Article

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Current Views on Cognitive Education: A Critical Discussion and Future Perspectives

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This article is, first of all, a synthesis of the various views on cognitive education (CE) as presented by the guest authors of this issue, and it is also a critical discussion of the field. We discuss how Sternberg's initial 5 questions were addressed by the authors, and we place these within the larger framework of the scientific literature on CE, metacognition, and dynamic assessment (DA). We try to unveil the strong and weak points of the various approaches, and we discuss some perspectives for the future.

Keywords: cognitive education; self-regulation; metacognition; dynamic assessment; learning test

In this article, we will make a synthesis of the various views on cognitive education (CE) as presented in this issue. We will discuss how Sternberg's initial five questions were addressed by the six authors; we will try to place these within the larger framework of the scientific literature on both CE and metacognition; and we will discuss some perspectives for the future.

WHAT IS COGNITIVE EDUCATION?

Cognitive education (CE), a term introduced by Carl Haywood[1] in the late 1970s (e.g., Arbitman-Smith & Haywood, 1980; Haywood, 1977) has a long history. Its underlying notions go back to the beginning of the 20th century when Alfred Binet (1909) first spoke of *mental orthopedics*, André Rey elaborated the concept of *educability* (Rey, 1934; translated into English by Haywood, 2012), Lev Vygotsky (1934/1986) introduced the *zone of proximal development*, and Otto Selz (1935) experimented on *the raising of intelligence*. Now, CE has arrived in the 21st century's computerized digital age (Shamir).

We can conclude that there is a fairly large consensus about certain characteristics of CE. All authors consider that the general aim of CE is *learning to learn* or *learning to think*, that is, developing the cognitive and metacognitive processes as well as motivational aspects implied in thinking and learning. This is different from a more traditional perspective of education as the *transmission of knowledge*. As a first consequence, CE is more focused on learning

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processes than on the content of learning. Second, the learning processes that are developed should be utile whatever the domain or content, that is, they should be transferable.

In spite of this large consensus, the broadness of definitions, scopes, and frameworks have brought about very different operationalizations of Sternberg's first question. According to the various authors, the aim of CE is (a) to foster the cognitive (mental) skills, which are thinking creatively, analytically, practically, wisely, and ethically (Sternberg); (b) to foster processes of systematic logical thinking (Haywood); (c) to foster self-regulated learning (Shamir); (d) to foster cognitive modifiability and mediated learning experience (MLE) strategies (Tzuriel); and (e) to rehabilitate cognitive functioning (Carlson & Wiedl).

To our knowledge, the term CE is not much used outside the circle of those who worked closely with Reuven Feuerstein in Israel or were trained in this tradition. In the scientific literature, we find terms such as *cognitive strategy instruction*, *cognitive skills instruction*, *thinking skills training*, *teaching thinking skills*, or *self-regulation training* (Costa, 1991; Hacker, Dunlosky, & Graesser, 1998; Hamers & Overtoom, 1997; Klauer, 2002; McGuinness & Nisbet, 1991; Nickerson, Perkins, & Smith, 1985; Segal, Chipman, & Glaser, 1985). When we compare the two traditions, CE on the one side and teaching thinking skills/self-regulation on the other, we see different names of concepts, but essentially, the two have the same general aim: developing metacognitive, cognitive, and motivational processes. In reviews or meta-analyses of training programs (e.g., Dignath & Büttner, 2008; Dignath, Büttner, & Langfeldt, 2008; Hattie, Biggs, & Purdie, 1996; Higgins, Hall, Baumfield, & Moseley, 2005), we generally find both CE programs and self-regulation or teaching thinking skills training. Haywood, as well as Carlson and Wiedl, in their reply to Robert Sternberg's initial question, also make reference to training programs from both approaches.

However, the two research traditions also show some clear differences. CE is more explicitly focused on cognitive functions and processes, and the term *metacognitive* was included only much later when research on metacognition became established in the scientific literature. The other approaches (strategy instruction, self-regulation) were based on sociocognitive and metacognitive theory (e.g., Pintrich & De Groot, 1990; Zimmerman & Schunk, 1989) from the beginning and this can, for instance, be seen in the evaluation of these interventions. Although metacognitive approaches always include assessments of progress in metacognitive and strategic behaviors, CE is primarily focused on the effects of the intervention on (perceptive) reasoning or intelligence but rarely on strategic behavior and metaknowledge.

