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EMBEDDING E-MAIL IN PRIMARY SCHOOLS: DEVELOPING A TOOL FOR COLLECTIVE REFLECTION

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ABSTRACT

Reflection is an important aspect of learning in groups. In collective moments of reflection, learners can share and compare their ideas with others, and by doing so can reach an articulated and personal understanding of a learning task and domain. In the research presented here, e-mail is examined as a means for reflection in the context of group learning. In two design experiments, an e-mail tool is developed that seeks to (1) support collective reflection, and (2) overcome practical problems related to e-mail use in primary classrooms. Two prototypes of the tool are presented and tested in five primary classrooms. We conclude that e-mail supports collective reflection on a learning task after adding the following supportive measures to the regular e-mail program: (1) a fixed partnership, (2) fixed timing, (3) an exercise of individual freewriting, and (4) collective use of a paper worksheet.

INTRODUCTION

An important benefit of group work is that it can help learners reflect on their knowledge and skills. When learners articulate their ideas in a group, others can react on them from their own perspectives. As a result, learners can think over

what they meant. Likewise, when learners listen to ideas of others, they can compare new ideas to their own. Derived from the Latin *reflectere*, meaning literally to *bend back*, this process of mirroring can be called *reflection* or *reflective thinking*. Many researchers have pointed out the benefits of a social setting for reflection. Group work is said to encourage reflection because of the presence of others who can point out irregularities, and bring in different viewpoints that raise the awareness of conflicting ideas (e.g., Boud, Keogh & Walker, 1985; Cohen & Scardamalia, 1998; King, 1998; Kravtsova, 1999; Lompscher, 1999). In accordance with this research, we view reflection as a process essentially occurring in dialogue. We call this process *collective reflection*.

Furthermore, we make a distinction between intellectual and personal reflection. According to Wardekker (1998), reflection is the route to *genuine* concept learning and the construction of *personal* understanding. In his view, reflection is the key process of critical participation in society. Such participation not only encompasses intellectual reflection on conceptual knowledge, but also personal reflection on the what, how and why of actions. Because we wanted children to reach personal understanding of scientific concepts and learning processes, this study aims at personal reflection. We define personal reflection as "thinking about the process and product of learning by articulating, elaborating and recapturing prior knowledge and new classroom experiences" (see also de Vries, 2004).

Reflection, although deemed important, does not come about easily. Children can be so engaged in their own actions that they forget to enter a dialogue with others. And children can be unfamiliar with working in groups and not knowing *how* to share their thoughts. Group dynamics can also get in the way. Some children may dominate the group work whereas others keep silent. Furthermore, conflicts between children may lower the motivation to collaborate.

Computer tools can provide the necessary support (e.g., Kyza & Edelson, 2003; Seale & Cann, 2000). Lin, Hmelo, Kinzer, and Secules (1999) argue that such tools can help making the learner's thinking visible in four (complementary) ways. First, computer tools can make explicit reflective processes by displaying them. Second, they can prompt learners to engage in reflection in different phases of task completion. Third, they can model the process of reflection, for instance by providing examples of experts' thinking. And fourth, they can provide opportunities for collaboration so that multiple perspectives become apparent.

Although e-mail is not explicitly mentioned by Lin et al. (1999), it seems a suitable tool for collective reflection. E-mail brings together learners from different locations. Collaboration with distanced others seems fruitful for reflection in several ways. First, it motivates learners to make their thinking explicit. Because e-mail partners do not share the same learning context, explication is needed, and attention needs to be paid to the articulation of details (Cohen & Riel, 1989; Tichenor & Jewell, 2001). Second, moments of sending and receiving e-mails prompt designated moments of reflection. How these moments are

embedded in the task further determines when and how learners will reflect. But not only the act of e-mailing can prompt learners to stop and think, also the content of e-mails may prompt them to reflect, for instance when a received e-mail contains questions. Third, the e-mail program allows *personal* reflection by providing a rather open format that does not require specific content and leaves it up to the learners what they will write about (cf. Blair, 1996; Loveless, 2003; Murphy, 2003), and by allowing a loose and talkative way of writing (cf. Baron, 1998). Because of the open format, however, extra instruction to model the process of reflection may be necessary. Fourth, e-mail is asynchronous. This gives learners the time needed to reflect (cf. Cheung & Hew, 2004; Marttunen & Laurinen, 2002; Weiserbs, 2000). Finally, e-mailing means writing for a real audience. The authenticity of e-mail communication has been found to be motivating (cf. Riel, 1990; Tichenor & Jewell, 2001; Yost, 2000).

