

## **Rethinking learning design principles for computer-based metacognitive tools**

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With flurry of computer-based tools being developed to enhance metacognitive processing, there is need to revisit some of the background literature and proffer possible ways by which new designs can benefit from these research results. We observed that while current strands of research and tools developed have been successful in promoting learners' self-regulated learning (SRL) skills, little attention has been given to SRL training, the role of computer self-efficacy and motivation in computer-based learning environment designed to foster metacognition. This paper highlights the importance of embedding these research results in future designs.

## **Using Web Surveys for Metacognitive Monitoring**

Olusola O. Adesope, Tracey Leacock, John C. Nesbit, Simon Fraser University, Canada  
Allison F. Hadwin, University of Victoria, Canada

The number of surveys being conducted over the web is increasing significantly. Although there are challenges in online surveys, the ability to collect large amounts of data without physical interview of participants and the processing of data without separate data entry requirement make the cost of doing web surveys very attractive. This paper presents different features of our online survey tool called Web Questionnaire and how we have used the tool for capturing metacognitive variables through the administration of Metacognitive Awareness Inventory (MAI). We will demonstrate students' evaluation of this tool and its potential for enhancing self-regulated learning.

## **Using Software Tools to Promote Metacognition – The Learning Kit Project**

Olusola O. Adesope, Tracey Leacock, John C. Nesbit, Philip H. Winne and the Learning Kit team<sup>1</sup>, Simon Fraser University

This proposal seeks to demonstrate gStudy, a cross-platform software tool for researching self-regulated learning in authentic context and for providing scaffolds that help learners in the self-regulatory processes. Building on research in self-regulated learning and metacognitive monitoring, gStudy, a major tool developed under the learning kit project funded by the Social Sciences and Humanities Council of Canada (SSHRC), has been instrumental in collecting authentic data of studying processes. This proposal highlights different features of the program and how these features can potentially aid learners' metacognitive processes. Numerous trace data are being collected for analysis on how students' learning is influenced by scaffolds and other computer-based metacognitive activities. Our presentation will also highlight strand of data collected through the software and initial characterization and conception of study activities.

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## **The assessment of children's emotion understanding: the Test of Emotion Comprehension (TEC) and its Italian validation.**

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Laura Arati and Paola Molina, Università degli Studi di Torino, Italy

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Within the theoretical framework of metacognition and emotion (Pons, Doudin, Harris, deRosnay, 2002) the Emotion Comprehension Test (Pons, Harris, 2000) was designed to evaluate children's understanding of emotion. This comprehension includes nine distinct components: recognition, external causes, desire, belief, reminder, regulation, hiding, mixed, morality (see Pons, Harris and de Rosnay, 2004). TEC allows the simultaneous assessment of all these components. For any given component, children are presented with a brief vignette and asked to identify the specific emotion that the protagonist would feel by choosing from four alternatives depicting different facial expressions. About 500 Italian children (3-12 years old) equally divided by gender, and regularly distributed by age, with no developmental and learning problems, were tested. Raven's Progressive Matrices were administered to 150 children from Rome, to assess their cognitive development. Data analysis shows a clear improvement by age in the comprehension of each component. Data will be discussed in terms of validation process, individual differences, and educational implications.

## **Students' Conceptions about Learning and Metacognitive Awareness of Independent Learning**

Alessandro Antonietti, Department of Psychology, Catholic University of Sacred, Milano, Italy

Naive conceptions of learning have been meant as referring to the goals of learning, the strategies used to learn and their control, the abilities that are required, the resources that are activated, the possible difficulties or sources of mistake, the motivating hints, and the learning outcomes. Many of these aspects are encompassed also by the «awareness of independent learning» proposed by Elshout-Mohr, Van Daalen-Kapteijns and Meijer (2004).

A sample of two hundred undergraduates attending to social sciences courses were administered both the «Questionnaire About the Popular Concepts Of Learning (QAPCOL: Antonietti, Liverta, Marchetti & Perez-Tello, 2004) and AILI. Correlations between scores in the subsections of the two instruments were computed in order to identify possible overlappings and the whole set of relationships among the distinctive dimensions measured by the two questionnaires. Analyses were also addressed to assess the psychometric properties of the two instruments.

## **Self-explanation in children with learning difficulties**

Qais Almeqdad, University of Cambridge, Faculty of Education

This study attempts to explore the capabilities of children with Learning Difficulties in using Self-explanation strategies. A multiple case study methodology was employed within the social constructivism framework of enquiry. Semi-structured interviews and videotaped observations were used in order to collect the data. A horizontal analysis was then conducted. Findings showed that children with learning difficulties were capable of using self-explanation strategies, explaining their and another's reasoning. Findings also revealed six types of questions which

effectively stimulated self-explanation including, prediction of process, relationship, concept, prediction of procedure and outcome and cause and effect. Those questions stimulated children to generate nine types of self-explanation including, prediction of process, evaluation of previous answer, relationship, concept, prediction of procedure, prediction of outcome, cause and effect, speculation and transferred explained answer. Cause and effect type of self-explanation was generated the most. Both types of questions and self-explanation were highly associated with mathematics and science contexts. Implications for future research are illustrated.

### **Assessment of learners' metacognitive knowledge during primary school years**

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Strategies involved in learning activities have been defined as mental representations of the ways in which learners approach challenging tasks and problems. The learners choose from different strategies those they believe are best suited to the situation of approaching a task in accordance with given goals (cf. van Dijk & Kintsch, 1983; Vauras, 1991). Further, *strategy knowledge* as part of metacognitive knowledge is learners' knowledge about how (i.e. by which strategies) to acquire a certain learning goal (Flavell, 1979). In this presentation the development of learners' strategy knowledge was studied in two samples, first from preschool to the second grade (6-, 7- and 8- year-olds) (N=198) and then in the fourth grade (10- year-olds) (N=441) using pictorial tasks modified from Annevirta and Vauras (2001). The preliminary results showed that learners' strategy knowledge seemed to increase each year. The development of strategy knowledge was manifested as a growing ability to refer to mental processing. More details of the results and the method will be described in the presentation.

### **Using instruments aimed at encouraging metacognitive processes in the foreign language and consecutive interpreting classrooms: An ethnographic- ecological approach to research**

Marta Arumí, Universitat Pompeu Fabra, Barcelona

The aim of the research is to investigate the metacognitive processes in foreign language and consecutive interpreting learning in the context of formal teaching in the university sphere. More specifically, we are interested in finding out about the relationship between consciousness of learning and learner autonomy based on the study of the metacognitive processes that result from the incorporation of teaching actions aimed explicitly at encouraging the process of reflection on learning itself.

The research has a double purpose:

- a) To identify the different degrees of consciousness resulting from the application of teaching instruments designed to encourage it.
- b) To draw up a learning-to-learn program that respects the micro-processes related to the levels of consciousness identified and which should prove useful for teaching purposes.

Conceptually, our research takes as its main theoretical reference the area of the learner autonomy and its direct relationship with metacognitive processes. Methodologically, we apply the criteria of ethnographic research and, more specifically, the ecological approach to research (van Lier, 2004).

## **Updating social mental models: towards the role of metacognitive control skills**

Christiane Baadte & Stephan Dutke  
Department of Psychology, University of Kaiserslautern, Germany

Metacognitive control processes are closely related to executive functioning. Thus, it is assumed that individuals with poorer central executive switching abilities should have less metacognitive control in updating social mental models. In particular, individuals with lower switching abilities should cling much more to their prior stereotypic evaluation of a target person by failing to inhibit the activated stereotype in the light of new, stereotype-incompatible information. This hypothesis was tested in three experiments. Results indicated that a) restructuring the person model did correlate with the central executive's switching ability, b) under a secondary switching task the performance in restructuring the initial model was diminished, in particular when the participants' switching abilities were low, and c) expected time pressure affected the reading strategies and the inhibition of the previously activated stereotype – in particular in readers with low switching ability.

## **Self-assessments of knowledge: searching for factors influencing their validity**

Maria Bannert, University of Chemnitz, Germany  
Christoph Mengelkamp, Centre of Educational Research, University of Landau, Germany,

Research in metamemory and metacognition often takes the estimation of one's own knowledge as a measure of metamemory which is a central component of metacognition. Most commonly, students are asked to rate their amount of knowledge before, during or after filling in a knowledge test to calculate the correspondence between such self-ratings and the actual test performance. The aim of this study is to analyse such self-assessments of knowledge in more detail by looking for determinants influencing their validity. The results of our empirical studies show that students' self-assessments correspond with their actual knowledge scores, and that the self-assessments of retrospective item evaluations correlate higher with the actual test scores compared to the global prediction assessment. Further, the results suggest that in respect to learning outcome item-specific evaluation is more valid for the multiple-choice-test than for free recall. Using structural equation modelling it can be shown that the results are in accordance with the accessibility hypothesis postulated by Barnes et al. (1999).

## **Role of individual writing on metacognitive awareness in scientific concepts learning**

Lucia Bigozzi and Claudio Vezzani  
Department of Psychology, University of Florence, Italy

The aim of this work was to investigate the influence of individual writing on metacognitive awareness concerning scientific concepts. The hypotheses were that individual writing enhances the use of metacognitive terms and the frequency of use regarding terms which distinguish appearance from reality. Seventy-three elementary pupils were divided into two subgroups, experimental and control group. A first experiment of comparison of liquids and a second experiment of "pouring off" were conducted. After each experiment, the experimental group was required to write a report of the events observed. Subsequently, for both groups, it followed a group discussion regarding the specific experiment, and finally it was demanded to both groups to write a report after the discussion. A content analysis of all the writings was performed. The

results showed a significant difference between the two groups, confirming the role of individual writing on increase of metacognitive awareness about scientific concepts.

### **Internet Surfing: Study of Epistemic Metacognition during On-Line Information Searching**

Angela Boldrin and Lucia Mason, University of Padua, Padova, Italy

This study investigates epistemic monitoring and judgment during Web searching. How do students evaluate and judge the veracity of on-line information? What source of knowledge do they accept as more authoritative and why? How do they combine conflicting information? The study involved 40 university students, who were asked to search the Internet for information in order to write a report on a controversial topic, and to think aloud during on-line searching. Individual interviews on how they collected information were also carried out. Qualitative and quantitative analyses revealed that (a) students expressed comments indicating epistemic monitoring and judgment during their on-line search, especially about the knowledge sources and justification of knowledge; (b) there was a significant relationship between general and contextualised (during on-line searching) epistemological thinking. The study underlines the educational importance of understanding how students manage and evaluate on-line information in order to produce knowledge using the technological resources available.

