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Education Environment Integration of Shared Desktop Storytelling

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Deliverable D2.1:
Education Environment Integration of Shared Desktop Storytelling

ABSTRACT

This document describes the school activities (Workpackage 2) in the first year of the ESPRIT ESE (Experimental School Environments) project KidStory.
The activities are based on four "philosophies", each described in a chapter:

- Children as Inventors
- Children as Storytellers
- Children as Collaborators
- Technology Infusion

Based on these ideas, manifested as a methodology of "Contextual Design", consisting of Contextual Inquiry, Participatory Design and Technology Immersion, an intergenerational team of 5 and 7 year old pupils, their teachers, and academic researchers, have integrated and studied shared desktop storytelling at Albany Infant School in Nottingham, and at Rågsvedsskolan in Stockholm.
The activities have consisted of Introduction of Partnership, Cooperative Inquiry, Introduction of first and modified prototypes. A special emphasis has been put on strengthening the children in their role as inventors.
The prototype desktop storytelling technologies infused are
KidPad, a tool for collaborative drawing, zooming/panning and linking elements to a dynamic drawing / story
Klump, a tool for collaborative modeling and shaping a screen representation of an elastic "blob"

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Task	2.1

1. Introduction - KidStory

Today, teachers and parents are looking to computer technologies to support learning activities for their students and children. The difficulty that educators are finding is that these new technologies are not completely supportive of collaborative learning experiences. Three children can build a castle with a pile of blocks, but can those same three children share one mouse with one computer screen to build a virtual castle? KidStory sets out to address this problem by developing technologies that are as inherently collaborative as a box of crayons or a pile of blocks. Children need these manipulatives to enable them to focus on the creative experience of building, drawing, or storytelling as opposed to spending time concerned with which child gets to hold the mouse next. Inherent in the approach of KidStory is to supply tools that break away from the standard notion of mouse, keyboard and screen and take advantage of what both the virtual and physical worlds afford. KidStory proposes to develop new technologies that support collaborative learning which itself may underpin the development of storytelling and visualisation skills along with the development of multiple forms of literacy.

KidStory involves three phases of technological development. In each phase, we construct a shared storytelling platform and associated applications for integration into school environments. Each phase builds on previous phases and extends the interface further away from traditional computer hardware towards more kid-friendly and inherently collaborative forms of interaction.

The first phase (year), with school activities reported here in deliverable D2.1 and technology and evaluation reported in parallel deliverables D1.1 and D3.1, concerns a SHARED SPATIAL DESKTOP COMPUTER, which is our first step beyond the current computer interface. We have extended existing software and hardware platforms to support shared access through multiple input devices. These allow children to share control over story creation when using a single computer in the classroom. It builds upon our previous experience with two kinds of interface approaches: 2-D zoomable interfaces and 3-D virtual environments.

1.1. KidStory WP 2 - Education Environment Integration

The goals of the KidStory research are thus to develop new technologies, as well as to develop, understand, and record the research methodologies we use in working with children, teachers, and researchers.

In this report, the first deliverable from Work Package 2, we describe these methodologies and the philosophy behind the techniques used in our research. In particular, we discuss the role of children as inventors, storytellers, and collaborators. In addition, the school environments, activities, and the process of technology infusion are examined. What follows is a brief description of each chapter in this deliverable.

1.2. Contents of chapters

Chapter 2: The English and Swedish School Systems and Specific Schools

This chapter describes the two very distinct school environments that offer a home to the KidStory research project. The chapter will briefly examine the English and Swedish school systems, and then will describe the specific school environments, resources, and personnel that are a part of the KidStory project.

Chapter 3: Philosophy 1- Children as Inventors

This chapter presents the first philosophy of our research: children as inventors and partners. The role of children in the technology development process will be explored, in relation to the evolution of this role, research methods needed, and the challenges as well as strengths of this role for children.

Chapter 4: Philosophy 2- Children as Storytellers

This chapter presents the philosophy behind children as storytellers. A brief review of the literature will be discussed in relation to narrative structure, story creation and retelling, the role of play, and the computer as a tool for storytelling. The storytelling activities of the KidStory project will be discussed as it pertains to this literature.

Chapter 5: Philosophy 3- Children as Collaborators

This chapter presents the philosophy behind children as collaborators. A brief discussion of collaboration as a tool for learning, the complexities of supporting collaboration, and the benefits of collaboration will be presented.

Chapter 6: Philosophy 4- Technology Infusion

This chapter presents our final philosophy: the process of technology infusion. A discussion of the methods for each of the progressive stages of technology infusion will be presented. This will be discussed in relation to the stages that have been reached in the KidStory project research.

Chapter 7: School Activities

This chapter describes the school activities that have taken place in the first year of the KidStory project. Session summaries were written by KidStory researchers that took part in the sessions. Activities and quick reflections will be presented.

Chapter 8: Experiences and Conclusions

This final chapter briefly summarises experience from the first year and outlines some matters for consideration for Year 2.

2. The English and the Swedish School Systems and Specific Schools

2.1. Introduction

The KidStory research project has partnered with two schools: Albany Infant School in Nottingham, England and Rågsvedsskolan in Stockholm, Sweden. This chapter is intended to give a 'flavour' of the differing school environments and schooling ethos. It is evident that the project is working in two very diverse environments and, while our goals remain the same in each school, the way in which we achieve these aims may differ due to cultural differences such as teaching methods, class structure and ideologies concerning assessment. In the chapter that follows, the two school environments the KidStory project works in will be described in regards to the school surroundings, structures, and personnel. In particular we describe the curricular and those aspects we have found in the school practices that can be used for and by the teachers to justify the time KidStory spends in schools with the children.

2.2. The English School System and Albany School

2.2.1. The English School System

The English school system at present has returned to a very structured approach to education with assessment throughout.

The table below outlines the class divisions by age and illustrates the assessment times and levels to be achieved.

Key Stage	Year	Age	Assessments
	Reception	5	Baseline Assessments
1	Yr. 1	6	
	Yr. 2	7	SATs, levels 1-3
2	Yr. 3	8	
	Yr. 4	9	
	Yr. 5	10	
	Yr. 6	11	SATs, levels 2-5

Curriculum

a) Baseline assessments are carried out on entry to school at 5 years. Children are then reassessed at the end of Years 2 and 6.

b) In September 1998, The National Literacy Strategy was introduced in the White Paper 'Excellence in Schools.' The aim of this strategy is for 80% of 11 year olds

achieving the expected standards of literacy (level 4 or above in the key stage 2 English tests) by the year 2002. This strategy outlines one hour a day to be devoted to literacy (reading and writing development). This is set to a rigid framework with set targets to be achieved at the end of each year. Term objectives are very detailed, for example, teachers are provided with examples of term and weekly planning sheets and vocabulary lists.

c) Schools are also required to teach numeracy for one hour per day.

Key Stage 1 Programme of Study

"Pupils should be given opportunities, where appropriate, to develop and apply their information technology (IT) capability in their study of English."

It is worth summarising some of the key points that are outlined under the Speaking, Listening, Reading and Writing sections in the programme of Study in order to illustrate their relevance to the storytelling and collaboration issues in KidStory.

Under the title 'Speaking and Listening' it is suggested that pupils should be telling real and imagined stories and reading and listening to poetry and nursery rhymes. They should be exploring and developing ideas and predicting outcomes. They should also be describing situations and experiences and explaining their actions and feelings. Children should learn how talk is influenced by the audience and thus they should experience discussion and presentation in groups of varying sizes and different audiences. Children should be encouraged to listen carefully, recall points that interested them and listen to others views. All children should be encouraged to take part in drama and performances. Attention should be brought to the meanings of words and their use in different contexts. They should become familiar with words associated with events (e.g., birthdays and language appropriate for storytelling e.g. "One day…")

The 'Reading' section suggests that children should be given experience of a wide range of literature, including stories, poetry, plays and picture books. They should read on their own, to the teacher, in groups and they should read their own work to others. Children should find information from a variety of sources e.g. dictionaries, encyclopaedias. The materials read should stimulate the child's imagination. They should be clear, with straightforward characters and plot and should be visually interesting to enhance the words. Language with repetitive patterns, rhyme and rhythm will help children to understand sound patterns. Contextual understanding should be encouraged. Children should use their knowledge of how stories are formed and patterns of language to understand what they have read. While reading stories and poems children should talk about the characters and plot, predict what might happen next, retell stories that they have read or heard and present and act out stories that they have read.

In 'Writing' children should be taught to organise and present in different forms ranging from diaries and stories to notices and invitations. Children should be encouraged to plan and review their ideas. Teachers should help children to compose

their work and give children the chance to work collaboratively. The importance of sentence structure, tenses, vocabulary and grammar should be introduced to the child.

2.2.2. Setting the scene - Albany School

The town where the school is located, Stapleford, lies five miles west of Nottingham close to the A52 to Derby. The town itself is a densely populated urban area with the present school zone consisting of private, council, and rented terraced housing. There are many small industries in the district.

The school was opened in 1971 and is an open-plan class design. There are two separate wings, each containing three class areas and adjacent quiet rooms plus several shared spaces. The wings are connected by a carpeted hall at one end and a library / dining area at the other. They face each other across an external paved courtyard.

The staff consists of a Head Teacher, a Deputy Head, one county post teacher, six standard scale teachers, one full-time nursery nurse and one part-time special needs teacher assistant. The separate nursery unit is staffed by a full-time allowance teacher, and two full-time nursery nurses and one special needs support assistant. Clerical help is 32 hours per week.

The children transfer to the newly built Albany Junior School and from there to Bramcote Park Comprehensive School.

2.2.3. Breakdown of classes

At the Albany school as a whole in the Autumn term there were: One Reception/Year 1 class of 28 children; two Year 1 classes of 30 and 31 children and two Year 2 classes of 28 and 29 children.

In the Spring term there was: One Reception class of 17 children; one Reception/Year 1 class of 28 children; two Year 1 classes of 30 and 31 children and two Year 2 classes of 28 and 29 children.

There was an intake of approximately 20 children in the Summer term.

2.2.4. Our Partners at Albany

The KidStory project is working in partnership with a Reception class teacher, Debbie Bradley, and her class which consists of 20 Reception children (age 5 years) and 7 Year 1 children (age 5-6 years) *and* a Year 2 teacher, Ella Roberts and her class of 28 Year 2 children (aged 6-7 years).

Although there is a range of ability the children’s’ test scores are above the national average.

Evaluation Philosophy

Although a generally qualitative approach is taken to the KidStory project, the Nottingham team has had to negotiate with the school and evaluate, using tools that the school both has at its disposal and can use within its evaluation framework.The positive effects of the project in order to justify the amount of time spent in school. Schools are judged by their children’s’ levels of achievement in the SATs, therefore the school

curriculum must be heavily based on achieving these results. Besides the Baseline Assessments, teachers at Albany keep a record of each child's progress by use of their own checklists. Children are divided into groups within the classroom dependent on these recordings. In standard lessons, the Year 2 class are sat according to ability. Ella places the children so that the "lowest ability" group are sat on the table closest to her. The two "middle ability" tables are parallel to one another and the "highest ability" group are farthest away. The Head teacher also teaches a variety of classes and takes measures of children's performance in certain areas (one of these being storytelling).

Ethics and concerns

The school staff was concerned that if control groups were used some children would be denied access to the technology. School staff also did not want to encourage first name terms between adults and children.

The Head teacher wrote to all parents/guardians of children involved in the project to gain permission for the children to take part and be photographed and/or filmed. The school had no objections to the use of a video camera.

Teachers' Perspective on KidStory at the beginning of the project

Teachers expressed their expectations of the project in terms of their personal interest and potential benefits for their children.

They suggested some of the following gains from their perspectives: A 'buzz' from being part of a project breaking new educational ground; the possibility of professional development; more insight into how children think and learn creatively; the opportunity to use new technology; raised standards due to an improvement in story and poetry writing; an improvement in communication skills; the provision of hardware to support their IT programme; the opportunity to raise cultural awareness through internet, video and school exchanges with Sweden; horizons broadened as curriculum has become very narrowly focused and as a preparation for children for life in the 21st century.

The teachers felt that the children may benefit in the following ways: Improved IT skills; creative thinking encouraged; a broader curriculum; raised cultural awareness; improved communication skills; higher standards and the opportunity to realise the potential of the computer.

2.3. The Swedish School System and Rågsvedsskolan

2.3.1. The Swedish School System

The table below outlines the class divisions by age and illustrates the national assessment times.

Year	Age	National assessment times
Nursery school / Daycare center	5	
Preschool / School for six year olds / Year (grade) F	6	
Year (grade) 1	7	
Year (grade) 2	8	National diagnostic test
Year (grade) 3	9	
Year (grade) 4	10	
Year (grade) 5	11	National test

Curriculum

The Swedish curriculum is very general and states goals more than procedures. The curriculum for the elementary school is from 1994. In general, the goals are formulated as skills and knowledge expected from pupils after the 5th and after the 9th (last) year.

Since January 1999 there is also a pedagogical curriculum for the nursery school. Compulsory school begins in Sweden the year the child turns seven. In Sweden, there is only one intake per year and that happens in August. In Sweden there is no grading of

the younger students. Traditional grading of all students (MVG=very well pass, VG=well pass, G=pass, U=fail) does not happen until age 14 (year 8).

The Swedish language (literacy) programme

The literacy programme is linked to the curriculum and formulated by a multidisciplinary Swedish national committee including a fiction writer. Here are some parts in translation:

"Ability to use the Swedish language in speech and writing is a prerequisite for active participation in society. It is therefore a main task for the school to create opportunities for pupil's development of the language. Education should give pupils possibilities to use and develop their skills in speaking and listening, reading and writing. They shall meet fiction, lay the foundations for good reading habits and get to know parts of our cultural heritage. Previous knowledge of Swedish can vary and therefore it may be necessary for pupils to have an education in Swedish as a second language.

Language and culture are inseparably united. In the language are our roots and our cultural identity. The language reflects differences between people, their personality, background, sex, interests, etc. The functional role of the language also reflects people's different motives, ambitions and positions. The significance of the language for our personal identity makes it important, within the task of the school, to teach pupils to speak and write well, to create respect for the language and ways of expression in speech and writing of others.

The language is also a way to knowledge and it is of basic significance for learning. Through the language, pupils master new concepts, learn to see contexts, think logically, review critically and evaluate. Their ability to reflect and understand the surrounding world grows.

The language has a key position in school activities. It develops a human being's thinking and creativity, her relation to others and her personal and cultural identity. Through the language, knowledge becomes visible and manageable. Language ability thus has great importance for all work in school and for the continued life and activities of the students."

"The school shall in its education in Swedish strive for
…
• development of the pupils' language confidence in speech and writing so that she or he with respect for others, wants and dares to express herself or himself clearly in different situations
• development of the pupils' fantasy and lust for learning through reading and creating with the language
…"

"The language:
Pupils develop their language abilities by using language in meaningful contexts: speaking, reading, writing and thinking. Through use of the language students learn to take care of situations which have linguistic requirements (e.g., formal correctness, degree of detail and empathy).

Language is developed in social interplay with others. It is developed if one actively participates in conversations, shapes, improvises, tells stories

and describes for other people, reads and understands, writes to express feelings, thoughts and ideas."

"Goals that should be acquired at the end of the fifth school year:
• the pupil shall be able to read children's and young people's fiction and fact books with good understanding and smooth reading
• the pupil shall be able to write stories, letters, notes and descriptions in clear handwriting and so that the receiver can understand
• the pupil shall be able to orally tell and describe so that the content is comprehensible for the listener and be able to read a text aloud in front of the class
• the pupil shall know and be able to apply the most common rules for the written language and the most common rules for spelling and be able to use a dictionary"

2.3.2. Setting the scene - Rågsvedsskolan

Rågsvedsskolan is situated in the suburb Rågsved about 10 km south of downtown Stockholm. Rågsved, as a suburb, has to deal with significant problems such as high unemployment, drug-related problems in the community, and lack of parental support. In terms of schooling, Rågsvedsskolan does not have a strong reputation. 98% of the housing in Rågsved consists of rented housing.

The school was built and opened in 1965. The school consists of 450 students and about 45 teachers. The students are between the ages 6 and 16. The classes for pre-school and grade 1-6 consist of mixed age groups. Grades 7 to 9 work in homogeneous age groups. During the last ten years, an increasing number of immigrants have moved into the suburb of Rågsved. Today about 50% of the pupils have a first language other than Swedish. Integrated within the school is the afternoon club (fritidshem), which is for students age 6-9 and supplies students with post-school activities (primarily for children that have two working parents). About 95% of 6-9 year old students attend the afternoon club. The teachers and staff who work with children of this age work closely together in teams.

The school is surrounded by six nursery schools that support approximately 350 children, ages 1 through 5. Although the school and the nursery schools have different management, administrators are actively collaborating within a school development project. This is a three-year project, which started in September 1997. One purpose of the project is to strengthen the status of segregated schools in Stockholm, by creating a safe, inspiring, exciting and joyful school day. The project uses different tools to create change and to develop better programs. Information technology is one tool that is being used.

2.3.3. Breakdown of Classes

During autumn term 1998 and spring term 1999 the school had:

Pre-school and Junior level (Year F-3)

Three classes Year F-1 with a total of 78 children. Each class had one nursery school teacher, one primary school teacher, and one staff person working in the afternoon club.
Three classes Year 2-3 with a total of 63 children. Each class had one primary school teacher and one staff person working in the afternoon club.
Two classes Year 1-3, reception class for immigrants, with a total of 17 children and two primary school teachers.

Intermediate stage (Year 4-6)

Five classes Year 4-6 with a total of 103 children.
Two classes Year 4-6, reception class for immigrants, with a total of 19 children.

Senior level (Year 7-9)

Three classes Year 7 with a total of 78 children.
Two classes Year 8 with a total of 43 children.
Three classes Year 9 with a total of 65 children.
One class Year 7-9, reception class for immigrants, with a total of 14 children.
One class Year 7-9, class for slow learners, with a total of 9 children.

Nursery schools in Rågsved

Six nursery schools with approximately 350 children.