Many primary schools still work with limited computer facilities, however, and have limited time at their disposal. Also, they work with children for whom writing is not yet an automated process (Baron, 1998). And as most children can't type fast, producing e-mails is time-consuming (Van der Meij & Boersma, 2002). Therefore, e-mail use has to be implemented in such a way that writing, typing and the actual sending and receiving become workable processes despite limited access to the Internet, limited time to spend, and limited skills to work with. Moreover, because in this study e-mail use is aimed at reflection, children have to become aware of writing as a learning activity. They need to get engaged in *writing to learn* instead of *learning to write*, and have to be encouraged to reorganize their thoughts, and evaluate these with others. Research has shown that children find this difficult (e.g., Bereiter & Scardamalia, 1987; Kumpulainen, 1996; Mason, 2001). Writing with the computer only partly stimulates such reflective writing. Writers do revise more but these revisions tend to be limited to things such as spelling and grammar (e.g., Goldberg, Russell, & Cook, 2003). And the precise influence of the computer remains rather unclear (Rowley & Meyer, 2003). In our study, e-mail has to be implemented in the lessons in such a way that it becomes a tool to think and learn with.

This article reports on the development of an e-mail tool for collective reflection in the primary classroom. Two issues are discussed: development and implementation of the tool. With regard to the first, we concern ourselves with finding ways to embed e-mail in a collaborative learning task in the domain of biology, and to invite children to reflect together. In relation to implementation, we seek to overcome the practical problems that constrain functional use of e-mail. For instance, schools may have limited computer facilities, teachers and children may lack skills, and teachers may have trouble organizing structural e-mail contacts that don't die after the first exchange of hello's (Riel & Levin, 1990; Smith, Whiteley, & Smith, 1999; Weiserbs, 2000). We adopted the approach of Design-Based Research by conducting two design experiments in which development and implementation, and theoretical as well as practical outcomes

are combined (Barab & Squire, 2004; Brown, 1992; The Design-Based Research Collective, 2003).

Central to Design-Based Research (and similar approaches such as developmental research) is the way formative evaluation is handled. Nieveen (1999) states that formative evaluation revolves around three qualities: validity, practicality, and effectiveness. *Validity* measures if the tool does what it was designed for. *Practicality* measures if the tool is usable and implementable. *Effectiveness* measures if working with the tool yields the desired outcomes. Based on these qualities, two research questions are posed:

1. How can e-mail be implemented in the classrooms so that children become engaged in collective reflection? (practicality, validity)
2. What is the reflective nature of the e-mail activities? (effectiveness).

THE FIRST DESIGN EXPERIMENT

The Learning Task

E-mail use was embedded in a learning-by-designing task in the domain of biology. In learning-by-designing (LBD), learners design objects for instance in poster presentations, computer simulations or by actually building three-dimensional ones (cf. Janssen, 1999; Kafai, 1995). In the domain of biology, LBD can be defined as: "Learning through the act of analyzing and designing a biological system according to a domain-specific design principle." In the research presented here, children worked in small groups on the design of an ecosystem of a self-chosen animal during six lessons of two hours each by applying a form-function principle. The children used a design heuristic that questioned the form-function relationships of (parts of) the ecosystem. In the first two lessons, the task and topic were introduced and the design process was demonstrated. The groups worked on their designs in lessons three to five, and presented these in the sixth lesson. The designs took the form of posters containing a map of form-function relationships, detailed drawings and written explanations (see Figure 1).

Embedding E-mail

Each lesson started and ended with teacher-led whole class discussion about the topic, designing, group work, and e-mailing. The discussions invited the children to think reflectively about the lessons. E-mail was embedded into the lessons to further support collective reflection. MS Outlook™ was used to send and receive e-mails. In addition, three supportive measures were taken to support collective reflection with e-mail.