### **Metacognitive training for children with learning difficulties: Transfer of metacognitive and cognitive strategies from decontextualised tasks to mathematical problems**

Mélanie Bosson, Stella Fontana, Jean-Louis Berger, Nadine Kipfer, Jamila Dorner, Fredi Büchel, Marco Hessels, & Christine Hessels  
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This presentation is aimed at the analyses of transfer processes in a metacognitive intervention comprising decontextualised tasks (non school tasks) and contextualised tasks (mathematical problems and reading comprehension). We will focus on the transfer of metacognitive and cognitive strategies from the decontextualised tasks to a mathematical problem and the comparison of performances in mathematical tasks before and after the metacognitive training.

### **Metacognitive monitoring and strategy use differences in reading comprehension of narrative and science texts among poor and good readers**

George Botsas, and Susana Padeliadu  
University of Thessaly, Greece

The aim of the study was to investigate differences in metacognitive monitoring and cognitive and metacognitive strategy use in reading comprehension of narrative and science texts among poor and good readers.

One hundred and twenty two 5<sup>th</sup> and 6<sup>th</sup> graders took part in the study. Half of them (N = 61) were poor readers phasing severe reading comprehension problems, while the rest were good readers. Two “think – aloud” procedures were used in order to assess monitoring and strategy use of a narrative and a science text, respectively. Various inconsistencies were inserted and presented on a PC screen.

Reading comprehension of narrative and science texts were assessed by measuring blocks of meaning that have been recalled after think – aloud procedure completion.

Additionally, reading comprehension performance was assessed by the relative subscale of a Greek standardized reading test

Data were discussed in light of reading comprehension disabilities, metacognition and domain specificity nature of cognitive and metacognitive abilities.

### **Realism as a metacognitive ability: Research results from a study on variables affecting the use of Confidence Testing.**

Serge Boulé, and Dany Laveault,  
Faculty of Education, University of Ottawa, Canada

Empirical research was conducted in order to better understand how individual differences as well as item metric and cognitive properties could be linked to student realism. Realism is a metacognitive ability and a component of the self-assessment and self-regulation processes. With feedback on realism, a student can validate the self-assessment of his knowledge and teachers and counsellors can also reconsider their approach.

In order to be valid, reliable and useful, the measure of realism must take into consideration individual and item characteristics. The research question is formulated as follows: How and how much confidence testing is affected by gender, item taxonomy level, student performance and item characteristics? A criterion-reference diagnostic test by means of confidence testing is administered to 122 adult subjects.

### **Learning from the experts: What can intuitive physics students teach us about learning and meta-learning?**

Richard Brock, Faculty of Education, Cambridge University, UK

Abstract: Anecdotally it seems that some students have a very natural intuitive grasp of physics. Whilst their contemporaries struggle with basic concepts, these expert few are able to understand even difficult concepts with apparent effortless intuition. Assuming that a goal of education is to encourage all students to perform in such a natural manner, one obvious starting point is to observe and question model learners and discover what they are doing differently. In particular, this project will focus on the learning skills, specific 'tricks', used by learners. It uses a grounded theory approach, using interviews and a concept mapping tool to try and understand the processes by which intuitive physics students learn. It is hoped that such observations may lead to the identification of learning skills or other tools that may be taught to less gifted students to facilitate their progress.

### **How Well Can I speak Albanian /Turkish and German? An Empirical Study on the Metacognition of First and Second Language**

Edina Caprez-Krompæk, University of Zurich, Institute of Education, Switzerland

This work in progress-study focuses on the specific linguistic situation of Albanian-Swiss and Turkish-Swiss school children with bicultural background. This study investigates the relationship of self-assessment to their first and second language achievement. The relationship between self-assessment and first and second language achievement was examined using the C-Test as an integrative test for language proficiency and a questionnaire for self-assessment in first and second language. In total, the study examined 83 Albanian and 54 Turkish minority pupils in the experimental group and 46 Albanian and 12 Turkish school children in the control

group. The children in the experimental group do visit the optional Albanian /Turkish native language and culture classes (Heimatliche Sprache und Kultur – HSK), the control group on the contrary do not. First we expect a high correlation between self-assessment and language achievement. Secondly this correlation should be higher by the experimental group than by the control group. Finally we suppose a gender difference in self-assessment.

### **Excel spreadsheet to support veterinary student's metacognition**

Jean-Loup Castaigne, University of Liège, Belgium

Students were submitted to 5 tests containing multiple choice questions with confidence degree and open answer questions with subjective estimation of the score out of 20. Use of confidence degree and estimation was left at the discretion of the students. We encouraged students to use metacognitive information given with their estimation regarding the correction. To help them we developed a spreadsheet to implement visible analysis and regulation of learning product and processes in both ante and post performance situations. After each test students downloaded their scores and pasted them into their own spreadsheet. Cognitive and metacognitive performance indicators were computed and graphs were drawn by the spreadsheet. Students were invited to comment their performances on the base of indicators covering different domains.

### **A situated self-regulated learning system: Evidence from Taiwanese children's constructs of mathematical problems**

Mei-Shiu Chiu, National Chengchi University, Taiwan

This study examined 75 Taiwanese children's personal constructs of diverse mathematical problems by the repertory grid technique. These constructs were 'situated' in the contexts of their solving the diverse mathematical problems in the classroom, and regulated by the children as 'psychological tools' in order to successfully participate in their mathematical learning world. By coding, categorizing and formulating these constructs, there emerged a situated self-regulated learning system that comprised three cognitive components (situated-perceptions, -strategies, and -aims), and one affective component (situated-affect). The relatively differential emphases on these components for diverse problems also suggested a 'situated' characteristic of children's sensitively regulating their authentic learning.

### **Metacognitive beliefs about multimedia: an interview study**

Barbara Colombo, Maura Lissoni and Alessandro Antonietti  
Department of Psychology, Catholic University of the Sacred Heart, Milano, Italy

Starting from the assumption that individuals develop metacognitive beliefs about the alleged benefits and limits of multimedia presentations and are able to verbalise and justify such beliefs, an interview based on combinations of texts and pictures derived from Italian Primary School textbooks was designed. It was aimed to investigate naïve conceptions that teachers, illustrators, students and common people share with references to the functions of different typologies of text-picture combinations. Similarities and differences with cognitive theories of multimedia learning emerging from data analysis will be discussed together with implications regarding metacognitive processes and instruction.

## **Can children's explanations of how they read and spell aid our understanding of spelling and reading representations?**

Sarah Critten and Karen Pine, School of Psychology, University of Hertfordshire, UK  
Professor David Messer, Centre for Childhood, Development and Learning, Faculty of Education and Language Studies, The Open University, UK

This study explores the nature of children's metacognitive statements as they read and spell in order to see whether representational levels of understanding (derived from the Representational-Redescription model, Karmiloff-Smith 1992) provide a useful framework for exploring the nature of implicit to explicit reading and spelling development in young children. In this, the first testing point of a study to be conducted over a year, 73 children (aged 4.5-5 years) were given single-word spelling and reading tasks and recognition tasks containing alternative spellings of words. In the spelling recognition task children were asked to identify and explain those alternatives they believed correct and incorrect. In the reading recognition task children were asked to identify and read the alternatives they believed to be real and pretend words and explain how they read those words. Results indicated that on the basis of children's explanations and performance they could be allocated to separate reading and spelling representational levels of understanding spanning Pre-implicit, Implicit and Explicit levels. Children's metacognitive awareness of how they read and spell can therefore provide insight into the nature of spelling and reading representations.

## **What does Jacobs and Paris' IRA questionnaire measure? A large-scale study among 3rd grade Hungarian pupils**

Csaba Csikos, Department of Education, University of Szeged, Hungary

Our study focuses on 3rd grade Hungarian students' answers on a Jacobs and Paris' IRA questionnaire on reading awareness. The sample consisted of 4663 3<sup>rd</sup> grade pupils who formed a representative sample of the population of Hungarian 3<sup>rd</sup> graders. Cronbach's  $\alpha$  (.40) was unacceptable for the purpose of use of the total score, therefore, means and SDs of each item are shown. The analysis of means and standard deviations suggests that elementary school students have strikingly marked beliefs about their reading process and about the phenomenon *how one can be a good reader*.

## **The Polish adaptation of the Jan Vermunt's "Inventory of Learning Styles"**

Ewa Czerniawska, Faculty of Psychology, Warsaw University, Poland

The paper presents the procedure and the results of the Polish adaptation of the Jan Vermunt's "Inventory of Learning Styles". The first part presents the procedure consisting of three independent translations of the English version, authorized by J. Vermunt, which were the basis of the version subject to back-wards translation. The final version was filled in by 243 students from three different faculties of the Warsaw University: Education, Law and Mathematics, half from the second, and half from the fourth year. The analyses showed that most scales had acceptable reliability. Higher coefficients were found in the whole group than in sub-groups. The results were differentiated more by the faculty than by the year of study. Relations between scores in „Inventory of Learning Styles” and GPA were also analyzed. The overall conclusion of the study was that the Polish version of the „ILS” might be a useful tool in educational research.

## **Interrelationships in children's cognitive development: an exploration of potential common cognitive skills underlying TOM and metacognition**

Demetra Demetriou

Faculty of Education, University of Cambridge, UK

The present study's aim is to combine aspects of research on Theory of Mind (ToM) and Metacognition since both areas broadly share the objective of investigating the development of children's knowledge and cognition about mental phenomena. As it will be argued through a review of research literature the ability of mentalizing, the ability to understand what one's own knowledge consists of, and the regulation of one's own behaviour seem to be related skills and crucial to a successful mental life.

More specifically the research questions that this poster attempts to approach are:

- Are there common cognitive skills underlying the success of both ToM and Metacognition measurements?

If yes then,

- What is the nature and extent of these common processes in ToM and in Metacognition?
- Is the nature and extent of these common processes influenced by the nature of the tasks employed in the measurement of ToM and Metacognition?

## **Teaching Self-Reflection for Identification of Subjective Needs**

Dilara Demirbulak, Çankaya University, Turkey

Nazan Tutas, Ankara University, Turkey

The aim of this study was to identify the subjective needs of undergraduate students attending English Language Teacher Certificate program apart from the courses pertaining to their field of study. Therefore, the courses they were taking were elective courses. Identification of learners subjective needs was an ongoing part of the class. This was done through the students' own reflection on how they learn and what they need from themselves, peers, and the professor to enhance their learning. This reflection process was carried out for one hour after class to discuss what they have explored about themselves and whether they had done any remedial work regarding their "perceived weakness" concerning their learning processes that particular week. The data collected were utilized to develop one of these Certificate courses titled "Instructional Technology and Material Development".

