skills emerge: awareness of relevant regulatory processes, the possession of regulatory skills, and the availability and use of processing skills. These strategies and skills can form the basis for metacognitive instructional programs.

2. Who Is Likely to Benefit from Metacognitive Instruction?

Teaching students skills and strategies they already possess is not likely to be very effective, but if students lack some basic cognitive skills and affective dispositions, the success of metacognitive instruction also may be impaired. Students who lack essential reading skills, for example, can hardly be expected to benefit from instruction aimed at the improvement of study skills or self-regulatory reading skills. Similarly, students who do not believe that it is possible to regulate their own learning or who dislike the strategies being taught to them are not likely to benefit from metacognitive instruction.

Ideal students, then, are those who lack metacognitive skills and strategies, but who are not deficient in other respects. As a consequence, some diagnosis of the students' knowledge and emotional base seems necessary to the success of metacognitive instruction.

3. The Basic Principles of Metacognitive Instruction

Several principles can be derived from current research on metacognitive teaching and learning. Among the most important are the following:

(a) Learning activities and processes, rather than learning outcomes, must be emphasized (Process Principle).

(b) Learning is "thematized" and students are helped to become aware of their learning strategies, self-regulation skills, and the relationship of these strategies and skills to learning goals (Reflectivity Principle).

(c) The interaction of cognitive, metacognitive, and affective components of learning is central (Affectivity Principle).

(d) Students must be made constantly aware of the use and function of knowledge and skills (Functionality Principle).

(e) Teachers and students should strive for transfer and generalization, without expecting either to occur without practice in context (Transfer Principle).

(f) Learning strategies and self-regulation skills need to be practiced regularly, with sufficient time provided and with practice occurring in appropriate contexts (Context Principle).

(g) Students should be taught how they can regulate, diagnose, and revise their own learning (Self-Diagnosis Principle).

(h) Instruction should be designed in such a way that there is an optimal balance between the quality and quantity of learning activity (Activity Principle).

(i) The responsibility for learning should be shifted gradually to the students (Scaffolding Principle).

(j) Especially with younger students, relationships with parents and other adults should be emphasized so that initial attempts at self-regulated learning can be supervised (Supervision Principle).

(k) Cooperation and discussion among students is necessary (Cooperation Principle).

(l) Higher cognitive learning goals which require deeper cognitive processing should be emphasized (Goal Principle).

(m) New subject matter is learned as it becomes anchored to existing knowledge and preconceptions (Preconception Principle).

(n) Instruction should be tailored to the current conceptions of students (Learning Conception Principle).

Not all programs need to include all principles. At the same time, however, programs which adhere to more of these principles are likely to be more effective.

4. Time Needed for Metacognitive Instruction

In general, too little time is allocated to metacognitive instruction in most programs. This assertion does not mean that short training programs cannot have effects. In a study with adult students learning a foreign language vocabulary, impressive results were attained within one hour (Simons and De Jong in press). At the same time, however, short programs generally are not effective with younger children, less able students, and learning-disabled students. Longer programs are more likely to be effective than shorter ones, although research on the optimal length of instructional programs for teaching metacognition is clearly needed.

5. Tasks Needed to Teach Metacognition

The tasks used to teach metacognition should be ecologically valid. That is, they should resemble those tasks that students frequently encounter in and outside of school. If possible, the tasks should be those that students are expected to master in school and on which their performance is systematically monitored and evaluated. Tasks not meeting these criteria are often seen as irrelevant to students.

In addition, tasks assigned to students should be of appropriate difficulty. If the tasks are too easy, students can rely on routine, automatic procedures, and there is no need for regulatory processes. Overly difficult tasks are also problematic. For example, when high and low performing students were given a very difficult task, low performing students stopped working on the task, while high performing students kept trying to accomplish the task despite the fact that their efforts were ineffective, inefficient, and not improving (Simons and Liew-On 1991).

Finally, tasks assigned to students should be similar to those they are likely to be assigned in the "real world." While dissimilar tasks are appropriate from an experimental research perspective to examine issues of transfer and generalizability, it must be realized that the likelihood of transferring learning from tasks used in instruction to very dissimilar tasks is extremely small for most students (Salomon and Perkins 1989).

