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The development of two observational tools for assessing metacognition and self-regulated learning in young children

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Abstract This paper reports on observational approaches developed within a UK study to the identification and assessment of metacognition and self-regulation in young children in the 3–5 year age range. It is argued that the development of observational tools, although containing methodological difficulties, allows us to make more valid assessments of children's metacognitive and self-regulatory abilities in this age group. The analysis of 582 metacognitive or self-regulatory videotaped 'events' is described, including the development of a coding framework identifying verbal and non-verbal indicators. The construction of an observational instrument, the Children's Independent Learning Development (CHILD 3–5) checklist, is also reported together with evidence of the reliability with which it can be used by classroom teachers and early indications of its external validity as a measure of metacognition and self-regulation in young children. Given the educational significance of children's development of metacognitive and self-regulatory skills, it is argued that the development of such an instrument is potentially highly beneficial. The establishment of the metacognitive and self-regulatory capabilities of young children by means of the kinds of observational tools developed within this study also has clear and significant implications for models and theories of metacognition and self-regulation. The paper concludes with a discussion of these implications.

Keywords Metacognitive development · Self-regulated learning · Observational methods · Young children

This paper argues for the efficacy of using observational methods in naturalistic settings in the identification and assessment of metacognition and self-regulation in young children.

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This is argued on two grounds. First, at the level of research and theory, it is argued that the development of observational tools, although containing methodological difficulties, allows us to make more valid assessments of children's metacognitive and self-regulatory abilities in this age group. Second, within the educational sphere, it is argued that the development of an observational instrument which can be reliably used by classroom teachers to assess children's metacognitive and self-regulatory abilities would be highly beneficial.

Metacognition and self-regulation

The work reported here, like much of the research in these areas, has been inspired by two traditions within developmental psychology: the cognitive information-processing tradition represented by the early work of Flavell (1979) and Ann Brown (1987), from which the terms 'metamemory' and 'metacognition' emerged, and the socio-cultural tradition founded on the work of the Russian psychologist, Lev Vygotsky (1978, 1986) from which the term 'self-regulation' (as opposed to 'other-regulation') derives. This second conception has become increasingly dominant in the literature and is broadly the model we have adopted within the present study, with metacognition forming the cognitive parts of self-regulation, which also encompasses affective, motivational and social elements. However, we have used both terms to recognise those parts of our model of self-regulation which draws heavily upon the cognitive tradition. This model includes the following three elements, which continue to be heavily represented in the research literature: metacognitive knowledge (Flavell 1987; Schneider & Lockl 2002; Pintrich 2002; Annevirta & Vauras 2001) metacognitive monitoring and control (Brown 1987; Nelson & Narens 1994; Son & Schwartz 2002; Pape & Wang 2003) and the monitoring and control of emotions and motivational states during learning tasks (Boekaerts 1999; Zimmerman 2000; Corno 2001; Efklides 2006).

Metacognition and self-regulation in young children

Much of the research effort into each of these areas, however, has focused on older children and adults. In the early work on metacognition, indeed, some writers argued that it is a late-developing capability and, even very recently, in a major review of the field, Veenman et al. (2006) reported that the picture emerging from much of the literature remained that 'metacognitive skills emerge at the age of 8–10 years' (p. 8).

We would wish to argue, however, that this is an increasingly untenable position. In a recent overview, for example, Bronson (2000) describes extensive research which has explored the emotional, prosocial, cognitive and motivational developments in self-regulation throughout the different phases of early childhood. Rothbart et al. (2006) have also reviewed the growing body of evidence linking the early emergence of various executive functions, such as inhibition, effortful control, and executive attention with self-regulation in children up to the age of 6 years.

Further, while studies with young children have often focused on their limitations in metacognition and self-regulation, other studies have shown that, in a number of cases, methodological difficulties have led to the abilities of young children being under-estimated. These methodological difficulties have arisen from an over-reliance on children's verbal abilities, from contextual issues related to experimental tasks, and from the limitations of young children's working memory abilities.

Difficulties in relation to young children's verbal abilities are evident in much of the earliest research concerned with the development of metacognitive knowledge, relying on their ability to respond to hypothetical questions (Kreutzer et al. 1975). While later studies, not surprisingly, have confirmed that metacognitive knowledge tends to improve consistently as a function of age and schooling (Justice 1986; Weinert & Schneider 1999), studies relying less upon the children's verbal abilities have tended to show them to be more knowledgeable than originally suggested (Annevirta & Vauras 2001).

The impact of contextual factors on young children's performance emerges when we look at the research in the area of metacognitive experience, including on-line planning, monitoring, control and evaluation processes. The evidence reviewed by Schneider and Lockl (2002), for example, has indicated that, in comparison to preschool children, older children can more accurately predict future performance, estimate if they are ready to recall a series of items, and tell if they would be able to recognise the names of items they were not able to retrieve spontaneously. However, the preschool children were much more accurate when the tasks were ecologically valid and meaningful to them. Cultice et al. (1983) showed that 4 and 5 year olds were able to provide accurate feeling-of-knowing judgements when presented with photographs of adults and children varying in terms of familiarity. Findings related to strategy use have also arrived at the conclusion that very young children can engage in strategic behaviours in the context of meaningful and age-related tasks (Istomina 1975; Deloache et al. 1985; Clark 1978). In their meta-analysis of studies addressing metamemory–memory performance relations, Schneider and Pressley (1997) found that, depending on the specific requirements of the tasks, correlations between memory monitoring and performance can be substantial even for young preschool children.

Further studies have demonstrated the methodological difficulties associated with young children's limited working memory capacities. Blöte et al. (1999), for example, studied the organizational strategies of 4 year olds using a task which was structured to minimize memory demands. They found that, in this condition, the children's spontaneous behaviour was highly strategic and, although most children did not spontaneously use the most effective strategy, they could be trained to do so and were able to transfer this strategy to new materials.

Observational methods: contributions to research and theory

Research concerned with metacognition and self-regulation in young children using experimental and verbally based methodologies has clearly revealed much of interest concerning the early emergence of these abilities. But, as we have seen, there have also been significant difficulties which cast uncertainty on some findings. Our argument in this paper, therefore, is that the increased use of observational methods has the potential to make a clear contribution, particularly with young children.

In an exhaustive review of methodologies used to assess metacognitive skills, Veenman (2005) reviewed the possible contributions and difficulties of all the common methods used within the literature, including prospective and retrospective self-report measures (questionnaires and interviews), concurrent self-report measures (think alouds) and systematic observation. As regards the self-report measures, there are clear threats to validity. To begin with, of course, such measures rely upon a level of verbal understanding and fluency which cannot necessarily be assumed in young children. As regards think alouds, while this procedure has clearly much to offer with adults and older children, with young children their lack of verbal proficiency is likely to lead to working memory overload, resulting in

either incomplete protocols or interference and distortion of their performance on the task (Garner 1988; Thorpe & Satterly 1990).