It can also be seen in the implementation of the training programs. Although strategy instruction and metacognitive/self-regulation training generally focus on processes and strategies that are specific to academic domains (mathematics, science, reading, writing), or on the integration of these processes in everyday teaching (infused models), CE training mostly intents to develop general thinking processes by using, what are called, content-free (i.e., curriculum-unrelated) tasks.

Regrettably, the literature shows that both communities of researchers have shown little interchange: Cognitive educationalists largely remain among themselves and use their own terminology, generally derived from Feuerstein's work (Feuerstein, Rand, & Hoffman, 1979; Feuerstein, Rand, Hoffman, & Miller, 1980), and the same is true for advocates of self-regulated learning or thinking skills.

Dynamic assessment (DA) is also considered an integral part of the tradition of the CE approach; we rarely find this type of assessment together with other approaches. According

to Haywood, we need DAs to evaluate the effects of our interventions. Resing focuses on the DAs of learning capacity to provide directions for intervention in school learning. For Carlson and Wiedl, fostering and evaluating developing abilities is important for accurate assessment of cognitive capacity and learning potential and to be able to tailor intervention to the rehabilitation needs of the client. Feuerstein's combination of the Learning Potential Assessment Device (LPAD; Feuerstein et al., 1979) and Instrumental Enrichment (IE; Feuerstein et al., 1980) is a good example of how DA, used to evaluate impaired cognitive processes, can directly lead to remediation. In this approach, DA is seen as an integral part of the intervention.

The development of DA procedures emanated from a large dissatisfaction with traditional intelligence measures (see Hessels & Hessels-Schlatter, 2010). The first criticism concerns the fact that intelligence is seen as a fixed entity, although it is well known that behaviors that are considered indications of intelligence can be trained (are modifiable). Furthermore, intelligence tests have been shown to be unreliable and, especially, to lack predictive validity in special populations such as ethnic minority children, children with learning difficulties, or people with intellectual disability. Other important criticisms regarding traditional IQ tests are that they neither provide any information about reasoning or problem-solving processes nor about what kind of pedagogical intervention would be appropriate.

The fact that IQ tests have limited reliability and validity is mainly attributed to the fact that intelligence tests measure the product of previous learning and not what may be learned. Carlson and Wiedl argue that performance does not necessarily accurately reflect the cognitive competence of the individual or as Haywood (2008) formulates it: "They [intelligence tests] rely on the assumption that typical performance is the best indication of ability (does = can; does not = cannot)" (p. 427). André Rey's (1934; Haywood, 2012) illustration of the trained dog that can do certain tricks and the nontrained dog that does not do these tricks is exemplary. Everyone would agree that it would be ridiculous to infer that the nontrained dog is less intelligent. We cannot know whether the nontrained dog could or could not learn the same tricks because we have never tried to train it. However, in intelligence assessment, this practice seems quite normal and accepted because such an evaluation is based on what a child can do at one particular moment. This practice is based on the (implicit) assumption that all children have had the same learning opportunities and have had the same learning experiences; in fact, an assumption of which we all know that it is false (see Hessels-Schlatter & Hessels, 2009). Therefore, we agree with Beckmann (2006) that "the orientation towards a learning product as a potential indicator for a learning process could lead to an underestimation of someone's 'true' ability to learn" (p. 37).

In DA, some form of learning is included in the test and the test administrator and child interact in this learning process. The way in which learning is operationalized in DA can be quite different from one procedure to the other. Rules and procedures may be taught before testing or in a pretest-training-posttest design, and the tests may also be accompanied by graduated (hierarchic) prompts procedures or by simple right/wrong feedback. We make here a distinction between learning *tests* that include standardized assessment and training (for a definition of a test; see, e.g., Anastasi, 1988) and more clinical *procedures* that are individualized, such as we find in the work of Feuerstein et al. (1979) and Feuerstein, Feuerstein, Falik, and Rand (2002).

Depending on the goals of the test administrator and the theoretical framework used, the type of teaching or training provided and the type of information collected will be different. A first aim of DA is diagnostic/prognostic, for example, to provide better estimates of a person's intelligence (defined as the ability to learn) than traditional intelligence tests, which requires

standardized testing. Several standardized dynamic tests that meet with generally accepted psychometric standards such as objectivity, reliability, and validity have been developed during the last decades. These tests, employing different procedures, have proved to be highly reliable and valid measures in situations where traditional tests generally failed (see Hessels & Hessels-Schlatter, 2010). The approach presented by Carlson and Wiedl, whose objective is the assessment of executive and memory functions in adults with psychosis, is an example of such a dynamic test.