The first supportive measure was a *fixed partnership*. We paired groups from one school with groups at the other school doing the same lessons in the same

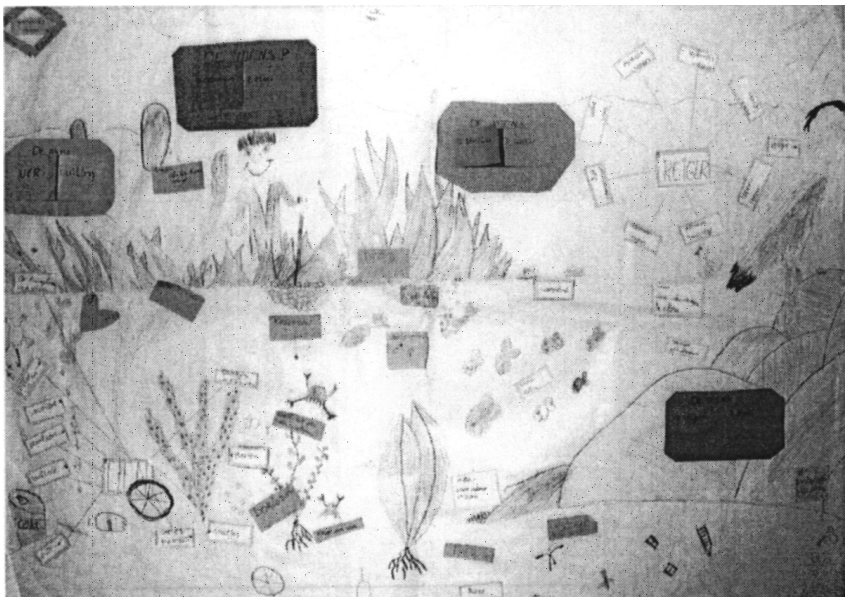


Figure 1. Example of a design product.

weeks. The fixed partnership structured the e-mail process by making clear who e-mailed to whom. This was viewed to be essential for building strong and meaningful work relationships (cf. Riel, 1990; Riel & Levin, 1990). By pairing up the schools, the teachers too had a fixed e-mail partner. A good contact between teachers participating in an e-mail project has been found to be crucial for its success (e.g., Weiserbs, 2000).

The second supportive measure was *fixed timing* and implied two things: a *fixed exchange pattern*, and *fixed e-mail moments*. Groups sent and received one message per lesson, thus a minimum and maximum of messages was sent. For instance, school A sent and received e-mails on Tuesday, and school B on Thursday. The pattern thus realized is a zigzag pattern (Van der Meij & Boersma, 2002). This pattern was expected to facilitate reflection. In incidental exchange patterns, the continuity of the dialogue would be at risk, and children would rapidly loose their motivation to share thoughts with the partner group (cf. Van der Meij, Van Graft, & Boersma, 2001). A frequent exchange pattern would give too little time for reflection, and would be difficult to realize in schools with only a few computers connected to the Internet, and with children that cannot type very fast. The second way to fix timing was by determining two e-mail moments within a lesson. The groups received e-mails *before* working on the design task, and wrote them *after* working on it. As a result, the design task became embedded within two moments of collective reflection.

The third supportive measure was use of a *paper worksheet*. The worksheet displayed an e-mail format with headings similar to an e-mail program. (To:; Cc:, Subject:). On the left, a short assignment prompted the groups to share experiences. General (without topic indication) and specific (with topic indication) assignments were tried out to discover what worked best (see Figure 2). The worksheet was expected to move writing from the computer lab to the classroom where more space was available for all group members to participate. It would also remove typing constraints from the process of reflection, and allow teachers to organize the typing and sending of e-mails according to the computer facilities and time available.

Summarized, three supportive measures were taken to embed e-mail in the lessons and stimulate collective reflection. Fixing the partnership and exchange pattern was expected to help establish a relationship between groups. Fixing e-mail moments was expected to strengthen the connection between e-mail and the design task. And the worksheet was expected to help children focus on collaborative writing instead of on practical demands of using a computer and e-mail program. Using e-mail was expected to make children aware of the learning process, and to encourage them to give expression to (meta)cognitive and affective reflections on a range of lesson-related topics.