2.3.4. Our partners at Rågsvedsskolan

Two nursery school teachers (Monika Möllberg and Ann-Louise Wikström)
One group of 5 year olds, 15 children.
Two primary school teachers (Ing-Marie Tirzitis and Christina Turén)
One after-school teacher (Ingvar Jordås)
Two groups of 7 year olds, 27 children (14+13)

Ethics and concerns

The research team, including the teachers, wrote to all parents/guardians of children involved in the project to gain permission for the children to take part and be photographed and video filmed. All accepted.

2.4. Summary

It is evident that Albany and Rågsved are two very different schools set in very different cultural contexts. The nature of the school sessions in the classroom and the evaluation of the KidStory project have been affected by this variation. It is especially interesting to note (detailed in Chapter 7) that although the project set out with identical session plan activities, these differences in school environments caused variations in activities to meet the same goals. While both countries are working with the same age children, the same technologies and with the same goals in mind, we expect to continue to see differences in future school activities due to distinct differences in school cultures.

3. Philosophy 1: Children as Inventors

3.1. Children and Technology

Children have their own likes, dislikes, curiosities, and needs that are not the same as their adult parents or teachers. As obvious as this may seem, we as designers of new technologies for children, sometimes forget that young people are not "just short adults" but an entirely different user population with their own culture, norms, and complexities (Berman, 1977). Yet, it is common for developers of new technologies to ask teachers and parents what they think their children or students may need, rather than ask children directly (Druin et al., 1999; Druin, 1996). This in part may be due to the traditional power structure of the "all-knowing" adult and the "all-learning" child, where young people are dependent on their parents and teachers for everything from food and shelter, to educational experiences. At times, these relationships may make it difficult for children to voice their opinions when it comes to deciding what technologies should be in schools or homes. In addition, we as designers of technologies have our own biases and assumptions about children. Some of us may be parents of our own children, but all of us were once children ourselves with special memories of what we liked and didn't like about the world. We may also have our own pre-conceived notions about learning theories and educational strategies, thanks to the many years of schooling that we all had to endure (Druin & Solomon, 1996; Papert, 1972; Solomon, 1986).

All of this adds up to a large amount of personal experience about young people that we may or may not choose to bring with us when we develop new technologies for children. But as we know, these personal impressions may not be enough to support today's children. While they are fast becoming tomorrow's power-users of everything from the Internet to multimedia authoring tools, they are still children that must go to school and depend on their teachers and parents for learning and living in this complex world. In addition, as we know, young children have a more difficult time verbalising their thoughts, especially when it concerns abstract concepts and actions (Piaget, 1971; Piaget, 1973). While children can be extremely honest in their feedback and comments concerning technology, much of what they say needs to be interpreted within the context of concrete experiences (Druin, 1999).

For all of these reasons, a child's role in the research and design of new technology has historically been minimised. In the Human-Computer Interaction community, we have a short but rich history of developing shared paths for communication between diverse users and technologists. However, this history of shared communication is even shorter and less developed for our children as users, testers, informants, and inventors in the technology development process. With the emergence of children as an important new consumer group of technology (Heller, 1998), it is critical that we support children in ways that are useful, effective, and meaningful for their needs. With this in mind, we

need to question how we can build new technologies that respect children for their ability to challenge themselves and question the world around them. We need to understand how we can create new technologies that offer children control of a world where they are so often not in control.

In the KidStory project, we believe that children should have the opportunity to take an active role in the technology research and development process. The better we can come to understand children as people and users of new technologies, the better we can serve their needs. This chapter will describe our philosophy of *children as inventors* as they partner with adults in the technology research and development process. How this role can impact the technologies developed and the research methods that are used will be discussed. How this compares to other roles for children will be examined, as well as how this role differs from adult participation. The strengths and challenges associated with children in the development process will conclude the chapter. By understanding these issues, it is our belief that we can make more informed decisions about our research and development practices with children that can have lasting effects for the future.

3.2. The Emergence of Children in the Development Process

A growing body of literature has emerged that discusses children, technology and human-computer interaction. Once relegated to one or two CHI conference papers a year (e.g., Frye & Soloway, 1987; Malone, 1982; Verburg, Field, St. Pierre, & Naumann, 1987; Wilson, 1988), today's HCI conferences include multiple paper sessions, panels, demos, and tutorials on these topics (e.g., Colella, Borovoy, & Resnick, 1998; Druin, 1999; Loh et al., 1998; Salzman et al., 1999; Smith & Reiser, 1998; Stewart et al., 1999; Umaschi Bers et al., 1998). Once thought to be the academic pursuit of educators and child psychologists, early discussions about children's interaction with technology primarily appeared in academic books (e.g., Davis, 1984; Dwyer, 1980; Papert, 1980; Solomon, 1979; Suppes, 1969), sporadic technology-oriented journal publications (e.g., Alpert & Bitzer, 1970; Candy & Edmonds, 1982; Hunka, 1973; Stodolsky, 1970), publications for educational researchers (e.g., Davis, 1976; Goldberg & Suppes, 1972; Lepper, 1985; Searle et al., 1974), or conferences for educational researchers (e.g., Amarel & Swinton, 1975; Feurzeig & Papert, 1968; Hoyles, 1985; Papert, 1972; Solomon, 1979).

These early discussions focused on the impact that new technologies could have on children as learners. With this understanding, researchers suggested new directions for future technology development, and new possibilities for future learning experiences with technology. During these early years, there were only rare instances where children had more direct involvement with technology developers, and actually tested experimental technology before it was in wide release. Interestingly enough, the development of programming languages such as Logo (Papert, 1977) and SmallTalk

(Goldberg, 1984), brought children into the process more than any other technologies created for children during the 1970s and early 1980s.

In terms of the HCI community, the first conference paper publication concerning children and HCI issues, was published at the 1982 Gathersburg Conference that led to the establishment of SIGCHI (Malone, 1982). This paper discussed a study that was done by Tom Malone (at the time from Xerox PARC) in which he analysed children's use of games. From his results, he proposed general HCI guidelines for designing enjoyable user interfaces. Malone's paper was the only one of 75 papers in the proceedings that discussed children as users. Subsequent CHI conference papers on children and HCI issues were not published until five years later, at CHI+GI'87 (Frye & Soloway, 1987; Verburg et al., 1987). Interestingly enough, the paper presented by Fry & Soloway (1987) was entitled "Interface Design: A Neglected Issue in Educational Software."

The sporadic appearance of papers that discussed children and HCI issues would not significantly grow until the early 1990s (e.g., Berkovitz, 1994; Noirhomme-Fraiture et al., 1993; Pausch et al., 1992; Steiner & Moher, 1992; Strommen, 1994). As the literature grew, so too did the active involvement of children in the technology development process. By the mid 1990s, children's roles as informants and design partners were discussed in papers that focused on everything from initial technology brainstorming experiences to final evaluation phases (e.g., Cypher & Smith, 1995; Druin et al., 1997; Druin et al., 1999; Oosterholt et al., 1996; Scaife et al., 1997).

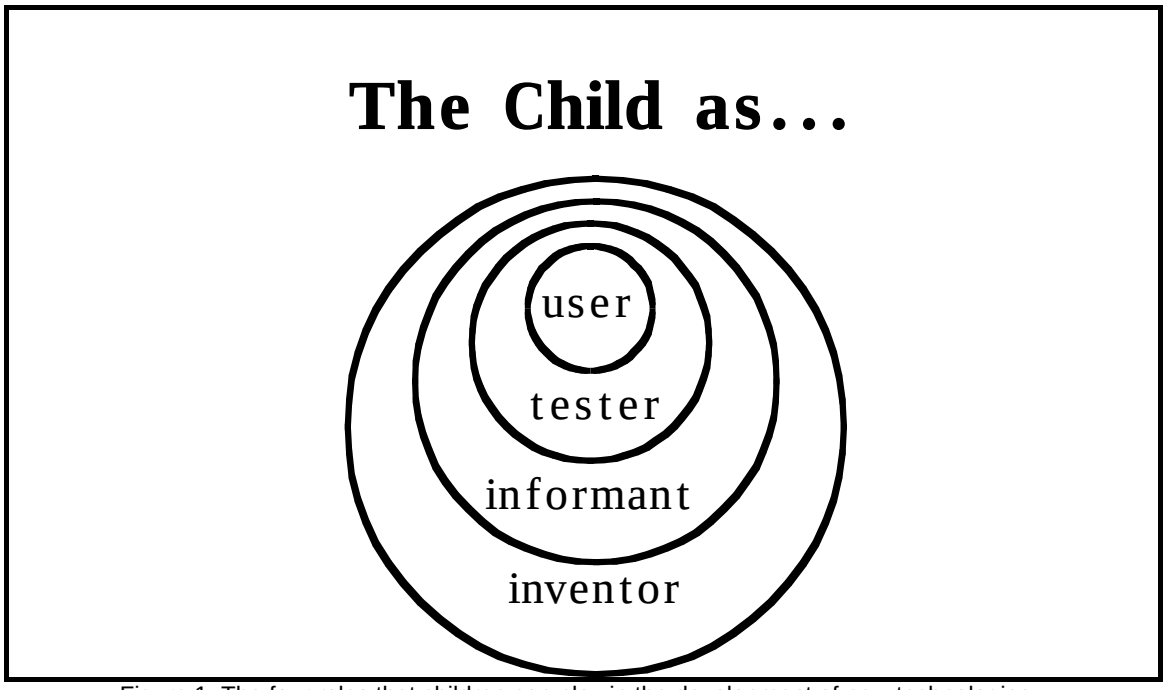

Figure 1: The four roles that children can play in the development of new technologies

Based upon an analysis of the literature and our own research which is supported by children as design partners, we have come to see four main roles that children can play in the technology research and development process: *user, tester, informant,* and *inventor*. In the role of *user*, children contribute to the research and development process by using technology, while adults may observe, videotape, or test for skills. Researchers use this role to try to understand the impact existing technologies have on child users, so future technologies can be changed or future educational environments enhanced. In the role of *tester*, children test prototypes of technology that have not been released to the world by researchers or industry professionals. As a tester, children are again observed with the technology and/or asked for their direct comments concerning their experiences. These testing results are used to change the way future iterations of the pre-released technology are developed. In the role of *informant*, children play a part in the design process at various stages, based on when researchers believe children can inform the development process. Before any technology is developed, children may be observed with existing technologies, or they may be asked for input on design sketches or low-tech prototypes. Once the technology is developed, children may again offer input and feedback. And finally, with the role of *inventor*, children are considered to be equal stakeholders in the development of new technologies throughout the research and design experience. As partners, children contribute to the process in ways that are appropriate for children and the process.

We have come to see that each role, user, tester, informant, or inventor can shape the technology design process and impact the technologies that are created. While each role for children is used today by some portion of researchers, each role has its own historical roots with its own challenges and strengths. These roles are not necessarily different from those of adult users, however the methods, context, and challenges can be different thanks to the involvement of children. Choosing to use any of these roles with children may depend, among other things, on the project's resources, timeframe, and the philosophy of the researchers involved. For the KidStory research project, we have chosen to collaborate with children as inventors. This has coloured all that we do in our research practices and all that is created as our technology.

3.3. The Child as Inventor and Partner

The role of *child as inventor* suggests that children be a part of the research and design process throughout the experience. With this role, the child is an equal stakeholder in the development of new technologies. While a child can not do everything that an adult can do, we believe they should have equal opportunity to contribute in any way they can to the design and development process. For example, adult researchers who are visual artists or educators can support the technology design process with domain specific expertise and experience. The same can be said of child researchers. They too have special experiences and viewpoints that can support the technology development process that other partners may not be capable of contributing (Druin, 1999). With this

role of design partner, the impact the technology has on children may not be as significant as the impact children can have on the technology development process.

This role for the child is one which the KidStory research is strongly committed to supporting. For the past year, our research team has been developing new technology development methodologies to support children in their role as inventor. What follows is a discussion of how these methodologies evolved, how these methods can impact the technologies that are developed with children, and what strengths and challenges can be expected due to this role.

3.3.1. Historical Context

Our belief in partnering with users as an important way to understand what is needed in developing new technologies has emerged from research practices over the past 20 years. This belief can be seen in *cooperative design* in Scandinavia (Bjerknes et al., 1987; Greenbaum & Kyng, 1991, Bødker et al., 1987), *participatory design* in the United States and the UK (Greenbaum, 1993; Schuler & Namioka, 1993; Druin, 1999; Haines & Wilson, 1998), and *consensus participation* in England (Mumford & Henshall, 1979). As Greenbum and Kyng (1991) have explained,

> *"We see the need for users to become full partners in the cooperative system development process….Full participation of (users) requires training and active cooperation, not just token representation" (pp. ix-1).*

This partnership between users and researchers from different disciplines was exemplified in the Scandinavia cooperative design work beginning in the 1970s. It was during this time that employee influence through trade unions grew, and collaborations between workers, management, and researchers influenced how new technologies could be created for, and used in, the workplace. Cooperative design methods supported the development of new technologies for carpenters, typographers, bankers, manufacturers, and more (Bjerknes et al., 1987; Greenbaum & Kyng, 1991; Bødker et al., 1987).

This approach to design attempted to capture the complexity and somewhat "messy" real-life world of the workplace. It was found that many times there were not sequential tasks accomplished by one person, but many tasks carried out in parallel and in collaboration with others. Interestingly enough, this description could also easily refer to the complexity and "messiness" of a child's world. In any case, this workplace design approach was not confined to the Scandinavian countries for long. By the 1990s, these practices were being adapted and applied to research with children (Druin, 1996; Druin et. al., 1997; Druin, 1999).

Druin's methods first took root in an intellectual environment that embraced building technology for children in a constructivist model of education. In the early 1980s, at the MIT Media Lab, she was a part of a community of researchers that strongly believed children should construct their own paths to knowledge, and that computer tools should support children as builders, designers, and researchers. It was a community that was grounded in years of developing Logo and Smalltalk programming languages for

children. Yet, surprisingly enough, when looking closely at the design practices of this community of researchers, it was not common to find children as inventors or partners in developing those constructivist tools. Children were primarily testers, and adults came up with the great ideas.

It would take Druin almost five years to begin to understand the full extent of a design partner, why children could be partners, and how partnering can come about (Druin, 1999). These concepts and understandings evolved slowly over time with numerous research and development experiences with children. She found that as a researcher she moved from working with children as testers, to informants, to finally and firmly as inventors and design partners. In Druin's early work at the MIT Media Lab as a Masters student developing NOOBIE, children tested ideas, offered suggestions, but she was clearly the one with the idea to build a 6-foot stuffed computer that replaced the keyboard and mouse with hugging and squeezing (Druin, 1987). In her later work with Bederson in New Mexico, children were clearly a part of the brainstorming process, but not continually (Druin et al., 1997). While she referred to them as partners even then, it has now become clear that they were only a part of the development process more sporadically than continually.

Today children are most definitely inventors and our partners in all that we do in the KidStory research project. Together we have become what we now call an "Intergenerational Design Team" pursuing projects together, writing papers, and creating new technologies (Druin, 1999; Druin et al., 1999). KidStory, is a collaboration between almost 100 children and 25 adult researchers in Sweden and England to develop new collaborative storytelling technologies for children. Researchers at the Swedish Institute of Computer Science, the Royal Institute of Technology, Sweden, and the University of Nottingham are collaborating with children and teachers in the Albany Infant School in Nottingham England and Rågsvedsskolan in Rågsved, Sweden. While KidStory is just in its first year, we can already see how children as inventors and partners have impacted the technologies we have developed.

The research methods we use, whether in Sweden, or England, have come to be called *cooperative inquiry* (Druin, 1999). These methods are based upon four years of previous reflection, revision, and use. They began as methods for bringing *adult* users into the technology design process. Such methodologies as *contextual design* (Beyer & Holtzblatt, 1998), *cooperative design* (Bjerknes et al., 1987), and *participatory design* (Greenbaum & Kyng, 1991; Schuler & Namioka, 1993), call for adults from different domains to partner with technologists during the technology development process. From brainstorming methods that ask users and designers to sketch out ideas (participatory design), to interviewing methods that can capture user tasks, roles, and design ideas (contextual design), innovative research methods are being found to work with users. While these methodologies for adults offer an excellent starting point, they need to be adapted to suit teams that included children, for example, to overcome the teacher-student paradigm invoked by groups of older and younger researchers in favour

of co-equal partnerships. Over the years, Druin (1999) has developed interview procedures, note-taking practices, data analysis, and day-to-day team interactions evolved. For example, it was found that interviewing procedures for adults were not appropriate when speaking with children. Since that time everything has changed from what researchers should use as notepads and how they should dress, to the process of capturing and synthesising data (Druin et al., 1999). [Note: For more details on the cooperative inquiry methods, see Chapter 6 - Philosophy 4: Technology Infusion.]

3.3.2. Impact of this Role on Technologies

The impact that children can have as inventors is enormous. Throughout the design and development process, children's voices are heard and can have a dramatic effect on the design of new technologies. While children are a critical part of the team, they do not dictate what must happen. They contribute as partners with adults in changing and developing technologies.

How much can this role impact the development of new technologies? The amount of impact truly depends on the university researchers and/or industry professionals that are a part of the team. Being a design partner with children is not something that comes naturally for adults and therefore, can take time to develop in team members. The same can be said of children. They too have little experience partnering with adults as inventors, and therefore they need time to develop into active team members. As with any interdisciplinary team of researchers, diverse individuals and experiences can offer a richness of ideas and talents. It can also be difficult to negotiate effective collaborations and communication paths. Therefore, while children can have a great deal of impact throughout the development process, it depends very much on the context of the design partners.

3.3.3. Challenges of Child as Inventor

The unique challenge of this role, is that adults are not in charge, but neither are children. Design partners must negotiate team decisions. This is no easy task when children are accustomed to following what adults say, and adults are accustomed to being in charge. Methods of communication, collaboration, and partnership must be developed that can accommodate children and adults as co-inventors. This takes time and patience to accomplish. Due to this unique challenge, the development process can take more time than with other roles. If tight deadlines are looming, this can be very difficult on a team.