A second aim of DA is clinical or guided toward intervention and pursues insight in the person's current cognitive processing to uncover strengths and weaknesses or specific deficits. Such interventions are entirely adapted to the needs of the child to obtain as much as information possible. As a consequence, they will usually be nonstandardized. However, such an approach has been criticized because it may jeopardize objectivity and reliability of the assessments (Büchel & Scharnhorst, 1993).

Resing's work, like that of Guthke and Beckmann (2000), can be positioned in between the two approaches. These authors try to provide better estimates of cognitive ability, using standardized procedures, while also providing information about learning profiles and strategies used.

HOW SHOULD COGNITIVE EDUCATION BE DONE?

Regarding this second question, we see that different practices are described by the authors. Resing, in her work, uses graduated prompts and guided discovery learning. Tzuriel and Shamir base their work on Feuerstein's MLE criteria. Like Haywood, their mediation technique includes what we would call metacognitive questioning (Bosson et al., 2010; Hessels, Hessels-Schlatter, Bosson, & Balli, 2009; Hessels-Schlatter, 2010). Haywood formulates "mediating questions as well as metacognitive questions," focusing learners' attention on their own thought processes and cognitive resources, for example, "Have you seen something like this before? What should you do first? What do you think would happen if . . . ?" Shamir and Tzuriel have operationalized MLE criteria in the form of task-oriented questions, for example, "What is the problem? Do you remember what we do after solving a problem?" Sternberg's approach is basically the same, but he directly includes metacognitive questioning in the task instructions given: "*Compare and contrast* the respective natures of the American and French revolutions; *assess* the strategy used by . . . ; *predict* changes that are likely to occur in . . ."

Other techniques that are mentioned are thinking aloud and verbalization as a tool for self-guidance (Carlson & Wiedl) as well as modeling (Sternberg, Shamir, Tzuriel). Carlson and Wiedl (e.g., 1978, 1992), as others (Berardi-Coletta, Buyer, Dominowski, & Rellinger, 1995; Dominowski, 1998; Rojas-Drummond, Pérez, Vélez, Gómez, & Mendoza, 2003; Short et al., 1991), have shown the positive effects on learning and transfer of having students verbalize their reasoning processes while solving a task. According to several authors (Borkowski & Muthukrishna, 1992; Brown & Palinscar, 1987; Cèbe & Goigoux, 2009; Ellis, 1993; Graham & Harris, 2005; Paris & Jacobs, 1984; Pintrich, 2002; Scruggs & Mastropieri, 1993; Veenman, Van Hout-Wolters, & Afflerbach, 2006), teaching should be explicit, that is, inform the student of why, how, and when to apply a strategy. Pressley, Graham, and Harris (2006) and Schraw (1998) report that the most efficient programs start with explicit teaching and modeling, followed by independent work accompanied by feedback—this method being more efficient than a discovery-oriented approach. This is particularly true for students with severe learning difficulties or intellectual disability. Carlson and Wiedl, working with quite different groups (i.e., adults with psychiatric disorders such as psychoses), also underline the necessity

to match instruction to the learner's cognitive level. In addition, they propose to train compensation strategies in case of insufficient modifiability of the impaired functions.

Still, other instruction methods are peer-mediated learning, as proposed by Shamir and Tzuriel, or encouraging teachers to infuse CE also in the way they assess their students' achievements and not only in the way they teach them (Sternberg). Furthermore, instructional procedures should emphasize self-monitoring and self-assessment (Carlson & Wiedl). We thus see that metacognition is at the same time an aim for CE and a tool to achieve it.

Finally, all authors report the need to address motivational factors. Indeed, being an active and strategic learner is subject to motivational conditions (Hessels-Schlatter, 2010); the learner must acknowledge the use of the trained strategies, be convinced of the benefits of applying these strategies, feel able to succeed, and perceive some controllability in learning (perceived use, self-efficacy, attributional style). Interventions that include motivational variables have been shown to be more successful than interventions that do not (Borkowski, Weyhing, & Carr, 1988; Dignath & Büttner, 2008; Dignath et al., 2008).

