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Sixth graders' understanding of their own learning: A case study in environmental education course

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Knowing 'what do I know' and thinking about 'how do I learn', that is metacognition, is an important element in learning. The Finnish curriculum points out metacognition in the choice of the studying methods. The methods should help the students to become aware of their own learning, to develop better learning strategies, and skills to apply the strategies in new situations. In this qualitative case study the metacognition of Finnish sixth graders (N=19) was studied in a virtual learning environment, ENO - Environmental Online. Pupils´ metacognitive knowledge and skills were studied in one ENO course. The aim was to describe what and how pupils monitor in their learning processes. It was found that 11-year-old sixth graders possessed declarative and procedural metacognition, and also some conditional metacognition. In this study, the social component of learning was especially emphasized.

Keywords: metacognitive knowledge, metacognitive skills, science education, primary school, ENO - environmental online

Introduction

A commonly accepted goal of science and environmental education is to develop students as lifelong, self-regulating learners. Consequently, as well as studying domain-specific knowledge and strategies, students should become conscious of their learning processes, and learn how to plan, monitor, evaluate, and regulate them. Being aware of the learning processes, knowing ´what do I know´ and ´what do I not know´, and thinking about ´how do I learn´ is known as metacognition (see e.g., Fairbrother, 2000).

The growing interest in metacognition over the past three decades relates to at least two aspects: first, metacognition anticipates improvement in learning outcomes through interventions that aim at developing students´ metacognition, and second, it reflects wider interest in cognitive theories of learning. In this article we, based on dominant view, identify two distinct aspects of metacognition: *knowledge about cognition* and *regulation of cognition* (see e.g. Flavell, 1979; Carrell, Gajdusek, & Wise, 1998; Niemi, 2002).

Knowledge about cognition refers to what individuals know about their cognition or about cognition in general. It includes at least three different kinds of knowledge: *declarative, procedural* and *conditional knowledge* (Schraw, 1998; Sperling, Howard, Staley, & DuBois, 2004). When we know something, we can not only know the factual information about it (declarative

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knowledge) but also how to use such knowledge in particular processes (procedural knowledge). We can also understand when and where this knowledge would be applicable (conditional knowledge). Declarative knowledge includes knowledge about oneself as a learner and about what factors influence one's performance. Individuals with a high degree of procedural knowledge perform tasks more automatically, are more likely to use qualitatively different strategies, possess a larger repertoire of strategies, and sequence the strategies effectively. Conditional knowledge enables learners to adjust to the changing situational demands of each learning task.

Regulation of cognition refers to a set of activities that help learners control their learning (see e.g. Alexander, Schallert, & Hare, 1991; Vermunt, 1996). Although a number of regulatory skills have been described in literature, three essential skills are included in all accounts: *planning, monitoring,* and *evaluation*. Planning involves the selection of appropriate strategies and the allocation of resources that affect performance. Monitoring refers to on-line awareness of comprehension and task performance. Evaluation of learning covers the appraisal of the results and the efficiency of one's learning. The knowledge about cognition and its regulation are related to each other (Schraw, 1998).

How effectively students learn varies, which relates to students´ metacognitive knowledge (Glynn & Duit, 1995). Metacognition controls other cognitive components, thus it has an executive function. It has been suggested that metacognition, in general, helps students to be consciously aware of what they have learned, to recognize situations in which the learning would be useful, and to recognize processes involved in using the knowledge. According to Gunstone and Mitchell (1998), metacognitive knowledge, awareness, and control are all learning outcomes and can be developed with appropriate learning experiences. Learning by using metacognitive ideas and beliefs is often unconscious, and therefore the learners find it difficult to articulate their metacognitive views. However, all learners have metacognitive views and knowledge of some form.

Children's self-regulating ability usually develops during the primary school years although the roots of metacognitive skills can be found in the intentional actions of infancy (Annevirta & Vauras, 2006). Metacognitive skills will become automatic without much conscious awareness, resulting from practice and habitual use. Metacognitive skills will also become conscious mainly in new or difficult situations when used skills are not appropriate for the situation. Further, Son (2005) has noticed that first graders can make some metacognitive decisions that benefit long-term performance, but those abilities are not fully developed for decisions that necessitate awareness of long-term future outcomes. Annevirta and Vauras (2006) also have found that a marked variability exists in the development of different individuals during primary grades. Also, Bransford, Brown, and Cocking (2000) have stated that children's hidden metacognitions are a part of learning outcomes. However, according to Adey et al. (as cited in Georghiades, 2004a), boys under eleven years do not benefit from the regulation of metacognitive skills. Further, Bartsch, Horvath, and Estes (2003) have noticed that children mostly talked about their learning, but rarely mentioned sources of their knowledge.

The influence of a learning environment to metacognition has previously also been studied. Thomas and Au Kin Mee (2005) have used different learning environments to enhance students´ metacognition. They have found that the primary school students knew the names of the strategies, how they were operationalised and why they might be valuable for them as learners. Such declarative, procedural and conditional knowledge forms the basis of students´ metacognition. In their study students became increasingly aware of the ´why´ element of conditional knowledge due to the teaching. The role of the teacher in developing metacognition is also crucial, stated de Jager, Jansen and Reezigt (2005). The context in their study was reading of 11-year-old primary school students.