## **Investigating self-regulatory behavior in different groups of students: Relations to performance and to academic self-concept**

Irini Dermitzaki, University of Thessaly, Greece

In the first study presented in this paper, participants were 196 kindergarten, first- and second-grade students. The students were individually examined in their academic self-concept in maths and in their use of cognitive, metacognitive and motivational strategies for regulating the solution process of a series of arithmetic-mastery of space tasks by means of a structured observation checklist. In the second study, 25 third-grade low achievers in reading comprehension were compared to 20 high achievers as regards their use of self-regulatory strategies during their efforts to solve reading comprehension tasks. Overall, the results showed that: a. there were close relationships between students' use of self-regulatory strategies during problem-solving and subsequent performance, b. a different pattern of strategic behaviour emerged between high and low achievers in reading comprehension, and c. students' academic self-concept was significantly

related to the use of motivational regulatory strategies, such as persisting and working autonomously, but not to the use of cognitive and metacognitive strategies. The educational implications of these findings are discussed.

### **The efficacy of self-regulated learning interventions at primary and secondary school level – a meta-analysis**

Charlotte Dignath, Gerhard Büttner and Hans-Peter Langfeldt  
University of Frankfurt, Germany

We will present the results of a differentiated meta-analysis of studies on fostering self-regulated learning. Based on literature search in the common data bases, publications were included if the study (1) employed a pre-post control group design and (2) descriptive data was provided.

In a first step the integration was limited to studies conducted at primary schools. As the results show, self-regulated learning training proved to be effective already at this level.

Subsequent analysis tested for the effects of two moderator variables: *integration of the intervention in the classroom vs. external intervention* as well as *duration of the study*. The analysis revealed clear effects in favour of interventions conducted in the classroom. The inconsistent results regarding the duration of the training refer to the existence of further moderators.

Further analysis include studies fostering self-regulated learning in older students. A comparison between the impacts of self-regulation training on primary versus secondary school students will be carried out.

### **Age Differences in the “Underconfidence-with-Practice” effect**

Anne Do Lam, University of Zurich, Switzerland

The “Underconfidence-with-Practice” (UWP) effect refers to the phenomenon of increasing underconfidence of Judgments of Learning (JOLs) while studying paired associates repeatedly, i.e., recall predictions become lower than recall performance. This finding implies a systematic underestimation of the effect of repetition, which may lead to a suboptimal allocation of study time. To date, the UWP effect has not been examined in older adults, although one might hypothesize that older adults’ JOLs are differently sensitive to repeated practice. The present study investigated age differences in the UWP effect in a sample of 34 younger and 34 older adults. Participants studied a list of 60 paired associates, across five learning trials. The results indicate that the UWP effect does exist in this study, and does vary between age groups. Furthermore, the findings argue for the assumption that younger and older adults’ JOLs differ in the sensitivity to extrinsic cues, especially those of practice.

### **A metacognitive tool for chemistry students’ comprehension of adapted scientific articles**

Yehudit Judy Dori and Liora Saar, Technion, Israel Institute of Technology, Israel

We investigated the effectiveness of a self-developed metacognitive tool for high school chemistry students’ comprehension of adapted scientific articles. Students were asked to assess the quality of the questions according to three dimensions classification taxonomy which characterize “complex and deep question”. About 300 honor chemistry students, divided into experimental and control groups, read five unseen adapted scientific articles and responded to two types of pre- and a post-questionnaires. One type was adapted from Wandersee (1988) and the other called for posing questions related to the article and arguing for selecting these questions.

Students in the experimental group used the metacognitive tool, while students in the control groups only read the articles and responded to the questionnaires.

We found that the metacognitive tool was effective in raising students' declarative metacognitive knowledge and their awareness to the way they self-regulate their scientific text comprehension, indicating that this tool should be further explored.

**Metacognitive knowledge and metacognitive experiences:  
Two facets of metacognitive monitoring and their cognitive underpinnings**

Anastasia Efklides, School of Psychology, Aristotle University of Thessaloniki, Greece

Metacognition has been defined as "cognition of cognition" (Flavell, 1979) or as "a model of cognition that is being informed about cognition through the monitoring function and informs cognition through the control function" (Nelson, 1996). Monitoring of cognition takes two forms: metacognitive experiences (ME) and metacognitive knowledge (MK). Metacognitive experiences are metacognitive feelings and judgments/estimates that constitute online monitoring of cognitive processing, while metacognitive knowledge is off line monitoring of cognition. The latter comprises declarative knowledge, namely ideas, beliefs, theories people have about persons (one's self included), tasks, strategies, cognitive functions (e.g., memory, attention, etc.), epistemological criteria of knowledge, and possibly theory of mind. In this presentation I am going to discuss the cognitive mechanism that presumably underlies metacognitive knowledge and metacognitive experiences. Metacognitive experiences are based on feedback loops and on nonconscious, nonanalytic inferential processes. However, when metacognitive experiences reach awareness, then they function as cues for analytic processes and control decisions. They also offer information that becomes part of the person's metacognitive knowledge. Processes involved in social cognition and explicit instruction also contribute to the formation of metacognitive knowledge.

**Building skills for interpreting the allegorical meaning of sayings and proverbs in children aged 5-7 years**

Rozalina Engels, Sofia University, Bulgaria

After showcasing the potential educational possibilities of sayings and proverbs as means for developing a meta-level of cognitive skills, this author's research aims to shed light mostly on the following:

1. The real and potential abilities of children aged 5-7 years for interpreting allegory.
2. Discovering the nature, the mechanism, and the dynamic of building skills for interpreting allegory.
3. Building a system of criteria and indicators, which can be applied in practice through an efficient system of diagnostic instruments, in order to assess the level of development of the skills for interpreting the allegorical meaning of sayings and proverbs in children aged 5-7 years.
4. Identifying the uniqueness of each child's interpretation of allegory as an additional criterion necessary for studying the skills under research.

## **In your shoes! Children's empathy and metacognition.**

Maria Eracleous, University of Cambridge

This paper will look at one aspect of emotional education which is to help children to be more considerate towards the emotions of others (empathy). This aspect seems to be closely related to the metacognitive skills of children.

Empathy is an emotional response that stems from another's emotional situation or state and corresponds to it (Eisenberg and Strayer, 1987). Research on the development of children's *theory of mind* has demonstrated that from the age of three, children begin to realise that other people have different feelings, desires, beliefs and intentions (Barnes, 1995).

## **Metacognitive judgments and study time in a self-regulated learning task**

Sabine Fabriz, Saskia Kistner and Gerhard Büttner, University of Frankfurt, Germany

This study investigates how students' metacognitive judgments influence subsequent study-time-allocation strategies. Perceived difficulty is considered to be important for regulating one's time spent within a learning task. It is dominantly assumed that the more difficult an item is perceived, the more study time is spent on it (*discrepancy reduction model*). A theoretical framework, called the region of proximal learning (Metcalf, 2002; Metcalfe & Kornell, 2003), contrasts these predictions. It predicts that most time is devoted to items promising best learning outcomes. In an experimental approach our study focuses on the conditions under which these assumptions are true. Following an experimental design used by Son & Metcalfe (2000) we developed a computer assisted self-paced learning task with complex text material referring to different topics. 64 undergraduates participated in our study. The amount of time pressure was varied and the influence of state motivation was tested. The use of metacognitive judgments for the regulation of study time under those conditions was determined.

## **Theories of Mind and Personal Epistemology: What can they tell us about meta-cognition and meta-knowing?**

Annick Fagnant, Service de Pédagogie expérimentale, Université de Liège

Marcel Crahay, Développement, apprentissage et intervention en situations scolaires, Université de Genève

This presentation aims at providing a reflection about how metacognition and meta-knowing are envisaged in two domains: Theories of Mind and Personal Epistemology. Both fields of research are interested in knowledge (and knowledge acquisition), but this concept doesn't have the same position in these two fields: it is only one of the various domains of interest of theories of mind and it is the central focus of personal epistemology.

The links between metacognition and both above-mentioned domains of research are questioned. Why did metacognition and theories of minds develop so independently? What are their complementarities? Which is the place of metacognition in the different theoretical approaches of personal epistemology?

To some extent, meta-knowledge is synonymous to personal epistemology, which includes four dimensions about knowledge or knowing. Do theories of mind tackle these various aspects and do they differ from personal epistemology? The dimension of *certainty of knowledge* illustrates this question here.

## **Meta-Cognitive Skills in Computerized Science Problem Solving: Effects of Different Scaffolding Programs**

Zvia Fund, Bar-Ilan University, Israel

Four scaffolding programs (integrated, strategic, operative and enrichment) for computerized science problem solving and a control group are compared as regards increasing effectiveness of three meta-cognitive skills: self-assessment of the solving process and of the final solution. Also, in the case of an incorrect solution, identifying the error and its source.

Participants were 187 junior high school students, in five experimental groups, each of three academic levels. Their problem solving activities were observed and transcribed. The resulting protocols were then analyzed, each student being assigned an effectiveness score for each meta-cognitive category. These scores were subjected to a 5 x 3 (groups by academic levels) ANOVA analysis. Results showed highly significant differences between the groups in all categories, and different patterns of effectiveness, depending on treatment and academic level. The findings are further elaborated upon in the paper.

## **The development of metacognition in preschool age: The role of the theory of mind.**

Eleftheria Gonida and Grigoris Kiosseoglou, School of Psychology Aristotle University of Thessaloniki, Greece

The study aimed at investigating the predictive value of theory of mind in the development of metacognition during preschool age. Specifically, the role of the theory of mind was examined in regard to the effectiveness of a cognitive-metacognitive training program. A sample of 140 preschoolers participated in the study; 70 children participated in the experimental group and 70 in the control group. The training program was infused in the daily program of the schools, applied by the teachers themselves who had been previously trained, and lasted for three months. All children had been pre-tested in two false-belief tasks measuring theory of mind and three cognitive tasks measuring logical thinking. Post-test measures included cognitive tasks and metacognitive explanations about their solutions to the tasks. Data analyses showed that theory of mind was a significant positive predictor of children's metacognitive performance. The results will be discussed within a developmental framework for metacognition.

## **Collaborative concept maps as a tool to analyse learning processes in cell biology**

Corina González Weil, Instituto de Biología Pontificia Universidad Católica de Valparaíso, Chile  
Ute Harms, Department of Biology I / Biology Education, University of Munich, Germany

This study focuses on the use of collaborative concept mapping as a tool for analysing the development of 9<sup>th</sup> grade students' understanding of the biological concepts "living being" and "the cell". Concept maps were elaborated by the students 4 times during their learning process. At the end the students were asked to use their concept map to solve a particular biological problem. Each concept map of every group was documented and evaluated, as well as the answers to the biological problem. The outcomes show that (a) the number of concepts in the map series increase progressively, particularly in respect to the microscopic level (b) most of the mentioned concepts on the maps refer to cell structures and not to processes (c) even at the end of the study many groups show difficulties to integrate the macroscopic and microscopic concepts in their map (d) groups that reflect a greater understanding in their last map gave more scientific answers to the biological problem.