Participants

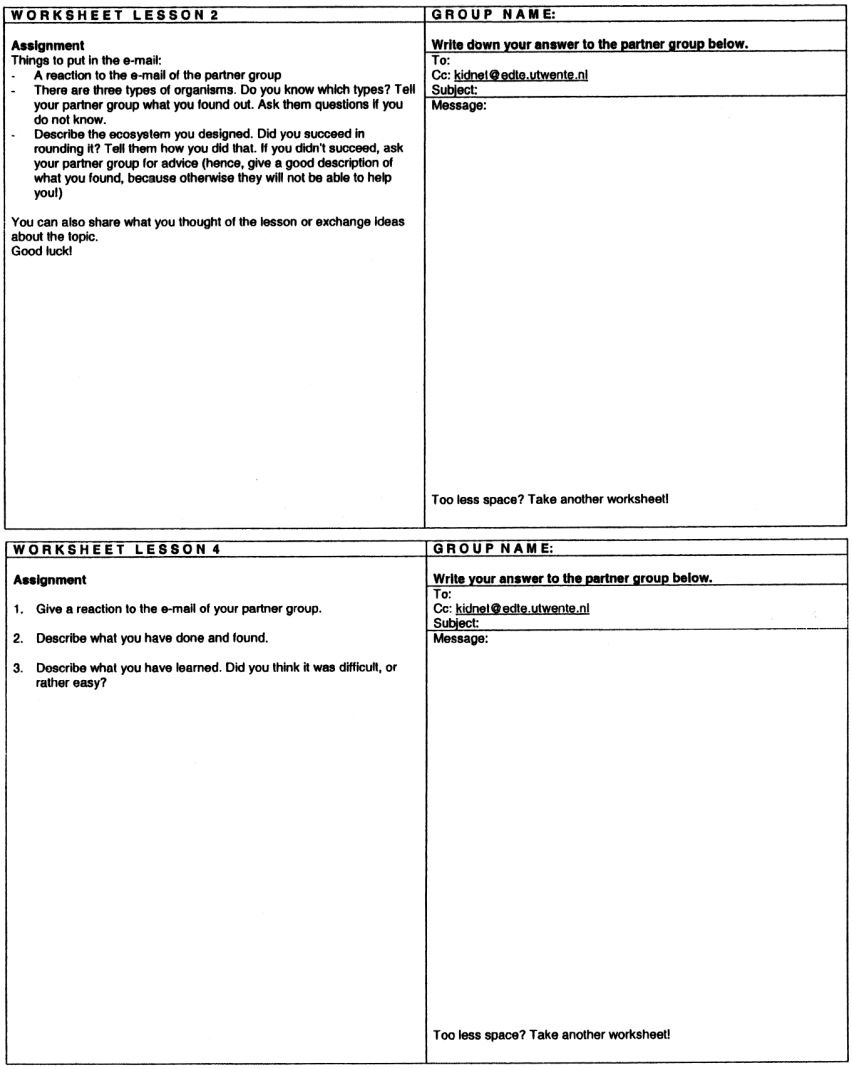
Two primary schools—partly paid for their time—participated in the first design experiment. The schools were sited in villages in a rural area of Enschede, the Netherlands. Both schools participated with one classroom (grade 5-6, aged 10-12). In total, 16 groups participated. One school had a normal student population, the other housed children with learning and behavioral disabilities.

The schools had access to at least one computer connected to the Internet. The teachers were familiar with the basics of e-mail software. The children varied in their experience with e-mail at home. E-mail had not been used in the classrooms before. The schools had some experience with working in groups. LBD, however, was new to both schools.

Before the start of the project, lesson materials were introduced and ideas, expectations, and practical issues related to e-mail use were discussed in a face-to-face meeting with the teachers. An e-mail schedule between the schools was drawn up, and it was determined how groups would be paired. Also, a pilot of three lessons was run before starting the project to make the teachers familiar with the materials and e-mail procedures. During the project, the teachers sent e-mails to inform each other about any changes of plans or to share experiences.