The type of tasks used and the associated question of generality versus specificity of the targeted processes and strategies are object of continuous debate (Haywood, 2010; this issue). Already 30 years ago, Sternberg (1987) commented that "the never-ending story of the thinking skills business seems to be whether thinking skills should be separated from or infused into existing curricula" (p. 254). It is probably one of the aspects that differentiate most between the authors' approaches. Whereas Sternberg directly applies his program to curriculum-related activities using the argument that teaching must relate to the real practical needs of students, Shamir and Tzuriel make use of curriculum-unrelated tasks. Carlson and Wiedl also stress that content and process must be combined. Some interventions, for example, Haywood's Bright Start program (Haywood, Brooks, & Burns, 1992), as well as our own intervention model (Bosson et al., 2010; Hessels et al., 2009; Hessels-Schlatter, 2010), alternate between the two kinds of tasks. Thinking processes and strategies are first trained with curriculum-unrelated tasks. Next, these sessions are followed by curriculum-related tasks so that the students can directly practice the application of the trained processes and strategies in regular school activities and, most importantly, experience that these are useful for their everyday learning. Starting with curriculum-unrelated tasks has the following advantages: (a) Because those tasks require little specific knowledge, the students can entirely focus their attention on processes, that is, reflect on the way to address the task, discover strategies, and evaluate them; (b) this reflection is neither hindered by a lack of content knowledge nor do difficulties related to task content generate a working memory overload, which would hinder the student's reflection; and especially (c) students with repeated school failure will show less resistance or mental block and engage more easily in these kind of tasks. Indeed, contrary to their experiences in curriculum-related activities, they have no negative experiences with such tasks. Moreover, these tasks are not threatening (no negative connotation regarding performance) and provide the opportunity to regain confidence in oneself and one's cognitive capacities.

An often exposed argument (e.g., Klauer, 1990) is that content-free tasks will favor transfer because the taught skills are not anchored to a specific content. However, as several of the authors acknowledge, thinking is always content loaded: We think about something in a certain context. There is no reason to believe that the probability that the trained processes remain attached to the specificities of the task or the task situation will be different for curriculum-related and curriculum-unrelated tasks. Students show difficulties in applying and adapting strategies or thinking processes to different situations. For instance, meta-analyses and

empirical studies (Blagg, 1991; Higgins et al., 2005; Loarer, Chartier, Huteau, & Lautrey, 1995; Romney & Samuels, 2001; Sanz de Acedo Lizarraga, Sanz de Acedo Baquedano, Mangado, & Cardelle-Elawar, 2009; Shiell, 2002) show that the IE program brings about rather modest gains in general aptitudes (especially considering the investment needed) and extremely low effects on academic achievement. This means that the participants do not transfer the acquired skills from one situation to the other.

Most researchers in the field now agree that teaching thinking skills or strategies should not be separated from the school context, which implies either using curriculum-related tasks or integrating the intervention within the regular school activities (Adey & Shayer, 1994; Ashman & Conway, 1993; Bransford, Vye, Kinser, & Risko, 1990; Brown & Campione, 1990; Conway & Hopton, 2000; Dignath & Büttner, 2008; Ellis, 1993; Hattie et al., 1996; Leat & Lin, 2003; Palinscar & Brown, 1984; Perkins & Salomon, 1989; Perkins, Simmons, & Tishman, 1990; Pintrich, 2002; Pressley, 1995; Vauras, Lehtinen, Olkinuora, & Salonen, 1993; Veenman et al., 2006; Wong, 1993; Wong, Harris, Graham, & Butler, 2003; Zimmerman, Bonner, & Kovach, 1996). However, whatever the materials or instructional methods used, transfer remains challenging and should be prepared explicitly. The various authors address this issue in different ways. The most obvious is to have the students practice the application of the learned processes, cognitive functions, and strategies in various contexts and situations. To support this, Haywood suggests establishing a "cognitive function of the day" so that students focus on it during the whole school day—whatever the tasks at hand. He also suggests posting it in the classroom in clear view. Several researchers (Andreassen & Bråten, 2011; Cornoldi, 2009; Hessels et al., 2009; Sutherland, 2002) have used such aids (memory aids or visual support) to assist learners: posters on the wall, individual stickers, or reminders directly integrated in task's instructions. These may function as an external memory that allows students to reactivate the strategy when needed. They also foster autonomy, leading the student from teacher-regulated to self-regulated behavior. This continuous reminder of the strategies also sustains implicit learning.