When children are inventors and partners, the traditional structures of school can also be a challenge to negotiate. The design team activities must work around the limitations of an already busy school day. For particular activities, permission may be needed from teachers and at times head masters. Limited school resources in terms of technology must also be considered as well as school safety procedures to keep new technologies from being stolen. In addition, the challenge of an on-going partnership with children must also be considered. No longer are children only a part of the

research activities for a day, or a month. On-going years of collaboration, means that the same children must be followed from one classroom to the next which can be difficult due to the school groupings of students.

Another challenge that must be overcome is the difficulty in finding researchers or industry professionals that want to work with children as partners. It is assumed that educators have been trained to do this kind of work, but they have been taught to "teach" not "partner" with children, and therefore, old habits must be challenged. With computer scientists, artists, and many other disciplinary professionals, the patience, experience, or desire to work with children may not be the reasons why they went into their respective professions. Therefore, team members need to be selected who can enjoy the "messiness," noise, and unconventional research activities this kind of collaboration can bring.

Yet another challenge may be in deciding how to best understand the changes that are occurring in the child and adult partners. Traditional methods of observation or testing of children may get in the way of developing a sense of partnership among team members. Educational researcher Jan Hawkins has pointed out, it is critical that we develop evaluation methods that can be "a system in which the pedagogy is not in tacit conflict with the accounting." (Hawkins, 1996). This is no small challenge if children and adults are truly to be inventors and partners. Therefore, we believe that it is important to look for change in social and intellectual development using procedures that are supportive of the partnership experience.

3.3.4. Strengths of Child as Inventor

The strength of this role for children is that they can feel quite empowered and challenged by the design partner process. Children have so few experiences in their lives where they can contribute their opinions and see that they are taken seriously by adults. This experience can build confidence in children academically and socially. It can also produce what we have come to call "design-centred learning" (Druin, 1999). This is a kind of learning that can come out of design experiences. We have seen that children and adults can experience changes over time due to their partnership and common design goals. Children can grow to see themselves as something more than users of technology. They can come to believe that they can make a difference as inventors.

For adults, they too can change as collaborators, researchers, and developers. Research methods long-used by experienced professionals may have to change due to the introduction of children. In addition, research directions may drastically change, again thanks to this collaboration with children. One unique strength of the design partnering experience is that there is no waiting to find out what direction to pursue. Instant feedback from children at every moment can be had if needed. This offers a great deal of flexibility for development activities. If researchers know that children will always be available at certain times, then less formal schedules need to be made.

Another strength of this role is the impact that such a role can have on new technologies. For educators, parents, and children, it can mean innovative technologies for teaching, entertainment, and learning. While our KidStory research experience is still relatively new, it has shown promising results for future new technologies.

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4. Philosophy 2: Children as Storytellers

4.1. Children and Storytelling

Most children start very early in their life to share their daily experiences through telling stories. Listeners may collaborate with the child storyteller by asking how things happen. Together they may create a story by constructing and reconstructing daily events. This kind of narrative is believed to be helpful with children in finding language, social, and cognitive structures. ”A shared narrative becomes a tool for thought” (Vygotsky, 1934/1986).

Hearing adults tell stories can be important to a young person’s development as a narrator. When children listen to stories they can understand diverse cultural traditions which can nourish their imagination. Through stories, patterns of behaviour and moral truths can easily be conveyed, understood and remembered. The storyteller knows, that while the story is told, the listener takes over the story and makes it his own. The storyteller and the listener meet in *the space between* and there everything can happen. Inspired by a story, children can create their own stories by verbalising, drawing or writing.

In the KidStory project, we invited children to a story the very first day of the project in the schools. In Nottingham, a mysterious box arrived at the University lab and the researchers “didn’t know where it came from. ” So they asked the children at the Albany school for help. In Sweden, the researchers started by telling a story about a magic mirror and asked the children to explore the space of “magic” it might contain. In both Nottingham and Stockholm the children were enthusiastic and full of expectation to hear more about the box and the mirror.

4.2. Narrative Structure and Theory

What is the definition of a story? Due to a large number of researchers studying narrative from the diverse viewpoints of their discipline (e.g., sociology, philosophy, psychology, and linguistics), many answers to this question exist.

William Labov and Joshua Waletzky studied and compared narratives among adults and youngsters (9-19 years old) living in Harlem/New York (1967). Labov and Waletzky studied these narratives from a socio-linguistic perspective. They have also studied the kinds of events that adults and the young people choose to tell in their stories. Labov provides a definition of a minimal narrative as:

“… a sequence of two clauses… containing a single temporal juncture”

According to this definition, Fatima, in Sweden, has told a story:

There was a boat.
In the boat was a treasure
Mum came and helped the treasure

But not Johan:

She saw a tree.
She liked the tree.
There were apples.

There are other definitions. Polanyi (1985 p.145) states that:

> *"…when you tell a story it is not the events which matter; it is the point that matters. The point says 'hey, you and I know the world is like this and so this behaviour, this event means this'"*

By *point,* Polanyi is likely referring to that element of the story that is the raison d'être, the *worth* of the story, that part of the story that has some kind of social, cultural or personal significance to the audience or storyteller.

It is very common for children to come to an agreement when playing. In the act of play, they create a story together; they improvise. Very often, one child may leave the play activities for a moment and act as a producer by endowing the other children with roles, and building up the set and setting of the story e.g.

> *"and you are the father. That is the house…"*

In the KidStory project, we have at times seen similar situations when children work in pairs with KidPad (see Deliverable D1. 1 for further description and for more on narrative structure as used in tools and their construction). The children create a story together, and when there is only one mouse, and depending on the power dynamics of the pair, the child who is without the mouse may take to giving these directions to the one with the mouse: "Draw a tree. No, a bigger one. He is hiding behind the tree…"

We have also seen that it is quite common for young children to only give a presentation of something which has happened or a list of events (Peterson and McCabe,1983). This is what 5-year old Farun has done

> *fire*
> *rain*
> *sun*
> *house*

Many young children jump from one event to another in an unsystematic way and may not include "important" parts. Other children may end the story on a *high point*. They tell a story and carry the story to a climax, but there is no resolution. Peterson and McCabe (1983) have produced a narrative model (p. 37):

- *Classic pattern* – The narrative builds up to a point, dwells on it, and then resolves it.
- *Ending-at-the-high-point-pattern* –The narrative builds up to a high point and then ends, there is no resolution.
- *Leap-frogging-pattern* – The narrative jumps from one event to another within an integrated experience, leaving out major events that must be inferred by the listener.
- *Chronological pattern* – The narrative is a simple description of successive events.
- *Impoverished pattern* – The narrative consists of too few sentences for any high point pattern to be recognised, or the narrative extensively reiterates and evaluates only two events.
- *Disoriented pattern* – The narrative is too confused or disoriented for the listener to understand.

- *Miscellaneous patterns* – any narrative that does not fit into one of the above categories is classified as miscellaneous

The above model provides a method of naming the narratives encountered from the children. In that way, the model can be used as a method for *description.* As yet the questions of narrative analysis are not directly addressed beyond the scope of the supporting the co-operative enquiry process. How such analysis might be useful, how it might be performed, and what models are appropriate are not put forward here. Thisuse of the above narrative model for description is explored further below. Andersson describes it as follows (Andersson, 1997, p 72-73).

> *"In their analyses of personal narratives from ninety-six 3:6 to 9:6-year-old children, equally distributed over age and groups and sex, Peterson and McCabe found that children develop their narrative structure with age and that they use increasingly more varied evaluations. It becomes easier for a listener to follow their experiences as their narratives become more coherent. Peterson and McCabe claim that children around six years of age generally employ a classic pattern in their personal narratives and that the narratives become longer, more well planned and fluent. The children also show that they can take a perspective other than their own. Peterson and McCabe suggest that this development is due to increased language proficiency and an increased knowledge about the world which makes it easier for children to remember what has happened. They also suggest that a more developed short term memory makes it easier for children to plan what they are going to say."*

In the KidStory project, we have found a striking difference between the 5-year old and the 7-year old children. From the beginning, the younger ones very often told a story with a disoriented pattern. But they were also more free, not so controlled, in the sense of the instructions given for storytelling. "Anything" could happen:

It was a boy.
The frogs and the balloon said hello.

The 7-year olds used more words but few of them created stories of a classic pattern:

She saw herself surf-riding during her holiday.
There were big waves.
The fishes were swimming close to the see-grass.
She was fishing from her surf-board
And all over everything the sun was shining.

We have noticed storytelling development in our children during the first year of the KidStory project. It has become more common for children to tell stories where they build up the story to a point and come to a conclusion: a form of storytelling often agreed upon as that which is most recognisable as a "story." A group story(7-year olds):

Once upon a time there was …
a cow with four legs, horn and a tail
She had three dots.
One day the cow was very angry when she saw the bull
She ran up to the bull
But there wasn´t any bull.

It was a tree.
She ran into the tree and lost her horn.
It was sitting on the trunk.
A man passed.
"Poor cow" he thought.
What to do?
He took his axe and hewed the tree.
Then he took the horn and pasted it on the cow.
Now the cow looked nice again.
She had four legs, a tail and three dots.

We have also found differences between the children at Rågsvedsskolan and at the Albany school. The Swedish children tend to be more restless. One reason for this may be that the Swedish children are not inside the school system until they are 6 or 7 years old. There is also a social difference. The Albany school is situated in a more working middle class neighbourhood. On the other hand, the Swedish school is situated in a suburb of Stockholm with a larger number of multicultural inhabitants and new residents to Sweden (see chapter 2 for descriptions of the school environments). None of the Swedish school's 5-year old children's parents are Swedish from birth. The children are sent to Rågsvedsskolan because the school is situated close to the children´s home. How much do the children's background and self-image influence their storytelling? Caroline Liberg (1997) suggests that there is indeed a connection between storytelling, language development, social perspective, and self esteem.

Should a story have a beginning, a middle and an end? There are many discussions about this. Labov´s definition of the *minimal narrative* is one way to look at the question. He also has another model, a more elaborate narrative structure, a classic pattern (1972):

1. Abstract; telling what the story is about.
2. Orientation; telling with whom, when, what and where something happened
3. Complication action; telling what happened
4. Evaluation; building up suspense and telling the point (the "so what" or high point of the story)
5. Resolution; concluding the narrative
6. Coda; returning the listener to the present time

In the KidStory project, our goal is not necessarily to develop the children´s ability to tell stories in a *correct way but to give children another form in which to represent their stories.*. However, we have observed that the children, in their role as storytellers, are developing as the project proceeds. Examination of some of these models may provide methods to describe this development.

4.3. Listen and Retell Stories

The best way to support children as storytellers is to give them the opportunity to listen to many stories. Sometimes good listeners can seem as if they are quite absent. But

listening is a very active action. The listener is in the situation of imagining pictures. The Italian author Italo Calvino (1988) writes that in the imagination there is a *rain of pictures*. These *inside pictures* can support the development of memory skills. Children who are accustomed to listening to stories can often retell the story with help from their "inside pictures." They visualise the story like a film. But there are others who are better helped by the rhythm and sounds in the story. We have been surprised at times with the children's memory recall ability. For example, when we came back to Rågsvedsskolan for our second session, the children, even the 5-year olds, were able to retell the story about the magic mirror. There were few details left out.

There are several purposes for asking children to retell a story. By retelling, the child can find the classic structure of stories. They also develop a repertoire of different stories helpful in gaining the attention of other children. Through this attention, the child's self-esteem can grow. In the KidStory project, we set aside time for children to retell their stories to other children. On occasion, groups of children retold stories with their KidPad drawings projected on a classroom wall.

The storyteller of today is a link in the long chain of storytellers from the past and to the future. Storytelling is still a living tradition in many countries. In the western world the art of storytelling is consciously being revived after years of decline. Regular storytelling workshops for teachers, librarians and students are held in England, Canada, the United States, Sweden and more. Festivals are held and courses are offered.

Many of the most highly paid and well-known contemporary professionals are involved in popular forms of storytelling. Actors, writers, directors and film crews are all a part of many storytelling societies.

4.4. Creating Stories in Play

In the act of play, children experiment and explore new experiences and thoughts. It is a creative process, where the child is at the centre and can attempt to test and explore new ideas. Children create stories when they are playing, alone or in collaboration with other children.

In the introduction to her book, The Tidy House (1987) the English researcher Carolyn Steedman describes the stories that some young girls create by playing in a doll house. It is a story/play which continues over a long period of time. In the same way children create stories with the help of blocks, for example, pens and crayons can also be helpful. Writing is very close to the play. An author is using the same kind of imagination when she writes a novel as the child does in play. Both of them are creating stories.

4.5. Creating Stories with the Help of the Computer

Digital media can also provide powerful storytelling opportunities. In *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*, Janet Murray (1998) lists the following four features of digital media that traditional media may lack:

- *Procedural*. The computer can execute a sequence of commands or follow a set of explicit rules. This can be repeated (comparatively) quickly and indefinitely.
- *Participatory*. The computer can respond when you interact with it. This makes it possible for the user to actively participate in the storytelling or story authoring.
- *Spatial*. The computer gives us the possibility to create navigable 2D and 3D spaces. Films and books portray spaces, but the user cannot influence the motion through them.
- *Encyclopedic*. The computer is capable of storing an enormous amount of information. For example, a CD-ROM can hold about 650 books. If the Internet and the WWW are considered, the storage capacity is virtually unlimited. This gives us the opportunity to use a high level of detail in the storytelling world.

The above list may provide ways to view the space of possibilities that the new media provides. That is to say, those kind of opportunities the media presents that might best augment the children's storytelling experience.

Until recently, most computer storytelling environments have been *interactive movies*, or *interactive books*, where the user navigates through and interacts with a story space. The events and interactions with characters are usually pre-defined by the author, so that when users move through the story space, they are effectively *electing* the order in which these pre-set events are visited. Computer games, such as *Riven* (Broderbund Software 1997) and other Broderbund children's storytelling titles are good examples of such digital narratives.

Current research is aimed at moving away from the limitations of the pre-defined story space. What if the the author's, e.g. the software producer's, job was to create a story space and set the basic rules of interaction for that space? This is a partial redefinition of what it is to be an author, since the computer and user create the story together based on the author's general rules. The interactivity and engagement of the story may be increased, perhaps at the cost of the author having to yield some control of the explicit structure of the story. This is a partial relaxation of narrative control on the part of the developer. In order to make such an environment work, the computer must have the ability to ”improvise” and ”play” (or ”control”) characters within the story. The Virtual Theatre project is an example of one project that focuses on creating such interactive characters (see http://ksl-web.stanford.edu/projects/cait/). Greater departures are possible from the merely *interactive book* style tools. The KidStory project is researching and developing ways to provide tools analogous to *building blocks* for storytelling, that put authorship in the hands of the children in way that is engaging and makes sense (see Deliverable 1.1 for more details on the starting points for these tools).

4.6. KidStory

The KidStory project aims to support creative storytelling by developing collaborative storytelling tools and environments for children. This year we have explored many different notions of storytelling. We have specifically considered three ways of incorporating storytelling in our research:

- *Storytelling as a tool for learning*: Can storytelling support cognitive and social development in such areas as problem-solving, collaboration, and literacy?
- *Learning and teaching the methods of storytelling:* Can we better support the learning and teaching of storytelling?
- *Observation of storytelling and storytellers:* What can we learn about storytelling, and what can this tell us about new tools needed for storytelling?

In the second year of the KidStory project, we expect to further refine our storytelling research focus. As for this past year, we initiated many storytelling opportunities. Adults told stories to children; children retold stories; and children created stories individually, and in collaboration with other children and/or adults.

These storytelling experiences have contributed to the development of the KidPad and Klump technologies for storytelling (see D1.1 for more details). The narrative focus of our research is to go beyond the scripted interactive book-style narrative, and enable children to create shared stories and storytelling experiences together. We are building two storytelling technologies with the expectation that the two approaches will compliment one another, both in their approach to narrative and in their mode of human-computer interaction. The first is KidPad, a zoomable desktop drawing program with a tool-based interaction metaphor and a *scene-based* narrative presentation. The drawing tools, crayons and eraser, enable the creation of the storytelling objects, settings and characters. Another tool, the magic wand, enables different locations in space and scale to be linked, creating the story structure. This system supports children in collaboratively authoring stories.

The second is KidDive, a 3D shared virtual environment which supports an improvisational form of storytelling. This technology is based on the DIVE (Distributed interactive virtual Environments) system. This system enables the creation of 3D objects within the context of collaborative virtual environments. We are working on methods and mechanisms that promote collaborative exploration and creative play and the creation of novel methods to provide time structuring within the 3D environment (e.g. cinematic, theatre or other forms of spatial and temporal linking). These methods and mechanisms include 3D objects that provide intuitive and everyday affordances for story creation and retelling. Some of the storytelling inspirations for these objects and mechanism come from ”story quilts”, puppetry, campfires etc.

Through our work with children as inventors, partners, and storytellers, these technologies continue to evolve as tools for storytelling, collaboration, and learning.

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5. Philosophy 3: Children as Collaborators

5.1. Children as Collaborators

Kruger (1993, p.179) defines collaboration as:

> *"Collaborating children are working at the level of ideas; they are finding errors, finding powerful differences, agreeing to disagree, conflicting. They are also labouring together, communicating their ideas to each other, making discoveries about what works, creating a good solution. Collaborative learning is learning from analysis of the other's perspective, and from the other's analysis of one's own perspective, and from a new synthesis of those analyses. It is dissection and creation"*

Roschelle and Teasley (1995, p.70) use the following definition:

> *"Collaboration is a coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of the problem"*

The common theme amongst most of the definitions offered is the establishment of a shared social reality or mutual knowledge. When Roschelle and Teasley (1995) examined the process of children's collaborations at a computer they identified a shared knowledge structure, which they termed a joint problem space (JPS). From microanalyses of the process of Computer Supported Collaborative Learning (CSCL) researchers propose that the fundamental activity in collaborative problem solving occurs by engaging with this shared problem space.