6. The "Where" of Teaching Metacognition

Since tasks used to teach metacognition should be as ecologically valid as possible, the most appropriate placement of these tasks is in the school curriculum. This embedding of metacognitive instruction in schools is not without its problems, however. Embedding often confuses students. Instead of only having to study and solve problems, students are asked to regulate the processes involved in studying and solving problems.

Prawatt (1991) has offered a resolution to this dilemma. He proposed that "immersion" approaches be developed. In immersion approaches the regulation skills are activated by the teacher without much attention from students. As a consequence, they initially are not viewed by the students as competing requirements. Only after they have been practiced by students and shown to be beneficial to them do they receive attention in the classroom.

7. Methodological Issues in Research on Metacognition

There are several methodological issues that need to be resolved in order to gain a substantially greater understanding of metacognition during the decade of the 1990s. They fall into three categories: experimental design, fidelity of implementation, and assessment of the effects of metacognition.

7.1 Experimental Design

One important question is the composition of a proper control group. Since only students who lack certain strategies and skills should receive instruction, the best control group consists of students who also lack the strategies and skills being taught, but who are not selected for treatment. Of course, random assignment to groups is essential in this case.

When random assignment is not possible, high achieving students who already possess the skills can be used as a "control group." Although these students do not comprise a control group in the traditional sense, they are better than no control group at all. The goal of metacognitive instruction is to give poorer students the strategies and skills used regularly by better students. In this regard, successful metacognitive instruction should be expected to reduce or remove the initial differences between poorer students who are provided with metacognitive instruction and better students left unaided.

7.2 Fidelity of Implementation

A second methodological issue concerns whether the metacognitive instruction envisioned by the designer of the instructional program actually occurs in the form intended in the experimental classrooms and does not occur in the control classrooms. There have been many instances in which intended interventions were distorted completely. In other cases students in control groups have been given the treatment, despite requests by researchers not to do so. Finally, students themselves can also distort interventions by failing to engage in or complete assigned work or failing to use materials or instructional aids offered to them.

7.3 Assessment of Metacognition

A third methodological problem occurs in the area of assessing the effects of metacognitive instruction. Most often, the goals of metacognitive instruction are stated in process terms. That is, instruction is expected to change the ways in which students pro-

cess information (e.g., summarize information, monitor their acquisition of information). Only indirectly is this instruction expected to influence student learning outcomes. Process measures are not always easy to design, efficient to use, or effective in terms of their technical qualities (e.g., validity, reliability). Nonetheless, the availability and use of adequate assessment techniques are the keys to understanding metacognition and improving metacognitive instruction.

8. *Guidelines for Future Studies of Metacognitive Instruction*

Based on the foregoing discussion, a set of guidelines pertaining to the design of studies attempting to increase or improve metacognition can be offered.

(a) Develop an instructional program which has the greatest likelihood of producing the desired results, and examine the effectiveness of the components of the program after its implementation by systematically dismantling it.

(b) Derive the content of the instructional program by looking at studies of the differences between high and low performers, experts and novices, and writings in a variety of theoretical frameworks.

(c) Develop an instructional program which includes at least the following goals or objectives: metacognitive awareness, regulatory skills, learning skills, and affective–motivation skills.

(d) In evaluating the effectiveness of the program, use students who lack the strategies and skills which are included as program goals or objectives. This will quite likely require some diagnosis of the current metacognitive levels of students.

(e) Extend the length of the program to ensure that the students have a reasonable chance of acquiring the metacognitive strategies and skills being taught.

(f) Evaluate the effectiveness of the program both during the program and after its completion.

(g) Incorporate into the program tasks that are ecologically valid and are of appropriate and varied levels of difficulty.

(h) Use effectiveness measures that estimate immediate achievement, "near transfer" of learning, and "far transfer" of learning. "Near transfer" can be facilitated by contextualizing the instruction; "far transfer" can be enhanced by decontextualizing the strategies and skills. Make sure that the learning process, rather than or in addition to learning products or outcomes are monitored.

(i) Embed instruction and immerse students in metacognitive learning in real school settings.

(j) Use control groups that either are composed of similar students (who are randomly assigned to treatment or control groups) or high performing students who serve as benchmarks for program success.