## **Teachers and metacognition: drawing together evidence from systematic review and action research**

Elaine Hall, Centre for Learning and Teaching, Newcastle University, UK

This paper brings together the results from recent systematic reviews into teachers' learning (Baumfield, *et al.*, 2005; Cordingley, *et al.*, 2003, 2005) with evidence from a university-supported practitioner enquiry project to explore the relative importance of *networks* and *spaces* for teachers' learning, reflection and metacognition. The content and intention of continuing professional development and action research will be considered as contributory factors to the level of impact from different approaches. In addition, the socially and individually mediated elements of learning will be included, in order to problematise ideas of universal application in teacher development. Teacher interviews, psychological test data (Tolerance of Ambiguity scale, taken from Whetton and Cameron, 1995) and field notes from network meetings provide resonant examples from the front line of the kinds of learning signposted by the EPPI reviews.

## **Metacognition, learning to learn and self-regulated learning: changing constructs and concepts**

Steve Higgins, Centre for Learning and Teaching, Newcastle University

This paper presents an analysis of key terms in education research and how they relate to contemporary practice initiatives in the UK. Based on series of systematic reviews into both theoretical and empirical literature on thinking and learning (Baumfield *et al.*, 2005; Higgins, Hall *et al.*, 2005; & Moseley *et al.* 2005) it presents an overview of the range of meanings of key terminology in this area and the way that they have changed over the past 30 years. A conceptual and empirical synthesis is proposed on the basis of this work.

## **Strategy perceptions, task difficulty and strategy maintenance in a free-recall task**

Nathalie Huet and C Escribe, Work and Cognition laboratory, Maison de la recherche, Université Toulouse, France

This study deals with the conditions of memory strategy transfer in adults. It examines the influence of the difference in task difficulty from training to transfer and the perceptions of a taught strategy on its maintenance and performance on a free recall task. In a learning phase, participants were taught how to use a categorization strategy either on a high typical word list or on a low typical word list. Besides, they had to assess this strategy about its utility, difficulty and effort after using it. Then, in a subsequent transfer phase, half of participants from each learning condition group had to do a free recall task either on a low typical list or on a high typical word list. At last, strategy perceptions were assessed. Results revealed that both perception of strategy utility during the learning phase and transfer task difficulty predicted strategy maintenance.

## **Metacognition and the patterns of networked interaction in mathematics**

Tarja-Riitta Hurme and Sanna Järvelä, Research Unit for Educational Technology, University of Oulu, Finland

Tuire Palonen, Faculty of Education, University of Turku, Finland  
Finland

The aim of this study was to examine metacognition as a social phenomenon in computer supported collaborative learning (CSCL) and problem solving in mathematics. The participants of the study were 13-year-old secondary school students (N=16) whose networked discussion was supported by Knowledge Forum (KF) learning environment. Eight student pairs produced 95 computer notes in geometry. The metacognitive content of the student pairs' computer notes was categorized as *metacognitive knowledge*, *metacognitive skills*, and *not metacognitive*. To examine metacognition as a social phenomenon the relation between the features of interaction and the metacognitive content of the computer notes was examined. The results of the study revealed that the metacognitive activity in networked discussions varied among participants. Also a relation between metacognitive activity and the features of interaction was found. The student pairs who hold a strategically optimal position in the communication network monitored and evaluated the ongoing discussions in networked learning.

## **Influence of readers' goals on information seeking questions asked on expository texts**

Koto Ishiwa and José Otero, Universidad de Alcalá, Spain

Vicente Sanjose, Universitat de València, Spain

José M. Higes, Universidad Complutense, Spain

This study examines the generation of information seeking questions (ISQs) asked on expository texts. The generation of ISQs is conceptualized as a search for information in order to remove obstacles towards a goal. Thus, given a certain textual input, different goals would lead to different questions. We examined this prediction by manipulating readers' goals through two different tasks: reading paragraphs for understanding or, alternatively, solving problems. Sixty eight 1st year university students read two short paragraphs and were asked to state in writing any question they think is necessary either to answer a comprehension test or to solve the problems. The results showed a significant increase in the number of causal questions asked in the understanding condition compared to the problem solving condition. This is interpreted as evidence of the influence of readers' goals on the obstacles found and the questions asked.

## **Those who know more do not know more about how much they know**

Anna-Carin Jonsson and Catarina Player-Koro, University College of Borås, Sweden

This study investigates the influence of crystallized intelligence (Gc) on the realism of confidence judgments (calibration) with structural equations modelling (Loehling, 2004). Seventy-nine high-school students answered questions on word knowledge (WORD), three tests on three occasions with two weeks between each trial. After each test question, each individual gave a confidence rating of his or her answer. The calibration measure was used on the confidence judgments. The three WORD-tests were related to the latent variable Gc (cognitive performance) and the three confidence measures were related to the latent variable calibration (metacognitive performance). The factor loading on the latent variables were strong but the relation from Gc (cognitive performance) to calibration (metacognitive performance) was close to zero. The chi-square was

not significant indicating a good-fit and the RMSEA measure were 0.079. However, only 79 participants participated which is problematic. However, statistical SEM-analyses could be of importance within calibration research.

### **Metacognitive strategy in chemical education: Guided question posing skill**

Zvia Kaberman and Yehudit Judy Dori, Technion, Israel Institute of Technology, Israel

This study investigates ways by which a metacognitive strategy affects 800 honor chemistry students' skills to pose complex questions and to analyze them according to a three-component taxonomy. By analyzing the questions according to this taxonomy students learn to aim at posing questions that should deal with hazards and possible solutions; require a response at a thinking level higher than knowledge or understanding; and calls for a response that uses at least two out of the four chemistry understanding levels—symbolic, macroscopic, microscopic, and process. Findings showed a significant incline in the number of students who asked questions that required higher order thinking skills and two or three levels of chemistry understanding. Interviews with students and teachers revealed that stimulating students to generate complex questions with a metacognitive strategy enables them to be aware of their own cognitive process and to self-regulate it with respect to the learning task.

### **Meta-cognitive approach for developing professional knowledge and competence of team leaders**

Gila Kaufman,. Kaye College of Education, Beer-Sheva, Israel

The presentation will focus on the professional learning of sixteen team leaders in a two-year Inset class via the going-meta approach (GMA), developed in this study. Research in the case-study methodology was integrated into the learning process of the GMA class. Two Heuristic Models were designed and used as a structured opportunity to guide the team leaders' meta-cognitive knowledge. The first one, "Learning how to learn a concept", helped the team leaders to create personally relevant conceptual frameworks; to deepen awareness of strengths and weaknesses in their conceptual knowledge and to lead on-site meta-learning practices with groups of teachers in their schools. The second model, "developing critical self-reflection", encouraged the team leaders to re-examine their priorities, personal strategies, expectations and assumptions about their team-leadership role. Our findings show how these Heuristic Models empowered the team leaders' awareness of their professional development and thus significantly increased their sense of self-efficacy as learning leaders.

### **Patterns of metacognitive strategies in the process of mathematical problem solving – think-aloud interviews with 5<sup>th</sup> grade students**

Rita Kelemen and Csaba Csikos, Department of Education, University of Szeged, Hungary  
János Steklács, Teacher Training College, Kecskemét, Hungary

The purpose of our research is using the interview and the think-aloud protocol methods to analyze and describe children's problems solving behaviour patterns. The participants were twenty fifth grade students from two schools of Békés County. One half of the sample was randomly selected from a group that was involved in a metacognition-based training in the fields of mathematics and reading (Csikos, 2005, EARLI conference presentation), the second half was randomly selected from a control group class.

The word problem that was used in this investigation was a simplified version of Kramarski, Mevarech and Lieberman's (2001) famous pizza-task. Students' observable behaviour was videotaped during 20 minute long think-aloud interview. We used Schoenfeld's (1987) method to represent students' behaviour patterns.

Our investigation has married two methodological ways of measuring metacognition. Using think-aloud protocols enabled on-line observation of strategic elements of behaviour, post-hoc analysis of videotapes enabled quantifying observable behaviour patterns.

### **Verbal Imprecision as an Indicator of Children's Metacognition**

Elizabeth Kirk and Karen Pine

The ability to think about one's own thoughts has been widely demonstrated to accompany and promote cognitive development. The very essence of development is change and with change comes an increase in meta-level awareness. This can be indicated by a reduction in verbal fluency and an increase in verbal imprecision. Verbal imprecision refers to the different ways in which speech can be dysfluent. When children are in a state of transitional knowledge, their speech is characterised by pauses, backtracks and hesitations and they begin to comment on their own lack of knowledge. We describe a study in which the speech of 103 children solving balance beam problems examined. The possibility that different types of verbal imprecision are symptomatic of problems at different levels of processing (at the level of lexical retrieval or information packaging) was explored. Verbal imprecision measures were found to be dichotomous, with two distinct categories emerging, one of which is clearly associated with the conceptualisation of knowledge. The relationship between verbal imprecision and another predictor of change, gesture, was also examined. By attending to *how* children say something in addition to *what* they are saying, verbal imprecision can help us to identify emerging knowledge, enabling the development of meta-level awareness to be observed, and thus the process of change.

### **Enhancing Teachers' Mathematical Knowledge: Effects of *General vs. Specific* Metacognitive Training**

Bracha Kramarski and Tali Revach, School of Education, Bar Ilan University, Israel

The study investigates the effects of *general vs. specific* metacognitive training on teachers' mathematical knowledge. Participants were 64 primary teachers who were exposed to metacognitive professional development programs. Thirty teachers were assigned to the *general meta-cognitive* training (*GMT*) and thirty four teachers were assigned to the *specific meta-cognitive* training (*SMT*). The training was based on the *IMPROVE* metacognitive questioning approach that emphasizes the use of four main questions: *Understanding; connection; strategy;* and *reflection* (Kramarski & Mevarech, 2003). The *GMT* teachers were exposed to the importance of metacognitive questioning in general, while the *SMT teachers* practiced the questions explicitly.

Results indicated that the *SMT* teachers outperformed the *GMT* teachers on various skills of solving mathematical real-life task, and pedagogical skills regarding planning a lesson. In addition, the *SMT* teachers exhibited more student-center discourse. Educational and practical implications will be discussed at the conference.

## **Declarative Metacognitive Knowledge of Young Writers**

Shirley Larkin, School of Education, University of Exeter, UK

This paper reports an analysis of young children's declarative metacognitive knowledge about themselves as writers and about how children in general learn to write. The paper is contextualised as one part of a larger project called Talk to Text, which aims to encourage children's writing through structured opportunities for talk. One aim of the Talk to Text project is to encourage the development of reflective thought and metacognition in terms of writing. 96 five to six year old children were interviewed about their attitudes, beliefs and opinions about writing and learning to write. Responses to two particular interview questions, which focussed on knowledge of the self in relation to writing and knowledge of how children in general learn to write, were categorised in terms of a continuum from cognitive to metacognitive responses. Issues surrounding the distinction between cognitive and metacognitive thought and age related development of metacognition are discussed.