What both of these definitions imply is that two conditions are necessary for a situation to count as "collaborative learning". Firstly, children must share a common goal or task focus; secondly, they must be actively engaged in solving the problem, constructing some shared understanding or artefact.

5.1.1. Why is it good for children to collaborate?

Reviews of both psychological and educational investigations of peer collaboration have demonstrated time and again that working in pairs and small groups can have beneficial effects on learning and development, particularly in early years and primary education (Wood & O'Malley, 1996; Rogoff, 1990; Topping, 1992; Topping & Ely, 1998). Piaget observed early on in his studies that pre-operational children (i.e., children aged around 7 yrs) could be assisted in decentering perspectives through interaction with peer (Piaget, 1932). These observations obtained further support from extensive experiments carried out by Piaget's colleagues, Willhelm Doise, Gabriel Mugny and Anne-Nelly Perret Clermont, all working in Geneva in the early 1980s (cf. Doise & Mugny, 1984; Perret-Clermont, 1980). Put simply, a large volume of work in Piagetian-inspired developmental psychology has shown that, under the right conditions, young children aged between 5 and 8 years can benefit from peer interaction

inn terms of general cognitive development. These effects are general, and tend to involve improvements in problem solving and reasoning skills.
Other research, largely inspired by a Vygotskian approach, has shown that young children can also benefit from working with slightly older children (see Rogoff, 1990 for an extensive review). The benefits of this asymmetrical arrangement tend to be in terms of learning particular new skills and procedures from a more able partner. However, there are benefits for the older child as well. These kind of cross-age studies of peer interaction are interesting from the point of view of the KidStory project, since they tend to involve children within the age range with which we are working (5-8 years).

There is also a more recent body of research in developmental psychology showing relationships between peer collaboration and aspects of social development (e.g., Tomasello, Kruger & Ratner, 1993; Wood, Wood, Ainsworth & O'Malley, 1995; Tan-Niam, 1998; Ashley & Tomasello, 1998). In summary, these studies show that children who have better-developed abilities to understand mental states and representations in others are better at collaborating with their peers.

5.2. Collaborative Learning using Computers

It has been suggested that learning environments supported by technology offer an opportunity for optimal collaboration (Barfurth, 1995). This is because there can be a shared goal where working with others will genuinely lead to an improved solution. However, for the situation to offer optimal collaboration the design of the computer system, computer software and tasks and the groups of children must be taken into account.

Computer Supported Collaborative Learning (CSCL) will not occur just because two students share the same computer, the computer should support peer interactions in a way that will increase learning gains (Suthers, 1999). A number of factors have been reported to have an effect on levels of collaboration at the computer. O'Malley (1992) categorises different factors that have been found to influence effective collaboration at the computer; these include task, group size, gender, and ability mix. Different combinations of users (number, ability and gender), computer systems and software designs will induce different changes in collaborative learning.

5.2.1. Computer System

One of the main aims of the KidStory project is to develop technologies that support and encourage children's collaboration. Computer based work has been identified as a useful vehicle to enable the exploration of collaboration between children. The computer lends itself to collaborative work in a number of ways. In classroom practice, the computer tends to be used by small groups of children as this offers practical benefits. In UK primary schools small group work is well-established (Galton and Williamson, 1990). This, combined with a high student-to-computer ratio, has

encouraged group collaboration around the computer. There are many studies which report the social and cognitive improvements developed by group interaction with a computer (Hawkins et al, 1982; Rysavy and Sales, 1991). The computer can provide a common frame of reference and be used for development of ideas between children.

However, traditional computer software and hardware have been designed with only one user in mind, two users must share a mouse and control over one cursor on the screen. This may result in an unequal balance between two children collaborating in this situation. Light and Glachan's (1985) study found that boys were more likely to take control of the mouse when access was limited. Cole (1995) found that when sharing one mouse in a group activity there was an unequal balance between the participants who contributed ideas towards what was happening on the computer screen. Surprisingly, the equity balance favoured the children who were not holding the mouse. These children contributed more ideas, while the child holding the mouse, trying to keep up with the ideas being shouted at them, did not contribute as much themselves. The students involved in this study still saw the mouse as a measure of control and felt a sense of disempowerment when they were not holding it.

There have been limited investigations into how the modification of some of the standard input features of a computer may effect collaboration. Light, Foot and Colbourn (1987) modified the input of a standard computer so two students had to enter information at the same time to succeed. A kind of dual key control was used. It was found that this enforcement of collaboration improved individual cognitive development. Crook (1994, p.125) states:

> *" Research of this kind – relating structural features of computer tasks to the social organisations they support – is all too scarce"*

In the computer games entertainment industry the encouragement of two player options is popular. For example in "Time Crisis II" and "Point Blank" there are two input devices (laser guns) and the combined efforts of two players shooting at 'the enemy' or 'the target' make it easier to complete the game. The two players may collaborate with each other to devise strategies and divide tasks; the players may also feel a sense of being part of a team as they attempt to achieve goals together.

KidStory aims to explore the development of new technologies that encourage collaboration. The features of the programme, the tasks within it, and the input devices used to communicate with the programme should all be adapted/developed to better support collaboration. For example, development of computer programmes which support the use of two or more mice working simultaneously, enabling two children to interact. How the interaction between two students may change, when new technologies that support collaboration are used, may be explored in the future.

5.2.2. Computer Software and Tasks

Suthers (1999) stresses how design considerations of collaborative learning software are critical, yet are insufficiently studied. His study concentrates on the different ways to represent concepts (linear text, graphs and tables). The representational methods

highlight different relationships between data and Suthers examines how the contrasting designs will effect interaction and collaborative learning.

It is therefore important that we recognise how the design of the software for KidStory technologies may support young children's collaborative learning. The creation of a story in KidPad, which involves creating links and zooming between picture/scenes or zooming deeper into the scene, can develop non-linear, complex structured stories. These story representations make salient the links between scenes and the overall structure of the story, something that may focus the children's attention and therefore opportunities for learning in a different way to the creation of a story using KidPix or a word-processing package.

When the children use KidStory technologies they are asked to collaboratively create stories. Previous research into CSCL has predominantly focused on scientific tasks, or tasks where there is an objective measure of group or individual productivity and outcomes (e.g. Tudge and Rogoff, 1989). The type of task has had a great impact on the degree of collaboration observed and therefore learning gains. Few researchers have looked at peer collaboration and creativity, where goals are less clearly defined and measures are more difficult to derive (Morgan, 1998). This factor provides an extra challenge when attempting to evaluate CSCL and is discussed in the next section.

5.2.3. Size and Composition of groups

The settings within which computer supported collaborative learning takes place may greatly influence what is learnt. Many studies have related the size and composition of groups of children with the behaviours experienced or learning gains made.

There have been a number of studies that have observed children when using computers. The main differences between the types of investigations being carried out depend on the socio-cognitive theory upon which the study is based. Rogoff (1990) reviewed these theories with respect to types of collaboration. Vygotsky's focus of understanding and skill development correlated with tutoring and guidance, frequently provided by an older, or more able partner. Piaget's work focused on a change in perspective and the reconstruction of concepts of peer collaboration.

Within the KidStory project the majority of activities involved similar ability pairs using technologies. Some of the activities in the first year followed a different structure and were led by an adult. Examples of this were a class storytelling activity structured by the class teacher (in the UK) and student researcher pairs (in Sweden) where the researcher helped the child in using the computer. Details of these sessions may be found in chapter 7 and deliverable D3.1.

There have been a number of studies that have looked at how the mix of gender may effect collaboration. The evidence seems to be inconsistent as some findings have found that girls do better when in mixed gender groups (Hughes and Greenborough, 1989). However other studies have found that in mixed gender groups boys frequently maintain dominance by non-verbal means such as taking control of the mouse in

computer based tasks (Barbieri and Light, 1992). The influence of gender also seems to be dependent on the task that children are asked to do.

O'Malley (1992) reports on how group sizes may effect collaboration. Pairs have been reported as more effective than larger groups and groups of three are more competitive than pairs. This factor may be compounded by the age of the children. From our informal observation of behaviour (see WP3, Chapter 5) we have found that the youngest children (aged 4 and 5) have the most difficulty in working collaboratively and cannot work effectively in groups greater than two. This informal observation has a good deal of support from the developmental literature. Wood, Wood, Ainsworth and O'Malley (1995) found that 3 year olds were very poor at both engaging in and benefiting from peer tutoring. Ashley and Tomasello (1998) found similar results for dyads ranging from 24 to 42 months of age with cooperative problem-solving tasks. By the time they are 3.5 to 4 years of age, preschoolers are just beginning to be capable of maintaining a shared tasks focus, with support. By the time they reach school age (5 years in the UK) they are at least able to benefit from peer interaction, but they are significantly poorer at collaboration than 7-year olds (Wood et al., 1995). By 7 years, children are capable of working quite well together in pairs and small groups, given adequate support. Researchers have linked these growing capabilities to developments in children's social understanding — in particular, their ability to understand others' mental states: beliefs, wishes, desires and intentions (Tan-Niam, 1998; Wood et al., 1995; Ashley & Tomasello, 1998).

5.3. Evaluation of Collaboration

In previous work on collaborative learning, it has been fairly common to use a classic pre-to-post-test design. In other words, children's abilities on some measure (e.g., their problem solving ability) are determined prior to collaborative sessions and measured again following some period of collaborative activity. Changes in outcomes are compared with "control" groups (typically involving individual work). Such simplistic approaches have rightly come under criticism from those who advocate a greater focus on the process of collaboration. Clearly, both measures of process and outcomes are needed if we are to say anything convincing about the relationship between the nature and quality of an educational activity and the benefits to individual children.
In the KidStory project we are interested in the extent to which collaboration between children (both with and without the technology) has benefits for storytelling ability, communication skills, and more general cognitive and educationally-relevant skills such as planning. Previous research (e.g., Flynn, Ding & O'Malley, 1998; O'Malley, Ding, Flynn & Wood, in preparation) has shown relationships between young children's narrative abilities, their skills in referential communication, their planning abilities and their abilities to collaborate.

However, we are also interested in analysing the process of collaboration and how it changes over the course of the project. In the interest of time and resources, we have selected a smaller group of children within two of the UK classes to observe in much more detail how collaboration changes with respect to verbal and non-verbal behaviour.

5.3.1. The Importance of Dialogue

A number of studies support the claim that language is a key mediator of learning outcome and that the most important aspect is reciprocity between two individuals. Roschelle and Behrend (1996) carried out a meta-analysis and found learning was most noticeable in children who were communicating responsively and who listened and responded to their partner's statements. Light and Glachan (1985) found that children working on a logic game made significant advances in skill from pre- post-test if they discussed differences of opinion but not otherwise.

Many of the different studies, looking at the process of collaboration by examining children's talk, focus on varying aspects of verbal communication. Three types of interactions that have been used to describe collaboration are defined:

- Articulation (Hoyles & Sutherland,1989) occurs when participants make their thinking explicit. This ensures the first participant understands the concept well enough to explain it to the second.
- Conflict is defined as disagreement between peers and efforts to resolve them. Light & Glachan (1985) have correlated degree of conflict with individual task performance.

- Co-construction (Foreman, 1989) occurs when children take individual responsibility for different activities to solve a problem, the work is dispersed, which makes the joint activity more effective. This is frequently defined as co-operative work.

In these cases the frequency of occurrence of certain behaviours has been correlated with cognitive changes.

Other studies have looked at a combination of interactions during computer use. Dawes, Fisher and Mercer (1994) looked at the nature of primary school children's talk when working together at a computer and identified three types of talk: Disputational, Cumulative and Exploratory. They conclude that exploratory talk offers potential for learning over and above that of the other two types and suggest that collaborative activities should be designed to encourage exploratory talk. Joiner, Messer, Light and Littleton (1995) looked at type of conversation using a computer-based problem-solving task. They looked at four key conversational features: repairs, collaborative sentences, collaborative plans and simultaneous utterances. They found that successful pairs used more of these linguistic structures than less successful pairs.

Grannott (1993) produced a theoretical framework for analysing interactions between two participant's collaboration and characterised the type of interaction into high, medium and low levels of positive collaboration. High levels of collaboration are characterised by the presence of common goals, sharing of the situation and understanding and co-constructions built up from equal dominance of information and action. Lower degrees of collaboration are characterised by two people working in parallel with each other, constructing knowledge separately with short periods of interaction.

Crook (1994) examines talk as a coherent discourse and concentrates on examples of coordinated focus of interest and attention. Language and action that are used to create a shared understanding, and to demonstrate that a shared understanding exists is studied. In the observation of use of KidStory technologies this type of observation analysis, looking at examples of collaboration in context, may assist the association of features of the technology with desirable (and non-desirable) behaviours. Linking features of the technology with certain behaviours may be used to inform the development of the technology so that it will better support collaboration.

5.3.2. Peer collaboration and creativity

Most evaluations of CSCL have given children a problem-solving task on the computer. This gives researchers an obvious way in which they can record and compare outcome. The process in solving a computer-based problem may differ from a more creative process. The KidStory technologies, which should support children's story creation, will result in a different outcome each time they are used. It is therefore less obvious how we should capture and understand the children's achievements. Different

interactions to those observed when children are problem solving may also be observed. The following studies detail peer collaboration and creativity.

Rogoff (1990) discusses how she sees the creative process occurring. She suggests that the mutual involvement of people working on similar issues is part of the social context of creativity. Dialogue, collaboration and building from previous approaches often provide the catalyst for putting two ideas together that would not have occurred without the need for the individual thinker to carry out, explain or improve on an approach. Analogical thinking, which is so powerful in creative thought is paramount to the achievement of intersubjectivity, as participants in a dialogue accommodate to make their perspectives mutually understood. Rogoff's work suggests that the establishment of a shared social reality is as important in creative tasks as it is in science based ones.

Johnson, Crook and Stevenson (1995) examined the use of a computer as a tool to facilitate the creative writing process of eight-year-olds. Children worked together in writing activities to produce a journal. Analyses of the composing and conferencing sessions revealed that peer interaction can expand evaluative perspectives by creating a sense of audience. Children using word-processing packages wrote longer more complex scripts than those produced normally. It was suggested that the children saw the computer as an instrument of play. The children continually evaluated themselves and others to determine what constituted a good piece of writing. It is the continual movement between a rule-governed and an imaginary world which provides the basis of learning and development.

Baker-Sennett, Matusov and Rogoff (1992) detailed one collaborating group where the children elaborated on an idea mentioned by someone else, with the product of the collaboration reflecting a creative advance which way exceeded that of individual contributions. When children worked independently to write their lines or develop their characters they constantly consulted one another in order to integrate their work. They helped one another with spellings and reminded one another of the story plan. The division of tasks and shared decision making that the group used to create their play worked as a planning process that advanced the group to their goal.

5.3.3. Non-verbal communication

We know more than we can tell, in that the knowledge that we possess is not always reducible to words. Children have used the computer as a shared workspace, where they communicate via direct action on the computer. Some studies have recognised this. Pheasey and Underwood (1995) found evidence of peer facilitation effects but low levels of verbal interaction. Children in this situation tested their ideas directly on the computer (see also Blaye, 1988). Children do not need to discuss their ideas because they become apparent through direct action. Through this direct action a common understanding of the task and the children's ideas is established (Morgan, 1998).

Researchers have developed a number of different coding schemes for analysing non-verbal collaborative behaviour. For example, Tan-Niam (1998) has developed a

detailed scheme for relating measures of preschoolers' joint attentional focus and their contributions to joint play. Ashley and Tomasello (1998) have developed a coding scheme to capture preschoolers' cooperative problem solving behaviour. Wood, Wood, Ainsworth and O'Malley (1995) have developed a scheme for measuring the extent to which each child's contribution to the interaction is contingent upon (builds directly upon) that of their partner. We will be developing an appropriate coding scheme based upon what is relevant and useful from several of these studies in order to relate processes of verbal, non-verbal communication and collaborative behaviour to our other outcome measures.

Finally, much of children's collaborative activity with the technology can be logged and analysed automatically. We have plans for exploring this capability in future work.

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6. Philosophy 4: Technology Infusion

6.1. Introduction of Technology Infusion Process

Technology infusion is an approach to integrating new technologies into school environments. It is an approach that suggests researchers and new technologies should be slowly integrated into the environment with the support and partnership of students and teachers. Traditional "interventions" suggest that researchers have control to intervene or change what and how activities happen in the school. On the other hand, with technology infusion, students and teachers are in control as much as outside researchers, and together changes can happen through partnership.

The following technology infusion activities will be accomplished during the three years of the KidStory research project in the Albany Infant School in Nottingham, England and Rågsvedsskolan in Rågsved, Sweden:

1) Introduction of Partnership
2) Cooperative Inquiry
3) Prototype Introduction
4) Technology Integration in Curriculum
5) On-Going Use of New Prototypes

From the start of the KidStory research in schools, university researchers discussed openly and honestly the need for partnership. It was explained to both students and teachers that they had a right for input into every step of the research process. Researchers pointed out that children and teachers are experts in knowing what children and teachers need in technology and that this is respected and needed in the KidStory research activities. Since that initial introduction, they have been asked to brainstorm and freely suggest new ideas, offer feedback, and think creatively. In addition, they have been asked to keep a journal to record their ideas about the research. Any ideas concerning the technology design, the use of the technology in the classroom, or the design team collaboration can be written, drawn, or collected in their journals. These journals have been used to understand and gather new design ideas, consider better ways of technology infusion, and make changes in partnership dynamics.

6.2. Cooperative Inquiry

The next step of the technology infusion process is the research methodology of *cooperative inquiry* (Druin, 1999). As was described in WP2-Chapter 3, in this phase, all research partners come to know each other and their views of technology in a number of different ways. By conducting cooperative inquiry, input into the technology design process is gathered.