A second difficulty with verbal self-report data concerns the extent to which individuals are capable, in any case, however verbally fluent, to report upon their own mental processes. Nisbett & Wilson (1977) presented evidence some 30 years ago that individuals made errors of omission and invention when reporting on their own memory processes.

This issue also closely relates to the important theoretical issue concerning the conscious and declarative or implicit and non-conscious nature of metacognitive processes. Contrary to the assumption in much of the early literature, more recent evidence increasingly supports the view that implicit processes which are not available to conscious awareness are likely to make a significant contribution to metacognitive development (Reder 1996; Siegler 1996; Fitzsimmons & Bargh 2004). Flavell himself, in his original experiments related to young children's memories (Flavell et al. 1966) reported that of those children who were observed to spontaneously rehearse (by observing lip movements), around 25% were unable to report that they had done so.

Arising from these concerns, Winne and Perry (2000) have argued that, particularly in relation to the study of metacognition and self-regulation in young children, systematic observational methods have at least three advantages. First, such methods record what learners actually do, rather than what they recall or believe they do. Second, they allow links to be established between learners' behaviours and the context of the task. And, finally, particularly crucial for young children, they do not depend on the verbal abilities of the participants.

We would also wish to argue for two further benefits. First, systematic observation, particularly where it involves video-recording, affords the opportunity to record non-verbal as well as purely verbal behaviour. Intriguingly, increasing evidence is emerging of the role of non-verbal behaviour in the development of young children's conceptual understandings and self-regulatory processes. In the closely related area of theory of mind, for example, Ruffman et al. (2001) have demonstrated that 3 year old children sometimes look to the correct location but give an incorrect verbal answer in a place-change false belief task. Analysis of their eye-gaze behaviour thus indicated a stage of implicit knowledge before fully conscious awareness which they were able to articulate. Further, recent work concerned with the role of gesture in conceptual learning and strategy development (Goldin-Meadow 2002; Pine et al. 2004) suggests that conscious articulation is only a part of the process of development in these areas. In other words, it seems highly probable that non-verbal behaviour is not only indicative in young children of metacognitive processes, but might also be an important part of the processes by which they are acquired.

A second further advantage afforded by observational methods in naturalistic, educational settings relates to the opportunity to record social processes involved in the development of metacognitive and self-regulatory abilities. There is, of course, a significant body of theoretical and empirical work, within the Vygotskian tradition, which suggests that social processes have a crucial role to play in this area (Zimmerman and Schunk 2001). Much of this work has emphasized the significance of mediation by an adult, and the impact of sensitive and contingent "scaffolding" in supporting children's learning. A range of studies, however, have also explored the significance of children's collaborative or peer-assisted learning of various kinds in the process of internalization of learning, and particularly in relation to the development of metacognitive and self-regulatory abilities (Karpov 2005; Elias & Berk 2002).

In recent research of problem-solving in small groups, Vaurus and colleagues (Iiskala et al. 2004; Vauras et al. 2003) have observed that during episodes of true collaboration,

cognitive regulation processes fluctuate among three levels: self, other and shared regulation. *Self* regulation refers to the traditional concept regarding the monitoring and control of individual performance, or intrapersonal regulation. *Other* regulation relates to the situation in which one partner masters a key element of the task but the other(s) does not, so that one partner instructs the other(s). Finally, *shared* regulation defines an "egalitarian, complementary monitoring and regulation over the task" (Iiskala et al. 2004, p. 150).

This interpersonal level of metacognition referred to as *other* or *shared* regulation exhibits two significant characteristics that distinguishes it from purely intrapersonal metacognition with regard to the cognitive activity involved, and that may enhance its contribution to metacognitive learning. First, working through collaboration allows a reduction in cognitive processing load, which, in itself, may facilitate enhanced metacognitive activity (Whitebread 1999). Second, at the same time the participants need to monitor and regulate the reciprocal use of the joint representation of the task, which obliges them to externalize and articulate their ideas and conceptions to others (Iiskala et al. 2004).

Metacognition, self-regulation and the education of young children

At the outset of this paper it was argued that the development of observational methodologies for the investigation of metacognition and self-regulation in young children, in addition to potential contributions to theory, could also make contributions within education. This is particularly the case given the now extensive evidence of the significance of metacognition and self-regulation for learning (Wang et al. 1990; Veenman & Spaans 2005).

Specifically in relation to young children, there is extensive evidence of the impact of their self-regulatory skills on their immediate and short-term educational achievements, and some suggestive evidence in relation to long-term outcomes. Ponitz et al. (2008) have recently reviewed evidence linking young children's self-regulation, including executive control, attention, emotion regulation and behavioural regulation, with effective classroom behaviour and high achievement, and identifying poor self-regulation as a predictor of future problems in school. Blair & Razza (2007), in a longitudinal study of 3–5 year olds from low income homes in the United States, have also recently demonstrated that early maths and reading ability were uniquely predicted by various aspects of self-regulation and executive control. This kind of evidence is particularly significant because of the now well-established position that a child's educational experience in the early years has both immediate effects upon their cognitive and social development and long-term effects upon their educational achievements and life prospects (Sylva & Wiltshire 1993; Sylva et al. 2004; Mitchell et al. 2008).

Alongside this, and of particular relevance for educationalists, is the evidence from the extensive literature developing and evaluating educational interventions intended to promote metacognitive and self-regulatory abilities, which has shown that they are highly modifiable (Hattie et al. 1996; Dignath et al. 2008). Typically, these interventions have involved children working on problem-solving activities, working in small collaborative groups, making metacognitive and learning strategies explicit, and encouraging children to reflect upon and talk about their learning. Several pedagogical techniques of this kind have been investigated and developed, most notably including, for example, Palincsar & Brown's (1984) *Reciprocal Teaching* and Brown et al. (1996) *Transactional Strategies Instruction*, both designed to help poor comprehenders with reading comprehension strategies.