Sixth graders, who were more metacognitively oriented, were more consistent in their tool selection, in a problem-based hypermedia learning environment (Liu, Bera, Corliss, Svinicki, & Beth, 2004). Students, who were more information processing oriented, were also more action oriented in performing the tasks. Liu et al. (2004) hypothesized that metacognitive students are more deliberate and strategic in processing information. Recently, Mason, Boldrin, and Ariasi (2010) examined epistemic metacognition in the context of online information searching on the Web. Their findings showed that eight grade students expressed reflections about the simplicity/complexity, certainty/uncertainty, source, and justification of knowledge at different levels of sophistication, according to three patterns of epistemic metacognition. Learning from Internet sources was also affected by study approach and epistemic reflections about the justification of online knowledge, as well as by the interaction between beliefs about the justification of scientific knowledge and beliefs about the justification of the knowledge accessed concerning the topic. Topcu and Ubuz (2008) noticed that metacognitive knowledge of the pre-service teachers partly explained the variance in the online participation score. According to them, most of the pre-service teachers were at the high or medium-to-high metacognitive knowledge level in their participation in online forum discussions.

Hurme, Palonen, and Järvelä (2006) have found some evidence of metacognition among 13-year-old students in a social context. The metacognitive content of the students´ notes in their networked discussions were related to the social interaction process. However, Anderson, Thomas, and Nashon (2009) state that even among highly collegial and collaborative student groups that might be deemed effective by teachers and are constituted on effective collaborative group work, there exists underlying metasocial or shared (group) metacognitive factors that can adversely influence and shape cognition and collaborative learning processes. The study of Malandrakis (2006) supports the findings of Hurme et al. (2006). Fifth graders' group learning activities were found to facilitate their learning and also increase the durability of the acquired knowledge. Malandrakis (2006) studied aspects of fifth graders' conceptual change regarding hazardous household items in the context of environmental education. Children attended teaching module of environmentally oriented science activities aimed at assessing their awareness about the environmental and health hazards posed by several typical household products. The results revealed that children followed three pathways of conceptual change ranging from the substantial alterations of their initial ideas to the qualitative enrichment of those ideas to the complete rejection of the new knowledge. Malandrakis (2006) also found indications concerning the situated nature and the social construction of the new knowledge, as well as that in environmental education moral and value issues are closely related to knowledge.

Promoting metacognitive activity can produce substantial improvements in science and environmental education. The development of metacognition should take place in content-rich contexts. Kaberman and Dori (2009) studied, in the context of chemical education, the influence of metacognitive activities to skills to pose complex questions and to analyze them. They found that metacognitive strategies significantly improved students' skills to pose questions, as well as the complexity level of the questions they posed. Tova, Mevarech, and Haibi (2009) investigated effects of metacognitive instruction at different phases of reading scientific texts on elementary school students' scientific literacy and metacognitive awareness. Findings indicated that those students who were instructed to metacognition had significant better posttest results. The role of metacognition has also been studied, for example in the context of electricity learning (Georghiades, 2004a).

Metacognitive skillfulness can be assessed, for example, by validated instruments. In problem solving and learning in chemistry, Cooper and Sandi-Urena (2009) demonstrated the influence by developing and validating an instrument to evaluate students' metacognitive skillfulness

in solving chemistry problems. Recently, also Yilman-Tüzün and Topcu (2010) used metacognitive awareness inventory, when studying what types of metacognition do sixth, seventh, and eights graders have. They state that both knowledge of cognition and regulation of cognition skills are within the capabilities of young students, and metacognition has a multifaceted nature.

Aim

This study clarifies sixth graders (12-13 years) perceptions about their learning and learning conditions. The aim of this study is to describe:

- what sixth graders monitor in their learning processes,
- how they monitor their learning processes,
- what kinds of skills to monitor their own learning they possess, and
- what kinds of knowledge to monitor their own learning they possess.

The context for this study is environmental education in a virtual learning environment ENO-Environmental Online and its´ local cuisine course.

Methods

Typically, assessment of metacognition relies either on inferences based on classroom performance, on analyses of ´think-aloud` protocols, or ratings based on interviews of pupils who are questioned about their knowledge and cognitive strategies. Recently, a number of self-report measures of metacognition have been developed but, as Schwartz and Metcalfe (1994) have critiqued, the use of the self-report measures raises questions of validity. In addition, it is difficult to apply the self-report approach in the context of primary school pupils. Recently, de Jager, Jansen and Reezigt (2005) have shown the power of the questionnaire in studying metacognition of primary school pupils. Cooper and Sandi-Urena (2009) as well as Yilman-Tüzün and Topcu (2010) showed the power of validated instruments in assessing metacognitive skillfullness. In this research, metacognition was studied with the aid of interviews, questionnaires and learning diaries. Learning diaries were, however, used as supplementary data.

Participants and Context of the Study

The participants of this qualitative case study were 19 primary school pupils (10 boys and 9 girls, ages 12-13) from the same class. The class was arbitrarily chosen among classes who take part in ENO-Environmental Online activities (http://eno.joensuu.fi). ENO activities were integrated into the science lessons of the comprehensive school. ENO is a virtual global school aimed at fostering environmental awareness. Each year, four environmental topics are studied in ENO School on the basis of weekly tasks for evaluation. At the time of the present study, the students who participated in the virtual global school were from about 150 schools, from over 50 countries and from all five continents. ENO-Environmental Online fulfils the premises of environmental education. Since, according to Kaivola and Åhlberg (2002), it is based on empiricism, ethics, and aesthetics, on education, ´on´, ´for´, and ´in´ the environment.

The ENO-Environmental Online program declares its goals as: studying to learn cooperatively in a Web community; promoting the use of new information and communication technologies in foreign languages; deepening environmental themes in education; adding global awareness and internationality in education; supporting sustainable development; and promoting the active participation of developing countries.