Through our research, we have found that both children and adults generally need time to negotiate a new "power structure," in which neither adults or children are completely in charge. Both must begin to work together towards common goals. Children need to learn their new role as inventors. We have done this by introducing the notion of *invention,* by asking such questions as: What is an invention? How are inventions created? When do we know something needs to be invented? Children work with researchers and educators on introductory design experiences, such as inventing a new sandwich; redesigning a new milk carton; and finding objects in their classroom to fix. In each case, children and adults work together in small groups to brainstorm and discuss "what is wrong" with the existing "technologies." Teams might, for example, decide that the problem with a milk carton is that it is too difficult for young children to pour from, and therefore it needs to be redesigned so that children can't spill milk easily. We have had groups "prototype" the "perfect" *spill-proof* milk carton out of plastic tubes, clay, and straws. We have had others groups decide that milk containers should be more fun and so children should be able to spill in interesting ways. (KidStory Research Notes, "Infusion Examples From Class Session", Stockholm, Sweden, March 16, 1999).

We have found, as children accept their role as inventors, they better understand their role evaluating and redesigning computer-related technologies, such as a new mouse or a piece of software. Research partners young and old become accustomed to working together as critics, designers, and inventors. Adults do not "give assignments" to children who "do all the work." Instead, all research partners establish common goals and participate in collaborative development activities. "Low-tech" prototyping tools (e.g., paper, crayons, clay, string, LEGO bricks, etc.) provide material to sketch ideas. Researcher journals for children and adults serve as a repository for ideas and research evaluation. These journals may be used to sketch design ideas, collect photos of technology artefacts, or reflect on team activities. Depending on the age, discipline, or note-taking style of the researchers, different methods of describing or capturing their thoughts can be used (e.g., drawings, text, photos, computer printouts, etc.).

As time goes on, our team members have begun to see themselves as technology inventors and partners: children begin to see themselves less as users and more as inventors and adults begin to see themselves less as lone researchers and more as partners. The team moves from "wondering how this is done," to planning "what will be done" (Druin, 1999). Children and adults alike gather field data, initiate ideas, test, and develop new prototypes. Team members do what they are capable of, and learn from each other throughout the process. We try to keep in mind that it is not easy for an adult to step into a child's world, and likewise it is not easy for a child to step into an adult's world. We have found that no single technique can give teams all the answers they are looking for, so a combination of techniques has been adapted or developed that form the methodology of *cooperative inquiry*QUOTE These techniques do not necessarily offer a magic formula for working with children, but rather a philosophy

and approach to research that can be used to gather data, develop prototypes, and forge new research directions. Cooperative inquiry activities include three research techniques: *Contextual Inquiry, Participatory Design,* and *Technology Immersion.* Each of these will be described below.

6.2.1. Contextual Inquiry

Contextual Inquiry: To observe what children do with what technologies they currently have. Younger children can be at times non-verbal or lacking self-reflection when abstractly discussing the world around them. Simply asking children what they want will not produce the user input that is needed to develop new technologies. Therefore, observation techniques specifically developed to understand children's exploratory activity patterns are used. This includes having adults observe children and having children observe children using technology. Notes are captured with drawings, words, and video. It is critical that children are as much a part of the data collection as adults.

When using contextual inquiry techniques, we often look for children outside of the team to observe, so that team members that are children can "watch" as much as adults. The note-taking techniques have also been developed to suit the needs of adults and children. We have found that adults gather data by writing detailed text descriptions (see Table 1). On the other hand, children combine drawings with small amounts of text to create cartoon-like flow charts (see Figure 1). Once adult notes have been compiled for a session, the adult tables are compared with the child notes. The adult tables are highlighted in the places that the child researchers have recorded in their notes. In this way, child and adult perspectives are captured.

RAW DATA:			**DATA ANALYSIS:**		
Time	**Quotes**	Activities	**Activity Patterns**	**Roles**	**Design Ideas**
39:20	"I want the playing one."	Child clicks on the scared cat and tries to take out another one. It doesn't work.	Difficulty with mouse dragging.		Look for alternative input devices or don't use dragging with a mouse.
39:50	"Awww. The kitten was afraid."	Child clicks on another basket with a cat.	Tells stories about actions on screen.	Storyteller	Offer children storytelling opportunities with technology.
40:20	"Which one's the playful one?"	Child looks for a playful cat.	Child knows what she likes.	Searcher	
41:00	"I don't want to name my kitty."	Child doesn't name her cat when prompted to by the computer.	Child knows what she likes.		
41:30	"That's to give milk."	Child clicks on different icons to see what they do.	Tests out what can be done.	Explorer	Make technology easy to explore.

Table 1: Portion of a contextual inquiry diagram created by adults

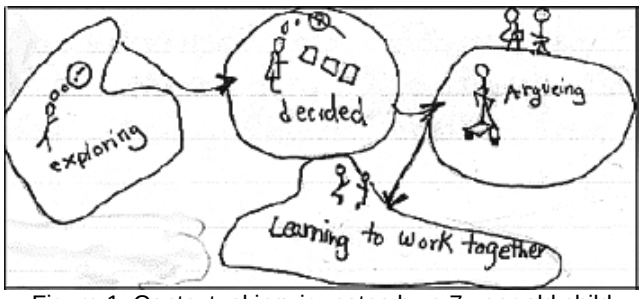

Figure 1: Contextual inquiry notes by a 7-year old child

Guidelines for Conducting Contextual Inquiry with Children:

We have found that the following ten points should be kept in mind when conducting contextual inquiry as a part of the cooperative inquiry research methods with children.

1. *Give children time*
   Children need time to become accustomed to their environment. Do not immediately ask questions about their likes and dislikes. Let them do what they would normally do. Slowly ask questions as they become more comfortable with you.
2. *Think about what you wear.*
   You should attempt to fit into your environment. Do not wear clothes that seem out of place or would attract attention to you. Instead you want children and teachers to be comfortable with your presence.
3. *Do not stand with young children.*
   Be one of them. If children are sitting on the floor, in a small chair, on the ground, do as they do. This keeps the activity "in a child's world," rather than an adult space.
4. *Use an object as a bridge.*
   Objects can help researchers to develop relationships. The object can be anything from a computer to a mirror. It will help to start conversations about what is going on in the environment.
5. *Ask about their opinion and feelings.*
   Questions need to be asked that get at how people feel about a certain situation. By using phrases, "I need your help…" the person answering does not feel that there is a "right" answer to guess at, but an honest response is wanted and respected.
6. *Use informal language.*
   Again, questions should be asked that put the person at ease so that they can be honest. Use language that is consistent with the culture of the environment.
7. *The interactor should not take notes.*
   The person who is interacting with the user, should not take notes. Users, especially children, are generally too distracted by note-taking to give an honest answer. Instead, note-taking should be made by different people that sit further away from the user and observe without discussion.
8. *Note takers work in pairs.*
   It is easiest for 2 people to work as a team when taking notes. Both should record the time, and one should record the quotes and the other activities. The time will be used later to integrate the quotes and activities into one diagram.
9. *Use small note pads.*
   If paper is used for note-taking, then small note pads should be used rather than

large ones. When large pads are used, users may feel that there are right answers to questions, as opposed to answers that can be shared honestly.

10. Note-takers should not move around.

The note-takers must become a background, non-moving part of the environment--almost invisible. Little eye contact should happen between the people being observed and the note-takers.

6.2.2. Participatory Design

Participatory Design: To hear what children have to say directly by collaborating on the development of "low tech" prototypes. We have found that, in addition to collecting data through observation, we need to hear from children directly (Druin et al., 1997; Druin, 1999). This is not to say that participatory design techniques must follow contextual inquiry. However, we have found that contextual inquiry enables us to first explore numerous ideas through observation. Then, during our data visualisation, we focus on an area of interest to pursue in more depth with participatory design prototyping. For example, our contextual inquiry observations led to an understanding that children wanted to be storytellers with technology. This insight was taken into a participatory design session where low-tech materials were used to prototype storytelling technologies for the future (e.g., see Figure 2). Teams collaboratively create low-tech prototypes out of paper, clay, glue, crayons, etc. The low-tech tools give equal footing to adults and children. There is never a need to teach people how to prototype, since using basic art supplies comes naturally to the youngest and oldest design partners. The low-tech prototypes that are developed support the brainstorming and idea generation stage of research. This form of prototyping is inexpensive, yet quite effective in quickly brainstorming new ideas or directions. It is from these low-tech prototypes that high-tech prototypes emerge.

Figure 2: An example of a “low-tech prototype” for a new storytelling technology. The design team explained that you can tell a story by talking through the straw/microphone. Feathers on the machine tickle you and make you laugh at the story. You can look into the machine’s eyes to see the story going on. In addition, the machine can fly to other places to re-tell and collect other stories (KidStory Researcher Notes, Nottingham, England, November, 1998).

Guidelines for Participatory Design Prototyping with Children:

We have found that the following ten points should be kept in mind when conducting participatory design prototyping as a part of the cooperative inquiry research methods with children:

1. *More than one child on a team*
   One child should never work with numerous adults in a design team. The child can quickly become overwhelmed or overshadowed by the adult design partners.
2. *More than one adult on a team*
   One adult should never work in a design team with multiple children. Then the dynamics of the team revert to traditional teacher-student power roles, as opposed to design partners.
3. *Adult interaction is important.*
   Adult-to-adult interaction is just as important as adult-to-child interaction. Many times the adults in the group become so concerned with interacting with the children on the team that they forget to consider the other adults.
4. *Low-tech prototyping tools should be diverse.*
   Low-tech prototyping tools should offer diverse forms of expression (2-D, 3-D). Such familiar art supplies as crayons, paper, tape, clay, yarn, balloons, and LEGO blocks can be used.
5. *Freely combine low-tech tools.*
   Children freely combine all media in non-traditional ways to produce prototypes. Adults should feel just as free to do the same. Don't be afraid to draw on a LEGO block and wrap it with clay and yarn.
6. *Introduce low-tech tools quickly.*
   Ideas grow more quickly when the low-tech prototyping tools are introduced as quickly as possible. When adults or children on a team start building or constructing with low-tech tools, the prototyping process is accelerated.
7. *More complex ideas can be developed.*
   The sooner the prototyping tools are introduced the more complex the final outcome/product is likely to be. The longer the team waits to start using the prototyping tools, the simpler the final ideas seem to be.
8. *Adults can be playful.*
   When adult team members become more informal and playful, children on the team are more likely to open up faster and feel more comfortable in the design process.
9. *The goal should be flexible.*
   The outcome for the design session should be flexible. If it is a very constrained design problem, then children and adults grow restless. More open-ended problems are better addressed with this design technique.

10. Contextual inquiry note-taking can be done on participatory design activities.
If there are enough researchers available, then contextual inquiry note-taking can be done while the design team is developing their prototypes. This may help the research team to better analyse the results of a participatory design session.

6.2.3. Technology Immersion

Technology Immersion: To observe what children do with extraordinary amounts of technology (similar to what they might have in the future). This process grew out of a need to see how children use large amounts of technology over a concentrated period of time (Druin et al., 1997). If children are only observed with the technology resources they currently have, then what children might do in the future with better circumstances could be missed. Many children still have minimal access to technology in their homes or school. If time is not a limiting factor then access to the newest technologies can be. However, in the future we see these limitations changing. Therefore, by establishing today a technology-rich, time-intensive environment for children, the observation techniques of contextual inquiry can be used to capture many activity patterns that might otherwise be over-looked. With technology immersion, it is critical that children not only have access to technology in a concentrated way, but are also decision-makers about what they do in that environment. There must also be enough time for children to accomplish a task that is meaningful. Without these ingredients, it is difficult to understand children's technology wants or needs. It should be noted that technology immersion need not be done continuously through the Cooperative Inquiry experience. Intensive periods of time can be selected based upon the needs of the research.

Guidelines for Technology Immersion with Children:

We have found that the following ten points should be kept in mind when conducting technology immersion as a part of the cooperative inquiry research methods with children:

1. *Support children with a technology-rich environment.*
   No child should ever have to wait to accomplish what he or she wants to—the technology should be waiting for him/her. PCs, Macs, digital cameras, scanner, printers, Internet access and more should all be available when the child needs it to be.
2. *Children should be decision-makers.*
   Children should be asked to make their own decisions concerning what to do with technology. They should feel that they are in control of their technology exploration.
3. *Create a time-intensive experience.*
   Children should have a great deal of time (e.g., 10 hours a day, for 5 consecutive days) to explore different kinds of technology and to make decisions about they like and don't like. If children are rushed from one activity to the next, then it may be hard to understand what their technology needs truly are.
4. *Use a problem-centred approach to using technology.*
   The focus of the children's exploration should not be on the technology. Instead,

the focus should be on a “problem” of interest to children, such as being a newsroom reporter for a conference, or being a participant in a multimedia software company, or being a tester of experimental technologies. In tackling these problems, children use whatever technology tools might be needed.

5. *Adults are facilitators.*
   Adults should function as mentors for children. The adults should be there to offer suggestions and provide feedback when children ask for it. Adults are most effective when they work in pairs with a team of children.
6. *Activities should support team collaboration.*
   Children’s activities should support team collaboration. Children naturally like to work with other children. It enables them to be less apprehensive about the technology immersion experience.
7. *Have large group meetings at least once a day.*
   If there are multiple teams working on numerous activities, at least once a day, all teams should gather in one meeting place. In this way, children and adults come to feel they are a part of a community experience.
8. *Time away from the computer is important.*
   Children and adults need to take time away from computers. Different children or adults need a differing number of breaks. Some may need to get away from the computer frequently for short periods of time. Others may need a long break in the middle of the day to let off steam. Still others may not want to take time away from the computers.
9. *One adult needs to oversee whole experience.*
   One adult should not be included in the team activities, so that they can support the entire experience. In this way children with special issues can be dealt with away from the group. Adults that are exhausted can also take breaks while another fills in.
10. *Contextual Inquiry note-taking can be done on participatory design activities.*
    If enough adults are available, then contextual inquiry note-taking can be done while the technology immersion activities are taking place. This may help the research team better analyse the results of the experience. It can also help to refine the technology immersion experience as well.

The combination of observation, low-tech prototyping, and time-intensive technology use can lead to the development of new technologies. Activity patterns and roles can suggest new design directions. Artefact analysis on low-tech prototypes can suggest

new technology features. These methods have been a catalyst in our first year of the KidStory Project to begin to develop new collaborative storytelling tools for children.

6.3. Prototype Introduction

Thanks to the design input and feedback throughout the Cooperative Inquiry phase, technology prototypes of KidPad and KidDive have been produced and introduced in the schools. These prototypes have been introduced to the children and teachers, not as finished products, but as works-in-progress. Students and teachers have been asked for their suggestions and ideas in relation to these prototypes. Contextual inquiry note-taking has been used to understand the value of these prototypes. And journals from children and adult researchers have been analyzed to better understand the changes that have occurred during the design process. Based upon the data gathered, new revisions have been developed and introduced in the schools. See WP1 for more discussion of this prototype evolution. See Deliverable D3.1 for the results of our initial evaluations of these technologies and changes in child and adult researchers.

6.4. Technology Integration in Curriculum

In our first year of the KidStory project, we have been happily surprised to find that we have reached stage 4 of the technology infusion process. One of our KidStory teachers in England initiated use of the KidPad technology in her classroom without outside researchers standing by to help. This was not something that the research team expected or even asked of the teachers. This teacher independently decided after the first 6 months of the project that she wanted to integrate KidPad into her curriculum. No other teacher in England or Sweden elected to do the same. We expect that in the coming year other teachers may progress to this stage when the prototype development begins to more fully stabilise. We anticipate teachers, students, and outside researchers will begin to develop new ways to use these technologies in the classroom. New approaches to teaching, new content areas, and new styles of interaction may be explored. We expect that once the team has agreed on certain directions, a technology integration plan may be developed and phased in over time. In this way, the technology will go from being an artifact for discussion, design, and change, to a tool for exploration and learning.

6.5. On-going Use of New Prototypes

We anticipate that this phase of the technology infusion experience will grow out of the previous phase. As teachers and students become more comfortable with these new tools, and the technology becomes more stable, on-going use can be established. We anticipate that teachers or students will no longer need outside help to use these tools. The technologies will become common place in their teaching and learning experiences.

It is our goal, that by the end of the KidStory three-year project, that this final phase of technology infusion will be accomplished.

6.6. References

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7. School Activities

This chapter describes the activities that were accomplished at Rågsvedsskolan in Stockholm and at the Albany Infant School in Nottingham. The first section describes meetings/workshops with teachers and coordinators at the schools. In the following sections the activities with pupils and their teachers are described in temporal order, first for Albany School then for Rågsvedsskolan. All the descriptions and observations included here have been written by the researchers present in the schools during session activities. Finally, a section summarises the classroom activities. When applicable, the text here refers to locations in D3.1 chapter 5 (the Evaluation deliverable report).

7.1. Teacher / researchers planning meetings and workshops

7.1.1. Rågsvedsskolan

Introduction and planning meetings 8-Oct-98,15-Oct-98 and 22-Oct-98

At the first meeting one of the technical researchers introduced the KidStory project and its origin and circumstances to the teachers for the 7-year-olds. The concepts Contextual Inquiry and Participatory Design were also introduced to the teachers. Then there was a long discussion about parents' concession to their children's participation in the project. At Rågsvedsskolan it can not only be questions about integrity but also religious reasons for not letting children be filmed etc. One of the pedagogical researchers got the task to make a draft of a letter to the parents to be discussed at the next meetings and was accepted at the October 22 meeting..

The meeting was also an opportunity to let the researchers get familiar with the school environment for the 7-year-olds. The second meeting was a similar contact with the teachers and environment (at a different site) for the 5-year-olds. The third meeting was a joint planning meeting.

The school's IT project coordinator, Susanne Svensson, has been deeply involved in the project already from the final Project Programme writing phase, which has been extremely valuable for paving the way into the school and in the teacher contacts.

The planning resulted in a schedule for biweekly sessions until Jan-99 with two classes of 7-year-olds, 14+13 children, their two teachers and after-school teacher, as well as a group of 5-year-olds, 15 children and their two teachers.

Teacher workshop 19-Nov-98

First it was recognised that all children had been allowed by their parents to participate in the project. The workshop started with a resumé of the first two classroom sessions with the "magic mirror". The teachers told how the children had reacted afterwards. They had been very positive and talked a lot about the "mirror problem".