Procedure

A range of data was gathered to gain insight in the teachers' implementation of the e-mail tool, the children's motives to engage in collective reflection and e-mail



WORKSHEET LESSON 2

Assignment
Things to put in the e-mail:
- A reaction to the e-mail of the partner group
- There are three types of organisms. Do you know which types? Tell your partner group what you found out. Ask them questions if you do not know.
- Describe the ecosystem you designed. Did you succeed in rounding it? Tell them how you did that. If you didn't succeed, ask your partner group for advice (hence, give a good description of what you found, because otherwise they will not be able to help you!)

You can also share what you thought of the lesson or exchange ideas about the topic.
Good luck!

GROUP NAME:

Write down your answer to the partner group below.
To:
Cc: kidnet@edte.utwente.nl
Subject:
Message:

Too less space? Take another worksheet!

WORKSHEET LESSON 4

Assignment

1. Give a reaction to the e-mail of your partner group.
2. Describe what you have done and found.
3. Describe what you have learned. Did you think it was difficult, or rather easy?

GROUP NAME:

Write your answer to the partner group below.
To:
Cc: kidnet@edte.utwente.nl
Subject:
Message:

Too less space? Take another worksheet!

Figure 2. Worksheets with a specific (above) and a general (below) assignment.

use, and the reflective nature of the e-mails. Classroom observations and field notes of all lessons were taken. Informal interviews were held with the teachers after each lesson and at the end of the project. All design products, and e-mails were collected. Semi-structured interviews with a few children ($n = 8$) randomly chosen from one classroom were held after each lesson. The e-mails were

segmented and coded to assess their reflective nature. All segments were coded as either personal/communicative or design task related (general coding). All segments related to the task were coded in more detail as either descriptive or evaluative (see also De Vries, 2004; Van der Meij, De Vries, Pieters, Boersma, & Wegerif, 2005). All coding decisions were recorded in a codebook. A second independent coder coded about 30% of the e-mail data. For segmentation, the interrater agreement was 94%. For general coding, Cohen's Kappa yielded .94. For detailed coding, Cohen's Kappa yielded .77.

Results

The teachers organized the e-mail process as indicated in the lesson plan. The fixed partnership led to structural contacts between teachers in which they shared e-mail schedules and experiences. The groups reported having fun getting to know their partner groups. They said it was easy to communicate with unknown children now that they had a concrete and common task to talk about. A structural exchange pattern was realized between the classrooms. The fixed e-mail moments helped structure e-mail procedures and classroom organization. The e-mails were written shortly after working on the design task. Most e-mails were sent immediately, some were sent later that day or the next day depending on the e-mail schedules the schools had agreed on. The worksheet helped structure the process of collaborative writing. It was used during all lessons in both schools. Writing the e-mail on paper first did not make it artificial as the children referred to it as e-mailing. Thus, the support measures helped to practically embed e-mail use in the lessons, and create favorable conditions for collective reflection.

Did the tool also engage the children in collective reflection? The e-mail process was successfully connected to the design task as the groups focused on the task when writing their e-mails. The following e-mail fragment illustrates this:

> [. . .] We have just discovered what a fish must be able to do. The blackboard is full of things we found: he has to breathe with his gills, steer with his tail, see with his eyes, feel with his nerves, eat with his mouth, and protect himself with his scales. Did you find other things? Did we find things you haven't found? [. . .]

In total, the groups produced 88 e-mails with an average length of 87.1 words (*s.d.* = 39.4), 41.8% of the content of these e-mails was about the design task. The e-mails described the process and product of designing and learning. To a lesser extent, they reorganized thoughts and evaluated by expressing appreciations, assessments and relating new to old experiences as illustrated by the following fragments:

> [. . .] We had to design an ecosystem of our choice and we chose the deer. We didn't like this lesson much. We have problems bringing it to an end. [. . .]

> [. . .] The other presentations were nice and instructive. [. . .]

The other parts of the e-mails were dedicated to personal talk and talk related to the communication itself. Because the groups did not know each other and communicated at a distance, effort needed to be put in establishing and maintaining a social and comfortable setting. Besides reflecting in their e-mails, the groups also reflected when reading and discussing received ones. These discussions were short, mainly addressed grammar and spelling issues, or tried to answer questions posed by the partner group.

