Online Appendix for Jessica Korte (2020), "Patterns and Themes in Designing with Children", Foundations and Trends® in Human–Computer Interaction: Vol. 13, No. 2, pp 70–164. DOI: 10.1561/1100000079.

11 Appendix A: Theme and Pattern Summary Tables

This appendix provides summary tables of themes and patterns identified in each design approach analysed for this monograph.

11.1 Bluebells

Major sources for analysis: (Kelly *et al.*, 2006; Fails, Guha and Druin, 2013)

Theme or Pattern	**Bluebells** (Kelly *et al.*, 2006; Fails, Guha and Druin, 2013)
Children involved	7-8 year old children with experience with the app context.
Goals	
Diverse data sources	"Collect ideas on the same topic in different formats e.g. words and pictures. This way issues can be explored in different ways and counterchecked against each other." (Kelly *et al.*, 2006, p. 367).
Provides useful design information	4 different types of design information to be gathered, one from each activity. "It gave the design team the chance to work dynamically in an alternation of design phases together with and without the children. This resulted in having a continuous contact and dialogue with the users, providing immediate feedback and minimising the conceptual model gaps between designers and users." (Kelly *et al.*, 2006, p. 366). "It is the view of the authors that the iterations of inclusion and exclusion from the design activities that are supported in Bluebells, allow end users appropriate and timely participation in the design process, whilst giving the design team space to develop their work, acknowledging the constraints of real world product development." (Kelly *et al.*, 2006, p. 367).
Maximised children's involvement	Overall: Informants: Children participate in the "during play" activities, but adults are responsible for fact-finding "before play" (setting problems?) and creating prototypes based on children's input "after play". I-Spy: Users. Hide and Seek: Informants. Blind Man's Bluff: Software designers/Informants → Creating their own interfaces based on prototypes provided. After play: Testers.
Principles and heuristics	
Appropriate adult design team roles	Adult involvement in "before play" to set aims and constraints. During play: I-Spy: Observers. Hide and Seek, Tig: Setting tasks. Blind Mans Bluff: Facilitators, prompting children in design of interface. "After play": Converting children's contributions into designs, creating & providing prototypes for testing.
Tailor activities to children's abilities	Hide and Seek: Gathering children's language related to context of use. "Keep in mind that children are not designers and may not be able to express their opinions in 'normal' ways. Allow them to express their ideas in ways they are more comfortable with e.g. drawings and paintings." (Kelly *et al.*, 2006, p. 367).
Continuity between sessions	"Remind the children of their previous activities – try to re-use their design products in later stages of the designs. This will both help them recall their previous activities and also validate their previous efforts. Giving value to their previous work will make them feel full partners in the design process." (Kelly *et al.*, 2006, p. 367).
Decision points	
Adequate time	Alternating periods of adult-only and child involvement.
Design team size	Blind Mans Bluff: Pairs of children + 2 designers/developers. Other activities: Larger groups.
Low-tech resources	Hide and Seek, Tig: Drawing. Tig: "The design team provided paper cut outs of items representing places for pictures, buttons and text etc. to assist children in" creating prototype screens (Kelly *et al.*, 2006, p. 365). Drawings: Children sketching "different kinds of activities related to an educational topic, visual representation of an ideal museum visit, path and links between different content and activities." (Kelly *et al.*, 2006, p. 365).

Setting / location	I-Spy: in context of technology = "in the field". Hide and Seek, Tig: School classrooms. Blind Mans Bluff: Quiet place in school. Evaluation: Initially school, lab → "as an unsophisticated application may too adversely affect the educational quality of a school museum visit." (Kelly *et al.*, 2006, p. 366); museum for final stage evaluation.
Activity patterns	
Teamwork	All activities with groups of children.
Brainstorming	Hide and Seek, Tig: words, ideas, concepts remembered from experiences in context; categorised by groups of children.
Exploration	I-Spy: Children explore "problem space" (aka context of application).
(Prototype) critiquing and evaluation	In the "after play" section, children as testers.
Iterative development	"iterations of inclusion and exclusion" (Kelly *et al.*, 2006, p. 367).
Prototype creation	Hide and Seek: Children create content for wireframe prototype. Tig: Children create "state chart"-like diagrams to show how to move between screens and artefacts. Blind Man's Bluff: Children work in pairs. One describes the interface, the other draws.
Reflection	Hide and Seek, Tig: Brainstorming relies on children's' past experiences of being in context.
Communication patterns	
Sensitisation or contextualisation	Hide and Seek: "Before any work is done, the children are introduced to the context via images and narrative." (Kelly *et al.*, 2006, p. 364). Tig: "Again, the children are introduced to the context… they are also introduced to the notion of way-finding using maps and web site navigation." (Kelly *et al.*, 2006, p. 364) Blind Man's Bluff: Prototype wireframe provided as starting point. Required because design sessions not occurring in context of use: "If your users are particularly young, be creative in setting the scene and using scenarios that they are familiar with. For example, show pictures of the context of use as reminders or prompts." (Kelly *et al.*, 2006, p. 367).

11.2 Bonded Design

Major source for analysis: (Large and Nesset, 2008)

Theme or Pattern	**Bonded Design** (Large and Nesset, 2008)
Children involved	8-12 years old.
Goals	
Respect for expertise of all team members Acceptance of all ideas as worthy of consideration	"respect for and acceptance that each team member's (adult and child) contribution is worthy of consideration" (Large and Nesset, 2008, p. 385). "A free exchange of ideas lies at the essence of Bonded Design, but this is also where the interaction between the adult designers and the children within the team can pose the greatest challenge. The designers must be willing to accept the ideas put forward by the children even if they have reservations about their efficacy and feasibility of implementation. In the same vein, the children should be willing to draw upon the expertise that the designers inevitably bring to the task. At the heart of Bonded Design lies the belief that the child users have things to tell the adult designers that the latter cannot grasp themselves" (Large and Nesset, 2008, p. 386).
Adequate support for children's abilities and communication level	Casual environment: "team sits around one large table, name badges (first name only)" (Large and Nesset, 2008, p. 385). Collaborative environment: "In other words, the team should promote a collaborative environment rather than a traditional classroom setting with its teacher-student relationships" (Large and Nesset, 2008, p. 385).
Diverse data sources	Only design notes, prototypes?
Provides useful design information	Problem definition, requirements, ideation, evaluation.
Maximised children's involvement	"embrace the idea that children should play an active role in the design process from start to finish rather than merely being evaluators or testers at the end of the design process" (Large and Nesset, 2008, p. 384). Between design partner and informant: "It shares the… belief in the ability of children to work as partners in all aspects of the design process, but has reservations about the extent to which full and equal cooperation can occur across the generational divide…" (Large and Nesset, 2008, p. 385).
Principles and heuristics	
Appropriate adult design team roles	"intergenerational team comprising adult designers and young users working together to produce a low-tech prototype" (Large and Nesset, 2008, p. 383). "It is the responsibility of the adults to ensure that the sessions are not dominated by one or two voices and that the more reticent are actively encouraged to participate" (Large and Nesset, 2008, p. 385). "Bonded Design is posited on the fact that the children by themselves do not have the necessary knowledge to design independently" (Large and Nesset, 2008, p. 368).
Keeping up momentum between sessions (continuity)	"use of a whiteboard to set out a map at the beginning of each session for what had already been accomplished and what remained to be done" (Large and Nesset, 2008, p. 384).
Decision points	
Adequate time Frequent design sessions	Much shorter time than other design methods: "limited number of design sessions extending only over a few weeks" p384-385.
Low-tech resources	"hands-on activities" (Large and Nesset, 2008, p. 383). Drawing: "These ideas, however, are not always expressed verbally; for example, ideas often can be expressed very effectively through drawings, and this technique enables children to present interesting ideas without the constraints that a written or verbal representation might entail for young people. Furthermore, technology designs will normally be visual and therefore lend themselves to visual expression" (Large and Nesset, 2008, p. 386).
Setting / location	"a casual environment where the team sits around one large table, name badges (first name only), and respect for and acceptance that each team member's (adult and child) contribution is worthy of consideration. In other words, the team should promote a collaborative environment rather than a traditional classroom setting with its teacher-student relationships" (Large and Nesset, 2008, p. 385).
Small groups	"If the design team is to work effectively and produce a low-tech prototype after a limited number of design sessions, it is also important to restrict the size of the team. In Bonded Design it is recommended that the team include between six and ten members (children and adults) to facilitate consensus building while providing a variety of ideas" (Large and Nesset, 2008, p. 385).
Activity patterns	
Brainstorming	"Brainstorming is an activity that promotes creativity by encouraging all team members to contribute ideas on a topic. At this stage all ideas are accepted as having merit and are documented for later discussion…. Brainstorming is an effective way to generate a rich pool of ideas" (Large and Nesset, 2008, pp. 386–387).

Critiquing and evaluation	Critiquing / evaluation: Evaluating existing technologies: “Evaluating any available examples of the intended technology is a critical aspect that can take place through- out the design process. This evaluation may draw upon team members’ prior knowledge of the product or upon examination of examples within the design sessions. Any evaluation should be critical, and team members should be encouraged to identify strengths and weaknesses that can in turn inform their own preliminary designs” (Large and Nesset, 2008, pp. 385–386).
Iterative development	Of prototypes.
Prototype creation	Low tech prototyping: ” through drawings” (Large and Nesset, 2008, p. 383) and ”drawing paper prototypes” (Large and Nesset, 2008, p. 384). “Prototyping… forms the bridge between discussion and brainstorming on the one hand, and the completed prototype design on the other. It can take various forms, but the most popular in participatory design methodologies is that of low-tech prototyping where participants use paper, modelling clay, or other such materials to represent design ideas. In Bonded Design, prototyping is used iteratively throughout the sessions in order to produce a final low-tech prototype. Bonded Design is particularly appropriate when working with children because they enjoy these types of prototyping activities and very successfully accomplish them” (Large and Nesset, 2008, p. 386).
Teamwork	Design team: “team environment where individuals are required to work together to reach a common goal” (Large and Nesset, 2008, p. 386). Consensus building: “In any team environment where individuals are required to work together to reach a common goal, consensus building must take place.... Before brainstorming begins it is important to establish evaluation criteria. One way to achieve this is through the initial user needs assessment, as it can identify design objectives and serve as a valuable basis on which to construct consensus. After brainstorming, when trying to reach consensus the team must determine which options best match the evaluation criteria. By matching options to pre-determined evaluation criteria, there is less chance that the opinions of one or two people will dominate” (Large and Nesset, 2008, pp. 386–387).
Training children to facilitate involvement	”learning by doing” (Large and Nesset, 2008, p. 384). “Bonded Design… provides a learning environment for all team members: children and adults alike” (Large and Nesset, 2008, p. 383).
Communication patterns	
Discussion or conversation	“discussing ideas as a group” (Large and Nesset, 2008, p. 383). Interviews.
Visibility of end users	Needs assessment: “An important preliminary step in the design process is to ascertain the needs which the design is intended to meet for any given user community. A needs assessment, where potential users are polled to elicit how and why they might employ the completed product, is an effective tool to achieve this objective. This holds true even when the users happen to be children. One way to undertake a needs assessment is to survey a user sample by questionnaire. As the users will be children, it makes for good practice to involve the team’s children in carrying out this assessment by administering the questionnaire to their peers” (Large and Nesset, 2008, p. 385).

11.3 CamQuest

Major source for analysis: (Berggren and Hedler, 2014)

Theme or Pattern	**CamQuest** (Berggren and Hedler, 2014)
Children involved	Aged 4-5 years.
Goals	
Build relationship/trust	"During the first encounter the children were initially gathered for a short introduction held by the teacher" (Berggren and Hedler, 2014, p. 186). Co-design "…makes the children feel more secure and confident in the presence of the designers, which in our case lead to a more natural and unaffected behavior in both ways" (Berggren and Hedler, 2014, p. 188).
Motivating and stimulating	Testing: "Both the introductory and finishing group discussion were very valuable for the learning experience, but also for the sake of the children's motivation and amusement" (Berggren and Hedler, 2014, p. 185).
Diverse data sources	Observation of testing, children's drawings, observation of prototype evaluation, interviews. "Observing children in their natural environment and analyzing their behavior turned out to be more useful than interviewing them" (Berggren and Hedler, 2014, p. 188). "The main advantage with co-design as a design method is that the designers can gain greater understanding and important insights about a user group that is very different from themselves" (Berggren and Hedler, 2014, p. 188).
Provides useful design information	Observations of testing provided problem definition, requirements, maybe ideation. Children's prototyped interfaces provided ideation. Evaluation provided evaluation & reflection information.
Maximised children's involvement	Children as testers and informants. Involved repeatedly, although not consistently, from problem definition through to prototype testing.
Decision points	
Design team size	Children designing interfaces individually. Children worked in pairs for first testing.
Low-tech resources	Drawing: Of prototypes, reflection on what cameras are.
Setting and location	Preschool.
Activity patterns	
Brainstorming	Children providing suggestions for future content ("quests").
Critiquing and evaluation	Prototype critiquing: Children evaluated the first prototype of CamQuest.
Prototype creation	Low-tech: drawings of camera/app interfaces.
Reflection	Reflective group activity as learning experience after first testing. on what cameras are as part of co-design.
Communication patterns	
Discussion and conversation	Interviews after evaluation. Not very useful because children too young to be reflective.
Sensitisation and contextualisation	First round of testing (and following reflection) acted as sensitisation / contextualisation for future activities.
Other notes	
Children's non-design learning	Subject matter (Geometric shapes). "We found that the children gained both confidence and knowledge, not only from being involved in the design process but also when it comes to their accomplishments with the application and the Ipad [sic]. From using the application in combination with other activities related to geometry, the children were able to transfer the knowledge about geometrical shapes to other contexts separated from the tablet. For example, the children started to ask the teachers for "rectangle papers" to draw on. Being able to distinguish between the names and the shapes provides the children with a vocabulary to use when discussing basic mathematical concepts. We believe that the transfer was successful because the fact that the combination of reality and tablet provided the children with a relatable context that is meaningful to them" (Berggren and Hedler, 2014, p. 188).

11.4 Child-Only Design Teams

Major source for analysis: (Kafai, Ching and Marshall, 1997)

Theme or Pattern	**Children in Design Teams** (Kafai, Ching and Marshall, 1997)
Children involved	Aged 10-12.
Goals	
Respect expertise of all participants	See "children as experts / teachers".
Collaboration	Implied within groups, but not discussed.
Motivating and stimulating	Not discussed.
Diverse data sources	"fieldnotes and video taping of students' interactions, students' notebook entries about work assignments and distribution, daily logfiles of the software, interviews with team members, and pre- and post-tests assessing students' science and programming knowledge and their views on collaboration and project management" (Kafai, Ching and Marshall, 1997, p. 119).
Provides useful design information	Requirements, ideation, evaluation: Programmed products.
Maximised children's involvement	Children as software designers.
Principles and heuristics	
Appropriate adult design team roles	Insufficient: teaching only, not interacting with products? Kafai et al. report that after evaluations, end users expressed annoyance at distracting errors such as spelling mistakes (Kafai, Ching and Marshall, 1997). Kafai et al. only mention adult interactions with the software designer during the evaluation session, where the classroom teacher seems to have had a facilitating role. The lack of availability of an adult to correct spelling errors and perhaps suggest alternate ways of thinking may have had an impact here.
Supported autonomy and children's control	Within groups, choices of topics to research and include in software.
Decision points	
Adequate time Frequent design sessions	3-4 hours per week for 3 months, totalling 46 hours.
High tech resources	Technological tools: computers, programming.
Setting / location	School.
Small groups	3-4 children.
Activity patterns	
Children as experts and teachers	Children creating educational software about astronomy.
Children conducting design and research activities	Children designing and building software.
Children conducting design and research activities	Children building software. Children doing their own science research in groups.
Iterative development	Programs expanded and improved as children's programming abilities improved.
Designer journals	Mentioned, but not discussed.
Teamwork	"students had considerable problems in the beginning sharing work and computer resources, as each team consist6d of 3-4 students each, but only one computer was available to all the team members" (Kafai, Ching and Marshall, 1997, p. 118).
Training children to facilitate involvement	"One week before the start of the project, students were given an introduction to the main features of the Microworlds TM Logo programming environment." (Kafai, Ching and Marshall, 1997, p. 118). Science instruction.
Communication patterns	
Discussion or conversation	Implied within groups, but not discussed in literature. Interviews.
Presentations	"User testing" was more like a presentation.
Sensitisation or contextualisation	"all the students had used computers in schools and were familiar with word-processing packages, spreadsheets, Grolier's TM multimedia encyclopedia, and searches on the World Wide Web" (Kafai, Ching and Marshall, 1997, p. 118). Pre-tests: "understandings of Logo programming and astronomy content" (Kafai, Ching and Marshall, 1997, p. 118).