This study was executed during the ENO-course ´local cuisine´ which was six weeks long. Besides the general goals of the virtual global school, the aim of the course was to introduce pupils to traditional food culture, to act with local experts, and to discuss the relationship between food and health. Additional goals were to prepare local and foreign traditional food and document the preparation process with video or digital camera, as well as evaluating ones own learning and activities during the course, thus metacognitive actions. It was also hoped that the course would activate local people to prepare traditional food with the pupils. In practice, the pupils worked both in classroom and in chat. Firstly, the pupils familiarized them with traditional food and culture. During the next weeks they discussed about the influence between traditional food and health, prepared to bake by searching receipt and translating it. Then they baked local traditional food with the aid of the experts of the local organisation as well as Iran traditional food. According to the strategies used in ENO-school, the pupils documented the work by technical equipments and sent data to ENO websites. The goals of the course especially relate to the cultural dimension of sustainable development.

Data Collection and Analysis

A questionnaire, interviews, and the pupils´ learning diaries were used to investigate sixth graders´ metacognition in the connection of environmental education and working on net. The questionnaire included five themes based on metacognition literature: understanding and assessment of cognitive processes, strategies, the monitoring of action, the assessment of action, and the use of what has already been learned. The five themes were investigated in ten open questions. The open questions gave the pupils the possibility of describing in their own words those things which they thought were the most essential.

Metacognitive knowledge was studied in the questionnaire by asking

- how the pupils saw themselves as learners,
- how they experienced the course, and
- how they used different learning strategies.

On the other hand, to clarify metacognitive skills, the pupils were asked

- how they planned and prepared for the course,
- how they monitored their action during the course,
- how they felt to have benefited from the course, and
- how they were aware both of their own learning and that of others.

In addition, the pupils described themselves as learners through the use of vehicle metaphor. We acknowledge that there are limitations of metaphors concerning the details, when only a part of the subject under consideration is included. Because of these limitations, metaphors are used in this study to complement other research data. The questionnaires, including the metaphors and answers to the open questions, were completed by the pupils at the end of the course.

Georghiades (2004a) has seen that writing in the learning diaries whilst under instruction, is a metacognitive action. Learning diaries support the learning process, outline thoughts, and develop self-assessment strategies. However, learning diaries in this study, even that they are used as metacognitive action, can be seen more as an open questionnaire. The reason for this is because primary school pupils mostly describe their actions mechanically, without reflective observation as also Georghiades has stated. The pupils in this study responded weekly in their diaries

to the questions: what did I do this week, what did I learn, what did I not understand, and what was impressive. They also marked which of the available technical equipment they used during their work. Writing learning diary belong to the activities of all the ENO courses. Ojeda-Barceló and Perales-Palacios (2005) have found that the learning diary in ENO-School was seen to be very helpful for the youngest pupils, but not so much for the older ones. They have considered that there was a need for some tool that would endow it with more importance, so that it could serve as an effective method of evaluation. Some schools did not use it because they regarded it as having no pedagogical relevance. However, diaries promoted pupils´ to observe of their own learning processes and metacognition as well.

Data analysis of this qualitative research focuses on the students´ abilities to monitor their thoughts and experiences. After analyzing the pupils´ answers to open questions, we noticed that eight pupils were sufficiently able to describe their thoughts to proceed to the more detailed study of metacognition. These eight pupils were then chosen to be interviewed. The interviews acted as main data for interpretation. The theme-interviews were semi-structured in nature (see Appendix 1). As such, it was possible for the pupils to tell in their own words about the themes previously defined by the researchers. Questions used in the interview were based on children's answers to the questionnaires and on the conceptions of metacognition derived from literature. Although the data analysis is mainly based on interviews, the analysis of the answers in questionnaire contributed to the results by supporting the interpretation of the interview when relevant. Also data from the questionnaire of the pupils who were not interviewed is analysed, and some descriptions explaining the categorization are shown. Data in the learning diaries is used to supplement the analysis in the cases where the pupil had written about issues related to the theme under consideration. In the same way a metaphor, part of the questionnaire, is used to support the analysis when relevant. The interview data with supporting data is categorized under the literature based themes in order to describe students' metacognition. When concluding the metacognitive knowledge and metacognitive skills, only the eight interviewed pupils are considered. The data collected from other pupils has been limited for making conclusions. For the pupils´ descriptions we use following coding: I refers to an interview; Q refers to a questionnaire; L refers to a learning diary; G refers to a girl; B refers to a boy, and numbers from 1 to 4 for both genders refer to the pupils interviewed, and others for those not interviewed.

Results and Discussion

Pupils´ metacognitive knowledge and metacognitive skills are both analyzed here with the aid of three themes: metacognitive knowledge is based on the pupils´ views of themselves as learners, views of the task, and of learning strategies; metacognitive skills are studied from the pupils´ views of the planning, monitoring, and evaluation processes.

Metacognitive Knowledge

Pupils´ views of themselves as learners

Pupils´ responses concerning themselves as learners can be divided into three categories: 1. *being in the ENO course* – this includes pupils´ descriptions about their styles and characteristics as learners, 2. *action in the ENO course* – this refers to pupils´ behaviour during the course, and 3. *pupils´ attitudes towards the ENO course.* Pupils´ views of themselves as learners in different categories are described in Table 1.

Table 1. Pupils´ views of her/himself as a learner

Categories: Pupils´ ideas about themselves as learners		Descriptions from both interviews of eight pupils and metaphors (19 pupils)
Being in the ENO course	Speed of pupils´ activities	I learn things fast A tractor because it moves slowly but surely
	Easiness of learning	I haven't learned those [objectives] in the best way A person car, it moves by its own speed
	Goodness and personal strengths of pupils	I am a quite good pupil
	Self-image	I am nice
Action in the ENO course	Diligence	I always do tasks I am quite hard-working
	Need for assistance	Sometimes I need help
	Sociality, extroverted	I am quite social I like to work with others
	Spontaneous activity	I have been spontaneous
	Ability to concentrate	Sometimes I can concentrate well and do well my work
	Obedience	I have done which has been asked
Pupils´ attitudes towards the ENO course	Interest	I am interested in that subject
	Absence of interest	Sometimes it is not interesting it is not my favourite subject

The pupils described their *styles and characteristics* as learners (category 1) mostly by talents such as ´I learn things easily` (IG4), or ´I always learn things fast` (IB3). Many pupils told that ´I am quite a good pupil` (QB3, QB4, QG4, QB2) (see Table 1). Although the pupils generally saw learning as an active process, they defined their features to be more constant.