Another way to promote transfer is to regularly ask the students to give examples of other situations in which the taught strategies could be applied (Haywood). This exercise proves to be very difficult for children with special educational needs or intellectual and developmental disabilities—reason for which we prefer hands-on experiences. Other principles to bring students to "learn-how-to-reach-transfer" (Resing) are careful development of metaknowledge (knowing why a strategy is useful, how and when to apply it, as well as knowing which characteristics of the tasks call on which strategy), systematic comparison of current activities with previous or new ones, and reformulation of the strategies on a more general level (also called *deconcretization*; Perkins & Salomon, 1989) so they may fit whatever kind of task (Hessels-Schlatter, 2010).

HOW SHOULD THE EFFECTS OF COGNITIVE EDUCATION BE MEASURED?

The first thing to verify, of course, is whether the intervention has led to improved performance in the ability trained (learning effect). The second, and probably more important aspect, is whether the intervention has had any transfer effects, for example, on school learning or better working capabilities, depending on the population. Associated with this second aspect are the questions of referral to special education (Haywood) and inclusion in social and professional environments (Carlson & Wiedl). A third aspect is maintenance over time of what has been learned, which can be evaluated by means of delayed posttests. These can be used not

only to assure that the acquired skills are maintained over time but also allow scrutinizing a possible usage deficiency (Miller, 1990; see also Bjorklund, 2005). Strategies and processes that are newly learned and that are not yet applied automatically require cognitive resources, next to those needed for the task at hand, and may lead to a working memory overload (Perkins et al., 1990). This means that the learner may have progressed regarding thinking processes and strategies but does not yet show improved performance because of this working memory overload. For instance, Bosson et al. (2010) observed that significant progress in strategy use during the first posttest was not accompanied by improved task performance, but significant performance gains were found on the delayed posttest 4 months later.

Of course, the choice of instruments to evaluate the efficacy of a particular program is important. That is why several authors (e.g., Boekaerts & Corno, 2005; Pressley et al., 2006) suggest combining different measures (triangulation), especially when assessing metacognitive processes or strategies and metaknowledge to enhance reliability and validity of the measures. Indeed, these components can be captured by questionnaires, interviews, thinking aloud protocols, or direct observations, but all of these procedures present some methodological disadvantages, which can be counterbalanced when triangulated.

Next to the effects of interventions, we also need to address the supposedly increased validity of DA. We have argued earlier that dynamic tests are more representative of learning behaviors than traditional intelligence tests because they try to provide optimized learning conditions to the examinee. Thus, the procedural aspect, that is, the way in which performance is achieved, is important (Guthke, Beckmann, & Stein, 1995). This concern is related to the ecological validity of the DA (see, e.g., Wiedl, 1984; Wiedl & Herrig, 1978). It implies that to estimate the predictive validity of a dynamic test, one should not so much employ school grades or standard measures of school learning as criterion measures but rather measure learning under equally optimized learning circumstances as the dynamic test (Hessels, 2009). Only under such circumstances can dynamic tests show higher correlations with measures of school learning than traditional IQ tests. Such dynamic measures of school learning should also take into account motivational factors because students with learning difficulties who are repeatedly confronted with failure in important school domains such as language and mathematics are likely to exhibit low self-esteem and low educational motivation. Examples of motivating and optimized (school) learning programs can be found in the work of Budoff, Meskin, and Harrison (1971) who elaborated a learning program on electricity; Beckmann (2001) who designed a computer-guided learning program on managing an agricultural terrain in the Sahel; and Hessels (2009; Hessels & Tiekstra, 2010; Tiekstra, Hessels, & Minnaert, 2009) who designed various dynamic measures of chemistry and geography for different types of students. The studies with these dynamic measures of school learning not only showed that the DA procedures largely outperformed traditional IQ test regarding the prediction of school-related learning of students with learning difficulties or intellectual disability but also showed that the traditional IQ scores did not hold any unique information, thus rendering them redundant.

WHAT, IF ANY, EXAMPLES EXIST OF SUCCESSFUL PROGRAMS?

Haywood and Carlson and Wiedl describe several elements that characterize a good program, such as a sound theoretical basis and empirical evidence of its efficacy. Although these authors inform us briefly about a large variety of programs, the other authors inform us in

extent about their own intervention and assessment tools. Here, we will not make a complete listing of successful programs. The reader is referred to the articles of Haywood and Carlson and Wiedl in this issue and to the meta-analyses discussed in the following text. We do want to mention that it is encouraging to see that the authors dedicate their work to very diverse populations: children; adolescents; adults; typically developing individuals; individuals at risk or with special educational needs (ethnic minorities, learning difficulties, attention deficit/hyperactivity disorder (ADHD), intellectual and developmental disabilities, psychiatric disorders), as well as parents, siblings, and peers.