Then three groups of 4 adults (researchers and teachers) made a participatory design (low-tech prototyping) session, where each team made an installation on a mirror prototype with beads, strings, paper, crayons, clay etc of what they imagined to see in the mirror, and then told a story around it.

The workshop participants were enthusiastic and imaginative, although we observed great differences between the groups, from which we realised that in the corresponding session with teams of children and adults also to expect great differences.

The workshop session ended with a very fruitful discussion about how to carry through the similar sessions with the children.

Finally practical issues were discussed, such as buying and keeping material. The project pays for all consumption material but the school's scissors and pens can be used. The workshop session was also a help in planning the session with the children. We saw what kind of material was too sparse and, e.g., that the glue was much too thin.

Evaluation and planning meetings 4-Feb-99 and10-Feb-99

The first meeting was between the researchers and teachers for the 5-year-olds, the second with the teachers for the 7-year-olds. Similar things were discussed. We started with an evaluation of the work during the autumn. The teachers were very positive, They thought that the children had developed. They also thought that KidStory had served as a development of competence for the teachers themselves. They had started telling stories much more to the children and to observe more the language development of the children.

The researchers presented the plans for the spring as it was developed at the Nottingham meeting with two main tracks: to work with the children as inventors and to let them try out KidPad and Klump,

With the teachers of the 5-year-olds there was a long discussion on how to make so small children feel as inventors. The teachers decided to work a lot with the children beside the KidStory sessions, e.g. read stories about inventors for the children. It was also decided to evaluate the sessions immediately afterwards. The teachers found this so valuable that they would try to be "child-free" for about 30 minutes after each session. (this has been kept and worked very well.)

With the teachers of the 7-year-olds the same things were discussed but it proved difficult to find a fixed timed for evaluation and discussion.

Planning meeting 29-Apr-99 with the teachers of the 7-year-olds

The session started with a discussion on where KidStory is now. The researchers described the development of two-mice-versions of the tools and that it was now time for working with the Klump in a more organised fashion.

It was also discussed how the cooperation has worked. All agreed that it is often a problem that the teachers can not take time to immediately sit down and evaluate after

each session. The researchers promised to better in informing about coming work via email. The teachers would try to use some part of their lunch-break for a short talk.

Apart from exchanging experience from inventor and KidPad use sessions, a closer involvement of the teachers was discussed. It was decided that

- in one of the 7-year-old groups the teachers would perform a session on the mouse as an invention on their own and that
- in both 7-year-old groups children's KidPad icon design should be initiated by and performed led by the teachers and then analysed in a session with researchers having implemented some of the designs in a new KidPad version

The meeting ended with letting the teachers work with the latest version of KidPad.

7.1.2. Albany Infant School

Teacher Workshop 1 (2-Nov-98)

Twelve teachers attended the workshop along with six professional researchers from the University of Nottingham. The session began with a discussion of Contextual Inquiry. Six teachers were grouped into pairs and asked to design their ideal school of the future using a drawing package on the school's computers. The remainder of the teachers and the researchers were split into action/quote note-takers. Interestingly, one group centred their school around Virtual Reality computers with no teachers, an interactive screen display and so on.

The teachers obviously enjoyed this activity from the amount of giggling going on! In the debrief they commented on factors such as:

Feeling self conscious about being observed (the role of an interactor was discussed).

Limitations of the present software, for example all of the pictures were drawn were black and white (or in one case where they pressed the wrong button, pink!).

The teachers suggested that children watch adults as note-takers before they join in.

The problem for the note-takers of getting everything down was discussed along with the possibility of being selective when possible.

A Participatory Design session followed. The teachers and professional researchers were divided into three groups and asked to design a storytelling technology of the future. During the design process, the groups were video filmed.

Although there was only time for a short time of design work, each group came up with a final product. For example, one design was a teddy bear with ears that were made of long pieces of string with cups on the end and these were described as almost like a walkie-talkie system. The stomach was a screen that you could reach into and move items around.

During the discussion the issue of noise levels was raised, as the school is open plan. Another quieter room will be available. Finally, the KidStory journals were introduced and everyone made their first entry.

Working with different age groups in class

The plan for class session 1 was discussed with the two teachers who would be involved. Ella's Year 2 class and Debbie's Reception class would be participating in the first year of the project. They were both happy with the scenario of the 'The Box' (described in session 1 in section 7.3.1). The only suggestion was that the teacher group the children, so the children have project partners running through the project. Debbie also suggested that the 5-year olds work better in pairs, therefore we should start out with pairs and move into groups of no more than 4 children.

Teacher Workshop 2 (11-Jan-99)

The purpose of this workshop was to review our activities within the school during the autumn term. The teachers were asked in advance to think of any comments or

concerns about the project. Generally, the attitude of the school as a whole is extremely positive. School Governors have observed some of our work in class and were very impressed by the amount of work on-task demonstrated in the Year 2 class.

The teachers commented on the creativity that the children demonstrated – much greater than they would have expected. There have been some difficulties for the Reception class, but these have been recognised and dealt with during the course of the class sessions. These difficulties stem from the researchers' lack of experience in working with 5-year old children in school. We had presented the tasks at too high a level and had not appreciated the short on-task concentration span of this age group (maximum 20 minutes). By session 3 we had modified our presentation of tasks to the Reception class. Other teachers within the school said that they would like to be involved in the project. They are very excited about the next phase of the project involving technology integration and are all looking forward to meeting the Swedish team when they visit the school.

Teacher Review Meeting (12-jul-99)

The purpose of this meeting was to review the activities in Year 1. Three researchers, two teachers and the head teacher were present. The following items were discussed.
1. The teachers said that they had enjoyed the year and working within the project.
2. The continuation of participatory design sessions, evaluation of the use of two mice or more and different screen displays were mentioned for consideration in Year 2. Also that the sessions with the whole class would be regular but at larger time intervals to enable time for the turn around of data.

The teachers commented on children liking routine. They both said that they would like to see more immediate changes to technology. One suggested that the children email after each session (interesting that this is what we discussed at the plenary last week!). Both teachers also commented that they felt that the participatory design sessions could be taken a step further enabling children to make something that really works eg. Electronic lego or something that needs a battery.
3. A closure session with the Year 2 class was organised for 22nd July. This will involve children being able to use the newest version of KidPad with collaborative tools and multiple mice.
4. The researchers will collect the KidStory computers from the school this week and return them at the start of next school term.
5. One of teachers asked if she could have some help designing the school webpages. She is to get the material together and help will be provided in September.
6. The head teacher expressed disappointment that there had not been much communication between the teachers in both countries. She would like a relationship to be built between the two participating school. She requested that the teachers involved in the project visit Rågsvedsskolan in the near future. (This has since been agreed and

the plan is that one or more of the teachers from Albany visit Rågsved in the coming term.)
7. The head teacher asked if other teachers could be involved in the project as she felt that this would raise the profile of IT in the school.
8. The researchers were provided with the new class lists for the coming year.

7.2. Class activities in Rågsvedsskolan

7.2.1. Sessions 1-5: Intro, Intro, PD, Retelling, CI (Nov—Dec-98)

Session 1 – The magic mirror 1 (5-Nov-98)

Activities

The children sat in a circle around a big candelabra, listening to a story told by one of the researchers. We had a large magic mirror with us:

> *"Once upon a time a long time ago when I was about the same age as you I stayed with my grandmother. She lived in the countryside with a big, lovely garden…*
> *Suddenly I heard a voice from the forest saying one, two, three…*
> *and I got very curious. I had to find out what it was…*
> *I saw an old lady, holding an old mirror in her hand…*
> *She suddenly got very happy looking into the mirror and said 'at last!',*
> *what did she see?"*

The story contained the classical elements of a story:

> *"once upon a time, walk out in the world, a mysterious gift, to be given a gift and finally being asked to solve a problem.*

The children individually drew pictures, telling about their story.

Reflections

Among the five-year olds, a large number of the children found it difficult to leave the concrete situation with the mirror, they drew the mirror and told details about it. Others only counted up what you could see in their pictures and a few could tell a story.

The seven-year olds were more able to tell short stories, either about the future or past time. There was a big difference between the stories of the older ones and the younger ones.

Session 2– The magic mirror 2 (25-Nov-98)

Activities

We repeated the story from last session, which ended with one of the researchers being given the mirror from the old lady. The lady herself disappeared and we were left with the mirror. We kept that mirror for years and now and then we repeated the words "one, two, three, what can we see" and one day something happened. We saw a red key in the mirror, and that reminded us of an incident from long ago. The children were told this story about a box on the beach to which this key belonged. When this box was opened a butterfly found its freedom, so it was a very happy moment.

We wanted to continue with the mirror metaphor, because we thought that the mirror could be followed by using the monitor of a computer. The children were asked after listening to the story to think of what they would like to see in their own mirrors.

The children were asked to draw a picture and tell a story about their own solution.

Reflections

We were surprised that the children remembered so well the story from the last session. Even this time, a lot of children found it difficult to feel confident in telling their own stories. This was important to realise. Many of the older ones referred to a situation, like at Christmas-time, when I go abroad…

Session 3–The magic mirror 3 – Participatory Design (2-Dec-98)

Activities

We retold the story again, repeating the magic words and this time they were going to think about the same thing as last time – what did they want to see in the mirror? This time they were going to create this together with other children and adults. Working with other children and adults, the teams made a mirror of what they wanted to see – participatory design. After the creative part when the mirrors were made, every group presented their mirror.

Reflections

The five-year olds were very active but not very interested in collaborating. The adults had a difficult time working with the children as a team. The children were very proud of what they had done, but not at all interested in what the other groups had made. Among the seven years olds you could see more collaboration, but the groups were of course very different. These children were more eager listeners.

Session 4–Interviews (9-Dec-98)

Activities

All the children were told the story of *Winnie the Witch*. They were not shown any pictures, We wanted to present only the spoken language to them, for us to ask them to retell the story. The 5-year olds were told the story in smaller groups 4-5 children.

Reflections

This activity was to be used for later evaluation of children as storytellers. With the 5-year olds you can realise that pictures are an important support to their remembering and understanding a story. For example, there is a cat called Konrad in the story. Konrad is also a Swedish name for a boy, and many of the children referred to Konrad

as a boy. They may have had another story in their minds than those thinking of Konrad as a cat.

Session 5–KidPix (14-Dec-98)

Activities

The children were working in pairs with the programme KidPix, which they had used before. One adult was helping the children with the computer and the other adults took notes, Contextual Inquiry and more general ones.

Reflections

The main reflections were 10 problems observed with the children using KidPix Studio that should be avoided or at least handled with consideration in KidPad:

- "Exploration" features like animations can be very distractive
- Many and complex interface options, modelled on adult drawing tool
- Small drawing window
- Slow features foster abundant mouse clicks (consider ignoring events)
- Standard Windows dialogs, e.g. for save and print, incomprehensible for children
- Obscure Undo
- Pull down-menus more difficult than icons
- Icon symbols should be chosen more carefully
- Predefined shapes tend to be used rather than children's own drawn shapes
- Confusing flood-fill, a single pixel hole devastating

7.2.2. Sessions 6-9: Prototype, Invent, Invent, Solve (Jan—Mar-99)

Session 6-KidPad (14-Jan-99)

Activities

For the first time, the children were going to use computers and they met KidPad and KidDive. They were presented with the idea of being co-designers and inventors of computers for the computers to be a good tool for children. We explained that we would like them to share with us what they want in new technologies and how things should change. The children worked in pairs with KidPad and with KidDive - doing whatever they wanted to do. Finally the drew their thoughts of inventions.

Reflections

The programme had bugs, so some of the children felt that they had failed with what they were doing – it was a pity because it shouldn't be like that.

Session 7–To be an inventor: inventing a new sandwich (11-Feb-99)

Activities

We began by talking about what an inventor does. The Swedish word "uppfinnare" was used with the children. They had suggestions of what it is and what such a person does. We also talked about their roles in "KidStory" and that they were going to be inventors

with us. We explained to them that their first activity as inventors was to invent a new sandwich, by using paper, clay and imagination. These sandwiches would make an exhibition. After making sandwiches we asked them to tell about their sandwiches.

Reflections

It was a very successful session. All the children were very enthusiastic. Among the smaller ones we found they had the courage to create anything. They are not limited to reality as the older are. We had decided before this day that it was necessary for us to work with the idea of being an inventor and after the day we found this was a good thought and also that this has to be done during many sessions. This role is not a role the children can define by telling them, they have to be put in the situation and define what it is all about.

Session 8– To change an old invention into something better - a milk package (25-Feb-99)

Activities

We started by presenting a small play, showing the difficulties of using the milk package. Everything went wrong and we pointed out the need for a better construction and that their activity for today was to invent a better milk package. Individually they drew their design of a new milk package. Finally they told about their own designs.

Reflections

The children thought we were a bit silly with our play. But that did not stop them from having some splendid ideas. They seemed to really enjoy the role of being an inventor. They liked the chance to dream and create anything. Most of the children found it difficult to leave what was already invented. This is a new role for them, which may take a long time to grow into and that's an experience which is important to the project.

Session 9–Problemsolving: How will the chicken come down from the tree? (18-Mar-99)

Activities

We started this session by telling a story about grandfather (married to the grandmother we told about when we started our work with the children. They still remembered the mirror). Grandfather had wanted to buy a chicken and he did so. Because of a dog the chicken got scared and landed high up in a tree. No one knew how this could happen, but it did and the big problem was now: How to get the chicken down again? The children listened to a story. We had a short discussion about what solving a problem means. Children drew individual drawings of how to solve the problem. Telling about their drawings

Reflections

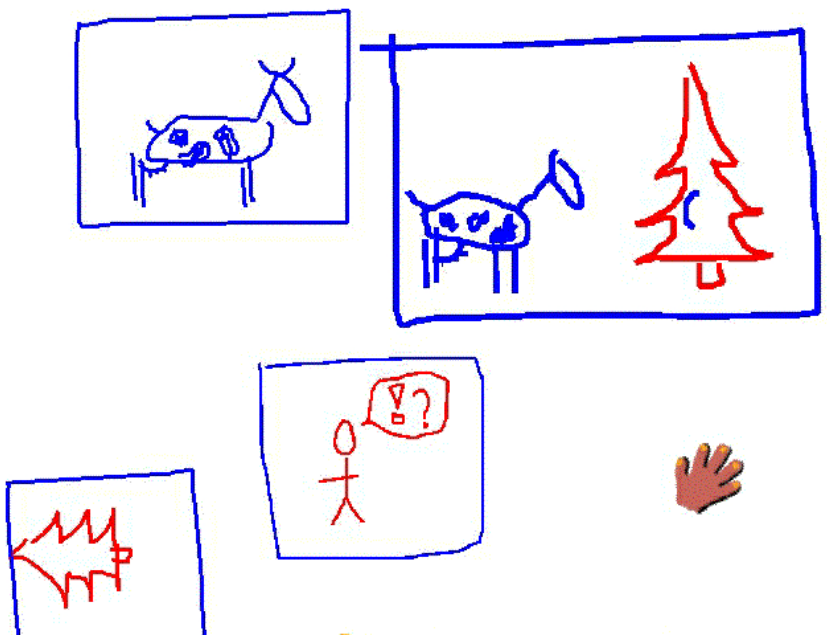
We found that the idea of solving a problem was concrete enough to the children to start working on it very eagerly. Again you can see the difference in believing in one's own capacity to create something.

7.2.3. Sessions 10-17: Group story & CI in KidPad, KidDive, Icons (Apr—Jun-99)

Session 10–Group-story with KidPad (8-Apr99)

Activities

We worked in the classes with groups of four children. These groups were asked to create a story with one of the adults. The children and adults worked together to create



a story. Another adult wrote down the story for the children to hear their whole story when they had finished it. At the same time, as the story grew one of the technicians used KidPad to draw illustrations connected with the story. These illustrations were shown on the wall for the children to see how heir story grew both verbally and with pictures.

Reflections

The goal was to demonstrate how KidPad can be used to support their storytelling. We found that the capacity of KidPad to zoom is really a good thing for storytelling. For example, we could zoom into a house and then go on drawing.

Session 11–KidPad (15-Apr-99)

Activities

The children worked in pairs with KidPad. We didn't suggest any particular activity to do. The children were just asked to draw and use KidPad.

Reflections

It's still very difficult for the children to tell what they would like to change but we adults can see possibilities for change thanks to our observations with CI.

Session 12–KidPad (22-Apr-99)

Activities

The children worked in pairs using KidPad (See session 12).

Reflections

See session 11

Session 13–KidPad (29-Apr-99)

Activities

One child worked with one adult using KidPad, and there were possibilities for both to communicate and collaborate.

Reflections

After asking the children to work in pairs in the latter sessions, we realised that there was a need for the children to work with us on an individual basis. They wanted to be a little more confident of how to use the programme, therefore, they worked individually with one of the adults helping them, answering all questions and demonstrating tricks of what can be done with KidPad.

Session 14–KidPad and KidDive (6-May-99)

Activities

We continued with individual work using KidPad. (see session 13). We also had one "station" with KidDive where the children worked in pairs and just explored the possibility of the programme.

Reflections

The children were very enthusiastic about the Klump. While the children have to produce their own pictures with KidPad,, with the Klump the children reacted, to an already created object (klumpen).

Session 15–KidPad and KidDive (20-May-99)

Activities

See session 14

Reflections

See session 14

Session 16–Group-story with KidPad (27-May-99)

Activities

We wanted to try this once again, but now have a child to be the illustrator for the group rather than an adult. A group of four children created a story together with an adult. One child took care of KidPad and made pictures for the story.

Reflections

It was difficult to create a collaborative story. When a group of children are making a story, it goes back and forth and it is difficult to decide what to draw. This made the session slow, too slow for the "story-creators" to keep concentrated while the person drawing decided what to make.