Visibility of end users	End user testing, although designers were reluctant to hand control over. “Designing the multimedia application provided students' with some valuable lessons in interface design. Students' experience as multimedia consumers did not necessarily have them factor in the user's perspective into their designs. We found that students had difficulties assessing user needs or problems. When the third and fourth grade students came to evaluate the software in progress, the designers "played" the software for them. Only after the teacher's intervention did they allow the younger students to navigate on their own, often still telling students what to do. It was obvious that they wanted their users have the full experience of their soft-ware, at least as they imagined it. Most of the designers' evaluative questions, either during or after the sessions focused on "Was this fun?" or "Did you like this better than a book?" In a few instances, the designers asked users for specific information, such as whether they should for example center the text on the page or whether the users found a particular simulation helpful. … It is evident that students need more information about what constitutes good interface design and user evaluation. But the interface issue masks a bigger issue to consider and that is to what extent students are able to take into account other people's learning experience. Taking other perspectives into account leads to becoming more flexible in thinking and representations. While interface design offers an opportunity to experience another perspective, it does not automatically afford this learning--as it was in the case of individual screen designs” (Kafai, Ching and Marshall, 1997, pp. 124–125).
Emergent phenomena	
Peer tutoring	One child in each group had more programming experience. This is implied, but not discussed in any way.
Ownership of design sessions	Through creation of product.
Other notes	
Children’s non-design learning	Programming, astronomy / science, teamwork.

11.5 Children as Co-Researchers

Major sources for analysis: (van Doorn, Stappers and Gielen, 2013; van Doorn, Gielen and Stappers, 2014)

Theme or Pattern	**Children as Co-Researchers** (van Doorn, Stappers and Gielen, 2013; van Doorn, Gielen and Stappers, 2014)
Children involved	9-12 years old.
Goals	
Equality between adults and children Respect expertise of all participants	"At the end of the feedback session all children were rewarded with a co-researchers certificate" (van Doorn, Gielen and Stappers, 2014, p. 239). See motivating and stimulating.
Motivating and stimulating	Children motivated by feeling like professionals, equal with adults who respect their findings. "More professional tools are introduced: the video cameras, mobile phones, tripods and research bags. The project is concluded with handing out research certificates, stating that the children successfully participated as co-researchers. Next to that, the overall attitude of the lead researchers towards the children is more professional and always focused on the value of their expertise" (van Doorn, Gielen and Stappers, 2014, p. 238). "Through the emphasis laid upon their expertise in every step of the process, the co-researchers come to feel they make an important contribution" (van Doorn, Gielen and Stappers, 2014, p. 240). "However, most important is to incorporate the children's expert role in the attitude of the lead researcher. It should not be deployed as a procedural gimmick for motivational purposes, but truly be at the core of the lead researcher's interest. Only then does it get naturally woven into the set-up and execution of all the interaction between researcher and co-researchers. By believing in it, the lead researcher mentions it more and uses it to motivate and compliment the children. This is also a good way to bring back focus when they tend to get off track" (van Doorn, Gielen and Stappers, 2014, p. 240).
Diverse data sources	audio-recording and notes (written and drawn) in a research booklet (van Doorn, Stappers and Gielen, 2013), audio recorders or video cameras. Mobile phones not advised (van Doorn, Gielen and Stappers, 2014). "When the co-researchers operated the camera themselves or placed it on the tripod it worked well. You can actually see the children, their facial expression, their (sometimes messy) rooms, what's hanging on their walls and how they interact with each other. It also gave the children the opportunity to emphasize certain objects or aspects by zooming in on them" (van Doorn, Gielen and Stappers, 2014, p. 239). "Some of the video interviews are more formal than the audio recordings because the children are more conscious of being filmed. In the end the choice to use a video or audio recorder depends on the subject of the research" (van Doorn, Gielen and Stappers, 2014, p. 240).
Provides useful design information	Problem definition, requirements, ideation: Information gathered by children through interviews was used to create personas for adult designers. Children offered their ideas.
Maximised children's involvement	Children as informants and data gatherers.
Principles and heuristics	
Appropriate adult design team roles	As trainers and facilitators of reflection. Scribes, developer of research booklets: "Another way to speed up the process was to let the researcher do the writing, steered by the children's input, this went much faster than when the children wrote themselves" (van Doorn, Stappers and Gielen, 2013, p. 2886).
Build trust Children's ownership of design sessions	"this project started with a kick-off. The whole class got a presentation about the project and engaged in a discussion about what research is. The main message towards the children was that they are experts and that we need them to gather important data. We wanted them to feel important and responsible. The children asked a lot of questions and seemed interested and eager to start" (van Doorn, Gielen and Stappers, 2014, p. 238).
Designers familiarising themselves with children's culture	Children's impromptu cultural probes.
Supported autonomy and children's control	Research booklets contained materials to support children's interviews: "interview tips and explanations, questions to ask, encouragements" (van Doorn, Gielen and Stappers, 2014, p. 238).
Decision points	
Adequate time	Children had to conduct 1-2 half-hour interviews.
High-tech resources	Technological tools: audio recorders, video recorders, or mobile phones.

Setting and location	Children as co-researchers can go to locations unavailable to adult researchers (e.g. children's bedrooms).
Small groups	Individually for interviews, small groups for icebreakers, training & discussion: "Another difference between the two studies was the group size. Groups of 4-5 worked well in the previous study, this time we used groups of 5-6. It turned out that a group of 6 is too big. It is hard to divide attention between all the group members, to listen to all their stories, to react adequately and to keep them focused." (van Doorn, Gielen and Stappers, 2014, p. 240).
Activity patterns	
Children as experts and teachers	See 'motivating and stimulating'.
Children conducting design and research activities	"In a case study, we explored if children (age 9-12) are able to do interviews and extract valuable insights as co- researchers and the merits and constraints of using this approach. Children became collaborators, researching their peers and grandparents" (van Doorn, Stappers and Gielen, 2013, p. 2884). "interviewing their peers" (van Doorn, Gielen and Stappers, 2014, p. 237). "Another important part of the session was filling in a research plan with the children about the choice of their participants and the timing and location of the interviews. It is important that the children choose participants they now very well and that the interviews take place at the participant's house since the questions were about personal belongings and include a tour through their bedroom. At the end of this training session" (van Doorn, Gielen and Stappers, 2014, p. 239).
Critiquing and evaluation	Children were intended to critique their own interviewing performance as the reflection part of the interview. This didn't always work out.
Homework	Children conducting interviews.
Reflection	"co-researchers still need to write down keywords in their research booklets, in order to remember the interviews and being able to reflect on their findings in the feedback session a couple of days after conducting the interviews" (van Doorn, Gielen and Stappers, 2014, p. 238). Research booklets included "a final question in which the roles were reversed and the interviewer became the participant, in order to reflect on the interview. The booklet ended with a question the co-researchers could fill in after the second interview to compare the two interviews as preparation for the feedback session" (van Doorn, Gielen and Stappers, 2014, p. 238). "The final page in the research booklet included an assignment to switch roles, giving the participant the opportunity to ask some reflecting questions to the co-researcher. For some children it did not have the effect that we intended with this assignment: reflecting on the interview together, in order to prepare the co- researcher for the feedback session. …The goal of this assignment was to let the co- researcher reflect on the interview and on his/her skills, about what went well and what could be improved. An unforeseen and unwanted side effect was that switching roles gave the original interviewer the opportunity to evaluate the participant instead of his own performance. … Next to that, even though some children gave some beautiful reflections and conclusions, the "similarities" and "differences", that were asked to reflect upon, were taken very literally, like "he is a boy and I am a girl" or "we have the same parents"" (van Doorn, Gielen and Stappers, 2014, p. 240).
Training children to facilitate involvement	"During these practice interviews the lead researchers guided the children on what follow-up questions to ask. The tips the children found most important, or personal tips that were given during the rehearsal interview, could be added in a special area in the margin of the research booklet…." (van Doorn, Gielen and Stappers, 2014, p. 239).
Teamwork	"It turned out to be hard for them to come up with questions individually. By making it into a group process and challenging the group to come up with a certain amount of questions, they let loose of their hesitations, inspired each other and came up with many more questions" (van Doorn, Stappers and Gielen, 2013, p. 2886). "Working with small groups of 4 or 5 children had advantages. During the training they gave each other tips on how to improve their interviewing skills. The groups worked very seriously and when one of the children misbehaved within the group, the rest of the group reprimanded him/her" (van Doorn, Stappers and Gielen, 2013, p. 2886).
Communication patterns	
Discussion and conversation	Children conducting interviews. As part of reflections after interviews.

Sensitisation and contextualisation	Brainstorming & design as contextualisation for why interviews were important. Also practice interviews, which showed the children they didn't know much about their grandparents' point of view, and made them curious (van Doorn, Stappers and Gielen, 2013). "The children were divided into groups of four or five, focusing either on peers or on elderly. Within these small groups they thought of questions to ask their target group and gave input for the development of a research booklet. With the input from the children, the researcher developed two different research booklets (one for interviewing peers, one for interviewing grandparents). These booklets are a mix of creative assignments and interview-questions the children came up with and are meant as conversation starters and a way to structure the interviews" (van Doorn, Stappers and Gielen, 2013, p. 2885). "After the group discussion their teacher divided the children in 5 groups of 5 or 6 children. Two lead researchers each guided their own groups. The goal of this first meeting was to get familiar with the research subject (borrowing, lending and using personal belongings together) and to think of questions to put in the research booklet. We started with an icebreaker in which they had to guess an object the other child had written down. We wanted them to experience that by asking the right questions you can find out information that you need and we also wanted the children to understand their expertise. They know and understand their peers better; if the lead researchers would ask the questions they would need more time to figure out the object. The final step of the first meeting was to think of questions that can be incorporated in the research booklets" (van Doorn, Gielen and Stappers, 2014, p. 238).
Visibility of end users	Children's findings were used to create personas, for adult researchers / designers. "A few co-researchers recorded extra material, for example videos of playing a computer game and the way home from school and audio recordings of breakfast in the morning and beatboxing. These additional recordings raise the level of empathy. They give a glimpse of the children's lives in an unguided way, which makes it new and surprising for the lead researcher. In this respect, the recorders functioned as collectors of more or less random probes into their lives" (van Doorn, Gielen and Stappers, 2014, p. 240).
Emergent phenomena	
Moderating distractions	Mobile phones and video recorders both presented difficulties re: Children getting distracted from interviews. "the focus of the children who used the mobile phones was on making photos, which made them forget to tell stories that belong to the photos. Therefore mobile phones are not advisable. Video cameras were used to give the children an increased feeling of professionalism and to get images accompanying the audio. In this case this worked well because they were showing personal belongings to the camera. A side effect of using video camera was that some children appointed a cameraman, an extra person who was sometimes distractive" (van Doorn, Gielen and Stappers, 2014, p. 238).
Ownership of product	"Overall the children were enthusiastic and motivated throughout the whole process. They felt connected to the project, felt ownership and wanted to stay in touch" (van Doorn, Stappers and Gielen, 2013, p. 2886).
Ownership of design sessions	Interview sessions, yes – see motivating and stimulating. "an indirect example of the finding that the children felt like experts is that one of the mothers told us that her son came home after the kick-off session telling her that he was the expert and that he therefore needed to do the interviews" (van Doorn, Gielen and Stappers, 2014, p. 240). "One content adjustment the children suggested was the addition of a blank space for a question of their own choice, which they could come up with during the interview. Although not all children used this question during their interview, it added to the feeling of ownership and occasionally gave an interesting insight" (van Doorn, Stappers and Gielen, 2013, p. 2886).
Social experiences	Within training groups.

11.6 Children in the Centre Framework

Major source for analysis: (Kärnä *et al.*, 2010)

Theme or Pattern	**Children in the Centre Framework** (Kärnä *et al.*, 2010)
Children involved	4-10 years, "physical and/or mental disabilities, autism spectrum disorders, and difficulties in academic and life skills such as concentration and communication" (Kärnä *et al.*, 2010, p. 218).
Goals	
Respect for the expertise of all participants	"core of the process… opinions of children and their family members." (Kärnä *et al.*, 2010, p. 218). Parents' expertise about children. Also learn about children ("new perspectives") when see them in new environment. Parents learn to apply new technologies/skills in home.
Acceptance of ideas as worthy of consideration	"It is extremely vital that the contents of the workshops arise from the interests of the children and their families." (Kärnä *et al.*, 2010, p. 218). "everyone's opinions are taken seriously" (Kärnä *et al.*, 2010, p. 219), but more relevant in relation to different problems/situations. "continuous development process includes perspectives of all participants in a democratic way." (Kärnä *et al.*, 2010, p. 219).
Build relationships	"having the same personnel working with the same children and their families and preparing children to work with different people alone and in pairs" (Kärnä *et al.*, 2010, p. 221).
Collaboration or elaboration	"The children's ideas are elaborated with their parents at home and implemented in technology clubs in cooperation with tutors and researchers." (Kärnä *et al.*, 2010, p. 218). "Child-parent and child-tutor collaboration is particularly encouraged during activities. In some workshops, collaboration is the main way to perform a task" (Kärnä *et al.*, 2010, p. 219). Multidisciplinary collaboration required to address the heterogeneous needs of children (Kärnä *et al.*, 2010, p. 221).
Motivating or stimulating for children	Short activities = "allows the children to interact with many technologies, which keeps them motivated." (Kärnä *et al.*, 2010, p. 219).
Adequate support for children's abilities and communication level	Multiple communication channels for children to express their ideas. "Even though the children's problems and limitations are acknowledged, their interests, strengths, and needs are emphasized and supported." (Kärnä *et al.*, 2010, p. 219). "children's interests, strengths and needs form the basis for all activities" (Kärnä *et al.*, 2010, p. 219).
Diverse data sources	Debrief between parents and researchers after workshops. Oral and written feedback from tutors.
Providing useful design information	"children and parents are involved in every step of the process: reflecting, planning, acting, and observing the environment, methods and equipment" (Kärnä *et al.*, 2010, p. 219).
Maximising children's involvement	Claims children are design partners with parents, tutors, researchers; but children's ideas "elaborated with their parents at home" (Kärnä *et al.*, 2010, p. 218).
Principles and heuristics	
Appropriate adult design team roles	Parents included: "Parents share invaluable information about their children and support their work at the technology clubs and elsewhere." (Kärnä *et al.*, 2010, p. 218). Researchers from special education and computer science. Tutors within workshops.
Tailor activities to children's abilities Be aware of non-verbal communication	"In practice, the children share their opinions and wishes by using photos, pictures (PCS), and verbal and non-verbal communications." (Kärnä *et al.*, 2010, p. 218). "Many children with special needs require time to adapt to changes, to start, and to maintain their focus on activities. This means that activities need to be organized in a flexible and personalized manner. The challenges can be dealt with by 1) having the same personnel working with the same children and their families and preparing children to work with different people alone and in pairs, 2) making small changes constantly to the tools used, 3) using pictorial aids such as personally structured maps of the activities, and 4) developing tools with a clear structure. Consequently, the children's needs are taken into account, children are better prepared for changes, and the connections between the children's own ideas and the new versions of the tools are easier to find. As a result, the design process is simple to piece together for the children." (Kärnä *et al.*, 2010, p. 221).
Flexibility	"The variety and severity of these children's needs require extreme flexibility and adaptivity and a need for novel technical solutions." (Kärnä *et al.*, 2010, p. 220).
Designers familiarising themselves with children's culture	Researchers with expertise in special education likely to be familiar. Researchers from computer science background, tutors not discussed. Parents' familiarity with their children's abilities.