The descriptions related to the *action* during the ENO - Environmental Online course (category 2) considered the pupils´ own role as a learner. References in this category were often highly accompanied by concepts used in school assessment: pupils emphasized, for example, that they were hard-working (´I always do my work`, IB3), sociable, interested in the theme, spontaneous and persistent in working (´I can concentrate well`, IG2). In addition, the need for help was mentioned (see Table 1). Based on the theory of metacognition, recognizing the limitations in their own knowledge and skills, e.g. the need for help, creates the basis to search for new knowledge. Although recognizing the need for help is not an action itself, the recognition led directly to the action, i.e. the pupils asking for help.

Descriptions concerning the *attitudes* towards the course (category 3) were mainly positive, but also occasionally negative in nature. The attitudes towards the subject of learning were connected with interest in the work as well as the ability to concentrate. Two pupils who were interviewed disclosed the absence of interest:

> "Sometimes I am able to concentrate and do my work quite well, but sometimes it does not interest me – however generally I do it". (IG2)

"It is not my favourite subject so I don't want to waste my energy on it". (IG4)

The pupils´ views varied according to the themes and the tasks of the course. This indicates that the pupils find some themes and tasks more interesting than others. One pupil, for example, told us about his interest in the course. Interest in the topic increases the motivation to work, as one pupil said: ´I just like to do that ENO project so then I work´ (IB2). The interview showed that this pupil can concentrate if the subject is personally interesting, a factor that Mayer (1998) also has noticed in his study. On the other hand, Sternberg (1998) states that although students are generally motivated to pursue areas in which they excel, and vice versa, yielding a correlation between motivation and cognition, a student may have the ability to be good at science even without being interested in it. In this case, pupils paid attention to the task instead of themselves as learners, regardless of their interest in the whole course or more limited interest in some tasks (see Table 1).

When asking the pupils to describe their learning by using a vehicle – metaphor, they chose it either without appropriate explanations or by explaining the choice. If pupils explained the choice of vehicle for the metaphor, the reason was connected either directly to the character of the vehicle or by explaining the connection between learning and the vehicle. From the following examples, the first shows that a pupil described learning as being apart from the vehicle, while in the second example, learning is connected with the vehicle itself: ´A bicycle, because *we* have gone quite slowly, crawling the course` (QG7) ; ´A tractor, because *it* moves slowly but surely´ (QB2). The difference is small but it reflects the idea as to how pupils understand their learning and the use of metaphors to describe it.

Among other things, pupils described the social aspects of learning in a vehicle metaphor. The pupils mentioned either working together, ´a car, because I have proceeded together with many people` (QB1), or a scaffold, given by other people, ´a car - there are some people helping` (QG4). This can be seen as a consequence of ENO - Environmental Online - virtual school, where the social component of learning (the goal to learn co-operatively) is supported. The tasks of the ENO Program have shown to stimulate the creation of teams and to encourage collaboration (Ojeda-Barceló & Perales-Palacios, 2005). The social interaction and cooperation are strongly emphasized in ENO Schools as the Computer Supported Collaborative Learning Environment which has probably influenced pupils. The observation of the social role in learning is also in accordance with the results among 13-year-old pupils in computer supported learning environment (Hurme et al., 2006) and with findings of Malandrakis (2006), which indicated social construction of the new knowledge. However, Thomas and McRobbie (1999) have found that the 15-16 year old pupils did not describe the social role of learning in their metaphors, even though they worked in groups during the research. Thus the computer supported learning environment may be the reason for different results (see Mason et al., 2010; Topcu & Ubuz, 2008).

In summary, when relating to learning, the pupils mostly stressed their diligence in activities, and also their goodpoints as learners. According to Paris and Cunningham (1996, p. 139), already when entering school, children monitor themselves as learners. Later, pupils´ conceptions as learners become more exact and start to guide behaviour. Overall, pupils´ metaphors in this study highlighted the easiness of the learning process, or the certainty achieved based on the slow action. The social component was also clearly pointed out, as well as the individual progress during the ENO - Environmental Online course.

Knowledge about the task

Metacognitive knowledge about the task includes the identification of the task and its demands, as well as knowledge about how the demands of the task will be achieved in the current situation

(see e.g. Hacker, 1998). The task as such is considered before and/or during the performance. However, the demands of the task are based on the knowledge gained during the activity, so they are considered to be in effect during or after the task. In this study, knowledge relating to the task is analyzed, based on pupils´ thoughts concerning the most important aspect of the course, and the significance of the course theme in general. The pupils, when interviewed, were also asked to evaluate topics related to the theme which had not been studied during the course.

In order for pupils to be motivated, it is important to appreciate the things to be learned. This can lead towards understanding the importance of the topic (see e.g. Corkill, 1996, p. 275). Hence, at the beginning of the course, the pupils in this study were asked to say if the theme was important for them and why. All the pupils thought that the theme was important and three types of reasons were described: 1) *to learn to prepare food, 2) traditional cuisine in different countries*, and *3) seeing culture and traditions more generally*.