There have been very few interventions specifically designed to encourage metacognitive or self-regulatory skills in young children in pre-school or in the early years of

schooling. Perels et al. (2008), however, in a very recent study, have shown that training kindergarten teachers about self-regulation has a significant effect upon the self-regulatory skills of the children in their classes. There is a growing body of evidence from Biemiller & Meichenbaum (1998), Perry (1998), Perry et al (2002), Dignath et al. (2008), Whitebread et al. (2005a, b; 2007) and others, however, about characteristics of classrooms and metacognitive interventions likely to encourage and facilitate children's self-regulatory development. Biemiller & Meichenbaum (1998), for example, found that grade 1–6 teachers who were more aware of this issue, who made metacognitive thinking more explicit in their classrooms, using a think-aloud technique when demonstrating and labeling children's metacognitive behaviour, and who used reciprocal teaching and co-operative learning, were more likely to encourage self-regulation in their children. Perry (1998) observed 2nd and 3rd grade classrooms and found that classrooms in which children exhibited high levels of self-regulated learning were characterised by challenging and open-ended activities; opportunities for children to control the level of challenge and opportunities for them to engage in self-assessment, the support of self-regulation through strategy instruction, and encouragement of a mastery-oriented approach fostering positive feelings towards challenge and emphasising personal progress and mistakes as opportunities for learning.

Measures of metacognition and self-regulation in young children

Given the clear evidence of young children's development of metacognitive and self-regulatory skills, but the accompanying difficulties of exploring these by means of experimental or self-report methods, it is argued that systematic observation of young children in naturalistic contexts would allow us to make more valid assessments of their capabilities in this area.

It is further argued that the development of a valid observational instrument which could be reliably used by early years teachers would be highly beneficial. In fact, there are quite a number of observational instruments in related areas, including those narrowly focused on behavioural regulation (Ponitz et al. 2008), those designed to be used by parents and caregivers (Rothbart et al. 2001) and those designed as a clinical instrument, focusing on behavioural problems rather than typical development (Gioia et al. 2000). None of these, however, cover the various aspects of self-regulation comprehensively or are designed to be used by teachers in the assessment of typically developing children in the younger age range.

The present study

This paper, therefore, reports an observational study of young children's metacognitive and self-regulatory abilities and the development of an observation framework designed as a research tool and an observational checklist designed for use as an assessment instrument by teachers. The Cambridgeshire Independent Learning[1] in the Foundation Stage[2] (C.Ind.

[1] The term 'independent learning' is widely used in UK professional and policy documents, and so was adopted for this study, which was funded by Cambridgeshire Local Education Authority. Within the project this term was treated as synonymous with self-regulated learning.

[2] The UK Foundation Stage is the first stage of state education, covering the age groups of 3-5 years.

Le) project was a 2 year study exploring the development of self-regulatory and metacognitive abilities in young children (aged 3–5 years) in educational naturalistic settings in the UK (English Nursery and Reception classrooms). The main research question driving this study related to the issue of whether metacognitive abilities are relatively late-developing (not emerging until middle or late childhood) or whether, given more sensitive methodologies, they could be observed in much younger children. Previous papers have presented initial data and analysis supporting the view that metacognitive and self-regulatory abilities can be seen to be emerging in the 3–5 age group (Whitebread et al. 2005a, b). and that different learning contexts (eg: working individually, in a small group, with an adult) appear to afford differential opportunities for children to experience and practise their metacognitive skills (Whitebread et al. 2007). Two observational tools were developed during this project, the C.Ind.Le Coding Framework constructed for research purposes, identifying verbal and non-verbal indicators of metacognition and self-regulation in the 3–5 age group, and the Children's Independent Learning Development (CHILD 3–5) checklist, designed as a practical assessment tool for classroom teachers of children in this age range.

Method

Participants

The study involved 16 early years teachers in the first year of the project and 32 early years teachers (including the original 16) in the second year, all teaching in Cambridgeshire, England and the 3–5 year old children in their classes. Altogether, over the 2 years of the project, this involved approximately 1440 children, of whom half were in the younger 'nursery' class age range of 3–4 years, and half in the older 'reception' class age range of 4–5 years. At the time of the observations made within the study, the younger children were all in the range 3.2–4.5 yrs (mean 3.9 yrs) and the older children were all in the age range 4.2–5.5 yrs (mean 4.9 yrs).

The teachers were selected to be included in the project based on evidence of their high level of skill as early years educators and their willingness to be involved in a project which would require them to engage in innovative practices. They were also selected so that the whole cohort comprised a representative sample of types of pre-school provision and socio-economic catchment area in the Cambridgeshire region. Of the 32 classes, 16 were 'nursery' and 16 'reception'; ten were in rural settings, eight were urban or inner-city, eight were suburban or in predominantly professional areas, and six were in mixed small town catchments.

Procedures

During the 2 years of the project, evidence of metacognitive and self-regulatory abilities amongst the participating children was collected in two ways. First, following initial briefing and discussions regarding the nature of metacognitive and self-regulatory behaviour, the teachers were supported to develop innovative learning activities which were constructed to be 'meaningful' for the children and most likely, on the basis of the research literature reviewed earlier in this paper, to facilitate and encourage metacognitive and self-regulatory performance (eg. involving planning, problem-solving, peer-tutoring, collaborative groupwork, reviewing learning). These learning activities included child-

initiated play of all kinds, both individually and in small groups, and other activities provided by the teachers involving children working individually and in small groups. In all these situations, children sometimes worked alone and sometimes were supported by the involvement of an adult.

In both years of the project, each class was visited on two or three occasions for half a day, and the children were video-recorded undertaking activities which had proved to be particularly interesting and productive. Altogether, approximately 2 h of video-recordings were made in each class in each year, giving a total of around 96 h of video data. As we discuss below, metacognitive and self-regulatory 'events' were identified within this data, and the analysis of these events involved the construction of the C.Ind.Le coding framework (See Appendix 1).

At the same time, in both years of the project, following initial training related to metacognition and self-regulation generally, and the use of the observation checklist in particular, the teachers also selected six children from their class (initially assessed by themselves as two high, two intermediate and two low metacognition/self-regulation/independence) and assessed their level of self-regulation and metacognition on three occasions during the school year. In the first year, the children were assessed against 35 statements drawn from the literature relating to previous studies of the development of children's self-regulation and metacognition (eg: Boekaerts 1999; Bronson 2000; Brooker 1996; Featherstone & Bayley 2001; Perry 1998; Schunk & Zimmerman 1994; Winne & Perry 2000). Each child was assessed against each of these statements on a four point Likert-type scale according to whether each was true of the child always, usually, sometimes or never. From the 16 teachers involved in Year 1 of the project, this resulted in data for 96 children recorded on three occasions i.e. a total of 288 assessments for each of the statements. As we will see later in the paper, analysis of this data enabled the production of a 22 item instrument, the Checklist of Independent Learning Development 3–5 (CHILD 3–5; see Appendix 2), which was then trialled with all 32 teachers in the second year of the study, producing a total of 576 assessments of 192 children.