Decision points	
Adequate time	"Technology clubs are structured around activities that last from five to 15 minutes." (Kärnä *et al.*, 2010, p. 218). "children participate in the workshops for about 10 minutes as many of them who attend the technology club have difficulties concentrating. The limited time allows the children to interact with many technologies, which keeps them motivated." (Kärnä *et al.*, 2010, p. 219).
High-tech resources	"The framework uses multiple technologies based on the idea that a variety of technologies makes the learning environment active and interesting for children and thus facilitates the emergence of their potential and hidden skills." (Kärnä *et al.*, 2010, p. 220).
Activity patterns	
Icebreakers / transitional activities	Warm up: greetings, song. Farewell song.
Children conducting design and research activities	"After the workshops, the children take photos of their favorite things in the club" (Kärnä *et al.*, 2010, p. 219).
Communication patterns	
Presentations	Children present photos.
Emergent phenomena	
Children's ownership of product or project	Ownership of technology generally increased by involvement in development? Increased courage to interact with other technologies/toys.

11.7 Co-Design Beyond Words

Major source for analysis: (Wilson *et al.*, 2019)

Theme or Pattern	**Co-Design Beyond Words** (Wilson *et al.*, 2019)
Children involved	Minimally verbal Autistic children, aged 5-8.
Goals	
Equality between adults and children	Authors claim minimally verbal children can be "equals and leaders…if designers are willing to offer sufficient choices and open-ended opportunities, and pay attention to children's responses" (Wilson *et al.*, 2019, p. 3).
Acceptance of ideas as worthy of consideration	"moments of interaction" with adults, technology, other children provides design data to inspire general design ideas & provides specific feedback.
Build relationship/trust	Not discussed. Researchers spent a lot of time in classrooms getting to know the children, their needs, interests, non-verbal communication signs, which could have resulted in trust/relationships being built.
Motivating or stimulating for children	Technologies under development were stimulating.
Adequate support for children's abilities and communication level	"supporting children as they are", rather than trying to increase language.
Diverse data sources	Foundation phase: Getting to know children involved. Interaction phase: Moments of interaction, in-the-moment. Reflection phase: Making design decisions based on knowledge of children, moments of interaction.
Providing useful design information	"CDBW yielded both broad design approaches (i.e. moments of interaction and the three stages described above), as well as specific and technical design details (e.g. squeezable, bouncy etc.)." (Wilson *et al.*, 2019, p. 10).
Maximising children's involvement	Equals and leaders.
Principles and heuristics	
Support and be guided by the children	All design decisions based on children's "moments of interaction" with prototypes, children, adults.
Flexibility	Identified as the main role of researcher/designer: "It is about being attentive, adaptive and agile to changing needs and circumstances. It is about using every glimpse into a child's interests and lifeworld as a potential bridge to design, while keeping it fun and fluid and building up interactivity, and while working towards a design outcome…. It is not only about which designs arose from the process, but also about how the children communicated their design needs and how these were put into action and turned into reality. Flexibility and responsiveness are key, as is a solid understanding of each child and their needs, before embarking on this process." (Wilson *et al.*, 2019, p. 11).
Keep up momentum	"…while keeping it fun and fluid…" (Wilson *et al.*, 2019, p. 11).
Appropriate adult design team roles	Researcher/designer & adult therapists, teachers, etc.
Tailor activities to children's abilities	Whole point of this design approach is working at children's level.
Be aware of non-verbal communication	Foundation phase involves researchers getting to know children's "normal" body language, signs of excitement, etc., to support awareness of non-verbal communication during design sessions.
Designers familiarising themselves with children's culture	Foundation phase – designers becoming aware of individual children's abilities, non-verbal communication, interests, etc. Not "culture" on large scale, being more individualistic, but has implicit awareness of "Autistic culture".
Decision points	
Continuity of design sessions Adequate time	Not discussed. It seems that multiple design sessions flow together into a single stream, depending on children involved.
Physical resources	"High-tech" resources: Technology under development. Low-tech resources: "craft materials".
Setting / location	School – ease of access to multiple minimally verbal children.
Activity patterns	
Teamwork Social experiences	Children interacting with technology in pairs. Child-child interactions happened, unsure how "social".
Exploration	Exploring how children interact with technology under development.
Iterative development	Children's interaction with technology under development inspired next iteration.
Prototype critiquing	Not directly, but adult designers evaluating prototype based on children's interactions.
Communication patterns	

Communicating design session aims: Implicit tasks	Mix of implicit tasks (play with ball) and explicit instructions from adults during design sessions.
Facilitating communication	Turn-taking, joint attention and imitation core to the design approach. Takes cues from several therapeutic approaches to support communication.

11.8 Contextual Inquiry with Young Children

Major sources for analysis: (Druin, 1999; Druin *et al.*, 1999)

Theme or Pattern	**Contextual Inquiry with young children** (Farber *et al.*, 2002)
Children involved	3-5 years old.
Goals	
Equality between adults and children	Casual clothing, friendly interactions – overcoming power imbalances.
Respect expertise of all participants	"Domain expertise" of observed children.
Build relationship/trust	Adults in casual clothes, acting like friends.
Diverse data sources	Note-takers. No cameras. Researcher debriefs after sessions.
Provides useful design information	Druin et al. claim this is a source of ideation (Druin *et al.*, 1999, sec. 2.1).
Maximised children's involvement	Children as users. This is only about understanding users, not about them contributing to designs.
Principles and heuristics	
Appropriate adult design team roles	2 observers/note-takers, 1 facilitator/interactor. "We found that if there were no interactor, the children being observed would feel uncomfortable— as if they were "on stage."" (Druin, 1999, p. 225).
Be guided by the children	Leading the interactions.
Keeping the situation natural	Interactor never took notes.
Decision points	
Setting and location	Real world. "In the case of users that are children, we observed them in their homes and favorite public places (e.g., children's museums, activity centers, game arcades)" (Druin *et al.*, 1999, sec. 2.1).
Activity patterns	
Exploration	Main source of information is children's exploratory behaviour.
Communication patterns	
Questioning in the now	"The interactor was always the researcher who initiated discussion and asked questions concerning the activity. The interactor asked questions that were directed to what the user was doing at the moment (e.g., How come you're doing that? Why do you like that? What's this?). The interactor would avoid asking questions that might steer the activities of the child (e.g., Could you show me this? How about doing that?)" (Druin *et al.*, 1999, sec. 2.1).
Emergent phenomena	
Social experiences	Between children and adults. Adults dress informally. Interactor becomes a "participant observer" (Druin *et al.*, 1999, sec. 2.1), the interactions is almost social.

11.9 Cooperative Inquiry

Major sources for analysis: (Druin, 1999; Guha, Druin and Fails, 2013)

Theme or Pattern	**Cooperative Inquiry** (Druin, 1999; Guha, Druin and Fails, 2013)
Children involved	5-14, most often 7-11 years old.
Goals	
Equality between adults and children	Explicit goal, recommendations given to achieve it (mainly focusing on informal setting). "Additionally, we "pay" our child design partners with a small technology gift, such as an iPod shuffle or robot dog, at the end of each year…. Offering our children the kind of pay that we can, given child labor laws, shows them that they are valued contributors to the group" (Guha, Druin and Fails, 2013).
Respect expertise of all participants	Explicit goal.
Build relationship/trust	"We find that most children at first are not entirely comfortable with allowing us to change their idea of power structures, but over time, they become comfortable with the idea of the adults on the team as their design peers" (Guha, Druin and Fails, 2013).
Collaboration	Idea elaboration. Everyone in design team adopting and building on each other's ideas: "the most important goal of a partnership between adults and children is `idea elaboration'. This is when one team member (adult or child) shares an idea with the team. From this idea, a new thought or direction may be inspired by another adult or child. When these ideas build upon each other to create new ideas, ultimately it may be difficult to remember whose ideas they were originally. What matters is that both adults and children share in the process together. It can be said that this elaboration process is the hallmark of any good design team with or without children. However, what makes this so important to partnerships with children is that idea elaboration is so difficult to have with young people. What is more common is that adults conceive of ideas and either teach them to children or ask for feedback from children. The notion of elaborating on each other's ideas is more difficult and therefore colours all that we do in our design partnership methods. To support the best circumstances for idea elaboration with children, our team has changed the way we set expectations, brainstorm and reflect as a team" (Druin, 2002, p. 14).
Motivating and stimulating	Through involvement throughout product life cycle & ownership of product, equality, idea elaboration.
Adequate support for abilities and communication level	Big emphasis on drawing (with annotation by adults) instead of writing for children who prefer it.
Diverse data sources	Videos, journals, low-tech prototypes etc. (Guha, Druin and Fails, 2013).
Provides useful design information	Problem definition, requirements, ideation, evaluation: courtesy of involvement throughout product life cycle.
Maximised children's involvement	Ur example of involvement throughout the project life cycle. ""design" includes all of the steps necessary to conceive, develop, and produce a technology – essentially all of the work from start to finish in the creation of technology, including brainstorming, coding, building, iterating, and testing" (Guha, Druin and Fails, 2013). Children as design partners
Principles and heuristics	

Appropriate adult design team roles	Intergenerational design team. “we generally have 6 to 8 children and 3 to 4 adults at a session” (Guha, Druin and Fails, 2013). “At the end of the session, the children leave, and the adults remain to debrief and discuss the day’s activities, outcomes, and what’s next” (Guha, Druin and Fails, 2013). “if adult partners are not mindful, the children can end up dictating the sessions. It is quite typical that a new adult who joins our team will be so concerned that the children have a voice in design sessions that they essentially offer no input. This is not the way an intergenerational design team using Cooperative Inquiry should function” (Guha, Druin and Fails, 2013). “There are some roles in Cooperative Inquiry in which adults do maintain typical adult responsibilities. For example, adults on a design team must provide structure to the design sessions and keep sessions on pace to accomplish the design tasks. This means adult design partners must plan the basic flow of design sessions before the children arrive. Occasionally, an adult will need to step a caregiver role, for example if a child needs to use the rest room we will walk into the hallway to ensure they safely make it there and back, or that if two child design partners are clearly not getting along we might need to intervene to help mitigate an argument between a seven and nine year old before feelings are hurt. It is important at any time that an adult is fulfilling these typically adult roles that we maintain our roles as partners – and that we treat children at all times with the same respect we would afford adults. We do not try to change all pre-existing adult/child relationships, merely the ones that exist in the context of the design process. We have never had a report from a child, parent or teacher where overcoming power structures within our lab has caused a child to behave inappropriately in school or at home. We find that children are able to differentiate between contexts and how to behave differently in different contexts” (Guha, Druin and Fails, 2013). “Likewise, there is a learning curve for adults in becoming design partners. Over the years, our team has included adults from a wide range of fields. We find that there tend to be field-specific challenges for adults in learning to design with children. Educators need time to get used to the idea of working with children as opposed to teaching to them” (Guha, Druin and Fails, 2013).
Keeping up momentum between sessions (continuity)	Through reflection.
Supported autonomy and children’s control	No, in favour of equality.
Decision points	
Adequate time Frequent design sessions	“Our sessions run twice a week, after school, in our lab at the university… Before these twice weekly sessions, which run through the academic year, we have a two week design team boot camp each summer in which our researchers and child design partners participate in two intensive weeks of daily, day-long design partner activities” (Guha, Druin and Fails, 2013).
Physical resources Low-tech resources High-tech resources	Bags Of Stuff technique: “Bags of Stuff is a prototyping technique in which children and adults use big bags filled with art supplies such as glue, clay, string, markers, socks, and scissors to create low-tech prototypes of technology” (Guha, Druin and Fails, 2013). “We have found that using a bag of art supplies can strongly supports bringing children into the design process. We have found value in tailoring the materials with which to prototype to specific projects…. it is sometimes necessary to tailor the contents of the Bags of Stuff to a specific project. For example, when exploring technology involving music, it is necessary to include auditory supplies – such as bells and noisemakers”” (Guha, Druin and Fails, 2013). Drawing. Technology immersion (historically): “While observing children in the long-term use of a technology can be valuable, we have found this particular activity to be time-consuming, and the results we were getting seemed to be less helpful than we had hoped in that the information gathered from these techniques did not contribute significantly enough to the design of new technology to support the amount of time needed to complete them” (Guha, Druin and Fails, 2013).
Setting / location	University lab – but kid friendly. Also used repeatedly, so children become familiar with it. Research space is kid friendly: “it includes a floor level table, comfortable chairs, couches, and inviting places to sit” (Guha, Druin and Fails, 2013).
Small groups	Large group breaks into smaller groups for activities.
Activity patterns	
Brainstorming	Big Paper technique: “we now often brainstorm on large sheets of paper, which allows numerous design partners to gather around a table or floor space to collaboratively work on one idea…. This two- dimensional brainstorming technique has been especially useful when working on screen-based interfaces. The advantage of the large paper versus a small sheet of paper is the collaboration and elaboration that can occur by gathering around one large workspace” (Guha, Druin and Fails, 2013).

Icebreakers & transitional activities	Every session. “When the children arrive for a design session, they eat a snack together with the adults participating in that day’s design session. This helps to ease children and adults from their everyday lives into their role as design partner” (Guha, Druin and Fails, 2013).
Critiquing and evaluation	Sticky Note Critiquing technique: “Sticky noting is a Cooperative Inquiry technique for critiquing an existing technology or prototype of a new one. The technique begins with all adults and children using a technology. As they are working, all partners write down on sticky notes what they like or dislike about the current technology, and any suggested changes to the technology. Each like, dislike or design idea is written on a separate sticky note. As the notes are written, they are gathered and given to an adult researcher who places them on a large wall space (see Figure 3). One or more researchers groups the notes in categories (e.g. likes, dislikes, design ideas) as well as subcategories which emerge from the sticky note comments. For example, many partners might like where the buttons are placed, or possibly lots of partners dislike the audio used. The outcome is a kind of informal frequency analysis [13] which shows possible trends that can inform directions for the next iteration of a technology” (Guha, Druin and Fails, 2013).
Fantasy, storytelling, role playing and enactment	“role playing to problem solve” (Guha, Druin and Fails, 2013).
Iterative development	Layered Elaboration technique: “In Layered Elaboration, design partners either create or are provided with a base design on which to elaborate and iterate. As each small group elaborates on the original design, a sheet of clear acetate is laid over the original design. Sheets of acetate can be added upon each other so that each group can add their ideas without “destroying” the original, or the work of other groups. Between iterations, we hold stand up meetings in which design partners quickly explain their ideas before the design is passed on to another group for further elaboration” (Guha, Druin and Fails, 2013).
Designer journals	Yes.
Prototype creation	Low-tech prototyping: “bags of stuff and large sheets of paper to prototype” (Guha, Druin and Fails, 2013). “the team sits on the floor to engage in low tech prototyping…. We also always break into small groups when creating low tech prototypes. Due to the small group prototyping, the process of sharing ideas is more structured. After the low-tech prototypes are created by groups of two to three children and one to three adults working together, each group presents their ideas to the whole team” (Guha, Druin and Fails, 2013).
Reflection	“journals, videos, and white-board discussions” (Guha, Druin and Fails, 2013). Journals, children videotaping, discussions. “We find that reflecting in this way can help all members, adults and children alike, to clarify ideas and continue the elaborative creative process. These reflective experiences can be adapted for use with all ages as children who cannot yet write can draw or speak about their ideas. If a child chooses to draw, an adult team member will sit with that child, and with her permission, annotate the drawn reflections in writing to provide clarification for later analysis. Likewise, if a child prefers, she can tell her ideas to an adult design partner who will enter them into the child’s journal” (Guha, Druin and Fails, 2013).
Teamwork	Inter-generation design team working together.
Training children to facilitate involvement	“As children who are involved as design partners enter into a long-term agreement, there is time at the beginning of their tenure as a design partner to train them. At any given time, our team includes both new and veteran child design partners. We have found that it often takes months for a child to become true design partner – one who understands and can use our methods and techniques, and who is not afraid of offering opinions and communicating ideas” (Guha, Druin and Fails, 2013). “the time it takes for a child to become truly comfortable as a design partner can often be a matter of months. During this time, children may be less likely to offer insightful ideas in the design process. Time and longevity are vital – we have rarely found a child who walks through the door on day one and is ready to participate as a full-fledged design partner. They need time to learn the method and its techniques and to get used to the process” (Guha, Druin and Fails, 2013).
Communication patterns	
Discussion or conversation	Yes, throughout sessions, as part of other techniques. “No matter what the activity, we end by coming together to have a large group discussion, share our ideas, and think about future directions” (Guha, Druin and Fails, 2013). “underlying truths are often discovered in large group discussions at the end of sessions in which adults and children ask critical questions to each other about designs, such as “Why does it need to be a rocket ship?” and “We can’t build a teleportation device by next week. What would be the next best thing?”” (Guha, Druin and Fails, 2013).