Various CE and metacognitive programs have been evaluated for their efficacy. The meta-analyses of these evaluations conducted by Dignath and Büttner (2008) and Dignath et al. (2008) as well as Higgins et al. (2005) on thinking skills (self-regulation training) programs executed in primary and secondary schools demonstrated that these approaches are effective because they found strong effects both on cognitive abilities and academic performance. Table 1 presents the mean effect sizes found in the three meta-analyses. In the Higgins et al. (2005) study, primary and secondary schools are taken together. The Dignath et al. (2008) study concerns only primary education. In the Dignath and Büttner (2008) study, the effect sizes are specified for respectively primary and secondary education.

Table 1 shows that the mean effect size on cognitive performance found by Higgins et al. (2005) is 0.62. The effect sizes for academic performance vary from 0.54 to 0.82. Effect sizes for strategy use vary from 0.72 to 0.88, and those for motivational/affective variables vary from 0.17 in secondary education in the study by Dignath and Büttner (2008) to 1.44 in the study by Higgins et al. The low effect found for motivational variables in secondary education should be interpreted with caution because this result is based on only 6 effect sizes (against 48 for primary education). More detailed information in the studies of Higgins et al. (all grades) and Dignath et al. (2008; primary education) shows that larger effect sizes exist for mathematics than for reading and writing, whereas the study by Dignath and Büttner (secondary education) shows the inverse.

The role of some moderating variables on the effect size variability that Dignath and colleagues analyzed are worth to be summarized here. That is, larger training effect sizes were found for interventions that (a) focused on metacognitive processing and metaknowledge and not only on cognitive strategies; (b) that tackled also motivational aspects of learning; and (c) that did not train students by means of collaborative or group work for primary school level, but that did so for the secondary school level. For the latter effect, the authors hypothesized that the young students might not have been used to working in groups and might not have received enough instruction about cooperative learning, whereas the cooperative skills of the older students were much more developed. Higgins et al. (2005) analyzed the effects

TABLE 1. Mean Effect Sizes of Intervention Programs

	Higgins et al. (2005)	Dignath et al. (2008)	Dignath & Büttner (2008)
Cognitive performance	0.62	—	—
Academic performance	0.62	0.82	0.61; 0.54
Strategy use	—	0.77	0.72; 0.88
Motivational/affective outcomes	1.44	1.04	0.75; 0.17

according to the kind of thinking skills intervention. They found that interventions that explicitly focused on metacognitive strategies yielded a higher effect size (.96) than the studies involving the IE (.58) or Adey and Shayer's (2005) cognitive acceleration program (.61). The greater impact of interventions centered on metacognitive aspects has also been reported by Marzano (1998) and the already mentioned studies of Dignath and colleagues.

The approaches considered in these meta-analyses vary considerably regarding content, teaching methods, targeted populations, and theoretical background. Thus, these meta-analyses do not prove the efficacy of one particular intervention but demonstrate the overall positive impact of thinking skills programs or approaches on learning and thinking. According to Higgins et al. (2005), "their effect is relatively greater than most other researched educational interventions" (p. 4), and this observation should encourage their use in schools. Because there is variation in the interventions' impact according to certain variables (e.g., subject, age), the authors underline the need to take into account the particular teaching contexts in which the programs should be applied.

WHAT RECOMMENDATIONS DO YOU HAVE FOR COGNITIVE EDUCATION?

What is probably the most important issue on which we have to spend more effort is teacher training (Haywood; Carlson & Wiedl). Indeed, as Haywood (1997) already underlined, the mere application of a thinking skills program is not enough to assure the generalizability and transfer of the processes and strategies learned. Teachers should exhibit a general metacognitive style in all domains and throughout the entire school day. Research (e.g., Carr, Kurtz, Schneider, Turner, & Borkowski, 1989; Coffman, Ornstein, McCall, & Curran, 2008; Kistner et al., 2010; Ornstein, Grammer, & Coffman, 2010; Perry, 1998; Rozendaal, Minnaert, & Boekaerts, 2005) shows that there is a strong link between the teachers' teaching style (more or less metacognitive; that promotes self-regulation or not) and the self-regulation skills in their students. However, research (Kistner et al., 2010; Pressley et al., 2006; Veenman et al., 2006; Waeytens, Lens, & Vandenberghe, 2002) also shows that most teachers have poor knowledge about concepts such as metacognition, self-regulation, learning to learn and learning strategies, and do not exhibit the competences to develop these skills in their students. For instance, Kistner et al. (2010) observed that teachers generally taught very few learning strategies and that if they did, these were mostly cognitive strategies but not metacognitive ones (planning, monitoring, evaluation). Moreover, when taught, strategies were mostly taught implicitly, and the teachers rarely constituted learning environments that would favor self-regulation.