Development of the C.Ind.Le coding framework

Bakeman & Gottman (1997) have argued that behavioural coding schemes can be located on a continuum ranging from 'physically-based' to 'socially-based' schemes. While the former involve the use of clearly observable categories which describe changes in the physiology of the participants (eg: direction of gaze, specific hand gestures, absence v. presence of talk) the latter comprise of categories of behaviour which are social constructs (eg: affect, responsiveness, control) which, by their very nature, involve a higher degree of inference and a shared cultural understanding on the part of the observers. Any coding framework dealing with metacognition and self-regulation, including that developed within the present study, is clearly of this latter, socially-based kind.

As a consequence, there are clear methodological challenges involved in developing such a scheme or framework, and these relate to issues of validity and reliability.

Within the present study, the issues of validity were addressed in three ways. First, by collecting the data within naturalistic settings, as discussed above. Second, by involving the classroom teachers in part of the analysis, since they had specialised knowledge of the children and the classroom contexts involved. Third, by video-recording the data, thus permitting the analysis of the data more fully in its social context.

The development of the coding framework consisted of three stages. First, metacognitive and self-regulatory 'events' were identified within the 96 h of video of the children playing and working in their classrooms. After each video-recording session, the teachers were engaged in a process of 'Reflective Dialogue'. This is a research and professional development technique that enables in-depth discussion and learning between practitioner and researcher (see Moyles et al. 2003, for a review of its development). It involves the following procedure:

- the practitioner watches the video-recording and selects particular sequences which they feel exemplifies important elements of the children's metacognition or self-regulation
- the researcher and practitioner watch these selected sequences together and the researcher engages the practitioner in a Reflective Dialogue, questioning the practitioner and requiring them to articulate what they feel are the special elements of the sequence, what is the observable evidence of metacognition or self-regulation, and what the practitioner has learnt from examining this sequence.

This procedure for the initial identification of metacognitive or self-regulatory 'events', while not exhaustive (the research team went on to identify further 'events' from the remaining sections of the video-recordings) was enormously valuable in helping the research team to understand the context of the tasks in which the children were engaged, the significance for the particular children of the behaviour recorded and so on. Involving the teachers in this first part of the analytic process was thus beneficial to them in terms of their understanding, but also vital in the initial stages of identification of events and the validation of our developing framework of understanding of the children's behaviours.

The second stage of the development of the coding framework involved the selection of representative subsets of events for detailed analysis. First, from all the video data collected, 582 events (lasting from a few seconds to as long as 5 to 6 min, but usually averaging around 2 to 3 min) were identified as showing general evidence of metacognitive or self-regulatory behaviours (involving all of the children in the sample at least once and in many cases on several occasions). From this initial analysis, a subset of 196 events (about a third) were selected that showed the clearest evidence and that were representative of the whole data set across curriculum areas of the learning activity, group size, and level of adult involvement. Equal numbers of events from nursery and reception classrooms were also included in this selection, to adequately represent the age range. This subset included data from 1062 children or 73.8% of the total sample, with approximately half in each age range. These 196 events were analysed for evidence of behaviours generally demonstrating metacognitive knowledge, metacognitive regulation, and emotional and motivational regulation. Finally, a further subset of 60 events (30 in each age group) was selected for detailed protocol analysis (just over 10% of the total events identified and including data from 260 children, or 18.1% of the total sample). These comprised 20 events of individual children working alone without any adult involvement, 20 of small groups without any adult involvement, and 20 of small groups with adult involvement which, from the previous analysis of 196 events, had emerged as having the highest frequencies of metacognitive and self-regulatory behaviours. As such, they may be taken to represent what appears to be achievable in these three learning contexts with children in the three to five age range, certainly as represented in our data.

The third stage of the development of the coding framework involved the protocol analysis of this final subset of 60 events, within which behaviours were coded at the most detailed level of categories represented in the coding scheme reproduced in Appendix 1. This involved the identification and analysis of specific verbal and non-verbal indicators of metacognitive and self-regulatory behaviour and of the self, other, or shared focus of the behaviour, adopting the definitions developed by Iiskala et al. (2004).

The final coding framework developed, as is typically the case with this kind of analysis, comprised a blend of *a priori* categories of behaviour deriving from previous research literature and new categories emerging from a 'grounded' analysis of the data. The *a priori* categories were derived from an analytical model of cognitive self-regulation, developed originally by one of the present authors within a related study (Pino Pasternak 2006). This attempted to incorporate significant aspects of metacognition and self-regulation which, according to the current research evidence reviewed earlier in this paper, appear to have an impact on the emergence of metacognitive and self-regulated learning within the 3–5 age range. This model involves three main areas:

- *Metacognitive knowledge* (Flavell 1987; Schneider & Lockl 2002; Pintrich 2002; Annevirta & Vauras 2001): the individual's knowledge about personal, task and strategy variables affecting their cognitive performance.
- *Metacognitive regulation* (Brown 1987; Nelson & Narens 1994; Son & Schwartz 2002; Pape & Wang 2003): the cognitive processes taking place during ongoing activities i.e. planning, monitoring, control and evaluation.
- *Emotional and motivational regulation* (Boekaerts 1999; Zimmerman 2000; Corno 2001)*:* the learner's ongoing monitoring and control of emotions and motivational states during learning tasks

The final coding framework developed is reported in Appendix 1. As recommended by Bakeman (2000) this includes operational definitions of each of the categories of behaviour, together with operational descriptions of behaviour related to each category and examples taken from the video-recorded events. Appendix 3 contains two brief illustrative examples of the kind of analysis undertaken. One consists of a 3 year old girl attempting to fill a toy digger with wooden blocks, and the other is part of a sequence of a small group of 3 and 4 year olds playing a card game.

It is at this point that the issue of reliability in identifying and coding behaviours arises. As Bakeman (2000) has indicated, such a coding scheme or framework should contain codes which are mutually exclusive and exhaustive. Developing such a scheme is an iterative process of going back and forth between the codes and the data until such a position of 'saturation' is satisfactorily achieved. The advantages of video-recorded data in relation to these procedures are clear. It enables repeated viewing and analysis of data, and shared viewing, analysis and discussion amongst a group of researchers. The issues and best-practice procedures in the use of video data for this kind of video-analysis have been usefully elaborated by a number of contributors to Goldman et al. (2007) very recent collected volume focusing on these issues.