## **Metacognitive activities and writing anxiety in university students**

Tracey L. Leacock, Philip H. Winne and John C. Nesbit, Faculty of Education, Simon Fraser University, Canada

A third year undergraduate instructional psychology class will use two questionnaires, in-class discussions, and peer feedback to enhance student awareness of attitudes towards writing, writing strategies, and ability to evaluate one's own writing assignments. The questionnaires focus on writing apprehension and common problems (writer's block, procrastination, etc.). In-class discussions encourage students to consider whether their questionnaire results match their perceptions of their attitudes and writing activities. An eLearning environment containing tools designed to scaffold peer feedback encourages students to reflect on feedback they give to partners and on how they could apply the same techniques to critiquing their own writing. Student performance across two essays – one immediately after they have been introduced to the idea of reflecting on approaches to writing and one after they receive feedback on their essay – will be compared for evidence of monitoring and strategy selection.

## **Theory of mind and metacognition: a study on children's knowledge about the mind**

Serena Lecce, Paola Palladino and Adriano Pagnin, University of Pavia, Italy

Theory of mind and metacognition appear both critical for children's cognitive and emotive development, but have rarely been linked one another. The main goal of this study was to explore existence and direction of the relations between children's language learning, their theory of mind and metacomprehension. To this end, 196 children attending the second and fourth school grades were administered vocabulary, metacomprehension, and comprehension tasks. To examine theory of mind, children were asked to complete two stories which were then coded for the frequency of inner state references. Results demonstrated a significant relationship between theory of mind and metacognition which was independent from variables such as vocabulary and children's school grade. Moreover, hierarchical regression analyses demonstrated the presence of predictive links between theory of mind and metacomprehension over and above the effect of language. These results highlight the existence of close links between different aspects of children's knowledge about the mind and its functioning.

## **Exploring the Relationships between Beliefs about Historical Knowledge and Knowing, Individuals' Polarization and Metacognitive Awareness in a Reasoning Task**

Margarita Limón Luque, Universidad Autónoma de Madrid, Spain

This study aims to explore if individuals' beliefs about historical knowledge and knowing and participants' level of polarization may predict their degree of metacognitive awareness about their performance after solving an ill-defined historical task in which two sides can be taken.

A sample of college students was presented the problem by mean of a multimedia presentation. Evidences supporting the two sides discussed in the problem were introduced. Questionnaires to evaluate both participants' beliefs about historical knowledge, their prior knowledge and initial positioning were administered during the pre-test session. Individuals' metacognitive awareness about their task performance was assessed during post-test.

The highest level of metacognitive awareness was expected to be found when polarization is low and individuals sustain an evaluativist view of historical knowledge. The lowest level of metacognitive awareness was expected when polarization is high and individuals sustain an absolutist view of historical knowledge. The study is currently in progress; therefore, no final results or conclusions can be anticipated yet, however preliminary data analysed seem to be in line with our hypotheses.

## **Word-Concept-Weft, as a Metacognitive Strategy for incoherences detection by learning biology**

Carolina Martínez and Corina González-Weil, Instituto de Biología, Pontificia Universidad Católica de Valparaíso, Chile

Word Concept Weft (WCW) is a research tool originally designed by Galagovsky & Muñoz (2002) to analyse oral and written speeches. Goal of this study is to validate the uses of WCW as a metacognitive strategy, particularly by the detection of incoherences, through a study lead in a control-group design, in where the experimental group is trained by two months in the construction and use of the strategy. The rate of incoherences detection, as well as the learning level is compared in both groups through pre- and post-tests. Metacognition level of students is evaluated by a test, and correlated with the two previous variables. The sample of the study includes 80 students of two parallel 11th grades of a same Chilean school.

## **Measuring High School Students' Metacognitive Knowledge, Skills and Attitude through AILI Relationships with Gender, Grade, Curriculum and Achievement**

Lucia Mason & Chiara Nadalon, University of Padua, Italy,

Since the seventies (Brown, 1978) psychological research has documented that metacognition plays an important role in learning. A shared issue among scholars is that the construct of metacognition is composite. This study aimed at measuring high school students' metacognitive competence by means of AILI (*Awareness of Independent Learning Inventory*), a self-report instrument which includes three main components: metacognitive knowledge, skills and attitudes (Elshout-Mohr, van Daalen-Kapteijns, & Meijer, 2004), as well as five topics of concern to learners. The study involved 492 Italian students in five branches (curricula) of high school, from the first (9<sup>th</sup> grade) to the last (13<sup>th</sup>) year. MANOVAs revealed significant differences related to gender, curriculum and grade level for each component and topic in favour of girls, students in the classical and scientific branches, and students in 9<sup>th</sup> and 13<sup>th</sup> grades. Overall students' metacognitive competence significantly correlated with their achievement in three major subjects.

## **Computers and Multimedia, Cognitive Style and Metacognition**

Anne McDougall and John Vincent, Faculty of Education, The University of Melbourne, Australia

This paper is based on two separate case studies. The first showed that some children with very low achievement in literacy can produce immediately markedly improved performance in writing when they work with computers and a multimedia environment. A test of cognitive style appeared to predict students who were helped in this way.

The second study provided an illustration that a child of primary school age could develop an awareness of her own distinctive, very visual style of working, sufficient to determine two years later that she would need to draw diagrams to assist herself in Mathematics that year as her new teacher provided verbal statements of problems but few illustrations.

The paper explores the possibility that children with low achievement in literacy might be helped to develop awareness of their own preferred styles of working, and arrange for themselves strategies, such as using computers and multimedia, to scaffold their writing processes.

## **Quasi-experimental research on metacognition using AILI**

Wil Meeus, Hilde De Paepe and Nadine Engels, Departement of Teacher Education, Free University Brussels, Belgium

The Awareness of Independent Learning Inventory (AILI) is constructed to measure metacognitive qualities of students in higher education (Elshout-Mohr et al, 2004). Research with students in teacher education shows that the AILI is capable of measuring differences in metacognition between students who work with or without a portfolio. An important conclusion of this study points to the role of the teacher educators, i.e., their confidence in the self-regulation of the students. The enhancement of metacognitive qualities appears to be positively influenced by their confidence. Moreover, the enhancement of metacognitive regulation is determined by the students' freedom to navigate.

## **Construction and Validation of a Questionnaire on Metacognition**

Joost Meijer, Marianne Elshout-Mohr, and Maartje van Daalen-Kapteijns, SCO-Kohnstamm Institution, University of Amsterdam, The Netherlands

Wil Meeus, Department of Teacher Education, Free University Brussel

Dirk Tempelaar, Faculty of Economics and Business Administration, University of Maastricht

The Awareness of Independent Learning Inventory (AILI) was initially constructed for the measurement of metacognitive qualities of students in teacher education. The psychometric characteristics of the questionnaire were investigated by means of classical reliability analysis, factor analysis and a generalisability and decision study. The analyses revealed favourable psychometric features of the instrument. The decision study showed that the questionnaire could be abbreviated without too much adverse consequences for its psychometric quality. Moderate to substantial correlations of the AILI-components with the factors underlying the Motivated Strategies for Learning Questionnaire (MSLQ) support the validity of the instrument. Associations of AILI-scores with academic performance could not be demonstrated. The abbreviated version has been translated into various languages and is presently being used for research purposes in different European countries.

## **Intelligence and metacognitive activity of 13- and 15-year olds**

Joost Meijer, Marcel V J Veenman and Bernadette H A M van Hout-Wolters, University of Amsterdam, Netherlands

In this study metacognitive activity was operationalised by nominal descriptions of mental behaviour observed in thinking-aloud protocols rather than by quality judgments. A taxonomy of metacognitive activities was developed. The framework of the taxonomy is built around the superordinate categories orientation, planning, execution, monitoring, evaluation and elaboration. Thinking-aloud protocols from 43 thirteen-year olds and 42 fifteen-year olds reading texts about history and physics were analysed using the taxonomy. Before the thinking-aloud sessions, participants had been tested for their intelligence and prior knowledge about the subjects of the history text and the text about physics. After the thinking-aloud sessions, posttests about the history and physics subjects were administered. Analysis of the data from the thirteen-year olds revealed that history posttest performance was only determined by pretest performance. For physics it appeared that executive activities enhanced posttest performance directly and intelligence determined posttest performance indirectly, through the pre-test.

## **Who Benefits from IMPROVE? The Differential Effects of IMPROVE on Mathematical Knowledge and Reasoning**

Zemira Mevarech and Shimon Fridkin, School of Education, Bar-Ilan University, Israel

The purpose of the present study is to examine the differential effects of IMPROVE, a meta-cognitive instructional method, on mathematical knowledge and mathematical reasoning of students with different mathematical background. Participants were 81 students who studied a pre-college course in mathematics. Students were randomly assigned into one of two groups and groups were randomly assigned into one of two conditions: IMPROVE vs. traditional instruction (the control group). Both groups were exposed to the same learning materials, solved exactly the same mathematical problems, and were taught by the same experienced teacher. The IMPROVE students were explicitly trained to activate meta-cognitive processes during the solution of mathematical problems. The control group was exposed to traditional instruction with no explicit exposure to meta-cognitive training. For the purposes of the present study's analyses, students within each condition were divided into two groups: lower achievers who scored on the pretest below average, and higher achievers who scored on the pretest above average. Results indicate that the IMPROVE students significantly outperformed their counterparts on all measures of mathematical knowledge and mathematical reasoning. In particular benefited from IMPROVE the lower achievers who progressed more than the higher achievers. The theoretical and practical implications will be discussed in the conference.

## **Reflection in Project-Based Science Courses for the Gifted**

Shirley Miedijensky and Revital Tali Tal  
Department of Technology and Science Education, Technion – Israel Institute of Technology,  
Israel

This study aimed at assessing reflective skills of gifted students participating in an elective project-based science course. This was part of a larger study that examined the implementation of embedded assessment in Pull-Out Programs for the gifted. Reflection was perceived here as a metacognitive strategy that regulates the learning process. The data included reflection questionnaires, distributed at different stages of the inquiry and learning processes and interviews

with selected students. Our findings indicate that most of the students moved from technical-descriptive statements to higher levels of reflection expressed by critical and dialogical responses. As might be expected from gifted students, we noticed that a few of them showed high level of reflection already at the beginning of the assessment process. This study highlights the potential of using different modes of assessment as a means to enhance metacognitive skills of gifted as well as all students

### **Children’s understanding of display rules: The role of second-order intentions**

Plousia Misailidi, University of Ioannina, Greece

The current study examined the hypothesis that children’s understanding of display rules is associated with their ability to attribute second-order intentions. Seventy two 4- to 6-year-old children participated in the study. Children completed a task measuring their ability to understand prosocial and self-protective display rules as well as a task that assessed their ability to attribute second-order intentions to others. Results showed that performance on the display-rule task and on the second-order intention task improved significantly over the age range examined. Children who demonstrated a capacity to attribute second-order intentions to others were also able to predict prosocial and self-protective display rules. In contrast, participants who failed the second-order intention task also failed the display-rule task. These results suggest that mastery of second-order intentions is developmentally prior and necessary for children to understand display rules.