Presentations	Formal, small groups to larger group, along with critiquing ("Big ideas"). Of low tech prototypes: "After the low-tech prototypes are created by groups of two to three children and one to three adults working together, each group presents their ideas to the whole team. We designate one adult team member to take notes on the Big Ideas on a white board during these presentations. As each team presents, the note-taker writes down the ideas that are surprising, most repeated among groups, or ideas that receive the most reaction from the whole team…. After the presentations, the team discusses these ideas and decides which to pursue" (Guha, Druin and Fails, 2013).
Sensitisation / contextualisation	Through sticky note critiquing and observation of users.
Emergent phenomena	
Ownership of product	Through involvement throughout the project life cycle.
Ownership of design sessions	Through equality with adults.
Social experiences	Yes, socialising between children and adults before design sessions (Guha, Druin and Fails, 2013). "We also find that during our summer two weeks which kick off our research year, informal fun time together is important for building relationships. We do this through adults and children participating together in activities like playing outside, visiting the campus farm, and participating in scavenger hunts (see Figure 6). These activities, which seem simple, have great influence when undertaken by adults and children together" (Guha, Druin and Fails, 2013).
Other notes	
Children's non-design learning	"Findings indicated that children involved in the technology design process in partnership with adults had social and cognitive experiences in the areas of relationships, enjoyment, confidence, communication, collaboration, skills, and content" (Guha, Druin and Fails, 2012, p. 1).

11.10 Cooperative Inquiry with Young Children

Major source for analysis: (Farber *et al.*, 2002).

The themes and patterns discussed here are those which differ from the original Cooperative Inquiry, as described in Section 11.9.

Theme or Pattern	**Cooperative Inquiry with young children** (Farber *et al.*, 2002)
Children involved	4-6 years old.
Goal	
Collaboration	Created mixing ideas to make it easier (Guha, Druin and Fails, 2013).
Adequate support for children's abilities and communication level	Whole design method adapted to better suit young children's needs, including less writing, to support children's communication level.
Diverse data sources	Notes, drawings, prototypes, etc.
Provides useful design information	Problem definition, requirements, ideation, evaluation: although examples given are mainly redesign rather than design.
Maximised children's involvement	Children as design partners.
Principles and heuristics	
Appropriate adult design team roles	Farber et al. found that young children need more support and guidance (2002). CI with young children also required adults to prompt children when required (Farber *et al.*, 2002), although it was a different context. "We have also found that when we work with young children, the adult partners need to offer more ideas, start discussions, and propose more design suggestions. In general, the young children we work with have a harder time collaborating than do the children in our lab design group. In order to get input from all of the children we often have to pause a discussion to ask what a specific child thinks about a subject. Sometimes we have an adult sit next to a child who tends to interrupt or dominate the conversation. If this child feels that he has to speak, he can whisper his idea to the adult without disturbing the group discussion" (Farber *et al.*, 2002, p. 130). Farber et al. informed teachers of goals and approaches for future design sessions so the teachers would help guide the session (Farber *et al.*, 2002).
Continuity between sessions	Bulletin board.
Keeping up momentum within sessions	Adults providing extra assistance, suggestions, etc.
Tailor activities to children's abilities	Mixing Ideas: Created to assist designing with young children, because it makes it easier for the children to see their contribution (Guha, Druin and Fails, 2013) – more information in its own section, below.
Decision points	
Low-tech resources	Drawing.
Setting / location	Children's preschool.
Small groups	Smaller than CI, because children struggled with working in larger groups.
Activity patterns	
Critiquing and evaluation	Prototype critiquing: conducted by a different team of children at another school. Sticky note critiquing: yes. Less than Cooperative Inquiry: 4-6 notes instead of 9.
Iterative development	"(1) interacted with a technology, (2) watched others interact with technology, (3) decided what they liked and did not like about the technology, (4) sketched their ideas for a new version of that technology and then (5) combined their best ideas to create a model of their new technology" (Farber *et al.*, 2002, p. 128).
Designer journals	Children drew in them, adults annotated the drawings.
Prototype creation	Low-tech. Also an extra stage of sketching ideas, to help young children.
Reflection	Bulletin board in classroom.
Training children to facilitate involvement	"The first time we went to the kindergarten classroom our team spoke to the class as a whole. We introduced ourselves and explained that we design new technologies for kids such as robots and drawing games. The class was informed that we work with older children to make educational technologies and we now want to work with their kindergarten class to make technologies for younger children. Next, we initiated a series of activities designed to motivate the children to explore the design process, feel like inventors, and to help them become familiar with us as partners" (Farber *et al.*, 2002, p. 128).
Communication patterns	
Discussion or conversation	Yes.

Presentations	Of low-tech prototypes, to whole class. Reduced compared to CI, because audience children couldn't sit through the presentations. Replaced with "Bulletin Boards for Parents and Class Communication" (Farber *et al.*, 2002, p. 130).
Sensitisation / contextualisation	Through evaluations of existing technologies.
Other notes	
Communication with school	"Website for coordination with teachers" (Farber *et al.*, 2002, p. 130).
Children's non-design learning	Problem solving. "Many also thought that they had learned how to better use the computer or specific applications on the computer" (Farber *et al.*, 2002, p. 129).

11.11 Creative Design + Evaluation with Nepali children

Major source for analysis: (Antle and Bevans, 2012; Antle, 2017)

Theme or Pattern	**Creative design** (Antle and Bevans, 2012)
Children involved	Urban Nepali children (Notable in that researchers were Canadian). "eight to sixteen Nepalese children aged eight to twelve" (Antle and Bevans, 2012, p. 466).
Goals	
Equality between adults and children	No – Nepali children's contribution summarised into "1-3 key ideas" and "basic child-personas" (Antle and Bevans, 2012, p. 467). Some consideration of power differentials, especially as exacerbated by cultural differences.
Respect for the expertise of all participants	Goal: create on-going collaboration between Canadian design team and Nepali children – shows respect for expertise of Nepali children. Using empathy to balance designer's goals and perspectives and participants' perspectives. Working in ways already known to the children.
Build relationship/trust	Research approach "includes several goals related to relationship building" (Antle and Bevans, 2012, p. 466). Workshop begins with "relationship building exercise": "The activity will involve each participant and researcher telling the group about the best and worst part of a typical school or work day, what they want to do when they grow up, and some- thing they think the other cultural group wouldn't know about their community or culture…. This activity is an important step to begin finding common ground between ourselves, local helpers, and workshop participants, and to set the stage for the creative and discursive group activities that will follow." (Antle and Bevans, 2012, p. 466). Commonalities of challenges experienced by children – build trust between children. Considerations of how to end relationships without causing emotional damage to children – involved not creating relationships directly with children at an orphanage, as the ending of a relationship could cause "attachment damage", but training their counsellors to run evaluation sessions. Long-term benefits to children and community: capacity building with staff, leaving resources for future use, contributing to community.
Motivating and stimulating for children	"Another goal is to enable Nepalese children to participate in a creative process of ideation and expression in ways that they find meaningful and authentic." (Antle and Bevans, 2012, p. 466).
Diverse data sources	Informal interviews, observation, field notes, surveys.
Provides useful design information	Personas for use by Canada-based design team. "The main outcome for the workshop is a shared understanding of issues that are important to the children, families and communities of the workshop participants, as well as an understanding of which of these issues could be addressed with edutainment-based interactive technologies." (Antle and Bevans, 2012, p. 466). Identifying challenges and needs the children face. Storyboards from ideation. "context setting, problem identification, opportunity and constraint setting, and ideation" (Antle and Bevans, 2012, p. 468).
Maximised children's involvement	Informants re: issues of importance.
Principles and heuristics	
Appropriate adult design team roles	Local helpers.
Designers familiarising themselves with children's culture	Acknowledgement that cultural differences mean that "benefit" is not a neutral term. Ideas of "benefit" informed by local community & experts, goals of children's school. Altered design of evaluation studies to fit culture.
Decision points	
Low-tech resources	Drawing, "simple art materials" (Antle and Bevans, 2012, p. 466). Storyboards: drawing, collage, photos, words.
High-tech resources	Interactive technology demonstrations.
Group size	8-16 children total. Break into small groups for some activities.
Activity patterns	
Reflection	Children's reflections on their lived experiences, including challenges and needs.
Brainstorming	Ideation in small groups.
Homework	"The children will leave with paper (and/or digital) post-cards with follow- up questions, which they will be asked to work on later and mail (or email) to us. This may help transition the relationship from a face to face one to a remote one." (Antle and Bevans, 2012, p. 467).
Communication patterns	

Sensitisation and contextualisation	Interactive technology demonstrations “with a focus on the activities and experiences that interactive technology can provide.” (Antle and Bevans, 2012, p. 466).
Possibility demonstration	Demonstrating how to use game to be evaluated. Pictures to communicate meaning. Child intermediary as demonstrator.
Other notes	
Survey	“to determine language background, education level, and technology experience in order to better customize our initial workshop and future research phases” (Antle and Bevans, 2012, p. 466).

11.12 Designing with Children with Severe Motor Impairments

Major source for analysis: (Hornof, 2008, 2009)

Theme or Pattern	**Designing with children with severe motor impairments** (Hornof, 2008, 2009)
Children involved	17 year old girls.
Goals	
Equality between adults and children	Goal: breaking down power structures to support children with severe motor impairments as design partners.
Respect for expertise of all participants	Particularly important, as these children may not have previously been given opportunities to express their opinions. May require extra support, reassurance that designers are truly interested/listening.
Build relationships and trust	Long-term, frequent visits with participants as a volunteer in their facility: "to get comfortable with the environment, build rapport with the two girls, learn how to communicate with them…." (Hornof, 2009). Build team around child – include people they already know & interact with (family, carers, medical professionals, teachers, therapists). Learning into children's desires.
Motivating and stimulating for children	Fun play activities. "Best practices for interacting with these children also demonstrate the need for the collaborators without disabilities to have a fun, creative, and playful demeanor if they wish to evoke the same from the children" (Hornof, 2008). Meaningful activities.
Adequate support for children's abilities and communication level	Build team around child, from people they know, based on their needs.
Maximised children's involvement	Goal: Design partners. Possibly closer to informants, as children likely unable to introduce new ideas of their own. Children choosing design topic from a list.
Principles and heuristics	
Designers familiarising themselves with children's culture	Long-term, frequent visits with participants – get to know participants, communication styles, difficulties in interactions & strategies to address such difficulties. Adults not used to working with children with severe motor impairments need to get past feelings of social awkwardness, uncertainty, doubt while interacting with children. May not be able to get past feelings of physical exhaustion. Communication with carers, children can help to ensure interactions are helpful & appropriate.
Appropriate adult design team roles	Build team around child – based on their needs, multidisciplinary, include people they know & interact with (family, carers, medical professionals, teachers, therapists). Parents (and siblings) involved in design team. Involvement of carers who know children's communication styles is important.
Be aware of non-verbal communication	Signals given by children may be non-verbal, especially opting-out.
Tailor activities to children's abilities	Use existing communication strategies known by the children. Adults designing prototypes "iteratively… with input from the girls across multiple sessions." (Hornof, 2009).
Decision points	
Low tech vs high tech resources	No-tech → Low-tech → High-tech communication approaches/aids.
Pair of children	Motivation, camaraderie, emotional support.
Adequate time	Hornof probably spent more time on rapport building & team building than was required; speculates "It appears as if a dozen or so sessions might have sufficed." (Hornof, 2009).
Setting and location	Home for children with severe disabilities, where the children lived.
Activity patterns	
Icebreakers	"Team-building collaborative design activities" (Hornof, 2009).
Training children to facilitate involvement	Introduction to designing & co-designing through conversation.
Iterative development	By adults, with a lot of input from children.
Communication patterns	
Facilitating communication	Frequent feedback about communication and understanding of child's intent. Turn taking is important, and requires patience and possibly re-phrasing or re-stating a question.
Discussion and conversation	Discussion possible with knowledge of children's yes/no responses, communication aids.
Emergent phenomena	
Social experiences	"camaraderie" (Hornof, 2009).

Children's ownership of project / design sessions/activities	"It appears as if providing enough support for each of the individual social and creative subtasks involved in a design process can start to give children with severe motor impairments a sense of ownership of the process." (Hornof, 2009).

11.13 Embodied Narratives

Major source for analysis: (Giaccardi *et al.*, 2012)

Theme or Pattern	**Embodied Narratives** (Giaccardi *et al.*, 2012)**.**
Children involved	Aged 10-11 years.
Goals	
Motivating and stimulating	"leverages children's natural playfulness to inspire and motivate the design process" (Giaccardi *et al.*, 2012, p. 1). "Competing. In each session, teams were working separately but in parallel. We observed that this fact produced additional motivational factors in the case of teams with camera that were moving around, and were occasionally interacting with children of the other team. As supported also by comments in the debriefing session, children constantly kept an eye on what the other team was doing, particularly with respect to the dangers children of the other team identified and to the progress of their storyboard. Sharing the same environment placed teams with camera in some sort of competition that pushed children to 'get the work done.'" (Giaccardi *et al.*, 2012, p. 6). "availability and use of the instant digital camera/printer spontaneously motivated children to explore their environment and keep themselves 'embodied' in context. It also boosted improvisation and collaboration between children. The camera became for the children both a stimulus to expressing perceptions of danger and a tool for the production of the building blocks of the game in the form of stickers" (Giaccardi *et al.*, 2012, p. 7).
Diverse data sources	Children's storyboards, notes from reflections, designer's photographs/video recordings, observation notes, debrief notes.
Provides useful design information	Problem definition, requirements, ideation: "Its outcome is not the final design but valuable material for further co-design activities" (Giaccardi *et al.*, 2012, p. 1). "The camera became for the children both a stimulus to expressing perceptions of danger and a tool for the production of the building blocks of the game in the form of stickers. In this sense, pictures taken by the children were both the performative expression of their perceptions and elements of their design outcomes (e.g., cards, game boxes, game pieces)" (Giaccardi *et al.*, 2012, p. 7).
Maximised children's involvement	Children as informants.
Principles and heuristics	
Appropriate adult design team roles	"As adults, we formed part of the domestic social environment, facilitating and participating in children's interactions and performances." (Giaccardi *et al.*, 2012, p. 4).
Decision points	
Adequate time	Single two hour time frame to perform multiple iterations of "(a) brainstorming, (b) performing, (c) shooting, (d) printing, and (e) sharing" (Giaccardi *et al.*, 2012, p. 3).