For the analyses of the 196 events and of the 60 events within the present study, inter-rater reliabilities were calculated. At the level of the 196 events, 20 events (just over 10% of the data set) were selected for this purpose, which two observers coded independently. For this analysis verbal and non-verbal behaviours were coded at the level of the three main areas of the coding framework i.e. metacognitive knowledge, metacognitive regulation, emotional and motivational regulation. The analysis of inter-rater agreement was carried out by calculating percentages of absolute agreement (i.e., the extent to which the observers agreed that the behavior observed constituted a unit of coding and assigned the same code). This level of agreement was 74.8%.

At the level of the 60 events, a subset of 12 events (i.e. 20%) were dual coded. For this analysis verbal and non-verbal behaviours were coded at the more detailed level of the subcodes within the three main areas (i.e. knowledge of persons, tasks, strategies, planning, monitoring, control, evaluation, emotional/motivational monitoring and control) and, for

each of the sub-codes a further analysis was conducted of the 'self', 'other' or 'shared' focus of the behaviour, adopting the definitions developed by Iiskala et al. (2004). The operational definitions of these focuses are reported in Table 1.

For this more detailed protocol analysis, as recommended by Bakeman & Gottman (1997), levels of inter-rater agreement were calculated at the level of 'unitising' (i.e. agreeing which units of behaviour should be coded) and at the level of absolute agreement (i.e. agreeing which codes should be assigned to the agreed units of behaviour). At the level of unitising the level of agreement was 66.0%, and at the level of absolute agreement, it was 96.1%. This disparity between the two elements of this process bears out the distinction made by Bakeman & Gottman (1997), but also compares favourably with rates of inter-rater reliability commonly found with this kind of observational coding. While the difficulties of precisely defining what constitutes a codeable unit of behaviour are evident in this kind of data, it is also clear that the distinctions between the various categories in the coding scheme we have developed can be maintained at a high level of agreement. Inter-rater reliability was also calculated for the categorisation of behaviours according to whether they were focused on self, other or shared regulation. The level of agreement here was 86%.

Data derived from the use of the developed coding framework has been reported in a previous paper (Whitebread et al. 2007). This reported the differential occurrence of self, other and shared regulation between groups of children working unsupervised and supervised by an adult. Significantly, unsupervised small groups of children working collaboratively were observed to engage in more 'other' and 'shared' regulation than groups working with an adult. Table 2 reports the frequency of occurrence of verbal and non-verbal behaviours indicating the presence of processes of metacognitive regulation in the 60 events subjected to detailed protocol analysis. The frequencies are reported as rates per minute, since this gives perhaps the clearest indication of the prevalence of the various behaviours.

Table 1 Operational definitions of self, other and shared nature of regulation processes (from Iiskala et al. 2004)

Focus of Regulation	Operational definition
Self-regulation	Regulation processes directed mainly to regulate children's own processes, with no apparent intentions to influence other children's cognitions, emotions or behaviours. It may include verbalizations regarding the child's own activity such as 'I am going to make a big circle' or 'I can count backwards' or evidences of non-verbal behaviour indicating monitoring or regulation of cognition in order to achieve a personal goal
Other-regulation	Regulation processes directed to influence the cognition, motivation or behaviour of one specific member of the group. This interaction always reveals certain asymmetry in the relationship. They are two different cases: - 'peer tutoring' in which one child monitors or controls another child who might need some help with some aspects of the task. - when one child is trying to influence another child's behaviour either because the second is not doing well in the task or is not behaving properly in order to carry out the activity (disengaged from the task, inactive, disruptive, etc.)
Shared-regulation	Regulation processes more related to group planning, monitoring and regulation of a joint activity. The verbalizations are usually directed to everyone in the group (or no one in particular) and the talk is more about what 'has to be done' than what 'someone has to do'. The talk is mainly in the plural such as 'we should do this', 'we are taking too long'.

Table 2 Mean rates per minute of verbal and non-verbal metacognitive behaviours in sample of 60 events

Metacognitive behaviour	Mean rate per minute	S.D.	t	p
Planning				
Verbal	1.04	2.21	2.751	.007**
Non-verbal	0.23	0.45		
Total	0.63	1.64		
Monitoring				
Verbal	2.92	3.18	5.137	.000***
Non-verbal	0.74	0.84		
Total	1.83	2.56		
Control				
Verbal	0.33	0.67	−4.527	.000***
Non-verbal	1.53	1.93		
Total	0.93	1.56		
Evaluation				
Verbal	0.02	0.12	−1.907	.059
Non-verbal	0.11	0.33		
Total	0.06	0.25		
Overall				
Verbal	4.31	4.14	2.811	.006**
Non-verbal	2.61	2.21		
Total	6.92			

The overall rates recorded at the foot of this table support the view that metacognitive behaviours are, indeed, very prevalent in children in this age group. It must be acknowledged that the 60 events analysed were specifically selected for their metacognitive richness. However, the combined frequency of verbal and non-verbal indicators of 6.92 behaviours per minute indicates that, given the opportunity, 3–5 year old children are very capable of engaging in metacognitive activity.

What is also clear, however, is that, while verbal indicators were more prevalent, overall non-verbal indicators (occurring at an average rate of 2.61 per minute) accounted for approximately 37.8%, or over a third, of all occurrences. The pattern of occurrences is also, interestingly, not consistent across the four areas of metacognitive regulation. In Planning and Monitoring there was a significantly greater incidence of verbal indicators or behaviours. In Evaluation, however, both verbal and non-verbal indicators made an equal contribution. But perhaps most notably, for Control non-verbal indicators made a significantly greater contribution to the overall frequency of occurrences than did verbal. Thus, in this area in particular, simply relying on verbal behaviour would under-estimate and distort the picture concerning the prevalence and range of metacognitive behaviours.

The CHILD 3–5 instrument

As reported above, the teacher observation instrument (CHILD 3–5; see Appendix 2) was derived from an original list of 35 statements derived from the existing literature. The 16 teachers involved in Year 1 of the project each assessed six children in their class two high, two intermediate and two low metacognition/self-regulation/independence) resulting in data for 96 children recorded on three occasions i.e. a total of 288 assessments for each of the statements. Each child was assessed against each of the 35 statements on a four point

Likert-type scale according to whether each was true of the child always, usually, sometimes or never. Figure 1 reports the scores for the three groups of children at the three assessment time points. As can be seen, the original checklist provided a clear discrimination between the high (H), intermediate (I) and low (L) independence groups. Within each of the groups there was also clear progression over the three terms, with the low independence group apparently making the most progress, which is perhaps what would be predicted. As the range of the low group has also clearly extended, it may well be that some children in this group, who were perhaps rather uncertain on first arrival in their new class, have made particularly rapid progress as they have become more secure.