### **Reflecting by writing**

Luigina Mortari, Department of Education, University of Verona, Verona, Italy

The phenomenological method is an approach to research, but it is also a way through which it is possible to educate to the reflection. Husserl speaks of a “second reflection”, that is a reflection on the life of the mind.

By interpreting the phenomenological method on the light of Buddhist thought, we can theorize that is useful to develop a mindful posture, that is, to educate the mind to lead back from its cognitive preoccupations in order to see its life while it flows.

On this premise I organized a reflective training for four young researchers; in order to promote the capability of reflection I proposed to them to write a “reflective journal” in which to record the reflections which accompanied their research. The paper presents the data which emerged from the analysis of the journals.

### **Instruction toward Meta-Cognition: What is actually taking Place in Online Courses?**

Ofra Nir-Gal,; Talia Nur, R. Gelbart, and R. Reingold, Achva Academic College of Education, Israel

The current research examined the actual application of e-learning instructional methods at the cognitive/meta-cognitive level, in 100 online course sites in higher education systems, including teacher education colleges, in Israel and in the USA.

The research data revealed a discrepancy between the stated goals and the actual application of higher level meta-cognitive thinking processes in online courses. Whereas in a significant number of courses, the stated goals were directed toward the development of meta-cognitive, as well as procedural and declarative knowledge, at the applicative level, very few assignments were

directed toward the acquisition of meta-cognitive learning. Moreover, the actual instruction related to the basic and the technical level of "what" the students should do, while almost no instruction was directed toward higher level meta-cognitive learning. It seems that the majority of the online teachers have not made the transition to a more constructivist, cognitive approach.

### **Pictures in my mind: Young children's metacognitive strategies whilst drawing**

Kate Noble, Faculty of Education, University of Cambridge, UK

This paper will look at the findings of a project examining at the development of visual literacy in young children. The data is taken from interviews with children in two different schools aged 5, 7 and 9 years, talking and drawing in response to visually challenging picturebooks. Video footage of the children making their drawings is analysed alongside the final drawings and the children's comments whilst reading the books. The findings reveal children's careful and deliberate thinking as they plan and make their drawings and demonstrate that drawing is a cognitively demanding and stimulating process. The research found that the most significant developmental differences lay in the strategies the children used when drawing.

### **Metacognition and motivation on Help-seeking in learning statistics on a web site**

Noury and Nathalie Huet, Work and Cognition laboratory, Université Toulouse II, France  
Hänsel, Learning laboratory, Technical University Dresden, Germany

Adaptive help-seeking as a self-regulatory skill has been mostly studied in traditional school contexts. In this paper, the impact of metacognitive processes such as monitoring (judgement of confidence) and motivation (achievement goal orientations) on help-seeking during problem solving, were examined in an online learning environment. Students in psychology had to solve easy and difficult statistic problems on a web site. They could spontaneously use help such as work-out problems, on-line course of statistics. In case of failure, they were presented automatically the help for correcting their errors as a feedback of assistance.

The results show that only for the easy problems there were significant influences: (1) the accuracy of the judgement of confidence was positively associated with the frequency of help used after feedback. (2) Performance goals were negatively associated with the frequency of help used before feedback. (3) Unexpectedly, no relationship was found between mastery goals and help seeking.

### **Influence of Planning and Familiarity on Individuals' Metacognitive Knowledge and Learning**

Jorge Oceja and Margarita Limón, University Autónoma of Madrid, Spain

Our general aim will be to explore the relationships among familiarity, planning, metacognitive knowledge and metacognitive skillfulness. Two tasks in which participants show a different level of familiarity with (low, high) will be presented to each participant (n= 60 college students in experiment 1, n= 60 high school students). A first sub-goal of our study will be to analyze if there are significant main effects of familiarity on the dependent variables measured (metacognitive knowledge, metacognitive skills, performance, learning).

Secondly, the influence of *planning* on individuals' metacognitive knowledge will be explored. The effect of three experimental conditions (no explicit plan asked, written plan before beginning

the task asked, plan designed by researchers is explicitly given) will be studied. The interaction *familiarity x planning* will be also analysed.

The study is in progress yet, however data from a pilot study already got seem to show a positive effect of providing individuals a plan, specially when the task is not much familiar to individuals. Instructional implications will be developed.

### **The influence of epistemological beliefs, attitudes, and metacognition on learner activities in a hypermedia learning environment**

Maria Opfermann and Peter Gerjets, Knowledge Media Research Center, Tuebingen, Germany

During recent years, hypermedia learning environments have gained increasing influence within educational contexts. They offer a high level of learner control together with the possibility to integrate and combine different representational codes and to address different sensory modalities. However, the question needs to be answered whether all learners benefit from such advantages in the same way or whether the relationship between the design of hypermedia learning environments and learning strategies as well as learning outcomes is moderated by individual differences, i.e., learner characteristics. In our study, we focus on the role of epistemological beliefs, attitudes, and metacognition. Two questions are in the focus of the research: (1) Is their influence domain specific or general? and (2) Is there an optimal degree of learner control for learners differing on these dimensions? The study is currently being conducted using a learning environment on probability theory, and results will be presented at the conference.

### **Pre-service and in-service teachers' metacognitive knowledge about problem solving strategies**

Panayiota Metallidou, University of Thessaly, Greece

The study based on the methodology that has been developed by Antonietti, Ignazi, and Perego (2000) with the aim to examine the level of conditional metacognitive knowledge adult participants have about problem solving strategies. 338 in-service (172) and pre-service (166) teachers participated in the study. They were asked, first, to give on a five-point scale frequency, efficacy, and facility estimates for the application of five problem-solving strategies (free production, analogy, step-by-step analysis, visualization, and combining) in 3 kinds of problems (interpersonal, practical, and study problems). Second, to check the mental abilities they thought to be involved in the application of strategies. The results strengthen Antonietti's et al. (2000) results by provided comparable evidence for the generality of metacognitive beliefs as regards the appropriateness and the usefulness of different strategies during problem solving. They, also, stressed the possible role of age along with work experience in the formation of beliefs about strategic behavior.

### **Theory of mind and correlates in 3-4 year old children**

Eleonora Papaleontiou- Louca and Niki Kyrou- Thoma, Cyprus College, Cyprus

Previous research (Astington 1998) has shown that theory of mind as measured by false belief tasks positively correlates with school achievement and verbal development in young children. The present research using children three to four year old aims at further investigating the correlation between theory of mind scores as measured by the false belief tasks according to J. W.

Astington and J. M. Jenkins (1999) on the one hand and on the second: a) The verbal development of these children as measured by picture vocabulary and Mean Length of Utterance, b) Non verbal intelligence measured by two subtests of WPPSI test of intelligence and the composite score of verbal and non verbal abilities and c) School achievement as given by teachers' grading.

More correlations will be conducted concerning the verbal output of the children in specific measurements in the contents of the speech output of the children.

### **Epistemological Beliefs and Metacognitive Calibration in Hypermedia Learning**

Stephanie Pieschl, Elmar Stahl and Rainer Bromme, University of Muenster, Psychology Department, Germany

Based on the COPES-model of self-regulated learning (Winne & Hadwin, 1998) we started a comprehensive project to examine the impact of epistemological beliefs on metacognitive calibration during hypertext learning. The results of two pilot-studies focusing on different stages of self-regulated learning according to the COPES-model will be presented. The first pilot-study (n = 72) investigated the impact of epistemological beliefs on the first two stages, (1) task definition and (2) goal setting and planning. Participants were presented with learning tasks differing in complexity and had to judge them on different dimensions. The second pilot-study (n = 51) concentrated on the third (3) enactment stage. Participants had to learn with a hypertext on genetic fingerprinting. Results indicate that learners do metacognitively calibrate their learning processes to task demands and that this calibration process is influenced by epistemological beliefs as well as by prior knowledge on all stages of learning.

### **Analysing Parent-Child Interactions during Study-Related Activities and their Impact on Children's Self-Regulated Learning**

Deborah Pino Pasternak, Faculty of Education, University of Cambridge, U.K.

This conference paper will present interim findings from a microgenetic study of parent-child interactive dynamics during a family intervention programme designed to foster a self-regulated approach towards academic tasks on the part of primary school children presenting difficulties in learning at school. Informed by sociocultural and microdevelopmental approaches as well as current research on self-regulated learning this paper will examine changes in the family's interactive styles and parental mediational strategies observed throughout the sessions of the intervention programme and will analyse the impact of these changes on children's self-regulated learning. The analysis presented in this paper will focus on elements such as the level of parental responsiveness and control, the affective tone of the parent-child interaction, the degree of distancing fostered by the parents' mediational strategies and the impact of these variables on the quality of the children's self-regulated performance.

### **Metacognitive behaviours - conflict in practice**

Christine Redman and Tony Jones, The University of Melbourne, Australia

Data reported in this paper will be interpreted using the idea that metacognition comprises both being able to recognise one's learning processes as well as whether or not one has completed a given task. We will take metacognition to include "the learner's realisation ... that there are limitations on their knowledge to complete a task, and ... that they possess strategies for

rectifying that situation” (Williamson, 2005). The degree of contrast between one’s prior experiences, expectations, social skills and engagement with content can obstruct the zone of proximal development (Vygotsky, 1978). We report on a dyad working together at an unfamiliar website. It takes time to begin working together and to jointly consider the website content. A fine-grained analysis of their conversation and actions showed that the students were attending to different aspects of the website. The metacognitive processes and strategies drawn upon are shown to be diverse, similar and dissimilar at different times of the journey depending on prior events and immediate demands.

### **The relationship between student's metacognition and instructor's scaffolding in online academic course**

Rikki Rimor, Teachers College of Technology, Tel Aviv  
Roni ReingoldAchva- College of Education  
Anat Kalay, Ben-Gurion University of the Negev

The research studies the relationship between manifestation of metacognitive processes expressed by students and the instructor's feedback, in online academic course on democracy and multiculturalism. Recently, interest in metacognition has greatly increased among researchers studying students' reflections in online learning environment (Anderson, 2001; Davis, 2003; Rimor & Kozminsky, 2002 ; Papaleontiou-Louca, 2003).

### **Private Gestures and Self-Regulation**

Cintia Rodríguez, Portsmouth University (UK) / Universidad Autonoma de Madrid (UAM)

Private gestures (ostensive and pointing) as they appear in the context of a conventional use of an object demonstrate at least two things: (1) The child has complex semiotic knowledge about the conventional and social meanings of his *own gestures*, and also about the conventional uses of objects *towards which* he applies these gestures. The child produces private gestures in order to think about pieces of reality whose uses are shared by the community. (2) If the child produces private gestures to help himself to “think externally” about how to solve a problem with spatial signifiers, then he already possesses degrees of consciousness and of self-regulation without the need for language.