Session 17–Making icons, a story told (27-May-99, 3-Jun-99)

Activities

This session was organized by one of the technology researchers. He gave the teachers crayons and paper for the children to create their own icons. In groups, the children drew their icons and sent them to the researcher who scanned them into KidPad before he met the children at the session. When he arrived at the school, he showed the children these icons in KidPad and the group discussed what they had done. Then one of the pedagogy researchers shared with the group a final story for the year. In this story, the mirror came back and out of it came a story.

Reflections

The children enjoyed seeing their own icons working as tools in KidPad. This is something we can start with next semester. The closing story could also be useful for the coming work in the fall.

7.3. Class activities in Albany School

7.3.1. Sessions 1-6: Intro, Intro, PD, CI, CI, PD (Nov—Dec-98)

Session 1 - The Box (9-Nov-98, 12-Nov-98)

Activities

The box was a large computer box decorated in gold, holographic and multicoloured paper with varying textures.

While the children were in the playground, a large box (decorated in gold, holographic and multicoloured paper with varying textures) was positioned in the centre of the quiet room with a large scarf placed over it. When the children came in, they sat in the quiet room around the new object. The children were told that a mysterious box had arrived at the University lab and that the adults did not know where it had come from or what was inside it. Children were asked for their help to understand this box. The scarf was whipped off the box and the children instantly began to talk about it and touch it.

One of the adults then produced a scroll that they had received about the box that read:

Dear Researchers,
Please look after this box. Do not open it. We will come and collect it.
X.

A lively discussion then began around the box. Each child was asked for his/her ideas and key words were written on the board. The KidStory journals were introduced and the children drew and wrote about what they thought was in the box and where it had come from. Ideas about the content ranged from chocolate and books to pigs and onions! The children were all brought together at the end of the session and it was explained that their ideas would be taken back to the lab and that the adults would be back the following week to work with them again.

Following the session with the 5-year olds, Debbie (their teacher) provided feedback. She thought the session had gone well. Debbie also commented on how tactile the children were and that they really wanted to touch the box. This has been taken into account when making changes to the box for session 2.

In general the 7-year olds were more inquisitive about the box and its purpose. They made lots of suggestions of ways to study what was in the box by means of techniques such as X-rays. They asked questions about the University and carrying out experiments.

Reflections

Overall these sessions were fun and all the children became really involved.

Session 2 – Inside the Box (16-Nov-98, 19-Nov-98)

Activities

For this session, the box was still a large computer box decorated in gold, holographic and multicoloured paper with varying textures. However this box now displayed a small hole in the side with a note sticking through it. While the children were in the playground, the box was again positioned in the centre of the quiet room with a large scarf placed over it. When the children came in they sat in the quiet room around the object. It was pointed out to the children that a letter had arrived at the lab and the adults had waited to share it with the children. It read:

> *Dear Researchers,*
> *Thank you for looking after the box. As you have looked after the box carefully for one week, you may find that there is a change to the box and you may reach in. Please do so carefully and do not upset or remove the contents.*
> *X.*

After reading this note, the scarf was removed from the box and the hole with the note sticking out of it was revealed. The adults and children debated what it might be and then one of the children carefully pulled it out and read it. It said the following:

> *If you have opened this letter, you must have looked after the box, so you must be a friend. But I must stay in the box. :)*

Some discussion about where the letter had come from followed. Then the children took turns at reaching into the box and feeling around inside. Each child's ideas about the feel of the box and what might have been inside were written on the board. Then followed a discussion of where the box had come from and why it had been sent.

The children then returned to the classroom and worked in groups (about 7 to a group) creating a large poster of their ideas. The adults tried to encourage collaborative work. Each group then presented their poster to the other groups and these were photographed.

What the box actually contained

A polystyrene ball was sprayed on one side with a silver spray which made it feel rough to the touch. The other side was a patchwork of multicoloured felt with pieces of curled soft pipe-cleaners and small furry ball shaped objects. Protruding from the box were three items: a pipe cleaner with a large fur ball on the end, a piece of foam with the end cut into teeth, and a feather. You have to feel it to believe it! It was made more tactile in response to the children wanting to touch the box in session 1.

Year 2

This session was really successful. The children were full of enthusiasm and came up with many ideas as to the contents of the box and where it came from. One of the ideas was that a Dr. X was in danger and had sent the contents of the box for safe keeping, another was that the contents of the box was a medical cure. Ella commented on the fact that every child had become really involved. There was some collaboration while

making the poster, although some children still insisted that their idea was better than the others! The children enjoyed presenting their work and generally had an appointed speaker.

Reception

The session with the reception class was much harder going. The children only came up with a few ideas. They described the feel of the object, but found it harder to get beyond that and suggest what it might be and where it may have come from. When in groups, they either worked alone and then put their idea on the poster or all drew similar items. This age group seems to have difficulty working in groups and it's almost impossible to gain consensus. They were also not very prepared to listen to one another when presenting their work. They were mainly interested only in their own poster. However, the children did have fun and did not become disinterested.

Reflections

- As in Session 1, some of the children were getting distracted by spelling and not getting their ideas down. Therefore, the adults took the writing role on the posters if children were struggling with words.
- Due to limited adults, the children were in groups of six or seven. In the future where possible these will be cut to groups of four (especially with the 5 year olds).

Session 3 - Participatory Design (23-Nov-98, 26-Nov-98)

Activities

The aim was to design a device to aid storytelling. A brainstorming session was held in the school hall, where the children and adults listed different mediums with which stories could be told/heard. There were many suggestions, from cartoons and videos, to songs, puppets and books. These were written on the whiteboard. Then followed a discussion about the differences between the storytelling media. The interactive versus passive elements were highlighted (for example going to the cinema enables one to hear someone else's story whereas creating a puppet show enables one to make up their own). The children and adults formed groups and made models of something that would help them in storytelling. We could use any of the ideas suggested earlier and incorporate any new or different ideas.

There were 4 groups (their usual tables, grouped by ability) each with 2/3 adults who would be their design partners. It was explained that the adults and children would be partners in the design process. Each group was given their box of materials and 45 minutes in which they could make their models. One adult observed each group, recording some of the experiences.

After building their models, each group presented their ideas to the class. It was interesting that three of the four groups of 7-year-olds came up with a 'machine' even though this was not specified or even mentioned in the briefing.

Year 2

There was an obvious difference in the model produced in relation to ability grouping. However, it is also worth pointing out that the highest ability group was the slowest in coming up with ideas. In a conversation afterwards, Ella commented that her highest ability were often less daring than the middle ones, as they liked to get things 'right.'

Reflections from Helen Neale with 7 year olds:

Danae's group (Venus, middle ability) needed some help to get started. Danaë tried to co-ordinate some of the ideas before they started building. She seemed to lead this group, bringing ideas together from the different children.

Debbie's group (Earth, the lowest ability) needed a lot of prompts to get them to contribute and to keep them going. The adults in this group needed to pull the ideas out from these children and build on the ideas themselves.

Claire's group (Mars, middle ability) all seemed to have different ideas. As there were three adults working with the group there tended to be three main focal points. This meant that the ideas became separated. By the end of the session a lot of time was spent where the adults were taking the children's ideas and trying to fit them together again.

Victor's group (Pluto, top ability) took a long time to get started. In spite of being the high ability group, 15 minutes into the session they had not come up with any ideas and seemed to be stumped. However, once the ideas started coming they worked well and had a lot of interesting ideas.

Reception

Almost impossible to get the children to collaborate effectively.

Reflections

- The 7-year olds now seem to be enjoying presenting their ideas.
- Even with the 7-year olds there was limited collaboration of ideas.
- The session and presentations were video taped.

Session 4 - Contextual Inquiry (30-Nov-98, 1-Dec-98)

Activities

The aim was observe the children working collaboratively in storytelling. The teacher initiated the session by first talking about different ways of telling stories on paper (comic strip, one large picture, writing a story etc.). Children were asked to tell a story about a magical land. They were given examples of *Topsy Turvy Land* and *Rainbow Land* and asked to create a story about their own magical Land. (The Reception class was asked to concentrate on *Nursery Rhyme Land*). The children then split into pairs and were given large sheets of blank paper to work on.

While the children were working, the teacher and a class assistant/researcher acted as the interactors and the other four researchers took notes. The children paid little attention to the researchers. The researchers observed a pair of children for a minimum of 10 minutes and a maximum of 20 minutes.

When the allotted time was up, the children presented their story to the class.

Year 2

Although the teachers commented that the children rarely work in pairs, the session went extremely well. There was an interesting difference in how children worked in pairs based on ability. The three groups on the lowest ability table immediately drew

lines down the middle of their pages and worked separately on either side! Then the other groups ranged from this method to very effective collaboration. We were surprised at the enthusiasm the children displayed in presenting their ideas to the class. One boy showed true potential as a speaker, appealing to the audience with questions and including them within his story! It was also noticeable how many groups incorporated themselves into the story and drew themselves into their magic land.

Reception

Yet again the children settled down well into working in pairs. They finished their stories within 20 minutes, allowing the note-takers to only observe two groups each. The Reception children were also keen to present and showed more confidence than in previous sessions. There was a mixture of those who worked separately and some who collaborated well. Interestingly, none of this group incorporated themselves into their story or drawing. Many of their stories were based on items the teacher had taught last week!

Reflections

Time scale - the Year 2 children had often barely finished their work in 45 minutes whereas all the Reception class finished within 20 minutes!

Session 5 - Contextual Inquiry (7-Dec-98, 8-Dec-98)

Activities

The aim was to observe children working collaboratively on computer packages presently used in the school. It is worth noting that the school computers are very old. The adults had not yet encountered a child using a computer in class. We learned that every child had used KidPix before but they did not use it on a regular basis. The reception class tends to use the computers with CD-ROMS but the items they used were not helpful for observing collaboration.

Two computers were used enabling two pairs of children to work on the computers at any one time. The Year 2 children were generally paired with the partner they were with in the previous contextual inquiry session, though this was not always so for the Reception class. A video camera filmed the activity around one computer and this was left running throughout the session. Two note-takers observed activities and quotes. The other two researchers helped the pair of children on the other computer and took general notes.

The children were asked to draw a school of the future using Kidpix. They were asked to imagine what schools might be like when they were grown up and their children were at school. They were then given 10-15 minutes to create their picture. After this time, each child was asked about their picture and encouraged to write or draw about their experience in their journal. One of the researchers helped them write their ideas down.

Year 2

A range of behaviour was observed. For example, two boys got up and swapped chairs every two minutes in order to take turns in using the mouse! Still others fought over the mouse. A common theme of the children's schools seemed to be smashed windows and the school burning! The adults were rather worried about this and asked Ella if the children had been doing any projects on vandalism. They had not, but Ella thought that they might have misinterpreted the school of the future as what would Albany school look like when they were old! Perhaps this indicates how children see the future or translate news in the media!

Reception

The Reception children were generally much more eager to explore the icons and produced more colourful pictures. They experimented, moved objects around and rubbed out drawings more than the Year 2 children. Children produced anything from a scribble to a neatly drawn house.

Reflections

- A longer period of time on the computer would be useful as children spend a while getting to grips with the package. This poses a problem as each child is supposed to be involved with each activity so as to maintain equality. Perhaps a session could be spread over a couple of weeks!
- It proved essential to have one researcher writing down what the children had drawn in their journals otherwise the meaning of the drawings would difficult to decipher later.
- The younger children were much less intimidated about using the computer than the older children.

Session 6 – Participatory Design (14-Dec-98, 15-Dec-98)

Activities

The aim was to create a model to tell a story about Christmas.

Year 2

The children and adults were divided into 6 groups. The groups had 30 minutes to come up with their design. One adult watched each group, moving them on if they got stuck, recording some of the experiences and monitoring the time. Each group presented their ideas to the class.

Reception

The children and adults were divided into 5 groups. The groups had 30 minutes to come up with their design. One adult watched each group, moving them on if they got stuck, recording some of the experiences and checking the time. Each group presented their ideas to the class.

Year 2

Yet again the children were energetic! The presentations were enthusiastic, with Paul (the entertaining speaker, mentioned previously) coming up with a lovely story about Rudolf getting stuck down a mine and his nose getting soot on it so that he could not see to get out! There was general enthusiasm to present ideas.

Reception

The children were very excited as it was nearing Christmas and they were therefore a little restless. However, they enjoyed the activity and each produced a story. One group portrayed “time” well. They created a story that involved the lead up to Christmas and then Christmas day. Each person described one particular day. It was interesting to see that the children brought themselves into the story).

Reflections

Rather a hectic day!

7.3.2. Sessions 7-12: Invent, Solve, Group story in KidPad, Icon, Mouse PD (Apr—May-99)

Session 7 – Inventing a new sandwich (15-Apr-99, 19-Apr-99)

Activities

The session began in the quiet room with Danaë discussing with the children the notion of "invention". Helen then shared the story of the invention of the sandwich. The role of all of us as inventors within the KidStory project was stressed. We then brainstormed ideas for a new sandwich. The class split into groups and a participatory design session was carried out with each group creating their own sandwich. On completion each group presented their ideas to the class.

Dr Stantons' group – Matthew, Gemma,

The sandwich was in the shape of a lorry. There was a remote control. You could make the sandwich bigger or smaller depending on how hungry you were. You could choose on the back what you wanted in your sandwich. There were indicator lights which showed when you were eating. There was music which played when you eat.

Miss Crosier's group - Louis

This sandwich was called 'Herbert Sherbet'. In the sandwich were – peas, carrots, sweetcorn, sausage rolls, pickled onions and spaghetti.

Mrs Manley's group – Grace, Lucy, Bradley…

Each one of the group made their own layer for the sandwich. There were 5 layers. There was jam and marmalade to stick the layers together and chips in the sandwich.

Reception Target Group – Dr. Cobb with Christie, Charlotte, Samantha, Joshua and Jack

Worked independently on their own layers of the sandwich. When asked they knew that they wanted to put all the ideas and layers together at the end. The team collaborated in pairs to help each other practically (e.g. cutting cellotape, holding down paper for the other to stick) but less collaboration of ideas.

Year 1 Group – presentation

Everyone put their own thing in the sandwich: Chips, sausage, pizza.
The sandwich is wrapped in paper to keep it clean.

Session 8 – Problem solving (22-Apr-99, 7-May-99)

Activities

The session began in the quiet room with Danaë reminding the children about their role as inventors. She then went on to talk about milk cartons and how difficult they could be to open, especially for children and elderly people. Related new inventions were described such as the carton that lets you know when it is out of date and the fridge that contacts the supermarket and restocks itself! The children and researchers then brainstormed ideas to reinvent the carton. The children then returned to their classroom to draw and write about their inventions in their journals. They worked in pairs and were encouraged to share ideas and draw and write about the same invention. At the end of the session, each pair presented their ideas to the class. During the journal writing session children also took it in turns to use KidPad.

Year 2

Some great ideas from this class. Ideas ranged from passwords to open the carton related to age (I was a little concerned that over 27 was deemed too old to be capable of opening a carton alone!) to dials indicating how full the carton was and to indicate drink by date. The children spent so long designing their cartons that there was not time to present!

N.B. Ella and Debbie have been really supportive by backing up the sessions with follow ups on making new sandwiches and then trying each others and talking about inventions in other areas. Both classes now have a computer running KidPad. The Reception class have started using it out of KidStory time and Year 2 have an allotted half an hour a day!

Reception

There was great enthusiasm as usual! Some children worked well in pairs, others insisted on doing their own thing! There was a range of ideas for example one pair designed a remote control carton that poured your milk for you and another group had an open and close button etc… Children's confidence in presenting is improving although they get fidgety when having to listen to each others presentations.

Session 9 – Creating a story with KidPad (6-May-99, 10-May-99)

Activities

The Year 2 class had received Victor's introduction before and it was felt that this session would run better as a whole class session. Ella led the session while the researchers took CI notes. Ella explained to the children that they would be creating a story as a class using KidPad. She then gave the story a title 'A day with the magic kite.' The class then brainstormed ideas as to why the kite was magic and what the day would be like. The class then gathered around KidPad and created a story which involved a boy finding his magic kite in the garage and getting it to take him to Toyland where there was a toy store and a slide and a swimming pool in the shape of a star. Ella asked the children for ideas and then drew what they asked for. If there were a selection of ideas she asked one child to choose which was the one they wanted. When it came to making links she asked the children to create them and then she asked a couple of children to tell the story using the links. The story was saved and then the children wrote in their journals.

With the Reception class, the children all sat so that they could see KidPad. Victor demonstrated all the features of KidPad by creating a picture of a house with a flower in the window. He went through each tool showing the children what its function was. Then the class split into groups of approx. 6 and each group created a story using KidPad. The children were then encouraged to write about KidPad in their journals and then present their ideas to the class.

Year 2

This session ran very well and the children were very involved in story creation for almost an hour. It was interesting to see how the story developed as it was visual rather than text based. The children and Ella were very skilled users, indicating that they had been practicing using the tools. It was felt that this type of session should be repeated.

Reception

Victor's class introduction was a great success. The children were very involved and attentive. However, when split into groups it was difficult to keep that excitement. Two or three children would contribute while others would not be concentrating. It was also difficult to get them to create a story without a lot of prompting from an adult. They would draw objects but not link them to make a story. Debbie suggested that the groups were too big and that she was impressed with how they had come on working in pairs.

Session 10 – Storytelling and Icon Design (17-May-99)

Activities

The aim was to create a class story using KidPad. Debbie led the session. All the children sat around the computer and Debbie sat at the computer so that she could do the drawing. The adult researchers were note-taking. Debbie decided use the same story line as the Year 2 class had 'A day with the magic kite.' Debbie asked the children for ideas and then drew what they suggested. Throughout the session she let the children guide the story and asked them how to use features on KidPad, for example 'I have filled the page. How can I make more room to draw?'. She also encouraged children to come up to the computer and help with the drawing. The story was about a kite that went into the clouds but this kite was special and it could speak (and speak different languages) and it said "Bonjour, I'm magic." It then went into the clouds and had a picnic.

Danaë then spoke to the children about icons, explaining what they are and how we could develop new ones. She then asked each child to design a new icon for KidPad and to write and draw about it in their journals.