Low tech vs high tech resources	Groups who were drawing did not do as well. "Key to the design process is the collaborative use of the Polaroid PoGo instant digital camera with built-in printer, which enables children to print pictures on adhesive film. The ability to print and share pictures among themselves instantly gives children immediate gratification, thus boosting children's playful exploration and improvisation…" (Giaccardi *et al.*, 2012, p. 3). "In general, teams without camera seemed mainly focused on the details and quality of their drawings, while the teams with camera were rather concerned with the rules of the game and social interactions among players. Compared, teams with camera went through a higher number of iterations, which allowed children to speed up the crafting of the storyboard, and gave them more time to spend in generating/testing ideas and performing scenarios together. Comparing video recordings of groups with and without camera, we also observed that the use of the camera promoted active collaboration between children through the creation and exchange of different roles around the use of the device..., whereas children without camera stayed focused on individual drawing and tasks" (Giaccardi *et al.*, 2012, p. 7). "In addition to the objects that could be found in the house, we provided a few props to stage adult roles such as firefighters, policemen and doctors, and facial make-up to simulate environmental and physical conditions (e.g., smoke, blood, injuries, etc.)" (Giaccardi *et al.*, 2012, p. 4). "Children used props and make-up as ritual elements to stage adult figures or to enter into a fictional space (e.g., a fire) in which to pretend and perform. This is a known co-design issue and aspect of child/play behavior. What we observed with EN is that the use of ritual elements was more prominent in the domestic setting of the first experiment (all children made use of them at some point or another of the process, whether they were props provided by us or objects found in the home). In the school setting of the second experiment only one of the three teams with camera tended to use props and make-up. Children in the school setting were spending more time outside, reliving and replaying personal experiences, whereas children in the domestic setting were more inclined to use props and found objects in order to invent imaginary situations that were disruptive of home stability. We infer this may be a result of the different social and physical nature of the two settings. Equally tasked, the two teams without camera of the second experiment did not use props and make-up at all" (Giaccardi *et al.*, 2012, p. 6).
Setting and location	Home or school: "familiar setting relevant to the domain of the design problem" (Giaccardi *et al.*, 2012, p. 3).
Small groups	Groups of 4-5 children.
Activity patterns	
Brainstorming	"During brainstorming, teams of children brainstorm upon what to design. At this stage, the surrounding physical and social environment is explored—including objects and people that are encountered in it—to support idea generation" (Giaccardi *et al.*, 2012, p. 4). "Once a digital picture has been taken and printed out in the form of a sticker, children brainstorms on what to perform next. At this point, after a first iteration, ideas are generated and performed in response not only to the surrounding environment but also to the unfolding narrative that participants begin to share" (Giaccardi *et al.*, 2012, p. 4).
Children as experts and teachers	"The girls were tasked with designing a game that would teach younger children how to avoid domestic accidents or to respond to a dangerous situation in the home when this occurs. It was up to them to identify potential dangers and perilous situations" (Giaccardi *et al.*, 2012, p. 4).
Children conducting design and research activities	After brainstorming, "…a scene is collaboratively set (performing) and captured (shooting) through the Polaroid PoGo. Adhesive stickers are instantly printed out (printing) and shared (sharing) as building blocks of the storyboard children are asked to develop to explain their game" (Giaccardi *et al.*, 2012, pp. 3–4).

Exploration	"uses technology as a part of the process to encourage exploration and improvisation in familiar settings" (Giaccardi *et al.*, 2012, p. 1). "This technique encourages exploration and improvisation in settings that are familiar to children by personal experience or close association (e.g., friendship), with the goal to facilitate situated narratives and embodied activities of idea generation" (Giaccardi *et al.*, 2012, p. 1). "Children exhibited different ways of exploring. Three out of the four teams with camera started to explore the setting without preconceived ideas about what the mechanics of the game should be or what kind of dangers they were going to include in the game. Only one team of boys with camera seemed to start off with a more or less clear idea of what the mechanics of their game should be. As a result, their explorations were targeted to identify what dangers could be included in the game they had in mind. In all the cases of teams with camera, however, initial explorations were negotiated and conducted together, whereas in the final stages of the process only a few, designated members of the team were conducting targeted exploratory activities on demand. Equally tasked, team without camera did not explore their surroundings" (Giaccardi *et al.*, 2012, p. 5). Looking around for either specific dangerous items, or being inspired/reminded by finding them as they explored.
Fantasy	Through performativity in design.
Iterative development	"We thought of EN as a rapid and iterative process composed of events that include: (a) brainstorming, (b) performing, (c) shooting, (d) printing, and (e) sharing" (Giaccardi *et al.*, 2012, p. 3).
Reflection	"A final debriefing, in which children were asked to verbalize their experience and give an explanation for critical events and interactions we observed during the activity, was carried out in the living room" (Giaccardi *et al.*, 2012, p. 4). "Within this context, the ready-made objects (e.g., a match, a pair of scissors, the school stairs) that children found in their explorations were used to trigger collaborative reflection-in-action in support of the creative process" (Giaccardi *et al.*, 2012, p. 8).
Teamwork	"Different observations come from the way children were interacting with each other. Even though different teams exhibited different degrees of democratic participation (e.g., was everyone allowed to propose ideas, perform a scene or use the camera?), this did not seem to significantly affect children's engagement. All children participated actively in the design process by spontaneously assuming and exchanging roles in taking photographs, performing scenarios, and adding pictures and captions to the storyboard" (Giaccardi *et al.*, 2012, pp. 4–5). "Children were open to follow instructions from teammates that asked them in a nice way to do something, and in general were willing to openly debate ideas for the game. As commented by children in the debriefing session, this aspect made children feel they contributed their opinion and participated in a fair process, even when a consensus was not achieved. Only in one case, i.e., the team of boys with camera that exhibited clear game mechanics from the start, the individual personality of the team leader seemed to get in the way" (Giaccardi *et al.*, 2012, p. 5).
Communication patterns	
Sensitisation and contextualisation	"the ideas of teams making use of the camera were contextualized with respect to both the domain problem (e.g., emergency preparedness) and the setting (e.g., home or school)" (Giaccardi *et al.*, 2012, p. 8).
Emergent phenomena	
Social experiences	Playfulness, social interactions, expression, creativity. "performances were held in shared spaces. As a result, the actions of each team added to the social setting of children's interactions" (Giaccardi *et al.*, 2012, p. 4). "Social relationships between children added meaning to the activity. Previous, shared experiences with friends and classmates acted as a reminder of dangerous situations: "We were walking along, saw the fence and remembered what the teacher had told us…" For some teams, existing friendship contributed additional fun to the activity. In other instances, the lack of an existing friendship generated novel and personal ways for children to interact, without hindering participation. For example, one of the two mixed groups with camera was composed of three girls, who were friends with each other, and one boy who was not friend with any of the girls. Although the boy never participated verbally in the excited brainstorming of the girls, he found his own way to contribute ideas. He systematically moved away from the girls and called their attention by performing a potentially dangerous action, of which the girls could then take a picture…." (Giaccardi *et al.*, 2012, p. 6).

11.14 Fantasy Narration Workshops

Major source for analysis: (Duh and Chen, 2010)

Theme or Pattern	**Fantasy Narration Workshops** (Duh and Chen, 2010).
Children involved	13 years old.
Goals	
Acceptance of all ideas as worthy of consideration	"Participants were encouraged to be as imaginative and original as possible and were reminded throughout the workshop that there were no pre-defined correct answers" (Duh and Chen, 2010, p. 4).
Diverse data sources	Video and audio recordings of workshop and focus group, children's game narratives, transcripts from focus group.
Provides useful design information	Requirements determined from data.
Maximised children's involvement	Children as informants.
Principles and heuristics	
Appropriate adult design team roles	"A local teacher as well as four experienced game designers moderated the workshop.... The role of the game designer was to simply answer any questions on the relating to the technical areas, such as feasibility of certain ideas and to keep the discussion on track" (Duh and Chen, 2010, p. 4).
Keeping up momentum	"A focus group session was arranged in the next day as participants were visibly tired from the day's activities and would be unable and unwilling to actively contribute to the discussions" (Duh and Chen, 2010, p. 4).
Keeping up momentum between sessions (continuity)	By reflecting on previous day during focus group.
Decision points	
Adequate time Frequent design sessions	"one-day workshop was conducted with a morning tea break and lunch break" (Duh and Chen, 2010, p. 4), followed by focus group discussion the next day.
Low-tech resources	Children encouraged to illustrate their narratives.
Setting and location	School.
Small groups	Large group work (23), work in groups of 5-6, focus group.
Activity patterns	
Brainstorming	As part of sensitisation / contextualisation, with visual prompts, on sticky notes.
Icebreakers	"Ice breaker games were played at the start of the workshop to create a more informal setting" (Duh and Chen, 2010, p. 4).
Children conducting design and research activities	"Participants were then requested to work within their smaller groups to devise an original game narrative, on the subject of 'Global Warming'. They were urged to use a variety of methods such as drawings and coloring to illustrate their ideas better. No criteria were given for the assessment of the game narratives, only that each narrative presented had to include the following four items: 1) Title, 2) Plot Points, 3) Premises and 4) Characters" (Duh and Chen, 2010, p. 4).
Fantasy	"A careful examination of the shared stories and dramatizations that occur during the group discussion exposes participants' perspectives of the specific topics of discussion" (Duh and Chen, 2010, p. 3).
Reflection	"The focus group discussions centered mainly on 3 areas: 1) which elements of the various game narratives did they prefer or dislike and why, 2) what was their previous experiences with educational games and what they thought of it as well as 3) how were the games designed to allowed gamers to learn about the topic, and how prior knowledge was utilized in the creation of such games" (Duh and Chen, 2010, p. 4).
Teamwork	Yes, but not discussed.
Communication patterns	
Presentations	"Each of the four groups then presented their game narratives to the entire workshop" (Duh and Chen, 2010, p. 4).

Sensitisation and contextualisation	"Step 1. Prompting and association of knowledge, where various presentations were used to trigger the prior knowledge of participants" (Duh and Chen, 2010, pp. 3–4). "At the start of the workshop, participants were shown a series of randomly generated images to reflect the topic of 'weather'. Images were shown using a projector at a rough pace of about 30 seconds each, and were displayed onscreen again as requested. Participants were encouraged to write down any thoughts/associations/feelings they might have upon seeing the presented images onto pieces of sticky notes. The materials used during the workshop were not from any weather-related teaching materials. This was to avoid participants restricting themselves to only curriculum-based knowledge. No limitations were placed as to the number of sticky notes used or the ideas. Participants then had to categorize their 'Sticky notes' on the wall, on bigger pieces of paper. They were asked to place their sticky notes on to the same column if the idea express was the same as the first sticky notes and on a different column if the idea expressed in one sticky note was different from the previous one(s). Ensuing participants then added on to existing column or created new columns" (Duh and Chen, 2010, p. 4).
Emergent phenomena	
Moderating distractions	Part of adults' role was keeping children on-track.

11.15 Fictional Inquiry: Mission From Mars

Major source for analysis: (Dindler *et al.*, 2005)

Theme or Pattern	**Mission From Mars** (Dindler *et al.*, 2005)
Children involved	Aged 10-11 years old.
Goals	
Equality between adults and children	No exactly equality, but they used the narrative to break down the barriers between adults and children.
Respect expertise of all participants	Children teaching the Martian about their lives.
Build relationship/trust Icebreakers/transitional activities	"Starting out with an informal introduction we tried to level with the pupils and relate ourselves to them in a different way than if we were teachers. This was accomplished by small-talking around subjects that are important to them, namely soccer, fast food and music. In this way they saw to some extent that we were like them and on common ground, which was a good starting point for introducing the narrative" (Dindler *et al.*, 2005, p. 42).
Motivating and stimulating	"Our experiences indicate, however, that it does not really matter if the test subjects believe in the story or not, because when they get excited over the task they play along. This is the positive thing with a workshop set up where we as designers meet with the children within the game, and where we cooperate towards a common goal" (Dindler *et al.*, 2005, pp. 45–46).
Diverse data sources	Debrief by adult participants, "video obtained from the preparation and broadcast" (Dindler *et al.*, 2005, p. 43).
Provides useful design information	Requirements. "• The everyday life of the future users • The context of the future system, in this case the school context • Social relations and behavior among the future users • The social relations in the context • The use of the existing systems today, in this case the physical school bag • The use and extent of personalization and customization of the context • The use and extent of personalization and customization of personal objects • The use and extent of personalization and customization of the existing system • The future users' attitude to order and sorting • The future users subjective opinion regarding all the things mentioned above" (Dindler *et al.*, 2005, p. 41).
Maximised children's involvement	Children as informants.
Principles and heuristics	
Appropriate adult design team roles	"The workshop leaders were four visible male researchers in their thirties and a fifth invisible female "Martian". There was one researcher per group, and one researcher that helped out where it was needed, and who also wrote/gathered documentation" (Dindler *et al.*, 2005, p. 42). "We had to help translate some of the questions asked by the Martian and could thereby in a legitimate way interpret it in a direction that could give new information that would seem silly or degrading if asked by an adult or researcher outside this temporary narrative context" (Dindler *et al.*, 2005, p. 45).
Keeping up momentum within sessions	Telling a story which allowed for "gaps" between "transmissions", so that children had time to prepare their presentations. Moving around, talking about other areas where other things had been set up. "…not all groups were convinced about the genuineness of the story, but because we could refer to other yet unknown spaces where the narrative would proceed later the focus and interest were kept intact" (Dindler *et al.*, 2005, p. 45).
Decision points	
Adequate time	Single three-hour session.
Physical resources	Children used their own school bags & contents as props for their presentations.
Setting and location	School.
Small groups	Pairs, groups of 3.
Activity patterns	
Children as experts and teachers	"2. Preparing for the encounter with the Martian • The children are divided into three groups. A member of the design team joins each group. • The children prepare what they want to present in the broadcast room. 3. Encountering with the Martian • The groups take turns presenting their material in the broadcast room. The member of the design team located in the other classroom can ask questions to the pupils regarding the material" (Dindler *et al.*, 2005, p. 42).

Fantasy	"We define a shared narrative space as a social constructed environment in which conventional cultural expectations are temporarily bypassed" (Dindler *et al.*, 2005, p. 41). Set up of the presentation rooms & Martian's ability to reply enhanced the fantasy. Children didn't all "buy-in" to the fantasy, but that didn't matter because they were willing to "play along". Martian not visibly represented, only strange voice (which adults needed to translate at times). This helped children to buy-in to the fantasy. "the Mars-method offers an opportunity to the technical developers and designers to engage with the children, establish the necessary level of confidentiality through role-play, and get to the actual requirement for making a design which is meaningful to its users in the context" (Dindler *et al.*, 2005, p. 45).
Teamwork	Working in pairs/groups to prepare presentation.
Communication patterns	
Presentations	To the Martian, prepared by children.
Questioning (in the now)	The Martian questioned the children for more information about their presentations, often with "stupid" questions, "that would be impossible to raise in a conventional setting" (Dindler *et al.*, 2005, p. 46).
Sensitisation and contextualisation	"Establishing the narrative • A member of the design team introduces the story that will provide the frames for the workshop. • The broadcast setup is introduced – the children must present their material in front of the camera" (Dindler *et al.*, 2005, p. 42). Started off setting the scene by "receiving messages" and "translating" them, which explained the Martian's interest to children.
Emergent phenomena	
Social experiences	"The children divided themselves into groups so they worked together with their friend/-s. This was important so they would not be shy in front of each other. The four girls were divided into pairs of two best friends working together. We had planned for four boys to participate, but at the end they were only three, so the three boys worked together as one group. This turned out to be an interesting constellation, since we got a first hand insight into how the children behave towards their best friend but also how they behave to a not so close class mate. The two best friends of the three were more dominant than the third boy, who was much quieter" (Dindler *et al.*, 2005, p. 42).