### **Relevance of planning strategies and self-perception of learning difficulties in CSCL**

Margarida Romero, Universitat Autònoma de Barcelona, Spain/Université de Toulouse, Maison de la Recherche. France

A growing number of papers warns of difficulties in Computer Supported Collaborative Learning (CSCL) implementation and acceptance (Hallett & Cummings, 1997; Kreijns, 2002). The aim of our study was to identify CSCL technical and social difficulties felt by virtual campus students in Bachelor's degree (L1, L2).

Results indicated that there are not technical difficulties due to computer use, but those due to extrinsic factors (Internet access difficulties or malfunctions in equipment or software). Results also show that self-difficulty metaknowledge (Printrich & Schunk, 2002) was different for virtual campus beginners and more experienced students. For beginners the main social difficulty was the feeling of aloneness. On the other side, experienced students considered collaborative work difficulties in priority.

According to reported social difficulties, we analysed the influence of main difficulty consideration and the relevance of learning strategies (Winstein & Mayer, 1986). First results show that students considering collaborative work as the main social difficulty are also more relevant on their learning planning.

### **Can writing on a blog promote metacognitive awareness? An experimental study**

Roberta Sala, Barbara Colombo and Alessandro Antonietti  
Department of Psychology, Catholic University of the Sacred Heart, Milano, Italy

To investigate the link among metacognition, multimedia and “conversational” narratives an experimental study was designed. Participants were divided into 4 experimental groups (plus a control group): paper communication, computer communication, email communication and blog communication. Participants were tested for metacognitive awareness before and after the experimental period, during which they were asked to attend to a multimedia task and to narrate their experience according to the condition they were assigned to. An improvement of metacognitive awareness is expected to be associated with more social and multimedia way of communicating.

### **Metacognition, theory of mind and emotions/affections: a possible integration**

Olga Liverta Sempio, Antonella Marchetti and, Giulia Cavalli, Università Cattolica del Sacro Cuore, Milano, Italia

Metacognition, theory of mind (ToM) and emotions are three aspects of the psychological functioning, till now studied separately or two by two. Considering the relationship among them by the light of the definition of ToM (the ability to conceive of its own and others’ mental states and their role in the explanation of behavior) we can think possible an integration. In particular, we analyze the contextualistic approach, that considers the relationship between language and metacognition/ToM, and the relational psychoanalytic perspective, focused on the concept of intersubjectivity.

This integration is also possible if we refer to the socio-relational conception of development, that considers influences of family/educational relationships, that are charged emotionally contexts, on ToM and metacognition development.

In the first part we speculate about this integration, in the second part we examine data from researches that, from different theoretical and methodological perspectives, consider the three topics together.

### **Elementary school children’s intuitive epistemologies of science**

Beate Sodian, and Claudia Thoermer, Department of Psychology, University of Munich, Germany  
Ernst Kircher, Patricia Grygier and Johannes Günther, Department of Physics/ Science Education  
University of Würzburg, Germany

While research on the development of theory of mind and metacognition indicates that elementary school children conceive of the mind as an active interpreter of information, the science education literature characterizes children’s intuitive epistemologies of science as absolutist and non-constructivist. We report results of a curricular intervention study in 4<sup>th</sup> grade classrooms, indicating that explicit metaconceptual instruction on the Nature of Science helps 4<sup>th</sup> graders grasp the notions of “idea/ theory/ hypothesis”, “test”, and “explanation”. Furthermore,

our assessment instrument, a clinical “Nature-of Science” interview consisting of abstract definitional questions about key concepts and elements of the scientific inquiry process, as well as of contextualized questions presenting concrete examples, indicates that an implicit understanding of the role of interpretive frameworks in the construction of scientific knowledge emerges with contextual support. We discuss the findings with respect to the importance of metacognitive development for science education in elementary school.

### **The interactive impact of academic emotions and cognitive factors on success in tertiary education**

Georgia Stephanou, University of Western Macedonia, Greece

This study investigated (a) Early Childhood Education female students’ (N=320) emotions experienced in the lectures of Psychology, Linguistics and Physics courses, (b) the role of this emotional experience and cognitive (ability self perception, perceived task difficulty, performance expectations and subjective task value) factors in students’ semester performance in the same courses, and (c) the role of the cognitive factors in the generation of academic emotions, and in the impact of academic emotions on academic performance. MANOVA analyses showed that the students experienced a variety of emotions and a variation of intensity of emotions. Discriminant analyses revealed that the successful students, compared to unsuccessful students, across the three courses, felt better in the lectures, and were superior in all cognitive factors. Hierarchical regression analyses showed that students’ cognitive (mainly, ability self-perception) factors had positive effects on their academic performance and emotions, and mediated the impact of academic emotions on academic performance.

### **Improving collaborative group-work using structuring aids, feedback and metacognitive tutoring**

Elke Sumfleth and Maik Walpuski, University of Duisburg-Essen / Chemistry Education, Essen, Germany

In this presentation two studies will be introduced. The first study (2003-2006) is concerned with two types of intervention influencing experimental group-work in chemistry education which are supposed to generate higher learning outcomes. According to previous results, group-work seems to have two major deficiencies: The students are neither able to recognize their own mistakes during the course of the learning process nor can they structure the group-work sufficiently. The first study resulted in a positive effect when mistakes were corrected by feedback but in no effects when the working process was structured. There is evidence that the students do not use the implemented structuring aids correctly because they are not able to reflect on their own working process. On this account a metacognitive training on scientific methods is introduced in the recent study.

## **The effects of self-explanation as a metacognitive strategy on solving mathematical word problems**

Hidetsugu Tajika, Narao Nakatsu and Hironari Nozaki, Aichi University of Education, Kariya, Japan

Ewald Neumann, University of Canterbury, Christchurch, New Zealand

The purpose of the study was to examine how a metacognitive strategy known as self-explanation influences word problem solving in elementary school children. Participants were 79 sixth-graders. They were assigned to one of three groups, the self-explanation group, the self-learning group, or the control group. Students in each group took two kinds of tests, a ratio word problem test and a transfer test. The results showed that students in the self-explanation group outperformed students in the other two groups on the ratio word problem test. Students in the self-explanation group also outperformed students in the control group on the transfer test. In addition, high explainers who generated more self-explanations relating to deep understanding of worked-out examples outperformed low explainers on both ratio word problem and transfer tests. The self-explanation effect is discussed.

## **Assessing Differences In Mathematical Metacognition Of Primary School Students**

Simona Tancig, Faculty of Education, University of Ljubljana, Slovenia

The purpose of this study was to investigate the mathematical metacognition according to pupils' gender and their achievements in mathematics, as well as to check the measurement characteristics of the used instruments.

The subjects of the study were 94 fifth-grade children from regular schools (mean age of 11 years).

Two metacognitive test were applied for assessing metacognition in mathematics. Both test are based of Cornoldi's metacognitive instruments (Cornoldi et al., 1995).

Qualitative analyses, descriptive statistics and t-tests were applied to collected data. Cronbach's alpha coefficient was used to check reliability of questionnaire (Form B). Factor analysis was carried out to examine the dimensionality and internal validity of questionnaire (Form B).

Using the criteria of gender and general academic success significant differences were discovered in metacognitive knowledge and metacognitive regulation.

As for the questionnaires measuring metacognitive processes and metacognitive knowledge, the girls and the group of academically successful students achieved comparatively better results than the boys and less successful children.

The questionnaire of metacognitive processes (Form B) showed high level of validity and acceptable degree of reliability.

## **Self-knowledge: Uniting reflection and metacognition**

Pina Tarricone, Edith Cowan University, Western Australia

Historical and more recent discussions provide a foundation for strongly suggesting that self-knowledge is an essential, uniting core between reflection and metacognition. These contributions fundamentally imply that self-knowledge and self-understanding are essential in knowing oneself; this can only be achieved through deliberate reflection, introspection and consciousness. If self-knowledge relies upon reflection and introspection, what are some of the differences between the two processes, and how do these processes relate to metacognition, and contribute to self-

knowledge? Essentially, what is the conceptual relationship between self-knowledge and metacognition and how does it inform the categories of metacognition.

### **Taxonomy of Metacognition**

Pina Tarricone, Edith Cowan University, Western Australia

Metacognition is an intricate construct described as obscure, fuzzy, vague and faddish (see Brown, 1987; Flavell, 1981a; Kitchener, 1983; Wellman, 1983). Its fuzzy multifaceted nature has led to its colloquialistic application in research, resulting in studies that fail to identify the theoretical foundation or elements of metacognition (Baker & Brown, 1984b; Brown, 1987; Brown, Bransford, Ferrara, & Campione, 1983; Brown & Campione, 1981; Cavanaugh & Perlmutter, 1982; Efklides, 2001; Flavell, 1981a; Flavell, Miller, & Miller, 1993; Garner, 1987; Kitchener, 1983; Schoenfeld, 1987; Schraw, 2000; Schraw & Moshman, 1995; Wellman, 1983; Yussen, 1985). In review of this, the research community has called and continues to call for a comprehensive understanding of the construct of metacognition (see Efklides, 2001; Flavell, 1987; Schraw, 2000). This presented a need for metacognition to be demystified and reconceptualized, providing researchers with a pellucid conceptualization of the construct depicted in a Taxonomy of Metacognition.

### **The relationship of implicit theories about intelligence and students' metacognitive abilities**

Dirk Tempelaar, Maastricht University

In this empirical study, we investigate the relationship between implicit theories and metacognitive abilities in university students. Implicit theories are meaning systems about personal attributes as e.g. intelligence (Dweck, 2000). Prototypical examples are the concept of entity theory, that assumes intelligence to be a fixed, nonmalleable traitlike entity, and the concept of incremental theory, where intelligence is portrayed as something that can be increased through one's efforts. This contribution will focus on relationship between implicit theories and metacognitive abilities, both measured by self-report instruments: the Awareness of Independent Learning Inventory (Elshout-Mohr et al., 2005), and surveys developed by Dweck, focusing on entity theory, incremental theory, viewing effort as a positive thing that activates ability, viewing effort as a negative thing that indicates low ability, and a relative measure pitting the inclination toward learning versus performance goals. The relationships are investigated using structural equation modelling.