Even teachers that are trained in thinking skills or self-regulation programs encounter problems in being really efficient, and their teaching style as well as their attitudes and beliefs systems appear difficult to change. The aforementioned meta-analyses by Dignath and Büttner (2008) and Dignath et al. (2008), as well as Hattie et al. (1996), showed that training effects were significantly higher if the interventions were conducted by researchers than by the regular (trained) classroom teachers. Ellis (1993) reported that teachers who were applying thinking skills programs did not really feel concerned by the teaching of strategies. For many of them, the aim of teaching strategies was only to lead the students to achieve the expected performance level but not to generally render them "smarter," more strategic, and more efficient. Strategies were often taught in isolation: one set of strategies for one kind of task. Conway and Hopton (2000) recognized that the application of their program in classrooms during

6 months was not long enough to modify teachers' behaviors and teaching style. In a study conducted by Leat and Lin (2003), the trained teachers reported that they encountered many difficulties in generating analogies, linking information, and summoning transfer contexts or situations in which the children could apply the taught strategies: These demands surpassed their competences. Andreassen and Bråten (2011) also reported a range of difficulties their trained teachers showed in putting several principles of the program to practice.

Even when teachers already show positive attitudes toward "learning to learn" methods, teachers need intensive training, systematic support, and supervision to become good strategic teachers (Vauras et al., 1993). Actually, thinking skills, self-regulation, and metacognitive skills should already be part of teachers' initial training. Already 15 years ago, Haywood (1997) stated,

> By virtually restricting our teacher training efforts to teacher re-training, that is, to short-term workshops designed to re-tread teachers who have already been trained to teach according to different methods, we have seriously underestimated the magnitude and seriousness of the changes that cognitive approaches require in the role of teachers. (p. 5)

As we mentioned in our editorial in 2009, the master students in special education at the University of Geneva receive an extensive training, both theoretical and applied, in CE. A recent study showed that most graduates apply CE methods in their practice (Delessert, 2012). Unfortunately, the students who are in regular teacher training do not follow these courses.

On a more general level, policy makers should be encouraged to integrate thinking skills approaches in schools. In England and Wales, these approaches are an explicit part of the national curriculum (Higgins et al., 2005) as a means to raise standards. However, according to Leat and Lin (2003), "There is little direct relationship between research activity and support for teachers in meeting these demands" (p. 383). In other words, teachers are left on their own, receiving little practical assistance to "make these concepts a reality in the classroom."

Researchers themselves should also pay more attention to the teachers, examine their needs, their beliefs and values, and how strategic teaching could be implemented in the classroom and have teachers more regularly and fully integrated in their research projects (Boekaerts & Corno, 2005; De Corte, 2000; Dignath & Büttner, 2008; Pressley et al., 2006). On an even more general level, organizations committed to CE, such as the *International Association for Cognitive Education and Psychology* (IACEP), could work as a mediator with professional organizations, as suggested by Carlson and Wiedl.

Efforts should also be directed to the way we assess the efficacy of our intervention programs. Most of the authors continue to use traditional IQ or aptitude tests to measure training effects. This is a rather paradoxical observation considering the fact that the authors are advocates of DA or dynamic testing. This contradiction is even more striking when the research samples consist of special populations such as young children, ethnic minority groups, low socioeconomic status (SES), or intellectual and developmental disabilities. As discussed previously, sufficient reliability and validity of these cognitive measures are generally not guaranteed with special populations.