They were mostly girls who described the importance of the course *as a skill to prepare food.* The health aspects were emphasized in these answers. As pupils stated, ´we learn to eat a more balanced diet` (LG2), and ´one learns what is healthy and what is not. One learns home economics´ (LG4). The second category of answers contained the preparation of both *national and foreign traditional cuisine*. Some pupils mentioned eating; ´one can eat different food` (LB2), while some other pupils emphasized knowledge about traditional food; ´one knows about the local traditional food` (LG6). However, most of the descriptions concerned the preparation of food, e.g. ´we know which kind of food is prepared in other countries and we can try to do it ourselves´ (LB4).

The third category of pupils' answers contained descriptions about the importance of the course. *Culture and traditions* were mentioned *at a more general level*. The pupils conceived traditions as being important, and they showed their eagerness to cherish culture and traditions through its one vital part, the traditional cuisine: ´one learns to respect one's own traditions´ (LG6), ´it is good to learn about the culture of other countries - - at the same time one learns to respect them´ (LG1).

All pupils found the traditional cuisine course to be important. The arguments of its importance were related to the goals set for the course by teachers. However, the pupils were aware of only some of the course goals. In general, knowledge of the goals helps the learner to adjust how deeply he/she delves into the theme (see Corkill, 1996, p. 276). In our study, one pupil described his own interest in the goals of the course; ´it is nice to know more about things concerning other countries´ (LB1). When describing himself as a learner, this pupil calls himself an active and hardworking pupil. This shows that the pupil's inner motivation seems to guide his behaviour during the course.

On the whole, pupils´ conceptions of the significance of the food-preparation skills reflected the general goals of the course. Pupils´ understanding of the goals became clearer and at the end of the course they used more of their own words in describing them. At the same time, the pupils directed more attention to the background knowledge. Instead of learning baking skills, pupils focused on developing their skills in the area they considered to be most important on the course.

Knowledge about learning strategies

Metacognitive knowledge contains knowledge of learning strategies, the awareness of the possible strategies, their choice, and the use of them for the task (Schraw, 1998). The activities during the ENO course were planned and guided, so that the pupils themselves were not able to independently choose the learning strategies. Thus we do not investigate the choice of learning strategies but, instead, we concentrate on the awareness of the learning strategies available, and on the

pupils´ conceptions of their use. The identification of the learning strategies makes it possible to associate them with different learning situations and the learners´ own tendencies. For example, the identification of the possibilities and limitations of computers helps pupils to use computers more effectively in learning processes. On the other hand, when pupils choose to work individually or in a group, they are able to decide the more effective way of acting in the given situation, if they are aware of the nature and benefits of both styles.

The pupils mainly used traditional learning strategies during the course, i.e. reading and writing. Moreover, they also pointed out hands-on experience and training. It must be remembered that the theme of the course was quite practical. The learning strategies the pupils described found in this study were: reading, writing, hands-on experience, listening, using the computer, thinking, sensing, remembering, discussion, group work, and working individually. Three pupils described learning by listening where a pupil is seen to have an externally passive role in learning. These pupils who learned by listening, also mentioned that reading and writing belonged to their learning. None of these pupils described their learning through practical work. On the contrary, descriptions about the autonomic action referred to the pupil's active role in learning. These references described the pupil's thinking and reflection. Also the advantage of senses was pointed out, as well as group learning which enables the sharing of experience.

The results of learning strategies mainly reflected the teaching, and the pupils´ ways of working. At the same time, pupils´ descriptions of the used learning strategies revealed their metacognitive analytical skills and awareness of the learning strategies. Every pupil described at least three learning strategies which she/he used. One pupil, for example, illustrated several learning strategies she had applied during the course. She said in the interview that she learned to bake an Iranian omelette not only by reading the recipe, but also by cooking the omelette. She also described her learning by writing in the learning diary. Moreover, the same pupil was aware of the importance of thinking actively; ´I must think myself`. She also mentioned her enjoyment of working alone, but also to discuss with others. However, the pupil did not differentiate between when and why she works alone or with others.

According to Sternberg (1998), knowledge monitoring always takes place in a context, relating to a particular goal or purpose. This study agrees the context dependence being ENO Online and environmental education, as also the dependence of the goal being sustainable cultural development. Altogether, the pupils monitor both learning food culture and other culture in their evaluation of the ENO course.

Results about metacognitive knowledge concerning one's self, the task and learning strategies are summarized in Table 2. These three elements are combined with declarative (e.g. self - I learn things easily), procedural learning (e.g. learning strategy - by writing in the learning diary) and conditional knowledge (e.g. task - …we can try to do it ourselves).

Table 2 shows that all the pupils in the study have reached the level of declarative metacognition in the ENO course. Some pupils achieved procedural knowledge and a few pupils conditional knowledge. However, in this environmental course all pupils were able, when concerning the tasks, to reach each level, i.e. declarative, procedural, and conditional metacognition in knowledge. Concerning self and learning strategies, some pupils reached procedural metacognition level and only few pupils reached the conditional metacognition level.