### **Relation between intellectual ability and metacognitive skillfulness as predictors of learning performance of young students performing tasks in different domains**

Manita van der Stel and Marcel V.J. Veenman, Dept. of Developmental & Educational Psychology, Leiden University, The Netherlands

The first objective of this study was to establish the relation between intellectual ability and metacognitive skillfulness as predictors of learning performance in young students (aged 12 years). Furthermore, the generality vs. domain-specificity of metacognitive skillfulness was investigated. Thirty-two first-year secondary-school students participated in this study. While thinking aloud, they performed two different tasks representing two different domains: A text-studying task for history and a problem-solving task for mathematics. Participants' intelligence, metacognitive skillfulness and learning performance were assessed. Results show that

metacognitive skillfulness contributed to learning performance (partly) independent of intellectual ability. Results also show that metacognitive skills predominantly appear to be general. Domain-specific metacognitive skills, however, played a secondary role as well. Implications for training of metacognitive skills are being discussed. This study is the first step in a longitudinal study where the same participants will be followed for three consecutive years as they enter secondary education. This is a crucial period in the development of metacognitive skills.

### **Metacognitive knowledge of writing: Students and individual differences**

Christina E. van Kraayenoord, Karen B. Moni, Anne Jobling, John Elkins and Robyn Miller, School of Education, The University of Queensland, Brisbane, Australia  
David Koppenhaver, Language, Reading and Exceptionalities Department, Appalachian State University, North Carolina, USA

This paper reports on the metacognitive knowledge of students in Years 5 to 9 with developmental disabilities and learning difficulties involved with their teachers in the WriteIdeas Project in Queensland, Australia. The students were assessed using the *Student Writing Interview-Revised* (van Kraayenoord, Moni & Jobling, 2004) prior to and after an intervention involving tailored instructional support in writing. The comparisons of metacognitive knowledge related to writing of the two groups of students and at pre- and post-assessment revealed both similarities and differences. The results highlight the complex issue of metacognitive knowledge of writing and of using such information to develop responsive instruction in writing for students with developmental disabilities and learning difficulties in inclusive classrooms.

### **Metacognitive skills as self-instructions**

Marcel V.J. Veenman, Dept. of Developmental and Educational Psychology, Leiden University, Amsterdam, The Netherlands

While there is consistent acknowledgement of the importance of metacognition in learning processes, inconsistency marks the conceptualization of the construct. This paper addresses the relation between metacognitive knowledge and skills from the perspective of Nelson's model of information flows between the cognitive 'object'-level of task performance and the meta-level, which regulates the object-level. As an extension of this model, metacognitive skills can be conceptualized as an acquired set of self-instructions, which set is activated whenever the learner is faced with task performance. This conceptualization of metacognition may also be helpful in resolving the homunculus problem or Comte's paradox in metacognition research: A higher-order agent is overlooking and governing the cognitive system, while simultaneously being part of it. Cognitive activities are the vehicles of metacognitive self-instructions. These cognitive activities in turn are subject to ongoing metacognitive monitoring and evaluation processes. This circular process of metacognitive and cognitive activities makes it hard to disentangle them in metacognition assessments.

### **Metacognition and transfer within a course**

Henk Vos, University of Twente, Enschede, The Netherlands

Can a metacognitive strategy for doing research (included transfer) be taught in a course of nine afternoons? How? How do the students learn? Literature research revealed four possible metacognitive variants that correlate. It was hypothesised that development of all had to be

implemented into the carefully designed course. The course was divided in three domains in which the strategy was met, practised, and applied respectively. The students were assessed on insight in the strategy. They were divided into three groups (weak, moderate, good) by their marks for other courses. The performance of the students was monitored by their marks, scoring of some metacognitive skills, observations, and time keeping. For strategy the moderate students scored as high as the good ones in the last domain, a unique result. The conclusion is that a metacognitive strategy, transfer included, can be taught in a short time if all metacognitive variants get attention in instruction.

### **Some speculations on the meaning of Metacognition**

Henk Vos, University of Twente, Enschede, The Netherlands

Metacognition is not clearly distinguished from cognition. It involves several variants under differing names. The variants are highly correlated what makes measurements easily irreproducible. A comprehensive model would further communication and research. The goal is to distinguish metacognition from the rest of cognition ('cognition'), to find the smallest complete set of independent variables that span cognition, and properties of the brain that may explain metacognitive phenomena. A literature research has been carried out to describe cognition and metacognition along levels of abstraction. The approach to construct an advance organiser was used. The framework found has been applied in research and revised afterwards. Neuro-physiological properties of the brain have been skimmed. Four independent variants are proposed. The relation with perception can distinguish metacognition from 'cognition'. A definition of metacognition is presented and two graphical models. Four properties of the brain could explain metacognition, one of which is overlooked until now.

### **Metacognition, Achievement Goals, Learning Strategies and Achievement**

Anneke Vrugt and Frans J. Oort, Department of Social and Behavioural Sciences, University of Amsterdam

This study focused on the role of metacognition in self-regulated learning. We examined the relationships among achievement goals (Elliot & Church, 1997), metacognition (measured by Awareness of Independent Learning Inventory, Elshout-Mohr, van Daalen-Kapteijns & Meijer, 2004), the use of metacognitive self-regulation, cognitive and metacognitive strategies, resource management strategies, effort (MSLQ) and achievement. First-year psychology-students (N = 545) participated in a collective test session. Exams were taken a few weeks before and after this test session. We controlled for intelligence and the scores on the first exam. Mastery goals contributed to metacognition. Metacognition contributed to metacognitive self-regulation, cognitive and metacognitive strategies and resource management strategies. These strategies contributed through effort to the scores on the second exam.

### **Understanding metacognition through the use of pupil views templates**

Kate Wall, Centre for Learning and Teaching, Newcastle University, UK

The Learning to Learn Phase 3 Evaluation is a research project funded through the Campaign for Learning (CfL) and supported by the Centre for Learning and Teaching at Newcastle University (for fuller detail see Higgins, Wall *et al.* 2005; 2006). As part of this project teachers have been supported in using an action research cycle to explore different innovations that they believe fit

under the umbrella term of Learning to Learn. The involvement of pupils and inclusion of their perspective within the schools' case studies has increased as the project has progressed. The teachers have indicated that the role and characteristics of pupils in a Learning to Learn school or under a Learning to Learn philosophy are important. As a direct result of this every school that completed a case study in Year Two consulted the pupils in some way or another. This paper will explore the method of pupil views templates (Wall and Higgins 2006) and how teachers have used this pragmatic tool (Wall and Hall *in preparation*) to research the pupils' perspective of Learning to Learn and the process they perceive to be involved.

### **Explorations in metalearning from a narrative stance**

Chris Watkins, Institute of Education, University of London, UK

This paper will offer:

- a. an outline of a narrative stance on human learning, its axioms and insights
- b. an account of the derivation of practices which promote an enriched story of learning, i.e. enhanced metalearning
- c. some evidence of experiences of how this leads to more engaged, active and self-directing learners.

The paper will argue that a narrative stance on learning offers a further development of conceptual trends in understanding learning which have characterised the 20<sup>th</sup> century, and that understanding metacognition as an interface between a person's "internal" narratives and the "external" discourses of their context is a rich culturally-sensitive idea with many implications for constructive action. A range of field experiments will be described.

### **Regulation of Learning – Bridging Perspectives on Metacognition and Motivation**

Esther Winther, Georg-August University Goettingen, Germany

Learners differ in learning techniques and learning behaviour itself; they invest effort and endurance in order to be successful. These two aspects have to be thoroughly measured to explain differences in learning and performance between individuals and to implement appropriate actions for supporting students' learning and performance. By an extensive study, our research group focused on the interplay of cognitive, metacognitive and motivational processes which is essential for effective learning. These processes have been analysed, operationalized and supported for the subject of business administration and accounting in the 11<sup>th</sup> -13<sup>th</sup> years of German business schools. By our results we demonstrate that the observation and the measurement of **learning traits** alone cannot explain students' performance and the differences between students' performance in detail. We, therefore, expanded the model and implemented also **learning states** as variables.

### **Facilitating Social MetaCognition of Children with Learning Disabilities**

Rivka Yogev, Rivka Glaubman, Yigal Gross and Hananyah Glaubman – Bar-Ilan University, Israel

A social metacognitive intervention programme (SMIP) for the facilitation of social processes through self-questioning of children with learning disabilities (LD), was designed on the basis of Crick and Dodge's (1994) social information processing model.

In this study the effectiveness of the programme was examined empirically on a population of LD adolescents numbering 111 students, from ten classes. The participants were divided into two

groups, an experimental group and a control group. The SMIP was applied to the experimental group, and a "life skills" programme to the control group.

The results showed more improvement in the experimental group in all the measures of social understanding and social behaviour, and marked improvement in their self-image.

Thus, the intervention proved successful, indicating the effectiveness of self-questioning strategies as a social intervention model, which can become an integral part of the curriculum and serve as an educational and therapeutic method for the enhancement of social understanding and behaviour in LD adolescents.

Crick, N. R., & Dodge, K. A. (1994). A review and reformulation of social information-processing mechanisms in children's social adjustment. *Psychological Bulletin*, 115, ( 1), 74-101.

### **A conceptual analysis of meta strategic knowledge: a specific case and general model**

Anat Zohar

School of Education, Hebrew University, Jerusalem, Israel,

The complexity of the concept of metacognition, the "fuzzy borders" between that which is cognitive and that which is metacognitive, and the "fuzzy borders" among the different sub-components of metacognition, often raises conceptual difficulties for empirical researchers in the field. The difficulties stem from the ambiguity regarding the precise characteristics and boundaries of the sub-component(s) of metacognition that are addressed by researchers in empirical studies. Consequently, when empirical researchers provide their working (or operational) definition of metacognition (or of its sub-component) which is the focus of their study, it is sometimes difficult to understand just what component of metacognition is being investigated, and what are the relationships between this and other metacognitive components. This state of affairs creates ambiguity, prevents comparisons of findings and hinders generalizations across studies. My first goal is to demonstrate a conceptual analysis of a specific component of metacognition which is called meta strategic knowledge (MSK) and to define the dimensions for its analysis. My second goal is to extrapolate from the specific example addressing the analysis of MSK in order to construct a general model for conceptual analysis that may be used in studying additional components of metacognition.

### **Explicit teaching of meta-strategic knowledge in authentic classroom situations**

Anat Zohar and Adi Ben David, School of Education, The Hebrew University of Jerusalem, Israel

Meta-strategic knowledge (MSK) is general, explicit knowledge about the cognitive procedures that are being manipulated. Following an earlier study that showed considerable effects of explicit instruction of MSK in laboratory setting, this study explores: (a) whether these effects are preserved in authentic classroom situations; and, (b) what is the process of change in students' thinking. Participants were 120 8<sup>th</sup> grade students from 6 classes of a heterogeneous school. Equal numbers of low-achieving and high-achieving students were randomly assigned into experimental and control groups. The findings showed dramatic developments in students' strategic and meta-strategic thinking following instruction. The effect of the treatment was preserved in transfer and retention tasks. Our findings show that explicit teaching of MSK had a stronger effect for low achieving students than for high achieving students. Several patterns of change processes were detected. The implications of the findings for learning and instruction are discussed.