Although e-mail use led to reflection, collective reflection was also hampered by some things. First, the communication was sometimes flawed by unclear connections between groups. In one school, groups had been rearranged due to absenteeism of some children, and this resulted in fewer groups. As a result, the communication flow between some groups was disturbed. While this underlines the importance of creating a strong and structural partnership between groups, it also illustrates its vulnerability to sudden changes. Second, in some groups the writing process was dominated by a few children who got hold of the worksheet. Third, the worksheet was too complex. The general assignments were hardly used, and the specific assignments were experienced as confusing. Fourth, because the instructions on the worksheet did not work, the teachers gave additional instructions for writing e-mails that tended to focus on posing questions and receiving answers. For instance, one teacher explicitly instructed the groups to 'pose two questions.' The following excerpts of e-mails illustrate this focus on questioning:

> [. . .] We have a few questions, please answer them as soon as possible. Can goldfish smell under water? If they can, how do they do that? How long do goldfish live on average? [. . .]

> [. . .] Hello, here are the Blubbies speaking to the Eagles. We sent you some questions, but you haven't. So we hope they come soon. Were the questions difficult or not? [. . .]

The focus on questioning often caused problems, because the groups found that they did not receive (good) answers or received these too late. Often, the groups posed quiz-like questions to test their partner group. Many e-mails witnessed these problems as illustrated by the following fragment:

> [. . .] SILLY QUESTIONS really. The questions we pose are: How many feathers does a fox have? And how many eyes has a fox? If you put silly questions like that, we'll do the same. [. . .]

The teachers noticed the unfruitful questioning and communicated about it with each other:

> [. . .] I think the e-mail process is not always going okay. My children have the impression they don't get answers to the questions they pose. I can't discover a straight line in the e-mails they receive. And the same goes for the e-mails my children write [. . .]

Summarized, in relation to the practicality of the e-mail tool we conclude that it fitted the circumstances at schools, and was successfully embedded in the lessons. In relation to the validity of the tool, we conclude that the children experienced e-mail as related to the task, and wrote down descriptions and to a lesser extent evaluations that witness the beginning of reflection. But the way e-mail was embedded also afforded unreflective questioning. In addition, e-mail had not engaged learners equally. Hence, reflection was not always collective. Finally, in relation to the effectiveness of the tool we conclude that most of the reflections were intellectual. Deep reflections in the form of personal evaluations were found only sporadically. Since the assignments on the worksheet had not worked, the most important influence on children's writing was the teacher's instruction. To stimulate collective and personal reflection, we decided to simplify the worksheet and structure the teachers' instruction more heavily.