The high level of self-regulation shown amongst this sample of 3–5 year old children is also worthy of note. A score of 105 on the checklist indicates that a child was, on average, showing the ability to 'usually' perform independently across the wide range of behaviours covered by the checklist. The results in Fig. 1 show that the vast majority of children in the 'high' and 'intermediate' groups, and even the top 25% of the 'low' group had achieved this by the third term in the year. As we have seen, this result was also borne out by the analysis of metacognitive and self-regulatory events reported above, based upon direct observations of the children's performance in their educational settings.

In order to develop a more streamlined, reliable and carefully validated instrument, however, the results for the original 35 statements were analysed to establish which appeared to be most significant for the 3–5 age group represented in the project sample of 96 children. The statements were ranked according to three criterion:

- those statements which discriminated most between high and low independence children (i.e. average difference of mean scores between these two group over the three assessments)
- those statements for which scores changed the most between the first and third assessments
- those statements ranked the most significant by the teachers in relation to the children in their class

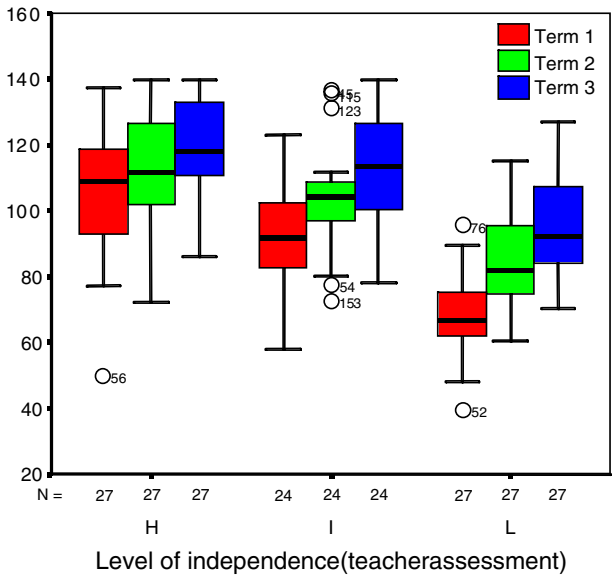

Fig. 1 35 item checklist scores for the high (*H*), intermediate (*I*) and low (*L*) metacognition/self-regulation independence groups in the first year of the study

As this instrument is intended to be used by teachers of young children, the order in which they ranked the statements was taken as the starting point for the selection of statements. Starting with the most highly ranked, statements were then included if they were ranked in the top 20 on both of the other criterion. In fact, there was a very high level of agreement between the three criteria, with 17 of the 18 statements most highly ranked by the teachers passing this test. To these were added a further three statements which had been more lowly ranked by the teachers, but were highly ranked according to the other criteria. This procedure produced a list of 20 statements which seemed to account for a very high proportion of the variance in scores, and were generally recognised by the teachers as significant. They also appeared to fall very equally into the four categories of self-regulation identified by Bronson (2000)—Emotional, Prosocial, Cognitive and Motivational—which may be seen as a validation both of Bronson's model and of the 20 statements which emerged. This was also instrumental in the decision to organise the statements under Bronson's categories, rather than according to the theoretical model developed in relation to the C.Ind.Le Coding Framework. The statements relate to commonly observed behaviours which can be reliably understood and observed by teachers in classroom situations, and so are at a different level of analysis to the theoretical categories developed within the coding framework. These behaviours may well recruit a number of mental processes, which need to be identified and separately considered for research purposes, and are part of the coding framework. The different basis of the structure of the CHILD 3–5 instrument, we would argue, is therefore appropriate and also important to distinguish it from the coding framework, which serves a very different purpose. Two further statements, which were not in the original list of 35, were also added under the Cognitive heading following the analysis of events from the classroom observations and video analysis ('Uses previously taught strategies' and 'Adopts previously heard language for own purposes'). It is interesting to note that these two statements perhaps reflect behaviours which would only be evident in an observational study of natural, educational contexts, and would not emerge within experimental settings. Together, these 22 statements formed the Checklist of Independent Learning Development (CHILD 3–5; see Appendix 2). In a previous paper (Whitebread et al. 2005a) a list was presented giving examples of events in which each of these behaviours was observed to be present.

In the second year of the project, as outlined earlier, the 22 item checklist was then trialled with all 32 teachers in the second year of the study, producing a total of 576 assessments of 192 children. Analysis of this data showed that the 22 item scale achieved a high level of internal consistency (Cronbach alpha =.97). To further examine the reliability with which the teachers were able to use the instrument, two further activities were undertaken. First, on one occasion all 32 teachers were shown four selected video-recorded events and were asked to identify two statements from the checklist which each exemplified. Table 3 reports the levels of agreement between the teachers in relation to the four areas of self-regulation. As can be seen, very high levels of agreement were achieved, showing that this group of teachers had achieved a very high level of mutual understanding of the statements, and that the statements are clear and distinctive.

Second, advantage was taken of the situation that in 13 of the Nursery classes, there was a qualified Nursery Nurse working alongside the classroom teacher. These Nursery Nurses were asked to each select two children from their class that had been assessed by the teacher, and to complete their own independent assessment against the 22 statements. Once again, very acceptable levels of agreement were achieved, with 56.1% of the total of 572 judgements this represents being identical and 95.5% only varying by one category of judgement (eg always/usually, usually/sometimes or sometimes/never). Given the almost

Table 3 Levels of agreement between the 32 teachers in the second year of the study in relation to statements exemplified by four events

Area of self-regulation	Events				Total
	1	2	3	4	
Emotional	85	95	93	89	90.5
Pro-social	83	93	87	100	90.8
Cognitive	64	98	100	89	87.8
Motivational	64	78	71	85	74.5
TOTAL	74.0	91.0	87.8	90.8	85.9

complete lack of any training of the Nursery Nurses on the use of the checklist, this attests very strongly to its utility with early years teachers. The statements are clearly very easily understandable and observable by qualified adults working with children in the 3–5 age range.

Analysis of the data produced in relation to the CHILD 3–5 checklist has thus shown that it reliably distinguishes between children who have high and low levels of metacognitive abilities, and that it is a valid representation of the key areas of development in the 3–5 age range. Teachers can use it reliably, with high levels of agreement concerning the operational definitions of the 22 statements (i.e. which behaviours are indicated by each statement).