11.16 The Hanen Therapeutic Approach for Autistic Children

Major source for analysis: (Abdullah and Brereton, 2012)

Theme or Pattern	**The Hanen Approach** (Abdullah and Brereton, 2012)
Children involved	Autistic child, age not given.
Goals	
Equality between adults and children	Within conversation. "Some typical roles adopted by parents tend to stifle interaction. Being too enthusiastic, the parent may become an entertainer or director and unintentionally limit the child's ability to participate. The Hanen method identifies roles that stifle interaction as a means of generating awareness of them and discouraging them" (Abdullah and Brereton, 2012, p. 4).
Acceptance of all ideas as worthy of consideration	Children's choice of topic and communication.
Motivating and stimulating	Through children selecting subject matter. "The iPad was simple enough for this child with ASD to use and they enjoyed taking and reviewing photos" (Abdullah and Brereton, 2012, p. 1).
Appropriate support for ability and communication level	Intended to facilitate communication by accommodating children's communication patterns / preferences. "The Hanen and Greenspan Floortime therapy approaches are part of a social practice of developing speech and language in children with communication difficulties, which focuses upon the children's competences, whatever they may be in order to enable them to take a turn" (Abdullah and Brereton, 2012, p. 4).
Diverse data sources	Photos, video recordings of conversations.
Provides useful design information	Ideation based on children's interests and choice of subject matter.
Maximised children's involvement	Bekker et al. suggest informants, but this seems closer to users. "there seems to be some potential in using video of interactions to promote reflection and discussion between parents, teachers and therapists" (Abdullah and Brereton, 2012, p. 5).
Principles and heuristics	
Appropriate adult design team roles	Parents as interactors. "The parent's role is to elicit interaction" (Abdullah and Brereton, 2012, p. 3).
Specialised adult assistants	Parents' behaviours as interactor here have some similarities to the support assistant role, with the note that they shouldn't be too enthusiastic, etc., or it might put Autistic children off. But they are here to facilitate communication and interaction.
Awareness of non-verbal communication	"Although a parent cannot interpret the child's mind, the parent can ensure a continuous flow of communication by observing their child's body language and noticing where they are looking, reaching or pointing" (Abdullah and Brereton, 2012, p. 3). Interest communicated through: Non-verbal vocalisations, physical touching of photos, interaction with saved photos. Disinterest communicated through: body language, disengaging by physically leaving. "By observing interactions closely parents can notice when the child starts to engage his body gestures, such as pulling and protesting, giving cues to follow his interest. It is encouraging if the parent can tune-in based on the child's interest, needs and abilities" (Abdullah and Brereton, 2012, p. 5).
Be guided by the children	Follow the child's lead for conversation. "parent participation and child led interaction play a significant role in enhancing communication and the development of language skills" (Abdullah and Brereton, 2012, p. 2). "the Hanen approach used in the therapy professions has for many years focussed on showing parents how to let their child lead in the development of their speech in a profound manner" (Abdullah and Brereton, 2012, p. 2). "Even though the child may not be able to conduct a meta- level or reflective narrative to discuss an activity that they have undertaken, the child, by their actions in the moment fully contributes to the interaction, and it is these actions themselves in the context, that guide therapeutic or design interventions. It is the child doing what they do in that situation" (Abdullah and Brereton, 2012, p. 2).
Supported autonomy and children's control	Conversation topics, photography.
Keeping up momentum within sessions	Following child's lead in conversations, taking turns.
Tailoring activities to children's abilities	Photo task chosen because children were already familiar with it from school activities.
Decision points	
High-tech resources	Technological tools: camera/iPad to take photos.
Setting and location	Familiar locations, school and home.

Activity patterns	
Homework	Interactions with parents at home, showing and conversing about photos that the children are interested in.
Communication patterns	
Discussion and conversation	Yes, led by the children.
Facilitating communication	Joint attention. Turn-taking interactions: "In the Hanen method parents are taught to observe, wait and listen to the child's interest as expressed by their turn in order to engage in and enhance the interaction" (Abdullah and Brereton, 2012, p. 5).
Questioning in the now	Limited. "With children with autism, a lot of concentration must be given by a child to process the information from questions, so care must be taken when asking questions in conversation. At early stages of communication, it is important to use short sentences and only one question at a time in order to simplify the amount of information that needs processing" (Abdullah and Brereton, 2012, p. 2).
Emergent phenomena	
Ownership of design sessions	Children initiating conversation about a topic of interest.
Other notes	
Children's non-design learning	Communication?

11.17 Informant Design

Major sources for analysis: (Scaife *et al.*, 1997; Scaife and Rogers, 1999)

Theme or Pattern	**Informant Design** (Scaife *et al.*, 1997; Scaife and Rogers, 1999)
Children involved	Aged 7-11 years.
Goals	
Equality between adults and children	No. "We also do not treat them as equal partners, as we are realistic as to how much they can be involved, since they neither have the time, knowledge or expertise to participate in the collaborative model prescribed in PD approaches" (Scaife *et al.*, 1997, p. 344).
Respect for expertise of all team members	Yes, but with a firm line on what various informants' expertise actually is. "Instead of seeing children either as users or participants, we view them more as (native) informants. Why use the term 'informant'? Clearly it suggests that they are aware of aspects of learning/teaching practices that we are not and which we need to be told of. Sometimes this will concern content as when they tell us what sort of feedback is fun, sometimes it will concern structural aspects, particularly when informing us about what encourages learning" (Scaife *et al.*, 1997, p. 344).
Acceptance of all ideas as worthy of consideration	No. "Weighing up and integrating the different contributions is also an important part of the process and it is unrealistic to take on board everyone's contributions. The design team have to decide how they fit together and whether they fulfill the project's objectives" (Scaife and Rogers, 1999, p. 31).
Build trust Keep situation natural	Not considered, and therefore some children struggled: "not all children are able or willing to be creative designers, or even informants about current practices. The demand characteristics of talking with unfamiliar adults, in a school context, can be a big inhibitor. Several of our informants offered typically short or uninformative contributions" (Scaife *et al.*, 1997, p. 350).
Diverse data sources	Interview records, audio/video, prototypes, critiquing notes. "Phase 1 – Define domain problems" "Children" "Explain difficulties with learning particular topics for identified goals" "Talk with pairs of children in school context with existing materials" "Phase 3 – Design low-tech materials and test" "Children" "Provide insight on building interface and motivational factor" "Design through scenarios, games, etc." "Phase 4 – Design and test hi-tech materials" "Children" "Evaluate interactivity and iterating designs" "learning tasks" (Scaife *et al.*, 1997, p. 345). "Finally we would envisage a phase not shown in the table – the testing of prototypes in a classroom context, as part of a lesson plan" (Scaife *et al.*, 1997, p. 346).
Provides useful design information	Ideation, evaluation: Prototypes, critiquing notes.
Maximised children's involvement	Children (and other relevant groups) are involved as informants at a time when it is most useful to the design team (Scaife and Rogers, 1999).
Principles and heuristics	
Appropriate adult design team roles	"multidisciplinary design team" (Scaife and Rogers, 1999, p. 28). Adults making decisions about relevance of children's involvement / suggestions. Low-tech prototyping & idea elicitation sessions: "The facilitator encouraged them to use the low-tech materials that they had been working with in the previous exercises. Typically each pair of children would talk for anywhere between ten and twenty minutes about their ideas, which we recorded on audio or video tape. The children would often talk extensively without prompting but if they seemed to be stuck the facilitator would ask about the consequences of the imaginary user behaving in a certain way, e.g. making incorrect links in the food chain. At the end the facilitator asked for suggestions about special effects, such as noises made during eating. Throughout the session the emphasis was on eliciting as many suggestions for animations as possible while minimizing input from the facilitator" (Scaife *et al.*, 1997, p. 348). "…it is hard for the facilitator to judge when to intervene to revive a flagging discussion: too soon or too often and the situation can become overbearing, with children possibly feeling that their contributions are not being listened to" (Scaife *et al.*, 1997, p. 350).
Be guided by the children	In the design of technology, not within sessions. "children are very good at expressing what motivates them in a learning context" (Scaife and Rogers, 1999, p. 31). "We also need to recognise, however, that children cannot design their own learning goals" (Scaife *et al.*, 1997, p. 344).
Decision points	

Low-tech materials	Limited & relevant, designed after problem defined, to ensure relevance (Scaife *et al.*, 1997). Constrained design: Not explicitly described as such. Giving children specific materials helped them focus & encouraged creativity by freeing them from hang ups of making things look "just right".
Setting and location	Schools.
Small groups	Pairs.
Activity patterns	
Children as experts and teachers	Designing a game to teach children younger than themselves (Scaife and Rogers, 1999).
Critiquing and evaluation	By children, of existing technologies (Scaife *et al.*, 1997, p. 348) and suggestions / contributions of other children (Scaife *et al.*, 1997, p. 350).
Prototype critiquing	Yes, children evaluating hi-tech prototypes (Scaife *et al.*, 1997).
Fantasy	Storytelling/enactment to explain prototype (Scaife and Rogers, 1999).
Iterative development	Of hi-tech prototypes, with children evaluating (Scaife *et al.*, 1997).
Prototype creation	"Our approach is to blend different low-tech and hi-tech methods that work in parallel whilst also informing each other" (Scaife *et al.*, 1997, p. 344). Low-tech prototyping: "A main finding is that the majority of children have absolutely no problem in using the paper materials to simulate an interactive game. They do this easily, providing animations, special effects, sounds and feedback with little or no prompting. Their animations were clearly understandable, mocking-up the kinds of interactions between creatures in the pond that they thought appealing. They had ideas about design at all levels, from the highly specific to the abstract" (Scaife *et al.*, 1997, p. 348).
Communication patterns	
Discussion and conversation	Interviews.
Sensitisation and contextualisation	Before children build low-tech prototyping, as part of explanation.
Visibility of end users	Telling informant children to think about making software to teach younger children.
Emergent phenomena	
Moderating distractions	See low-tech materials.
Social experiences	Working in pairs helps children be involved as designers.

11.18 Instructional Software Design Project – Solo Child Software Designers

Major sources for analysis: (Harel and Papert, 1990; Harel, 1991)

Theme or Pattern	**Children as Solo Designers** (Harel and Papert, 1990; Harel, 1991)
Children involved	Aged 9-10.
Goals	
Equality between adults and children	Not discussed, but seems to have been demonstrated in interactions between adults and children.
Respect expertise of all participants	See "children as teachers / experts", children giving training.
Collaboration between adults and children	Children inspiring each other: after one child realised it was important to teach that fractions were in the real world, other children followed her lead (Harel and Papert, 1990, p. 18). Children consulted and collaborated with each other and adults as they wished.
Motivating and stimulating	See "ownership". Children discussed feeling like they were doing something to educate younger children, needing to find ways to explain it.
Diverse data sources	Formal interviews before and after design session series, observations by researcher and teacher, video, notebooks, finished and in-progress programs
Provides useful design information	Ideation, evaluation: Programmed products.
Maximised children's involvement	Children as software designers.
Principles and heuristics	
Appropriate adult design team roles	Teacher and researcher "walked around among the students, sat next to them, looked at their programs, helped them when asked for, and discussed with them their designs, programming, and problems in a friendly and informal way" (Harel and Papert, 1990, p. 5).
Be guided by the children	Children guided training topics.
Flexibility	Training, topics and timing.
Continuity between sessions	Writing in and re-reading notebooks provided continuity between sessions.
Keeping up momentum within sessions	Not a consideration. Children were able to switch as they wished between "periods of intense concentration" and "periods in which students' attention is elsewhere: sometimes looking at a neighbour's work, sometimes engaged in play, chatting, and interactions that have no discernible connection with the project" (Harel and Papert, 1990, p. 20).
Supported autonomy and children's control	Adults supported children's activities towards design aims. Children were not forced to work towards design aims, although they were forced to "spend a specific amount of time at the computer each day" (Harel and Papert, 1990, p. 4).
Decision points	
Adequate time Frequent design sessions	Four hours per week over a period of 15 weeks.
High-tech resources	Technological tools: computers, programming.
Setting / location	School IT labs.
Activity patterns	
Brainstorming	Not discussed. Undertaken by individual children.
Children as experts and teachers	Teaching "something about fractions" to a target audience a year younger than themselves. Children would teach each other in focus sessions.
Children conducting design and research activities	Designing and building programs.
(Prototype) critiquing and evaluation	Children and adults critiquing each other's work and ideas.
Iterative development	Likely, with the way children worked, but not discussed.
Designer journals	Children kept designer notebooks where they wrote down plans, difficulties encountered, changes made, lessons learned.
Reflection	In notebooks, on changes, challenges, lessons learned, plans, etc.
Training children to facilitate involvement	"Several "Focus Sessions" about software design, Logo programming, and fraction represention [sic] were conducted in the classroom during the project" (Harel and Papert, 1990, p. 4) on an as-needed basis.
Communication patterns	
Discussion or conversation	Between adults and children, informally and at will. Interviews.
Presentations	Informal presentations, children looking at and discussing each other's work.
Sensitisation or contextualisation	Pre-test and interviews about fractions, teaching and discussing fractions during focus sessions.
Visibility of end users	End user testing sessions, with feedback.
Emergent phenomena	

Minimising distractions	Distractions weren't minimised at all. Children were able to switch as they wished between "periods of intense concentration" and "periods in which students' attention is elsewhere: sometimes looking at a neighbour's work, sometimes engaged in play, chatting, and interactions that have no discernible connection with the project" (Harel and Papert, 1990, p. 20).
Ownership of product / ownership of design sessions	A "shift from a reluctant, impersonal, and mechanical mode of working to a growing personal engagement, assertive individuality, and creativity" (Harel and Papert, 1990, p. 19).
Social experiences	Children's informal interactions with other children and adults.
Other notes	
Children's non-design learning	LOGO, resilience, problem solving, fractions, teaching, considering other's needs, etc.