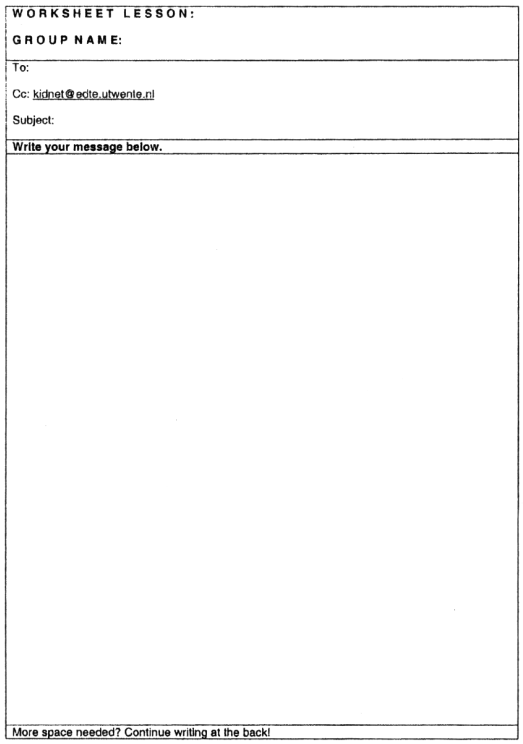
THE SECOND DESIGN EXPERIMENT

Embedding E-mail

The e-mail tool underwent two major adaptions. The worksheet was simplified by removing the assignments. The worksheet now contained an e-mail format with a header to note lesson number, group name, addressee, and subject (see Figure 3). To stimulate personal reflection by all group members, we inserted an individual freewriting exercise before the group started writing an e-mail. During this exercise children thought about the lesson in three minutes of absolute silence. After that, they wrote down their thoughts associatively for five minutes (cf. Elbow, 1973). The children were asked not to pay attention to grammar and spelling. Instead, they were instructed not to take their pens off their papers and keep writing. The children were to use their freewritings to compose a group e-mail. Freewriting structured the children's reflective thinking. Now all teachers led their children into a similar process of reflection. We expected freewriting to have a positive influence on the collective and personal character of reflection, because children now got the opportunity for individual reflection before entering the group process. Individual preparation was expected to stimulate the emergence of multiple perspectives when composing a group e-mail (cf. Brown & Renshaw, 2000; Dysthe, 1996; Van Boxtel, Van der Linden, & Kanselaar, 1997).

Participants

Three schools voluntarily participated in the second design experiment. The schools were sited in villages in a rural area of Enschede, the Netherlands. All schools participated with one classroom (grade 5-6, aged 10-12). In total, 12 groups participated. Two schools had normal student populations, the third school housed only two children because of closure at the end of the school year.


WORKSHEET LESSON:

GROUP NAME:

To:

Cc: kidnet@edte.utwente.nl

Subject:

Write your message below.

More space needed? Continue writing at the back!

Figure 3. The revised worksheet.

The schools had access to at least one computer connected to the Internet. The teachers were familiar with the basics of e-mail software. The children varied in their experience with e-mail at home. E-mail had not been used in the classrooms before. The schools had some experience with working in groups. LBD, however, was new to the schools.

Before the start of the project, lesson materials were introduced and ideas, expectations, and practical issues related to e-mail use were discussed in a face-to-face meeting with the teachers. An e-mail schedule was drawn up, and it was determined how groups would be paired. During the project, the teachers sent e-mails to inform each other about any changes of plans or to share experiences.

Procedure

A range of data was gathered to gain insight in the teachers' implementation of the tool, the children's motives to engage in collective reflection and e-mail use, and the reflective nature of the e-mails. Classroom observations and field notes

were taken, and interviews with the teachers and some children ($n = 11$) were held. All products and e-mails were collected. The e-mails were segmented and coded to assess their reflective nature. A second independent coder coded about 25% of the e-mail data. For segmentation, the interrater agreement was 95.9%. For general coding, Cohen's Kappa yielded .95. For detailed coding, Cohen's Kappa yielded .80.

Results

The revised worksheet was easy to use according to both teachers and children. It structured typing and sending messages as it did before, but left out distracting and time-consuming activities. Freewriting was realized in all lessons and evaluated positively by both teachers and children. The teachers were skeptical in advance, especially about the three minutes of silent thinking. But afterwards they stated that it had structured and smoothened collaborative writing. The children were motivated to express their thoughts, and produced freewritings with an average of 63.7 words (*s.d.* = 25.3). The freewritings revealed rich stories that contained descriptions of the process and product of learning, and many expressions of appreciations, assessments, and related personal experiences. For instance, after the sixth lesson Etiën wrote:

> We had to present a poster about our topic. I liked doing that very much. I wrote a text and I got help doing that. At the end I wrote everything down in small pieces and what everybody had to read aloud during the presentation. If you found something in the text that was wrong, you could rewrite it. We divided everything in small pieces. During the presentation one of us pointed at the poster, and someone else talked about it. We did several animals, we chose the ditch with frogs. At the end we got remarks and questions. They asked for instance: why is there an owl in your design? This was a report about the presentation.

And Willem wrote:

> [. . .] I have learned from this afternoon's lesson something. that we have to discuss things in the group and not keep them to ourselves and about fish I didn't know very much yet but a lot more now and I like that. [. . .]

The individual writings were used as a source for group writing. Composing e-mails now took less time. With the individual preparations at their disposal, children had more to discuss. They read each others writings, cited and discussed them, and compared ideas. The e-mails became longer ($m = 148.5$ words, *s.d.* = 122.0), and covered a wide range of lesson-related topics. No unreflective, quiz-like questioning was found in the e-mails. The largest parts of the e-mails were still dedicated to giving descriptions, but these descriptions were longer and more detailed than before. In one school, personal appreciations and assessments started to dominate the e-mails. The following e-mail excerpt illustrates this:

> [. . .] We liked the lesson about the goldfish. And especially it's nice to have a fish in our classroom. We knew a lot about fish. We think it is a dull animal because it just swims around in circles. It has scales to protect itself. [. . .]