Table 2. Pupils´ metacognitive knowledge and declarative, procedural, and conditional knowledge (8 pupils total; some refers to 3-6 pupils, and a few to 1-2 pupils)

		Elements of metacognitive knowledge concerning		
		Self	*Task*	*Learning strategies*
The levels of metacognitive knowledge	*Declarative metacognition*	All pupils were able to describe themselves as learners	All pupils were able to describe the tasks	All pupils were able to describe the used learning strategies
	Procedural metacognition	Some pupils utilized procedural knowledge for reflecting own roles as learners	All pupils developed their understanding about goals of the course; pupils learned to take the background knowledge more into account	Some pupils expressed limited procedural knowledge about the ways of taking advantage of the learning strategies
	Conditional metacognition	A few pupils analyzed their roles metacognitively on a conditional level	All pupils were able to mention when and how to apply the learned knowledge	A few pupils analyzed used learning strategies

Metacognitive Skills

Planning

Metacognitive skills are studied here from the pupils´ views of the planning, monitoring, and evaluation processes. In planning, all of the pupils interviewed knew that the goals of the course could be found in their learning diaries. Most of the pupils also mentioned that they had discussed the goals with their teacher. The role of the teacher was to guide the pupils in their work according the needs of the pupils. According to the pupils, the goals of the course were ´food preparation so that they could do something` (IB2), and ´learning about traditional food and to bake` (IG3). The action was a part of the goals. One pupil described how ´we did practical things` (IB2) and ´it is more fun to do` (IB2), compared to using passive learning strategies. On the other hand, the pupils described the realization of the goals in practice. The practice of the ENO School is based on different activities, where the pupil is an active participant. It can therefore be supposed that the pupils combined the goals with the functional study styles. The pupils also differed from each other in their learning styles. One pupil, for example, mentioned in several contexts how doing practical things is more favourable and easier than passively following teaching. According to pupils´ own words, it helps him if ´the teacher - shows how to do it` (IB2).

Besides the goals of the course, the pupils had their own goals written in the learning diaries. In their own course goals, pupils raised traditional or foreign food preparation. One pupil mentioned interest in learning things not included in the task. In the interviews, however, pupils protested that they had not set their own goals. They claimed that the teacher had not given them guidance or, as one pupil argued, that they had not been able to set their own goals. One said it was unnecessary because the goals were in the learning diary anyway.

What did the pupils know about the subject before the course? In terms of the Iranian omelette, called kookoo, the pupils did not have any background knowledge. One pupil said that food traditions were not well known. She felt that she did not even know national traditional food well

and ´kookoo I could not make it but now I can`. Most of the pupils had baked local traditional food before the course. In other words, the pupils knew about their local traditional cuisine but food from abroad, in this case from Iran, was unfamiliar. Because of the pupils´ background knowledge and skills, compared with other lessons they felt it not only easier to work but also to help others. They also felt it possible to prepare themselves beforehand for the new situations and collect data on the topic.

When studying the pupils´ metacognitive planning of the action, it was noticed that the pupils become aware of the general goals of the course. The pupils cited the general goals in their personal goals, which had more detailed description. Pupils felt that by collecting data the background knowledge helped them to prepare for the lesson beforehand. The background knowledge also helped them to work both in ENO lessons and at home.

Monitoring of the action

Metacognitive monitoring of the action consists for example of understanding, remembering, and use of the things learned, effective action, critical thinking, problem solving, the choice of strategy in different phases of the working process, activation of the background knowledge, and the benefit of feedback (see Schraw, 1998). Many pupils in the study saw the course as being easy, that nothing seemed difficult: ´I did not experience any difficulties – it was easier than ordinary school science´ (QB1), ´it was the easiest of those [courses] which we have had, because there wasn't much work´ (IG3).

The pupils experienced the course as being easy, mostly because the course did not contain theoretical aspects. To clarify this point of view, pupils described other courses: ´we generally had to write or do something with the computer` (IB3); ´we were not [now] much on the computers but we did practical things` (IB2). The practical tasks during the course were divided among the pupils and it may have been possible, that because there was not always enough to do for everybody, the pupils experienced that the course was easy.

The most difficult task for the pupils was to translate the English recipe. Pupils felt the text to be difficult. However, they got help from the dictionary or from adults: ´The English was difficult and there was so much of it´ (IB4); ´there were strange words and everything else. (…) I asked the teacher and checked the dictionary´ (IG4).

ENO School serves as a place where pupils can interact in Internet Relay Chats. It has clearly been found as a benefit in regard to motivation, participation, environmental awareness, and promotion of sustainability (Kaivola & Åhlberg, 2002). The most interesting themes of the ENO Program were those related to the natural environment from the cultural, social, or economic aspects (Ojeda-Barceló & Perales-Palacios, 2005). The proposed activities and tasks were clearly coherent with the objectives and the content, and represented challenges for the participants that were sufficiently operative, and also easy put into effect. The easiness of the course was also pointed out in this study. According to the study of Ojeda-Barceló and Perales-Palacios (2005), the activities were seen in many cases as being too theoretical, and there was a need for more interaction with other schools. We have found that the traditional food course was, on the contrary, more practical than theoretical, which the pupils felt to be positive. The interaction between other ENO schools was not mentioned by the pupils, although it was an essential part of the program.

Metacognition helps the learner to take into account the feedback on the progress of the task and according to the feedback to change his action either while pursuing the action or later (see Gourgey, 1998, p. 82). Surprisingly, regardless of the advice giving by teachers, the pupils described the lack of feedback during the course. Only one pupil mentioned a situation when the teacher assessed her work positively. In spite of the positive feedback, the pupil said in the inter-

view, that it did not influence her work. This pupil was of the opinion that some other pupils thought negatively about her attitude to school. The pupil probably did not like to differ from her peers. On the other hand, the pupil was able to be in direct contact with feedback itself.

Young people avoid situations, which may be embarrassing (Paris & Cunningham, 1996, 138-140). The pupils are aware of social comparison and are afraid of negative attention. This may cause pupils to see success in school as being a social risk. Social acceptance strongly influences pupils´ self-esteem (Wigfield, Eccles, & Pintrich, 1996, p. 153). However, adaptive help seeking is an important strategy of the self-regulated learner, although it is unique among learning strategies because of its social-interactive nature. A young learner who asks questions and obtains the assistance needed from teachers and peers, does not only alleviate immediate academic difficulties but also acquires knowledge, skills, and strategies that can in turn be used to help oneself regulate one's own performance (Annevirta & Vauras, 2006).