(k) Monitor the program to ensure that it is being implemented as intended; also, monitor the control group to check on the strategies and skills, if any, that they are being taught.

9. *Conclusion*

Understanding and being able to regulate what and how human beings think is central to teachers' ability to improve substantially how they teach their students. Providing students with metacognitive strategies and skills enables them to negotiate and meet the demands of a wide variety of educational settings and situations. While some students appear to use such strategies and skills almost naturally, most students can be taught to acquire and use them if the principles of effective metacognitive instruction are followed.

See also: Metacognition

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Mexico: System of Education

1. General Background

The United States of Mexico is a federal country located in the North American continent. It has a total area of nearly 2 million square kilometers. To the north it has a border of over 3,000 kilometers with the United States of America, and to the southeast it is bordered by Guatemala and British Honduras. To the east is the Gulf of Mexico and the Carribean Sea, and to the south and west there is the Pacific Ocean. Mexico has 31 states and one federal district. Each state is organized into municipalities of which there are 2,402 in the whole country.

Mexico has a population of 81.4 million inhabitants (1990 census). With one of the highest population growth rates in the world, Mexico has had more than a fivefold increase in its population since the beginning of the twentieth century, when the population was 15.1 million. Although in the period from 1970 to 1990, the annual population growth rate decreased, 60 percent of the population is under 24 years of age. An enormous effort was required to offer educational services to such an expanding population, and this explains why enrollment in the formal school system is only 31 percent of the total population.

The population is unevenly distributed. Population density in the states ranges from 43 to 5,500 inhabitants per square kilometer. The Federal District and one neighboring state include 22.2 percent of the total population. The percentage of the population living in urban areas increased from 42.2 in 1950 to 58.7 in 1970 to 71.3 in 1990. From 1970 to 1990 the percentage of the population living in cities of greater than 100,000 inhabitants increased from 23 to 44.4 percent.

Spanish is the official language, although more than 93 languages and dialects are still used by 5 million inhabitants, of whom nearly 1 million do not speak Spanish. Among the most important languages are the Mayan and the Nahuatl. Nearly 90 percent of the population is Roman Catholic.

The labor force comprised 24 million persons in 1990; of these, 19.6 percent were female. Nearly 23 percent of the active population was engaged in agriculture but contributed only 8 percent of the Gross Domestic Product (GDP). Some 28 percent of the labor force was in the secondary sector and 46 percent in the tertiary sector; these sectors contributed 23 and 52 percent to the GDP respectively.

Since the early 1980s, Mexico has gone through a series of transformations after the severe crisis triggered by the decline of oil prices at the beginning of the 1980s, and with an external debt burden of more than US$150 billion.

After joining GATT in 1986, Mexico moved away from protectionist policies to raise industry competitiveness. In 1993, it signed a commercial agreement (NAFTA) with the United States and Canada, which will start to operate in 1994.

The public sector deficit representing 16 percent of the GDP in 1987 was transformed into a financial surplus in 1993. Strong adjustments were made in terms of size and activities in the public sector. A large number of state-owned enterprises were privatized, and changes in public expenditure resulted in increased resources towards social development.

Exports have changed since the early 1980s. In the early 1980's, oil exports accounted for a considerable proportion of total exports, but in 1992, although oil exports accounted for 18 percent of total exports, the manufacturing sector accounted for 77 percent.

Mexico has been able to negotiate its external debt successfully through the use of different mechanisms, and significant payments of the internal debt were made. The public net debt moved from a proportion of 62.4 percent of its GDP in 1988 to 28.4 percent in 1992.

After several years of high inflation and low or negative rates of growth, the economy achieved an annual economic growth rate higher than 3 percent from 1989, and single figure inflation is expected by 1993. However, there is still a strong unequal distribution of income. Furthermore, there was, in 1993, still the challenge to create more than 800,000 new jobs per year for a young and increasing population. The informal sector had increased considerably and the need to train workers was still on the agenda.

According to the results of the 1990 census, schooling levels for the total population were still low but 83 percent of the 15 to 19-year old age group had completed primary school. More than 10 percent of the population was still illiterate, with slightly more females than males being in this condition. However, only 4.3 percent of the 15- to 19-year olds were illiterate.