11.19 Interviewing Children in the Home Setting

Major source for analysis: (Coad *et al.*, 2015)

Theme or Pattern	**Interviewing children in the home setting** (Coad *et al.*, 2015)
Children involved	Details not given.
Goals	
Equality between adults and children	Power imbalance: Children likely to see researchers as authority figures. Encouraging children's curiosity about the researcher can help to equalise relationship. Negotiating with children re: level of involvement, even if parents eager for child to be involved; respecting if child is uninterested/unwilling.
Building relationships and trust	**Before interviews/project:** Importance of building a rapport from recruitment phase – influences success of interview. Requires communicating about research in a way that supports children's understanding & ability to consent. Proving to child and parent that researcher is trustworthy & child will be safe. Pre-interview visits can help to build rapport & familiarity, but can also be burdensome on family. Initial introductions: relaxed, friendly manner, first name, brief professional history. Use child's preferred name. Answer questions about research and self ("appropriate personal questions" (Coad *et al.*, 2015, p. 437)) **During interviews/project:** Long-term interactions build up relationships, friendships. Research involvement may be a drain, especially for children who are ill. **At the end:** Exiting the child's home with sensitivity at the end of an interview or study. "In terms of safe transition, this is what therapists call the termination phase and is about being respectful, engaging and participatory in the final phase of the process." (Coad *et al.*, 2015, p. 438). Transitional process, respecting "feelings, experiences, expectations of the child as well as" (Coad *et al.*, 2015, p. 438) those of the researcher. Exit has to be negotiated per project/child/family. Within a family, may be different desires for end/continued contact between parent and child. Continued contact possible; depends on relationship, desires of family. Should be guided by children and families.
Motivating and stimulating for children	Altruism: wanting to make things better for other sick children, wanting to help researchers.
Principles and heuristics	
Flexibility	Need flexible interview structure.
Appropriate adult design team roles Parents	Presence of parents can limit children's contribution, but "parents can also act in a valuable support role, helping children to contextualise their contribution" (Coad *et al.*, 2015, p. 435).
Be aware of non-verbal communication	Researcher needs to be able to recognise anxiety/distress/unwillingness, which may be communicated non-verbally.
Designers familiarising themselves with children's culture	Getting to know the children, what is important to them?
Support and be guided by children's autonomy	Very useful in icebreakers, rapport building.
Decision points	
Setting and location	Home: Familiar for child, but has ethical dilemmas (confidentiality & privacy, conventions of being a guest to both child and parent/s/carer/s). In theory maximises child's control over situation, but "the home is shared with many other people; parents, siblings and friends can drift in and out, or even stay within the interview space, and may influence the child's willingness to talk." (Coad *et al.*, 2015, p. 436). Safe environment matters. Location does not negate power relationships – *may* mediate them. Home environment requires researchers be "good guests" (Coad *et al.*, 2015, p. 440).
Adequate time	Sufficient time required. Extra time required for "getting to know" the children, building rapport.
Activity patterns	
Children conducting design and research activities	Involved in recruitment & research design as co-researchers/advisors.
Icebreakers	Getting to know the children.

Communication patterns	
Discussion and conversation	Interviews.

11.20 KidReporter

Major source for analysis: (Bekker *et al.*, 2003)

Theme or Pattern	**KidReporter** (Bekker *et al.*, 2003)
Children involved	Aged 9-10 years.
Goals	
Motivating and stimulating	Stated goal, because "They should get something out of it as well." (Bekker *et al.*, 2003, p. 188). "The assistants, and in some cases the teacher, provided an important source of motivation by giving a good introduction to the activities" (Bekker *et al.*, 2003, p. 195). Photos were expected to be a motivating activity on their own. "The children were very capable of making their own sets of questions. This helped them to determine what story they wanted to tell" (Bekker *et al.*, 2003, p. 197). Children wanted to use the recording technology, so much so that it sometimes distracted them from the actual interviews. Children very motivated by article writing – possibly because they were going to be made into a newspaper, possibly because they just enjoyed writing the articles. Questionnaires: "Since, it was the last activity of the day, they provided with extra motivated to fill it in by being promised a sweet when they handed in the questionnaire" (Bekker *et al.*, 2003, p. 197). "It is unclear whether the motivation to participate is a result of the motivating environment, the zoo, or the interesting activities. It really depends on choosing an inspiring environment, and phrasing concrete enough tasks for the children to contribute to the newspaper on a related topic" (Bekker *et al.*, 2003, p. 201).
Adequate support for abilities and communication level	Stated goal: "It should be suitable for children's reading and writing level. Children differ in how quickly they develop these skills, and have different preferences for expressing themselves verbally or through drawings" (Bekker *et al.*, 2003, p. 188). "The original specification of the method stated that it would be suitable for children of six years and older. Special care should be taken to phrase the tasks clearly for a particular age group, taking into account their vocabulary, grammar and reasoning skills. In general, the planning of activities should be checked for being suitable for the age group involved" (Bekker *et al.*, 2003, p. 200).
Diverse data sources	Stated goal: "Combining diverse data sources should optimise the quality of the data. With adults, but possibly more so with children, it is important to check for consistency of answers, by gathering similar information from different sources. For example, using various methods such as interviews, observations and diary methods" (Bekker *et al.*, 2003, p. 188). "The combined KidReporter method provided the children with various media, apart from a verbal medium, to express their opinion" (Bekker *et al.*, 2003, p. 195).
Provides useful design information	Problem definition, requirements, ideation: "Finally, the technique should result in useful information for the designer of the educational game" (Bekker *et al.*, 2003, p. 188). "The content of the newspaper, created using the KidReporter method, is intended to infer user requirements for a specific product" (Bekker *et al.*, 2003, p. 189). "The results from the various sub methods made it easier to understand the information provided by the children. Unexpectedly, the fact that the children were asked their opinion in different ways helped them determine the purpose of the questions, and thus their decision-making process of what answer to give. For example, the fact that children were asked to look around the zoo and to take a picture of an animal that they were really interested in, helped them think about why they had actually chosen that animal. Furthermore, being allowed to make up their own questions for parts of the interviews allowed them to tell the story they wanted to tell. A drawback was the technology used for gathering the data, which sometimes distracted the children from the actual information gathering activities. This, however, was managed by the supervisors helping the children to keep on track" (Bekker *et al.*, 2003, p. 195). "The designer conducted the user study to get more detailed information necessary to make design decisions relating to the animals that were where most interesting, the games (in-house games, outside activities, and electronic games) the children preferred, navigation skills, vocabulary, grammar, and possible gender differences in their preferences and skills. The feedback from the children provided the designer with insights into what kind of animals, and what kinds of topics children of this age group are generally interested in. They are more interested in animals that are cute or have a strange appearance or ability (e.g. very fast, very big, very dangerous). They are interested in all sorts of topics related to animals, such as territories and reproduction, but do not seem to prefer anything in particular. From the questionnaire, the designer was able to determine what kind of game elements, such as competition, creativity, sports and social aspects, were appealing to boys

	and which to girls. The questionnaire also shows that games with many different elements were preferred rather than games with fewer elements. Based on some observations, and the description provided with the photo's it was clear that children of this age group are not yet capable to do map reading, but manage to navigate through the zoo by asking adults and using the signposts. The designer also got a good impression of the kind of vocabulary and grammar that the children used, which informs the way that the information will be presented in the educational game. Finally, the designer also learned a lot about gender differences: what different aspects of games boys and girls prefer, and that there are some differences in the verbal skills of boys and girls. In summary, the information helped the designer determine requirements for the topics and animals that should be covered by the educational game, what kind of game would be appealing for both boys and girls, and ideas about how the educational part of the EEIG [electronic educational interactive game] might be embedded. Furthermore, knowledge about verbal and reasoning skills of this age group and ideas for supporting the children navigating through the zoo was acquired. As expected it was found that while some of the information was similar to that found in the literature, a large part of the information, such as preference for animals, vocabulary and grammar use, has turned out to much more detailed than the literature, thus allowing to make more informed decisions in the design process" (Bekker *et al.*, 2003, pp. 198–199). "Based on our findings, the fact that children could choose between different activities and worked with different media, and in some cases combined different activities contributed positively to the quality of their input. However, the results also show that many aspects of the actual implementation of the method can have a major impact on the outcome of the method. For example, because children were so interested in taking pictures, they took less time in writing the descriptions of the pictures. This in turn may have influenced the quality of this material" (Bekker *et al.*, 2003, pp. 200–201). "The requirements gathered with the method focussed mostly on domain related issues, and not on implementation platform issues" (Bekker *et al.*, 2003, p. 201).
Maximised children's involvement	Children as informants.
Principles and heuristics	
Appropriate adult design team roles	introducing activity, assisting children, keeping children on track. Children "only asked the adults for information in a limited number of cases.... the general impression was that the children mostly asked or received feedback from the supervisors about the procedures of the design activities and not about the content of the information to be provided" (Bekker *et al.*, 2003, pp. 195–196).
Decision points	
Adequate time	Ran out of time for children to write articles.
Physical resources High-tech resources	"Taking pictures and writing argumentations about why the picture was taken and what was interesting or appealing about the content of the picture" (Bekker *et al.*, 2003, p. 3). Cameras, audio recorders for interviews.
Setting and location	At a zoo / "On-location". "As expected the children felt comfortable participating in the various activities in the inspiring location of a zoo, and provided more detailed information than when the designer asked the information from the children separately (Bekker *et al.*, 2003, p. 195).
Small groups	Up to 3 per group.
Activity patterns	
Children as experts and teachers	Writing newspapers to inform other children.
Children conducting design and research activities	"Article writing, in which a limited number of children would have the opportunity to provide a more detailed story about a topic they were interested in. The article would provide an opportunity for children interested in providing detailed information about one topic, as opposed to more global information about a number of topics. Interviewing, in which pairs of children developed a list of questions intended to elicit information about what interested them in a zoo, and providing them with the opportunity to tell their story. Article writing, in which a limited number of children would have the opportunity to provide a more detailed story about a topic they were interested in. The article would provide an opportunity for children interested in providing detailed information about one topic, as opposed to more global information about a number of topics" (Bekker *et al.*, 2003, p. 189).
Homework	"The article writing did not go completely as planned. Although the children were very motivated and handed in the articles at the end, too little time was planned for this activity. As a consequence, some groups took their assignment home, and it took the designer some effort to get the children to hand the article in at a later stage" (Bekker *et al.*, 2003, p. 197).
Training children to facilitate involvement	"When the methods would be applied to a domain about which children have less knowledge, than it is likely that extra activities should be planned, to first provide them with enough knowledge to enable them to contribute to the making of the newspaper" (Bekker *et al.*, 2003, p. 201).
Communication patterns	

Discussion and conversation	"Interviewing, in which pairs of children developed a list of questions intended to elicit information about what interested them in a zoo, and providing them with the opportunity to tell their story" (Bekker *et al.*, 2003, p. 189). Tape recorder, to record the answers to the questions.
Sensitisation and contextualisation	"The children received an introduction from the designer about the purpose of all the activities. She explained that they would be helping her to make a product, and that in return the children would receive the outcome of their activities in the form of a newspaper" (Bekker *et al.*, 2003, p. 189). Children "were asked to be reporters, and to help gather information that they thought would be interesting to other children. After a short introduction, the children could choose which of the three roles they preferred to take: photographer, reporter or article writer. All children were asked to fill in a questionnaire at the end of the session" (Bekker *et al.*, 2003, p. 191).
Emergent phenomena	
Moderating distractions	Children got distracted in recording technology. "This, however, was managed by the supervisors helping the children to keep on track" (Bekker *et al.*, 2003, p. 195).
Social experiences	When taking photos.
Other notes	
Survey / questionnaire	"Filling in a questionnaire. The children had the least influence on the content of the questionnaire. This was a more controlled medium to elicit similar information from all children, as opposed to diverse information from separate groups of children" (Bekker *et al.*, 2003, p. 189). "The questionnaires were filled in by 50 of the 63 children. Since, it was the last activity of the day, they provided with extra motivated to fill it in by being promised a sweet when they handed in the questionnaire. Most questions were understood correctly, and provided useful information for the designer." (Bekker *et al.*, 2003, p. 197).

11.21 KidsTeam Libraries

Main sources for analysis: (Yip and Lee, 2019)

Theme or Pattern	**KidsTeam Libraries** (Yip and Lee, 2019)
Children involved	7-11, ethnically diverse.
Goals	
Equality between children and adults	As goal of Cooperative Inquiry approach. Librarians and children interacting as co-learners. Librarians struggled somewhat, as their normal role involves providing answers, where codesign requires partnership.
Building relationships and trust	A priority. Developed by long-term interactions.
Collaboration or elaboration	Big Paper. As goal of Cooperative Inquiry approach. "Being codesigners means that the librarian needs to toss the ideas back and forth by asking critical questions of whether such design will play the intended role or adults suggesting and adding on to the idea." (Yip and Lee, 2019, sec. Children as Codesigners Compared to Children as Users).
Diverse data sources	Video recording, photographs of sessions. Journal reflections & memos. Interview with librarian involved. Discussion of results at end of sessions. Empathy, ideation, definition, testing, evaluation.
Maximising children's involvement	Design partners.
Principles and heuristics	
Flexibility	Children do unexpected things, but can be learning opportunity for child and adult design team members.
Decision points	
Setting / location	Public library: informal learning spaces.
Design team size	10 children + university students, professors, librarians.
Physical resources Low-tech resources	Low-tech prototyping, sticky note critiquing, big paper.
Adequate time	6 sessions.
Activity patterns	
Prototype creation Low-tech prototyping	Low-tech prototyping.
Critiquing or evaluating	Sticky note critiquing. Evaluating existing technologies.
Reflection	Researcher journal reflections & memos. Interview with librarian involved. Discussion of results at end of sessions.
Communication patterns	
Discussion and conversation	Interview with librarian involved.
Visibility of end users	Helps librarians build empathy towards children.

11.22 MESS Days + School-Based Design and Evaluation

Main sources for analysis: (Read *et al.*, 2006; Read, 2011, 2015)

Theme or Pattern	**MESS (Mad Evaluation Sessions with Schoolchildren) Days** (Read, 2011)
Children involved	3-16.
Goals	
Building relationships and trust	Explaining research & related concepts to children in a way they can understand, including motivations in terms of publishing, funding, etc.
Motivating and stimulating for children	Part of stated philosophy of designing with children: "that it will be messy, that it should be inclusive, that it should be fun, and that it should be fast paced and constantly refreshing." (Read, 2011, sec. MESS Days).
Diverse data sources	Requirements, paper prototypes, evaluations, children's ideas. Designs presented primarily as drawings.
Maximising children's involvement	No – emphasis is on children's involvement being useful for programmers / development teams.
Decision points	
Design team size	"whole school class" (Read, 2011, sec. MESS Days). Small groups of children selected for specific activities (Read *et al.*, 2006).
Adequate time	"anything between an hour and all day, depending on the work being done" (Read, 2011, sec. MESS Days).
Setting / location	MESS Days: University labs. School-based activities: Schools – includes considerations of how to work with schools, building relationships with schools, etc.
Physical resources Low-tech resources	"paper and cards, pipe cleaners, glue, and other prototyping items" (Read, 2011, sec. Design: Obstructed Theatre).
Activity patterns	
Critiquing or evaluating	Activities include evaluations of products. Fun Toolkit: tools for evaluating with children.
Prototype creation Low-tech prototyping	Paper prototyping.
Communication patterns	
Sensitisation or contextualisation	Obstructed Theatre: actors talk about and interact with an unknown technology without ever showing it, to demonstrate "key requirements for the product to be designed without giving anything away about how it should look" (Read, 2011, sec. Design: Obstructed Theatre).
Visibility of end users	For programming team: "A turning point in the design space was when the software programming team came face-to-face with children users for a prototype product exercise in the UK. More than any of our other communications, this event really made the users come alive for the development team. They came to realize that the children were not simply smaller users." (Read, 2011, sec. Children: Not Simply Smaller Users).
Emergent phenomena	
Children's ownership of product or project	Children "adding their own uniqueness to the prototypes (for example, making icons, adding music, and titles)" (Read, 2011, sec. Including Children in Real Projects).