Did freewriting lead to more equal participation? Analyses of the freewritings and e-mails suggest that it did. The content of most e-mails was composed from all the freewritings of a group. The groups often started with a simple cut-and-paste from one or two writings, but later the composing process evolved into a complex cutting and pasting from all writings. They encircled important parts in each writing and copied these to the worksheet. Sometimes they copied literal sentences, but often sentences were summarized into a group opinion. For instance, Etiën had written that he liked doing the presentation. The other group members had written: "I liked doing the presentation, but I was nervous," and "I liked our presentation, but it was difficult." Together, these opinions were summarized as follows: "We all found it very difficult, but nice to do." The process of realizing a group opinion is further illustrated by the use of personal pronouns. In the freewritings "I" is used to refer to oneself, and "you" to refer to a group member. In the e-mails, "we" is the most common pronoun. Brown and Renshaw (2000) also found that children changed perspectives when they switched between individual and group work: "The small group processes that follow this individual work are designed to move students to an agreed representation (or set of representations) of the task. Here the speaking positions alternate between explaining or defending personal representations and moving toward a common view. There is a movement from 'my ideas' and 'your ideas' to 'our ideas'" (p. 58).

Summarized, the revised worksheet and the freewriting exercise effectively dealt with the validity and effectiveness problems encountered in the first design experiment. The children participated more equally and the individual and group writings became more personal. In addition, the freewritings led to reflective discussions about what to put in the group e-mail.

CONCLUSION

In the present study, e-mail was embedded in a collaborative learning task in the domain of biology for the purpose of collective personal reflection. Four supportive measures were developed: a fixed partnership, fixed timing, individual freewriting, and a paper worksheet. The practicality, validity, and effectiveness of these measures were examined in two design experiments. We concluded that the supportive measures helped to embed e-mail within the learning task (practicality), and encouraged individual and collective personal reflection on the process and products of learning (validity). The children wrote individual reports, and used these to compose group e-mails. They gave descriptions of the learning task, explicated personal appreciations and assessments, discussed freewritings and received e-mails, and became aware of different views (effectiveness).

Composing a group e-mail by using individual freewritings as a starting point proved to be fruitful for collective reflection in various ways. First of all, it provided the children with the opportunity to give expression to their own personal voices, and defend these when constructing a group opinion. Besides that, the freewritings made the children aware of different views that resided in their groups. Reading each other's freewritings often led to acknowledging the uniqueness of each writing and to copying unique parts from each freewriting into the group e-mail. Sometimes these unique parts were summarized in a new group opinion.

Implementing freewriting led to more extensive dialogues surrounding the writing of e-mails. Hence, reflection not only occurred through *writing*, but also through *talking*. And when receiving e-mails from the partner group, *reading* and *talking* were prevalent activities. Thus, collective reflection with e-mail comes about through a diversity of language-based activities. Although reading, writing, and talking are all language-based activities, children's motivations for them differ. Mason and Boscolo (2000) report that in general children find it easier to talk than to write. Also, their functionality differs. Talking can be best in one situation, whereas writing is more appropriate in another. Some researchers have argued that a combination is most beneficial (e.g., Dysthe, 1996; Rivard & Straw, 2000). The present study supports this view. Subsequent research on how reading, writing and talking unite when using e-mail therefore seems desirable.

In her report on e-mail use in a primary classroom, McKeon (1999) concludes: "Using e-mail gave the children a chance to 'make public' their individuality. Perhaps this occurred because the children were initially unfamiliar with their partners and wanted to share knowledge about themselves in order to establish a relationship with a new person. If so, classroom e-mail partnerships may provide students with a new way to learn about themselves as they select information that defines who they are and send it via e-mail to another" (p. 703). The present study first and foremost underlines this particular strength of e-mail communication: it brings close someone who is at a distance. This in turn triggers children to bring out in the open their own personal voices. And the children thank each other for the opportunity:

> [. . .] This was our last e-mail. Thank you for everything, it was great fun to work with you. [...]

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