Metacognitive knowledge of itself and of others includes the knowledge as to how other people interpret the individuals´ communication. The pupil described above, has skills to see herself and her behaviour from the viewpoint of others. From the viewpoint of developmental psychology, the individual's cognitive development is connected to the monitoring others psychologically. At the same time young people want to be friends with others who possess similar features (Wigfield et al., 1996).

Evaluation of the action

Reflection on the course activities took place by finding out 1. What the pupils had learned, 2. The self-experienced limitations of the pupils´ knowledge, 3. The use of studied knowledge and skills, 4. The need for changes in behaviour, and 5. The awareness of pupils´ learning.

Most of the pupils said they had learned to prepare food, especially the Iranian omelette, and gained some knowledge about food during the ENO course. From the metacognitive point of view, metacognition includes the knowledge on what the individual knows and what is missing. Pupils´ awareness of the limitations of their knowledge was studied by asking them to tell about the things which they would still like to know. Four pupils mentioned that extra knowledge was not necessary. The pupils often expressed their interest in knowing more about the food culture of different countries and baking different types of food. For example, the pupils pointed out their interest in ´what other traditional food exists in the world` (QG7); `new food and how to prepare it` (QB8); and also ´it would be nice to taste the food of some other countries` (IB3). The pupils were generally interested in getting to know more about other cultures. The pupils saw food culture as a part of becoming familiar with other cultures.

The pupils were also asked to say in what kinds of situations they thought they could use their knowledge and skills learned during the course. The pupils highlighted food preparation and baking skills as the most useful aspects of the course. The pupils also pointed out internationality; knowledge of different food traditions; skills for discussion in English; or skills to cope with staying abroad. The increased knowledge and benefit in the home country were associated with sharing the learnt things with parents or using the knowledge in different games. Two pupils mentioned the external benefit of the course; the easy course was seen as a basis for a good school mark.

The pupils were also asked what they would like to do differently if they were starting the course now. Many pupils were satisfied with their present action and did not see any need for changes. The descriptions about change concerned the action itself, English skills or studying in general. One pupil expressed her hope to be more motivated. However, the same pupil said in the questionnaire that she would continue working as actively as earlier. In other words, this pupil

Table 3. Pupils´ awareness of their own learning (all 19 pupils are taken into account)

Categories: Pupils´ awareness of their own learning		Descriptions
Descriptions concerning knowledge	Increase in knowledge	One knows more
	Application of the knowledge	One begins to use the knowledge in normal things
	Telling others	One is able to tell it to others
	Remembering	It [learned things] has stayed in the head
Individual feeling or action	Feelings, emotions	Good feeling appears
	Change of him/herself	Oneself changes a little
	Thinking	So brain working happens of course
Outward feedback	Outward evaluation	[you know learning] from the school certificate

separated participation and her own interest. She would like to keep the participation stable but develop her interest.

The pupils also discussed the being aware of their learning. The answers can be divided into three groups; pupils realized their learning from knowing more, from the feeling or the action, or from external feedback (see Table 3).

The expressions about the application of knowledge, thinking and "brain work" reflect an active conception of learning in which learning took place through personal action and its observation. For example, one pupil strongly combines the awareness of learning, with its benefits in practice. According to her, without benefit there is no change or learning. Other notions, like remembering, or external reward, reflect more passive action during studying. In this case the pupil does not actively monitor his learning and action. This is in contradiction with the descriptions about thinking or brain work. One pupil, however, mentioned that he observed learning by an increase in knowledge, which shows that he has monitored the causes of his learning. In addition to active and passive action, pupils can observe learning through positive feeling and experience.

Metacognitive skills of pupils in this study are gathered together in Table 4. Pupils´ knowl-

Table 4. Metacognitive skills about planning, monitoring, and evaluating the action compared with the levels of processing the knowledge (8 pupils total; some refers to 3-6 pupils, and a few to 1-2 pupils)

The levels of processing the knowledge	*Components of metacognitive skills*		
	Planning	Monitoring	Evaluating
Identification	All pupils knew the goals and where to find them. The awareness of the goals increased during the course	All pupils named easy and difficult things and matters in the course	All pupils showed their consciousness of learning; they mentioned things what they have learned, and how they could change their behavior now
Implementation	All pupils have set own goals for the course	A pupil recognized the help of feedback during the course	All pupils expressed the ways to use gained knowledge in future

edge processing is divided into two stages: at first pupils have to identify the knowledge, and then they can implement it into practice. In this study, all pupils were able to identify their actions in planning, monitoring, and evaluating stages. All pupils were also able to implement the knowledge in their planning and evaluation processes during the course. However, only one pupil noticed the help received during the lesson, regardless of the support and advice given by the teacher and the assistant.

Conclusions and Implications

The results related to metacognition in this study show declarative and procedural metacognition of sixth grade pupils. In these categories, pupils describe their attitudes and motivations during the ENO - Environmental Online - traditional cuisine course. Individual learning styles, their own learning attitude, and motivation were described at a more developed metacognitive level. The pupils were able to describe the task and its significance for them.

The ability to plan, monitor, and evaluate cognitive activity does not automatically imply that a learner can steer and direct his or her learning process without the help and support of a teacher or a textbook. The role of the teacher in enhancing students´ metacognition has been acknowledged (de Jager et al, 2005). From the learners´ point of view, seeking help from a knowledgeable person can be more beneficial than giving up prematurely, more appropriate than waiting passively, and more efficient than persisting unsuccessfully on one's own. The pupils´ metacognition also enhanced towards the end of the ENO course showing some influence of teaching.