There has also been some initial external validation of the CHILD 3–5 instrument through its use in two unrelated research projects. Perels et al. (2008) used it with 35 German kindergarten teachers who were undergoing a self-regulated learning training program. The teachers recorded CHILD 3–5 scores for 97 children. Alongside this they carried out structured interviews with the children to assess their metacognitive and self-regulatory skills directly, based upon the procedure devised by Zimmerman and Martinez-Pons (1986) where the child is asked to talk to a puppet about how they can ride a bike etc. The overall interview scores correlated significantly with the overall CHILD 3–5 score (r= 0.31, p<.01). In an as yet unpublished study carried out separately by one of the research group (Demetra Demetriou) 54 Cypriot nursery school children, aged 4–5 years of age, have been assessed on a range of measures including theory of mind, inhibition and source memory (an aspect of metacognitive monitoring). Once again, all of these measure correlated highly with the overall CHILD 3–5 scores (false belief: r=0.40, p<.01; inhibition: r=0.32, p<.01, source memory: r=0.46, p<.01).

Discussion: theoretical & educational significance

Given the well-established significance of metacognitive and self-regulatory abilities for educational achievement, the accurate description and measurement of these abilities in young children is clearly important and advantageous, both in relation to developing theory and research and in relation to educational effectiveness.

The observational coding framework developed within this study has proved to be a valuable research tool, providing evidence of verbal and non-verbal indicators of metacognitive and self-regulatory processes occurring within the 3–5 age group. Of course, caution needs to be exercised in interpreting the results of this particular study, as it was based on a very selected group of teachers and the 'events' examined were also clearly highly selected in terms of their metacognitive richness. It will be important for future studies to observe behaviour amongst this age group in other contexts and, clearly, any

evidence concerning actual prevalence of metacognitive and self-regulatory behaviours within this age group will need to be based on a much wider evidential base.

However, the importance of the opportunity afforded by such observational methods to identify non-verbal indicators, and social aspects of metacognitive and self-regulatory processes, in particular, has been shown to be potentially very significant. The prevalence of non-verbal behaviours, as we have indicated in the earlier parts of this paper, may indicate emergent metacognitive and self-regulatory behaviours in the young children in the present study, although caution must be exercised in these interpretations, as the relationships between non-verbal and implicit behaviours clearly need to be further investigated. It should also be noted that simple frequency counts alone of particular behaviours cannot capture the full richness and quality of children's early metacognitions and, indeed, might be potentially misleading. In our analysis of the self-regulatory behaviours arising in different individual and socially grouped tasks (Whitebread et al. 2007) frequencies of behaviours were accompanied by qualitative analyses, and it remains our view that this triangulation of quantitative and qualitative methods will be most productive in this area. However, given these caveats, it seems likely that observational studies of this kind may be particularly productive in illuminating the debate within metacognitive theory and research concerning the inter-relationships between implicit and conscious processes.

There are, however, considerable methodological challenges in work in this area, as Bakeman & Gottman (1997) and Veenman (2005), for example, have usefully reviewed. The children's goals and intentions have to be inferred and their internal representations are not available (as they might be, to some extent through the use of think-aloud procedures with older children and adults). Only directly observable behaviours can be coded–so, for example, theory would predict that all control behaviours must be preceded by internal monitoring, but this cannot be coded unless it is directly observable (by, for example, eye gaze movements in checking behaviours). The high level of inference involved in identifying the 'socially-based' behaviours involved in this kind of analysis is clearly a challenge to reliability. Levels of agreement concerning which behaviours constitute a unit of analysis of around 60–70% urge caution, and it would clearly be ideal, wherever resources allow, for all behaviour to be dual-coded and only those behaviours on which there is absolute agreement to be included in any analysis. We have demonstrated to some extent, however, that the observation of behaviour in natural contexts, the involvement of class teachers who know the children and the classroom context well, and the use of video-recorded data, allowing the interpretation of the children's behaviours in context, can all help in facing some of these challenges.

It is also clear that the CHILD 3–5 instrument, when thoroughly validated, will be an invaluable assessment tool for early years teachers. It would be hoped that in future work, and perhaps future developments of this instrument, particular key individual differences in metacognitive and self-regulatory abilities could be identified which predict important aspects of children's short and long-term academic and broader development. Further, there are early indications that the use of this instrument enhances teachers understanding about the significance of metacognition and self-regulation in the development of young children as learners and that this, in turn, may enhance the effectiveness of their practice in supporting children in these areas of development.

We are in the very earliest stages of developing observational instruments and methodologies in the areas addressed within the present paper. However, the evidence which has emerged from these early and perhaps rather crude attempts strongly suggests that this general methodological approach may be very fruitful in the further investigation of the early emergence and development of metacognition and self-regulation.

Appendix 1

C.Ind.Le Coding Scheme: Verbal and Nonverbal Indicators of Metacognition and Self-Regulation in 3- to 5-Year-Olds

Category name	Description of behavior	Examples
Metacognitive knowledge		
Knowledge of persons		
A verbalization demonstrating the explicit expression of one's knowledge in relation to cognition or people as cognitive processors. It might include knowledge about cognition in relation to: - *Self*: Refers to own capabilities, strengths and weaknesses, or academic/task preferences; comparative judgments about own abilities - *Others*: Refers to others' processes of thinking or feeling toward cognitive tasks - *Universals*: Refers to universals of people's cognition	Refers to his/her own strengths or difficulties in learning and academic working skills Refers to others' strengths or difficulties in learning and academic working skills Talks about general ideas about learning	*I can write my name* *I can count backwards* *I don't know how to sing the song*
Knowledge of tasks		
A verbalization demonstrating the explicit expression of one's own long-term memory knowledge in relation to elements of the task.	Compares across tasks identifying similarities and differences Makes a judgment about the level of difficulty of cognitive tasks or rates the tasks on the basis of pre-established criteria or previous knowledge	*They need to put their boots on. And when they put their boots on, they dig a hole*
Knowledge of strategies		
A verbalization demonstrating the explicit expression of one's own knowledge in relation to strategies used or performing a cognitive task, where a strategy is a cognitive or behavioral activity that is employed so as to enhance performance or achieve a goal.	Defines, explains or teaches others how she/he has done or learned something Explains procedures involved in a particular task Evaluates the effectiveness of one or more strategies in relation to the context or the cognitive task.	*We don't need to use the sticky tape, we can use the glue* *You have to point it up this end so that it is going to grow*
Metacognitive regulation		
Planning		
Any verbalization or behaviour related to the selection of procedures necessary for performing the task, individually or with others	Sets or clarifies task demands and expectations Allocates individual roles and negotiates responsibilities Sets goals and targets Decides on ways of proceeding with the task Seeks and collects necessary resources	*I'm going to make a big circle* *I know… me and Harry could be the knights and you could be the peasant* Child compares two objects before deciding which to use on task