Reception

The class story telling session went very well. Many children seemed to be familiar with the tools in KidPad. This was a chance for the children who knew about KidPad to demonstrate their knowledge but also a chance for those who were having difficulties to learn. It was good to see the children helping their teacher out. We thought it would give the children confidence to see that even their teacher needed help! We were impressed by the enthusiasm and long concentration span that this session produced.

At first we were not sure whether the children would understand the concept of designing their own icons. Although some children just duplicated the icons already in KidPad, others came up with new ones.

Reflections

We were saving as we went through the story (especially when we made links) to avoid losing work if it crashed.

Implications for Method

From this session it was evident that KidPad could be integrated into class activities.

Session 11 - Participatory Design of Input Devices (Year2, 24-May-99)

Activities

“Birdy num num” was introduced. Birdy num num was a big fluffy bird sent to Albany School by Ragsved school in Sweden. He came armed with a camera to learn about the children and way of life at Albany. Although Birdy num num is living in Sweden he only knows a little Swedish but he speaks English. The idea is that he stays in the classroom until July when Danae and Sue take him back to Sweden. He brought with him some pictures of the Swedish children involved in KidStory. Albany children were quick to point out that the Swedish children did not wear shoes in class, or uniforms. They were a much smaller class and they had a settee in their classroom!

The aim of this session was to create a new input device. Birdy num num (alias Helen Neale!) showed the children different types of input devices currently used (e.g., a mouse, a joystick, a spaceball etc.). The children were then encouraged to come up with a few ideas in a brainstorming session. Finally, the class was split into groups and researchers, Ella and the children worked together in their groups to design new types of input device. On completion each group presented their ideas to the class.

Year 2

There were some groups who came out with a joint effort and others who still want their ‘own’ model. Ideas ranged from a remote control device that needed no leads to a device through which you need do nothing but talk.

A couple of examples:

Emily:

> *If you press it's nose it beeps. When you pull the green feather it asks what do you want it to do. When you touch the blue feather you speak and it does what you want. If you pull the left tail the arrow goes to the left. If you touch the straw it talks to you.*

Brynn:

> *2 worms and a chicken feather. When you touch the worm it sticks to your finger and doesn't come off - when you move your finger the cursor moves as well. Wave the feather to rub it out. The baby doesn't like being touched. If you touch him you will hurt him.*

Reflections

The idea of being able to talk to the computer and it talk to you keeps reoccurring.

Implications for Method

The children were thrilled with their 'Swedish' visitor and this is a fun way of introducing children to other cultures. Participatory design activities seem to always produce some great ideas. Children's confidence in presenting is noticeably improving.

Session 12 – Participatory Design of Input Devices (Reception, 27-May-99)

Activities

The aim of this session was to create a new input device. Helen showed the children different types of input devices currently used (e.g., a mouse, a joystick, a spaceball etc.). The children were then encouraged to come up with a few ideas in a brainstorming session. The class was then split into groups and researchers, Debbie and the children worked together in their groups to design new types of input device. On completion each group presented their ideas to the class.

Reception

Ideas ranged from a speaker so you could talk to the computer and tell it what to do, to a button that inserts an outline of the picture you want. One group wanted their input device to be like a person. They thought they should all be able to use it at the same time.

One eye was a camera and when you moved it, it changed the picture. The other eye changed colours. The nose was to switch it on and off. When you pressed the mouth at different parts it put items into the picture. You moved the bowtie around (in 3D) to move where you wanted to be in the picture.

Reflections

Note the audio reference again!

Implications for Method

As above

7.3.3. Sessions 13-15: Class story in KidPad, Icon (Jun-99)

Session 13 – Second Class Storytelling with KidPad (Year 2, 7-Jun-99)

Activities

The aim was to create a new class story using KidPad. Ella sat at the computer and the children sat round. The researchers were note-taking. The story began with an old man in an aeroplane. Ella encouraged the children to come up to the computer and put in their piece of the story. At intervals she would ask a child to tell the story so far. As the computer crashed after they had made some links the class started a new story. This story was about a ghost and a little girl. The ghost was afraid of the girl. Unfortunately, the computer crashed again. Children were asked to complete the story in their journals and also to comment on what they felt about KidPad.

Year 2

The children were disappointed when KidPad crashed and they lost their story. Ella has handled this well by getting the children to document any problems. The children realise that they are part of the design team and that they must try and pinpoint problems.

Reflections

The sessions changed because Ella ran the design icon session without us in school time. She was using KidPad and as children were making suggestions of new features she decided it was a good time to do this. However we must be careful that researchers do not miss these sessions as otherwise valuable data will be lost. As a result of this change we ran this session as a storytelling session instead

This type of class storytelling seems very successful but it is essential that KidPad or any other technology is relatively stable if it is going to be integrated into the timetable and used when there is not technical support at hand.

It was very encouraging to hear that both Debbie and Ella have been using KidPad in their lessons.

Ella commented that if her children had used KidPad for storytelling every week for the year she felt that this would have reflected very positively in the SATs.

It is interesting to note that storytelling in KidPad is mainly pictorial and these pictures are linked showing the storyline. It is often true ‘that we know more than we can tell.’ Language limitations can crush creativity perhaps KidPad allows more creativity.

Working in groups enables children to bounce ideas off one another. Most of this has been very positive and it would be interesting to look at the language used in depth (we have videos).

Implications for Method

Year 2 of the project could involve KidPad (with improved stability) being left with the new Year 2 class. It could be integrated into their story telling sessions and the effect of continued use over the year evaluated.

Session 14 – Second Story Telling with KidPad (Reception, 8-Jun-99)

Activities

Debbie found it difficult to draw on KidPad and coordinate the children's ideas at the same time, so Debbie led the discussion, Helen drew, and the children directed the story. The remaining researchers took notes. Debbie and Helen encouraged the children to use all of KidPad's functions (e.g., zooming, using the home key to return to the start and so on.) The children created a story about a cherry cake that had magical properties, if you eat one of the cherries it made you well, if you eat another it turned you into a frog. After 25 minutes, Debbie and the children took a break and Debbie shared a story with the children about "magical places" to get their imaginations going. After 40 minutes. Debbie asked one child to go through and tell the whole story using KidPad. The computer then crashed, so Debbie asked them to continue the story in their journals.

Reception

It was impressive to see the 5 year olds concentrating for 40 minutes on one activity as a group. Many children now can use all the tools in KidPad. There was a great sense of excitement and enthusiasm.

Reflections

These sessions always seem to go well, but again KidPad is still a bit buggy which made the day more difficult..

Implication for Method

We interviewed the teachers after these storytelling sessions to see if they were leading the story to a particular point or letting it run with the children. As teachers often don't have time to write in their journals it might be worth carrying out a quick interview with them after each session just to capture their immediate responses.

Session 15 – Presentation of Icon Design (Year 2, 11-Jun-99)

Activities

Ella reminded the children about the icon design session that they had had and asked them to label their drawings and then present their ideas to the class. Each child presented their ideas individually and most children had come up with a variety of new icons that they would like to see in KidPad. Ideas ranged from more coloured crayons to a time machine which allowed you to review and replay your story! The presentations were video recorded.

Year 2

Most children were confident enough to present their own ideas. There were a wide variety of ideas and every child came up with something 'new'.

Reflections

It would be good to see some of these icons in KidPad. Unfortunately this class will move on, but the Reception class will be with us next term so it would be good to illustrate where they have produced change.

Implication for Method

It would be interesting to look at their icon design in January and compare it to that of this session.

7.4. Summary of School Class Activities

In this final section, the session activities, objectives, and data collection methods will be summarised in tables. These same tables will be expanded in Deliverable D3.1 to include more information relevant to evaluation. Where relevant, reference is given to the corresponding section in Chapter 5 in D3.1.

Table 1. KidStory Activities at Rågsvedsskolan - Autumn Term 1998

Activities	Objectives	Data collection	Reference in D3.1
The Magic Mirror 1. 5th November 1998	Listening to a story. Drawing a picture, telling about their story individually.	Individual drawings put into journals.	5.2.1.1
The Magic Mirror 2. 25th November 1998	Continuation of theme. Listening to a story. Drawing a picture, telling about their story individually.	Individual drawings put into journals.	5.2.1.1
The Magic Mirror 3 - Participatory Design. Design a device to help in storytelling. 2nd December 1998	Continuation of theme. Short listening. Collaborative group design. Suggestions for technical development (WP1)	Models created. Group presentation (video recorded).	5.2.2.1
Story re-telling assessment. Winnie the Witch 9th December 1998	Listening. Re-telling	Audio tape and transcription	
Contextual Inquiry. Children working in pairs to draw a picture using KidPix. 14 th December 1998	Collaborative working (pairs) using computer drawing package (KidPix). 10-15 minutes.	Pairs picture printouts. Individual drawings in journals. CI notes (speech & actions) Video recording.	5.2.3.1

Table 2. KidStory School Activities at Albany School - Autumn Term 1998

Activities	Objectives	Data collection	Reference in D3.1
The box. A brightly coloured box and a message. Children discuss what might be inside and draw their ideas. 5 year old class – 9th November 1998 7 year old class – 12th November 1998	Children get used to researchers leading their class activities. Creative thinking, group discussion.	Individual drawings put into journals.	5.2.1.2
Inside the box. An object had been placed inside the box and there was a hole in the box. Children could put their hand in to feel the object but not see it. 5 year old class – 16th November 1998 7 year old class – 19th November 1998	Continuation of theme. Collaborative work.	Group poster and presentation (video recorded).	5.2.1.2
Participatory Design. Design a device to help in storytelling. 7 year old class – 23rd November 1998 5 year old class – 26th November 1998	Whole class brainstorm for ideas. Collaborative group design. Suggestions for technical development (WP1)	Models created. Group presentation (video recorded).	5.2.2.2
Contextual Inquiry. Children work in pairs to create a story about a magical land or nursery rhyme land. 7 year old class – 30th November 1998 5 year old class – 1st December 1998	Collaborative storytelling (pairs) No-technology (shared piece of paper)	Pairs drawing on paper. CI notes (speech & actions) Pairs presentation to class (video recorded)	5.2.3.2
Contextual Inquiry (2). Children working in pairs to draw a picture using KidPix. 7 year old class – 7th December 1998 5 year old class – 8th December 1998	Collaborative working (pairs) using computer drawing package (KidPix). 10-15 minutes.	Pairs picture printouts. Individual drawings in journals. CI notes (speech & actions) Video recording of target pairs.	5.2.3.2
Participatory Design (2). Create a model to tell a story about Christmas. 7 year old class – 14th December 1998 5 year old class – 15th December 1998	Collaborative group design	Models created. Group presentation (video recorded).	5.2.2.2

Table 4. KidStory Activities at Rågsvedsskolan - January - June 1999

Actvities	Objectives	Data collection	Reference in D3.1
KidPad / KidDive 14th January 1999	Working in pairs with KidPad/KidDive – whatever they wanted to do. Drawing their thoughts of inventions.	Contextual Inquiry Individual drawings put into journals.	
To be an inventor – inventing a new sandwich. 11th February 1999	Making a sandwich in groups. Telling about their sandwich.	Journals. A photograph of the sandwich was put into individual journals and the children wrote about them. Photographs of their sandwiches.	5.3.1.1
To change an old invention into something better – a milkpackage. 25th February 1999	Individual drawings of a new design. Telling about their designs.	Journals	5.3.1.1
Problem solving – how will the chicken come down from the tree? 18th March 1999	Listening to a story. Short discussion of what solving a problem means. Individual drawings. Telling about their drawings.	Journals	5.3.2.1
Group story with KidPad 8th April 1999	Creating a story in groups of four. Researcher using KidPad.	Each story was put into the children's journals (both words and pictures).	5.3.3.1
Paired use of KidPad 15th, 22nd April 1999	Working in pairs with KidPad (no set task)	Contextual inquiry	5.3.6.1
Single use of KidPad 29th April, 6th, 20th May 1999	One child working with an adult – to provide individual help.	None	5.3.6.1
Paired use of KidDive 6th, 20th May 1999	Working in pairs exploring KidDive.	Contextual Inquiry	5.3.7.1
Group story with KidPad 27th May 1999	Creating a story in a group of four. One child using KidPad.	Video	5.3.3.1
Making icons 27th May, 3rd June 1999	Working in groups the children had designed their own icons for KidPad. These were scanned into KidPad and shown to the children.	The icons	5.3.5.1

Table 5. KidStory Activities at Albany School - April - June 1999

Activities	Objectives	Data collection	Reference in D3.1
Inventing a new sandwich 15th, 19th April 1999	Working in groups to make a sandwich. - 5 yrs (5 groups) - 7 yrs (4 groups) Presentation of designs to class.	Video of target group. Researcher notes on collaboration within the group.	5.3.1.2
Problem solving – redesigining the milk carton 22nd April, 7th May 1999	Group discussion of existing design and brainstorm ideas. Working in pairs to draw and write about new design.	Journals. Video target group. Presentation to class	5.3.1.2
Creating a story using KidPad **5 year olds** 6th, 10th May 1999	Demonstration of a story created in KidPad. Showing functions of technology (zooming, links, home, text, save).	In groups (approx 6 children) create their own story in KidPad. Write about KidPad in journals.	5.3.6.2
Class story telling using KidPad **7 year olds** 17th May 1999	Demonstration of a story created in KidPad. Showing functions of technology (zooming, links, home, text, save).	As class creating a story. Teacher drawing in KidPad. Journals. Contextual Inquiry notes Post-session interview with teacher	5.3.3.2
Class story telling using KidPad **5 year old class** 17th May 1999	Group creation of story. Teacher drawing in KidPad (assisted by children and researchers)	Video of story Contextual Inquiry notes Post-session interview with teacher	5.3.3.2
Icon design **5 year old class** 17th May 1999	Class discussion about the icons in KidPad. Individual drawing of new icons for KidPad.	Video Journals	5.3.5.2
Participatory design of input devices **5 year olds,** 27th May 1999 **7 year olds,** 24th May 1999	Class examination of existing input devices. Working in groups to create a new input device. Presentation to class	Video Researcher notes on their own group.	5.3.4.1
Icon design **7 year olds** 11th June 1999	Class session run by teacher in response to children's suggestions for KidPad.	Icon designs in journals Presentation to researchers (video recordings)	5.3.5.2
Second Class story telling using KidPad **7 year olds,** 7th June	Teacher directing story creation but ideas from children. Children taking turns to use	Video Note-taking Journals	5.3.3.2

1999	KidPad.		
Second Class story telling using KidPad 5 year olds, 8th June 1999	Teacher directing story creation but ideas from children. Researcher drawing using KidPad.	Video Note-taking Journals	5.3.3.2

8. Challenges and Lessons

Our methods of conducting research have taught us a great deal about children as inventors, storytellers, and collaborators. Our methods have also taught us a great deal about ourselves as research partners with children, teachers and schools, and - the challenges of interdisciplinary work. For a more complete analysis of the changes adults and children experienced over our first year see deliverable D3.1. In this chapter, we briefly discuss the challenges experienced and lessons learned from our first year. These challenges and lessons are ones that may help other researchers who want to partner with children and teachers in schools and across countries. They are lessons that have not been easily learned and are of course guiding us for in planning activities in years 2 and 3.

Challenges of the Technology Immersion Process for Researchers

Negotiating time in a busy school day is difficult for schools to agree to. It takes time to come to an agreement of when researchers can come into schools. It takes even more time for researchers from different countries to negotiate with the school staff in different countries to agree on the goals let alone the research methods. Many times they have to be different due to the culture of a particular school in a particular country.

The technology immersion process is a time-intensive experience for adult researchers, not only in working with the children on a weekly basis, but also in working with teachers helping them understand the research methods. Teachers and administrators must agree to the activities for them to be successful.

It is also difficult to balance teaching the technology immersion process to children and teachers with being their partner. At first researchers have to teach about the roles people play, the research goals that need to be worked towards, and the methods that need to be used.

Technology immersion is a messy process. We have goals we are working towards, but the answers to what we develop in technology are not obvious. It is hard to know when adults or children should participate in the design process. Sometimes it may seem that children should be involved in certain design aspects, and other times it may seem that adults should be elaborating on what they see and moving forward. There is an art to involving children and adults in the design process at the right time.

One of the biggest challenges we have had in our first year is maintaining a continual and punctual flow of information learned in the schools to our researchers in the laboratories. Because the technology immersion process is so time-intensive, it is difficult to develop communication mechanisms that are timely and supportive of change.

Challenges of Children as Inventors and Research Partners

Children (and teachers) keep treating adult researchers as if they are teachers instead of research partners. When a traditional power structure exists, children have a hard time believing that adults really want to listen to them. They think they are being tested for right answers, and so they will attempt to give adults "the right answers they want to hear" rather than the ideas they have.

It takes time for children to move from being a user to a tester to an informant to finally being an inventor and partner. Children start off being very non-reflective and have a hard time not saying, "it was fun" when asked about what they experienced with the technology. It may take months before they might say, "It was fun because 2 people could use the mouse at the same time."

It takes time for adult research partners to truly believe that they are partners with children and teachers. Many researchers are more used to being in control of their "experiments". In this case, no one is in control, and partnership needs to be continually developed.

Experience and Lessons

As previously described in chapter 7 we have experienced all these challenges in year 1 and have been able to cope with them at least to such an extent that we have been able to conduct at least 15 class sessions in each of the two European schools. In most of the sessions researchers have met and cooperated with enthusiastic children and teachers. Some sessions have provided substantial material and observations, others less.

We have learnt that even if we prepare very carefully for collecting results we sometimes miss to document and/or disseminate observations among the partners. There is progress, the spring was better than the autumn and for year 2 we know better how to cooperate and disseminate in this intergenerational project. Closer feed-back loops have been established, e.g. meetings immediately after each school session for discussion of the session and collating data to be sent to technology design. A specific effort will be made to involve the teachers even more in the project activities.

It takes time, resources, and trust for these methods to produce new technology and learning. It is not easy, but we are now just seeing the fruits of our labour. We expect that our second year will offer new surprises, continued developments, and exciting partnerships for the future.