Training effects are expected to be different according to the learning capacity of the students, which implies that a small training effect does not necessarily mean that the program is not effective. For instance, people with moderate-to-severe intellectual deficiency will generally need much more training and will show a much slower learning rate than typically

developing individuals. Regarding transfer effects, often perceptive reasoning tasks that are very close to the trained tasks are used as measures of transfer. Furthermore, the approaches in CE, contrary to self-regulation training approaches, rarely developed specific and effective instruments to assess metacognitive and strategic behavior or motivational variables. Finally, Higgins et al. (2005) deplore the fact that studies often report little about the programs and the way they were implemented. We also observed empirical studies designated to asses program effects that display methodological flaws, such as lack of control of the contrast groups' capabilities *before* training. Further research is also needed to gain insight in "what works," and more research should be done in natural contexts (Davidson & Sternberg, 1998; Pressley et al., 2006).

Concerning DA, the authors and advocates of dynamic tests regularly complain that these are not or hardly used in practice by school or educational psychologists (e.g., Karpov & Tzuriel, 2009; Lidz & Elliott, 2000; Sternberg, 2000). However, we have to acknowledge the fact that, regarding standardized learning tests, the chance of finding such a test in one's own language, normed for the particular individual to assess, and that is available on the regular market is close to zero. In this context, we cannot help thinking about an article that Wiedl wrote in 1984 (and that still seems appropriate) that carried the title "Lerntests: Nur Forschungsmittel und Forschungsgegenstand? (Learning Tests: Only Means and Object of Research?)." It is true that some clinical assessment procedures are more easily obtainable, but without specific training, they cannot be used in an effective way either or, at least, used in the way they were meant to be used.

Also, as discussed earlier, we ascertained that the validity is not always evaluated in an appropriate manner. Dynamic tests are still often validated with static criteria that suffer from the same fallacies as the traditional IQ tests. We have argued that dynamic criteria of school learning should be used to warrant the ecological validity. Research in which such criteria were actually used also confirmed the inferiority of the static measures (e.g., Hessels, 2009).

As was the case for CE, if we wish to enlarge the use of DA by school psychologists and teachers, these techniques should at least be included in the initial curriculum of educational psychologists and special class teachers.

DA is seen as a means to inform intervention. However, until now, the relationship between evaluation and intervention has been far from satisfying. In a clinical situation, knowing the child's learning capacity is not very relevant. Whatever the learning capacity of the individual, we must do all we can to promote the development of the cognitive functions of the individual. Another challenge is the communication of results from DA by psychologists to teachers who are rarely informed or knowledgeable about the concepts used. This implies that teachers cannot do much with the information derived from a DA procedure, even though they are interested in having certain results (Bosma & Resing, 2008, 2010; Bosma, Hessels, & Resing, 2012). For referral or diagnostic purposes, the aim of dynamic tests is to help avoiding false negatives (Carlson & Wiedl), that is, avoiding underestimating the real capacities of certain individuals, which might lead to their referral to a special class, a lowering of the demands in their learning curriculum, as well as lowering learning objectives, which may all be detrimental to the individuals' cognitive development (Hessels-Schlatter & Hessels, 2010). Yet, a higher estimate of an individuals' potential for learning and a better prediction of future curriculum-related learning will be useless when the individual remains in unfavorable conditions. If the student does not receive the stimulation or support needed to develop the cognitive variables that limit his or her functioning, little

will change (Hessels-Schlatter & Hessels, 2010). Or as Elliott (2000) formulates it, "Unless the child's current environment can be transformed, there is little likelihood that any 'potential' can actually be realized" (p. 718). It is exactly in this area that more works needs to be done.

Finally, a continuous problem is the fact that scientific journals keep requiring IQs of participants before they will publish a research article. The scientific community is, apparently, still convinced of the infallible value of IQ. Again, for special populations, it has been shown that IQ scores are far from reliable and valid, whereas dynamic tests do provide reliable and valid measures. We have shown, for instance, that the outcomes of research in individuals with mild intellectual disabilities based on matching by IQ or matching on learning capacity does not lead to the same conclusions (Hessels, 2012; Hessels & Gassner, 2010). These results indicate that conclusions based on research using IQs may not be valid.

To conclude, we are convinced that DA and CE make valuable contributions to the field of cognitive development and learning. However, on a theoretical as well as on a practical level, we think that CE could profit from a stronger exchange with the field of metacognition and self-regulation. We find it therefore very satisfying to know that upcoming issues of the *Journal of Cognitive Education and Psychology* will be dedicated to self-regulated learning, related to both assessment and intervention.

NOTE

1. H. Carl Haywood is one of the founding fathers of the IAECP, and for many years has served on the editorial board of the *Journal of Cognitive Education and Psychology*.

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