Those second grade children (6-8 years) who expressed high-level knowledge of the factors and strategies affecting cognitive activity (metacognitive knowledge), could also better regulate their performance (metacognitive skills) (Annevirta & Vauras, 2006). The ability to refer to mental cognitive processing in academic performance (metacognitive knowledge) was connected with the ability to skilfully regulate and direct one's performance in a play-like situation (metacognitive skill). There was also variance among the children. On the contrary, the pupils in the ENO course differed very little in their metacognition. However, the pupils differed for example, in their learning styles, which may, according to Mason et al. (2010) affect learning from Internet sources. Metacognitive knowledge explains also, according to Topcu and Ubuz (2008), the variance in the online participation. The pupils were guided to share what and when they had learned and in some cases also how they had learned. Also Bartsch et al. (2003) have noticed that both children and adults most frequently referred to what was learned and who learned it, and less frequently to when, how, and where the learning occurred. This pattern did not change as children got older. When asked, the pupils in this study also expressed how and when they could use this learning. The pupils also described the possibility of using the knowledge at home. Thus, the pupils possessed not only both declarative and procedural knowledge but also conditional knowledge.

According to Georghiades (2004b), eleven year old pupils´ practice of metacognition is feasible. The older pupils, the sixth graders in this study clearly possess metacognitive knowledge and skills as expected from this age group. Older pupils, seventh graders have shown declarative and procedural metacognition (Lehtelä, 2001) as well as metacognitive content was related to the social interaction process (Hurme et al., 2006). According to Veenman and Spaans (2005), two years older pupils show still more metacognitive activities than the seventh graders. The pupils in this study seem to take up a position in this developmental continuum. However, only eight of the 19 pupils were able to show their metacognitive knowledge and skills.

By studying metacognition in the context of ENO School, this study contributes to the descriptive knowledge on the metacognition of six-grade pupils in the context of environmental

education or sustainable development education. Knowledge about own sensitivity towards environment, knowledge about own knowledge of environment, knowing how to act and participate in environment, as well as monitoring the actions and participation are essential elements in environmental education. This knowledge is related to metacognition, thus metacognition can be seen as a key factor in environmental education. Based on the premises of qualitative research, we do not attempt at a generalization of the findings. Although the study has been performed in the ENO School, it seems that metacognition found is not unique only to this context, but could also be seen as metacognition of sixth graders. Metacognition interacts with many other aspects of student – abilities, personality, learning style, and so on. The understanding of metacognition will probably be most useful if it is complemented by an understanding of these other aspects of students´ functioning, and of how they interact with metacognition (Sternberg, 1998). Further research might focus on the dependencies of these factors with metacognitive knowledge and skills. Another interesting focus of future research might be to study ENO pupils in different countries, from the viewpoint of metacognition. Furthermore, it might also be useful to repeat the study of metacognition in the context of another ENO course but with a different theme. Understanding pupils´ metacognition helps to develop metacognitive activities in the ENO-school as well as in other learning environments.

Appendix 1. Interview Protocol

Warming up

- Presenting the researcher and the interview
- Description of the pupil's role in the interview and ethics of interview
- Pupil's name, age and previous experience of interview situations

Understanding and evaluating cognitive processes

- Which things did you feel you learnt during the course? Which things were left unclear? Do you feel you got new information? Is there something you would like to know more about? Feeling of learning – feeling of success.
- Knowledge of learning. Class mates' learning.

Strategies

- Learning strategies in general. What kind of knowledge and skills did you need during the course? Did they support your learning? Why did you choose these particular skills and knowledge? How did they help?
- Learning diary – was it a help? Alone or together?

Monitoring the action

- Difficult and easy things. What felt difficult during the action? Why? What did you do to change/ease the situation? Easy things. Mistakes.
- The level of the pupil. Grade. Feedback.
- What did the class not carry out?

- Background knowledge and making use of it. Information given by the teacher beforehand.
- Goals of the course and reaching them. Own goals. The most important thing in the course.

Evaluating the action

- If you were to start the course now, what would you do differently / the same way? What are you good at? What are you not good at?

Applying the learnt

- In what kind of situations outside school can you make use of what you learnt on the course?

End of interview

- Is there anything else you would like to say? Do you have any questions?

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Altıncı sınıfların kendi öğrenmelerini anlaması: çevre eğitimi kursunda bir örnek olay çalışması

‘Ne bildiğini bilme’ ve ‘nasıl öğrendiği hakkında düşünme’ olarak ifade edilebilecek üstbiliş öğrenmede önemli bir elementtir. Finlandiya müfredatı üstbilişi çalışma metotlarının seçeneklerinde vurgular. Metotlar öğrencilerin kendi öğrenmelerinin farkında olmalarına, daha iyi öğrenme stratejileri geliştirmelerine ve stratejileri yeni durumlara uygulayabilme becerisine yardım etmelidir. Bu niteliksel örnek olay çalışmasında altıncı sınıf (N 19) Finlandiyalı öğrencilerin üstbilişi bir sanal öğrenme ortamında (ENO) ‘Çevre Online’ çalışıldı. Öğrencilerin metakognitif bilgileri ve becerileri bir ENO kursunda çalışıldı. Amaç öğrencilerin kendi öğrenme süreçlerini ne ve nasıl gözlemlediklerini betimlemekti. Çalışmada 11. sınıf öğrencilerinin bazı şartlı üstbiliş ile birlikte, bildiren ve işlemsel üstbilişe sahip olduğu bulundu. Bu çalışmada, öğrenmenin sosyal bileşeni özellikle vurgulandı.

Anahtar kelimeler: üstbiliş, üstbiliş beceriler, fen eğitimi, ilköğretim okulu, ENO-çevre online