Category name	Description of behavior	Examples
Monitoring		
Any verbalization or behaviour related to the ongoing on-task assessment of the quality of task performance (of self or others) and the degree to which performance is progressing towards a desired goal	Self- commentates Reviews progress on task (keeping track of procedures currently being undertaken and those that have been done so far) Rates effort on-task or rates actual performance Rates or makes comments on currently memory retrieval Checks behaviors or performance, including detection of errors Self-corrects Checks and/or corrects performance of peer	*I think we've got one left* *This bit doesn't fit anywhere* *Hang on, we've got it a bit wrong here* Child stops mid-way through an action (placing puzzle piece), pauses and re-directs action to place it somewhere else
Control		
Any verbalization or behaviour related to a change in the way a task had been conducted (by self or others), as a result of cognitive monitoring	Changes strategies as a result of previous monitoring Suggests and uses strategies in order to solve the task more effectively Applies a previously learnt strategy to a new situation Repeats a strategy in order to check the accuracy of the outcome Seeks help Uses nonverbal gesture as a strategy to support own cognitive activity Copies from or imitates a model Helps or guides another child using gesture	*Let's have a practice* *Can you help me do it?* Child points to spots on a die as he counts Child looks at a physical model (example: word on whiteboard) repeatedly while completing a task Child points at computer screen or interactive whiteboard to indicate where another child should click the mouse
Evaluation		
Any verbalization or behaviour related to reviewing task performance and evaluating the quality of performance (by self or others).	Reviews own learning or explains the task Evaluates the strategies used Rates the quality of performance Observes or comments on task progress Tests the outcome or effectiveness of a strategy in achieving a goal	*He's done really well* *We learnt how to cut, and how to stick things together* Child rotates scissors in hands while opening and closing them before initiating cutting activity
Emotional and motivational regulation		
Emotional/motivational monitoring Any verbalization or behaviour related to the assessment of current emotional and motivational experiences regarding the task	Express awareness of positive or negative emotional experience of a task Monitors own emotional reactions while being on a task	That wasn't very nice It's a bit sad I don't want to be a peasant
Emotional/ motivational control Any verbalization or behaviour related to the regulation of one's emotional and motivational experiences while on task	Controls attention and resists distraction or returns to task after momentary distraction Self-encourages or encourages others Persists in the face of difficulty or remains in task without help	Mine is going to be a lovely one Child looks towards activity of others in the classroom, then re-focuses on task at hand and resumes activity

Appendix 2

Checklist of Independent Learning Development (CHILD) 3–5

Name of child: _____ Teacher: _____

Date: _____ School/setting: _____

	Always	Usually	Sometimes	Never	Comment
Emotional					
Can speak about own and others behaviour and consequences					
Tackles new tasks confidently					
Can control attention and resist distraction					
Monitors progress and seeks help appropriately					
Persists in the face of difficulties					
ProSocial					
Negotiates when and how to carry out tasks					
Can resolve social problems with peers					
Shares and takes turns independently					
Engages in independent cooperative activities with peers					
Is aware of feelings of others and helps and comforts					
Cognitive					
Is aware of own strengths and weaknesses					
Can speak about how they have done something or what they have learnt					
Can speak about future planned activities					
Can make reasoned choices and decisions					
Asks questions and suggests answers					
Uses previously taught strategies					
Adopts previously heard language for own purposes					
Motivational					
Finds own resources without adult help					
Develops own ways of carrying out tasks					
Initiates activities					
Plans own tasks, targets and goals					
Enjoys solving problems					

Other comments:

Appendix 3

Vignettes of event coding

A. Filling The Digger

Individual activity: No adult

Ellie is sitting in a small, carpeted area of the classroom. The area is resourced with a number of toy vehicles and some open boxes of play materials including 'small world' materials and wooden blocks. As the observation starts, Ellie is holding a large toy vehicle. It is an excavator, or digger, with a bucket mechanism in front of the driver's cab.

The following table presents an account of Ellie's activity and its analysis.

Observed Activity	Analysis
Ellie reaches to the box of wooden blocks and selects two small cubes. She places the blocks in the digger's bucket.	As a choice of play materials is available, the reaching to the box of blocks suggests a purposeful choice linked to a planned activity. *Planning: seeking and collecting necessary resources*
As a third block is added, the digger tips forwards, spilling all the blocks from the bucket. Ellie rights the vehicle and starts to refill the bucket.	
After putting three small cubes into the bucket, the digger starts to tip again. Ellie steadies the toy with a hand, but one block spills from the bucket.	The action of steadying the digger whilst adding blocks is a new strategy suggestive of a response to the previous spillage. *Control: Changing from one strategy to another on task*
Ellie picks up the spilled cube and places it between the bucket and the cab of the digger.	The selection of a new position for the blocks is a departure from the previous strategy of placing them in the bucket. *Control: Changing from one strategy to another on task*
As more blocks are added, the digger tips forwards again. Ellie pauses and looks at the digger.	This pause combined with eye gaze in the direction of the toy indicates observation of the task element or consideration of task progress. *Reflection/Evaluation: careful observation of progress of task performance or component*
After righting the toy, Ellie places two blocks between the bucket and cab.	
With one hand remaining on the digger, Ellie pauses and looks around the classroom apparently watching the activities of other children, before returning attention to the digger	Although there is a passing interest in the surrounding activity, the return to engagement with the task is indicative of a motivational self-regulation. *Regulation of motivation: returns to task after distraction*
She rolls the digger forwards on the carpet, watching the digger as she does so.	The focus of gaze during this activity suggests elements of evaluation of the loading strategy. *Reflection/evaluation: Testing the outcome of a strategy in achieving a goal*

B. Finding a place for the card Event P30

Collaborative small group. No adult. Problem solving

A group of six girls are playing a lotto game. Each child has a game board divided into six squares each with a different image. Individual picture cards in a central pack are taken in turn, and children match these to the images on their boards.

Observed activity	Analysis
Hannah: *leaning towards Nalini and looking at the card she is holding*.	Although the phrasing of this statement suggests that some unknown strategy is being drawn upon to support the assertion, the confident analysis of the interaction is that one child is helping another to complete a task.
You should have that one.	*Control and regulation: Helps or guides another child*
Nalini holds her card by one corner and moves it around her board, she looks repeatedly and alternately at the card and board.	The movement of the card around the board indicates an extended process of checking. This inference is supported by the pattern of eye gaze. Monitoring: Checks performance

Observed activity	Analysis
A\s she finds a match she places the card in position on the board, looks up to Hannah and smiles.	The non-verbal communication of the smile indicates an awareness of a pleasure in the successful completion of the matching task. *Emotional/motivational monitoring: Expresses awareness of positive emotional experience*

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