11.23 Online Survey for Gathering Children's Preferences

Major sources for analysis: (Allsop *et al.*, 2010, 2011)

Theme or Pattern	**Online Survey for Gathering Children's Preferences** (Allsop *et al.*, 2010, 2011)
Children involved	Range of ability levels, 4-12 years old. "The prevalence of medical disorders included CP (N¼11), varying levels of deafness (N¼7), global development delay (N¼2) and Down's syndrome (N¼1)" (Allsop *et al.*, 2011, p. 151).
Goals	
Acceptance of all ideas as worthy of consideration	Children were not offering ideas.
Motivating and stimulating	Support assistants helped with this for students with disabilities. Not discussed for children without disabilities. Children were told that their participation would "help to design better assistive devices" and help other children (Allsop *et al.*, 2011, p. 152).
Adequate support for abilities and communication level	Physical accommodations, support assistants. "All children were able to complete the tasks from the survey, although children with disabilities had higher completion times and most required a form of assistance from support assistants and/or sign language interpreters." (Allsop *et al.*, 2011, p. 148). Attempted to build it into the survey, but found that some children still struggled with e.g. understanding the questions without added adult assistance.
Diverse data sources	Survey responses.
Provides useful design information	Evaluation, ideation.
Maximised children's involvement	Children as informants
Principles and heuristics	
Appropriate adult design team roles	"Researchers and SA's [sic] [Support Assistants] were available to help any children who indicated that they required support during login and completion of the tasks" (Allsop *et al.*, 2011, p. 151).
Specialised adult assistants	"Most children with disabilities required some level of assistance to complete the survey. All children with profound deafness required a sign language interpreter (SLI) to translate verbal instructions throughout the login process. Once logged in, SLI's [sic] were still available to answer any questions, however they were only needed by a subset of children with hearing impairments: (i) those with additional learning difficulties, or (ii) younger children (4–6 years old) who required help with general language comprehension. Because these children were unable to hear the audio file instructions they lacked the alternative assistance embedded within the interface that was available to the other children. Children with hearing impairments in the higher age categories (7–11 years old) rarely presented any questions to the researchers or SLI's [sic] and, once logged in, completed the task without difficulty. A limiting factor for a small number of the children with disabilities was language comprehension. The children who participated with genetic disorders such as Down's syndrome or global learning delay often had an SA in place because of other language comprehension difficulties that occurred in their day- to-day education. As such, the SA's [sic] continued their role in explaining any aspects of the tasks to the children. The majority of the time this consisted of reading the text aloud, and where necessary, explaining the instructions in more detail. Although this may have influenced a child's interpretation of the survey, it supported the aim of gathering the children's preferences. Although audio files were available to verbalise the instructions for the children, researchers highlighted in post-trial meetings that children with comprehension difficulties re- ported that the audio files were often too fast" (Allsop *et al.*, 2011, p. 153). "The assistance of SA's [sic] was often very vocal and involved, and they would try to motivate the child to complete the survey. Individualised methods were often adopted to provide support to children with learning difficulties. In most cases, the SA would read questions aloud to the child, and ensure that they worked through the task in a similar manner to their regular work rate. Although SA's [sic] did not suggest responses to questions, they often discussed and described available options, and this may have altered the experience of the survey for these children" (Allsop *et al.*, 2011, p. 153). "There are also issues with relying on the school-based assistants to aid completion of the survey, and the resultant effect that their assistance may have on a child's interpretation of the surveys content" (Allsop *et al.*, 2011, p. 154).

Tailor activities to children's abilities	Survey made according to basic accessibility principles, and tailored according to adult expert advice. "A wider problem to address is the communication requirements of children with hearing impairments and learning difficulties. Children with deafness often have lower average reading comprehension scores than children without [21], so it is crucial to improve the accessibility for these children and remove the necessity for an SLI. It is possible that video-based sign-language instruction would have been a useful addition for these individuals" (Allsop *et al.*, 2011, p. 154).
Decision points	
Adequate time Frequent design sessions	For children to complete survey. "Despite the available assistance, children with disabilities took approximately twice as long to complete the survey, with large differences in their response times. Care needs to be taken when working in groups to ensure that there is no stigma attached to requiring longer to complete the survey" (Allsop *et al.*, 2011, p. 154).
Setting and location	"normal school environment" (Allsop *et al.*, 2011, p. 148).
Activity patterns	
Critiquing and evaluation	Prototype critiquing: Through survey. This seems like a weak example, though, because children only got to look at pictures, not test out the various joysticks.
Communication patterns	
Sensitisation and contextualisation	Before beginning survey, "brief discussion of disability and rehabilitation" (Allsop *et al.*, 2011, p. 152).
Other notes	
Survey / questionnaire	Yes.

11.24 Participatory Design with Rural School Children in Underdeveloped Regions

Major source for analysis: (Kam *et al.*, 2006)

Theme or Pattern	**Participatory design with rural school children in underdeveloped regions** (Kam *et al.*, 2006)
Children involved	10-16 year old primary school children in rural, underdeveloped regions of India (Uttar Pradesh). High-achieving students selected by school principal.
Goals	
Equality between adults and children	Child participants paid with US$20 worth of stationery. Child facilitators paid with certificates of participation and US$10 books. Presence of teachers & principal as observers made children nervous; teachers & principal asked to leave.
Build relationship/trust	Researchers report successful rapport building. Local facilitators helped build partnership. Spontaneous interactions between children and child facilitators.
Motivating and stimulating	Awarding participants stars for attendance. Computer use.
Adequate support for abilities and communication level	Researchers(?) and/or facilitators(?) used high-tech prototyping tools for children.
Diverse data sources	Video recordings of reflective interviews with local facilitators. Video recordings of children doing design activities. Low-tech prototypes. High-tech prototypes. Questionnaire interviews with children and facilitators – children interviewed with help of new interpreters. Post-workshop review by researchers.
Provides useful design information	Time constraints and high chance of student drop-out, so decided to "focus less on polishing up the prototypes and more on generating design ideas." (Kam *et al.*, 2006, p. 27).
Maximised children's involvement	Between partner ("full partners in the spirit of "participatory project planning" that several community development practitioners subscribe to" (Kam *et al.*, 2006, p. 25)) and informants (concerns about "limited resources (e.g. time and children's knowledge) to build the ideal design partnership with rural students" (Kam *et al.*, 2006, p. 25)).
Principles and heuristics	
Tailor activities to children's abilities	School children chosen specifically because minimum literacy levels were required.
Designers familiarising themselves with culture	All researchers had previous experience working "with children from the rural schools and urban slums in Uttar Pradesh" (Kam *et al.*, 2006, p. 26). Local researcher with relevant experience involved. "organizers of a PD workshop with rural school children could build a more equal design partnership by displaying a genuine interest to learn more about the local culture and language." (Kam *et al.*, 2006, p. 30). Local adult facilitators helped guide researchers in how to be more appropriate in interactions with school staff & parents. Researchers needed to build trust with community: school staff, local facilitators, parents.
Appropriate adult design team roles Interpreters Older children as intermediaries	Local adult and child facilitators/interpreters: Child facilitators asked to wear school uniforms to workshop, "to help participants identify with child facilitators" (Kam *et al.*, 2006, p. 27). Child facilitators tended to teach more than facilitate; but also had more spontaneous and "moral support" interactions with children – increased children's confidence during design activities.
Interpreters	Communication throughout design sessions in Hindi. Researchers relied on local facilitators as interpreters.
Flexibility	Moved away from brainstorming/low-tech prototyping because it frustrated the children, and back to high-tech prototyping because it interested the children.
Decision points	
Setting and location	Rural primary school - Working with a school with which researchers had an existing relationship. Held in afternoons, after classes, to avoid disrupting classes. Choice of location influenced by: • Support of school staff & long-term relationship existing • Sufficient indoor space • Enough students could travel to the school without design team needing to provide transportation.

Adequate time Frequent design sessions	Two-week PD workshop. "Every afternoon lasted 2.5-3 hours. This timeframe was a major consideration: a longer workshop would ensure a more productive design relationship, but our findings from earlier fieldwork about irregular school attendance implied that any commitment exceeding 2 weeks would make it difficult to obtain parental consent for enough children to participate." (Kam *et al.*, 2006, p. 27).
Small groups	12 participants broken into 4 groups of 3.
Physical resources	Tablet computers, which children wanted to use. Locally available stationery & inexpensive materials.
Activity patterns	
Teamwork	Randomly assigned participants & facilitators to groups.
Training children to facilitate involvement Sensitisation/contextualisation	Warm up phase to get children "up to speed" with computer practice/confidence, engage creativity, allow researchers to understand children's computing behaviour, sensitise children to educational video games, and get children used to workshop routine.
Icebreaker	At start of each afternoon. Especially important with new groups assigned at start of each phase.
Homework and probes	Cameras sent home overnight/weekend on rotating basis, as cultural probe.
Brainstorming Low-tech prototyping	Children struggled with brainstorming and low-tech prototyping, found it frustrating, "difficult to come up with initial ideas and to iterate on their initial designs" (Kam *et al.*, 2006, p. 30). Could not seem to make connection between low-tech prototyping and functionality of software; by comparison, picked up very quickly how to use elements of software in high-tech prototyping.
High-tech prototyping	Prototyping tool was more complex than programs the children were used to, even with examples. Children preferred high-tech prototyping, showed pride in the prototypes created. Augmented with paper prototyping when children had technical difficulties with prototyping software.
Iterative development	Children encouraged to iterate on prototypes.
Communication patterns	
Sensitisation/contextualisation	Exposing children to educational video games.
Possibility demonstration	Example simulations to demonstrate usage of high-tech prototyping tool.
Discussion and conversation	Discussions about prototypes to encourage iteration. Interview at end of project.
Emergent phenomena	
Ownership of design artefacts	Over high-tech prototypes.
Other notes	
Children's non-design learning	English, computer skills. Finished each session with a daily review, so children could "report back" to parents about what they were learning.

11.25 Requirements Elicitation Prototyping with Deaf children

Major sources for analysis: (Korte, 2012; Potter, Korte and Nielsen, 2014; Korte, Potter and Nielsen, 2015)

Theme or Pattern	**Requirements Elicitation with Deaf Children** (Korte, 2012; Potter, Korte and Nielsen, 2014; Korte, Potter and Nielsen, 2015)
Children involved	Deaf, 7 years old.
Goals	
Respect for expertise of all participants	For expertise as children, with games, and in life.
Acceptance of all ideas as worthy of consideration	All of children's suggestions were considered, but not all were enacted, especially within time limits of project.
Build relationship/trust	Mainly through time and demonstrating that the children's suggestions had meaning. Very nervous during early sessions (demonstrated non-verbally) → children who trusted adult designer and were familiar with the design sessions got excited about the sessions. Promoted communication from Deaf children.
Motivating and stimulating	Initially, the promise of playing a game. Once they knew the impact of their suggestions, motivated.
Adequate support for abilities and communication level	Children communicated in a mixture of Auslan and English, according to their comfort and preferences. Interpreter (member of school staff) to assist with signing.
Diverse data sources	Observer notes, participant comments, debrief notes.
Provides useful design information	Evaluation and ideation.
Maximised children's involvement	Children as informants.
Principles and heuristics	
Appropriate adult design team roles	Observer, interpreter (who offered suggestions when the kids were stuck / nervous).
Awareness of non-verbal communication	Hugely important. Lots of information here. Relied on body language and expressions for feedback during early prototype evaluation sessions.
Be guided by the children	Yes.
Keep situation natural	Design sessions quickly became natural. Difficulties encountered during design sessions, especially technical difficulties, which adult designer was expected to fix.
Designers familiarising themselves with culture	Deaf culture.
Flexibility	Required for adapting to unexpected behaviours.
Interpreters and support assistants	Yes. Children didn't sign a lot, interpreters somewhere between interpreter and support assistant. Would sign to children, prompt them to sign. Children rarely signed unless prompted.
Tailor activities to children's abilities	Gestural Think-Aloud Protocol (Roberts and Fels, 2006) instead of Think-Aloud Protocol.
Decision points	
Adequate time Frequent design sessions	Weekly.
Setting and location	School.
Small groups	One boy for pilot; Pair of boys for majority of study.
Activity patterns	
Critiquing and evaluation Prototype critiquing	Yes, mostly high tech, some low-tech.
Iterative development	Yes, and the children loved it.
Communication patterns	
Novelty and surprise	Changes to prototype usually provoked reactions.
Questioning in the now	As part of prototype testing.
Emergent phenomena	
Peer tutoring	Spontaneous.
Moderating distractions	Seating within room chosen on this basis.
Ownership of product	Through children seeing their suggestions having an impact.
Social experiences	The 2 boys weren't close when the sessions started, but they had fun together during sessions. Showing off parts of the prototype they liked to each other.
Other notes	
Surveys	Demographic data, from parents.

Children's non-design learning	Auslan/communication, confidence (maybe). Children learnt by watching and discussing the prototype with each other.

11.26 SID For Snoezelen

Major source for analysis: (Larsen and Hedvall, 2012)

Theme or Pattern	**SID for Snoezelen** (Larsen and Hedvall, 2012)
Children involved	Children with a communication gap, 6 to 16 years old.
Goals	
Acceptance	Focus on ability rather than disability is all about observing and accepting the way children interact with technologies.
Motivating and stimulating	That is the point of Snoezelen.
Adequate support for abilities and communication levels	That is the point of Snoezelen. Children are not expected to provide explicit communication.
Diverse data sources	Video.
Design information	Ideation: "It is the long-term designerly dialogue with the practice around the design artefacts – and herein the children's actions – that shape formative design orientations" (Larsen and Hedvall, 2012, p. 39).
Maximised children's involvement	"In one sense the children are simply observed by adults and the child may not in any way feel empowered by the design pro- cess (but possibly by the design). Seen from another perspective we ask 'questions' with artefacts and the children give generative feedback. From a perspective of designing (for) emerging practices and not only products- in-spe, the children indeed have agency. While we may not claim the children as design partners, the dimension nonetheless questions how to keep them in the design process, even when they cannot be around" (Larsen and Hedvall, 2012, p. 39).
Principles and heuristics	
Awareness of non-verbal communication	Children's actions and interactions are more important than their verbal communication.
Be guided by the children	Adult designers guided in designing & ideation by (videoed) actions of children.
Tailor activities to children's abilities	Removing need for explicit / abstract communication.
Decision points	
Physical resources High-tech resources	"we are not aiming for intervening with instantiations of possible products-to-be, but rather explorative sketches or probes…. we have learnt that for the children to take part, the design artefacts have to be truly interactive. Yet like sketches, they should also be manifold and easy to alter as we learn from the children's actions. We have tackled this challenge by trying to build the most basic interactive artefacts to carry our curiosity on emergent qualities in the interaction. This is not only different from prototypes negotiating fidelity; it also moves technology probes to a fundamental level of inquiry" (Larsen and Hedvall, 2012, p. 39). Props: Snoezelen artefacts.
Setting / location	Snoezelen rooms, known to the children.
Activity patterns	
Exploration	"Our design process is explorative, searching for potentials, i.e., where formative designerly orientation takes place. As such it is more specifically aimed at inspiration and ideation than Druin's more general category of ad- dressing 'better design', but all types of learning are welcomed. The crucial point is to open up for ways of engagement rather than trying to pin down understanding of the children or their prior use of technology" (Larsen and Hedvall, 2012, p. 39). "using basic yet interactive design artefacts to intervene in a pedagogical setting in a way that enables the action of the children to affect formative design orientations when we cannot rely on dialogue or pretending" (Larsen and Hedvall, 2012, p. 40). Snoezelen created partial designs for children to respond to.
Iterative development	Implied, but not discussed.
Communication patterns	
Questioning in the now	SID artefacts can be seen as questions, which the children answer through their interactions.

11.27 Sparkles of Brilliance

Major source for analysis: (Hamidi, Saenz and Baljko, 2014)

Theme or Pattern	**Sparkles of Brilliance** (Hamidi, Saenz and Baljko, 2014)
Children involved	Across communication gap (language & culture difference), 5-13 years old.
Goals	
Equality between adults and children Respect for expertise of all team members	Promoted by having children control reflective discussion.
Acceptance of all ideas as worthy of consideration	Of children's chosen topic, etc.
Build relationship/trust	"importance of establishing trust though local contacts" (Hamidi, Saenz and Baljko, 2014, p. 77). One author had existing relationship with children. "Meet and greet: A key ingredient for successful intercultural collaboration is trust. The first author had not met the kids previously and did not speak their native language, Spanish. Therefore, it was essential for him to be introduced formally by the second author who had worked with the children before and had a close relationship with them. This transfer of authority is something that can be achieved by a simple introduction (preferably accompanied by a physical and symbolic act of greeting such as shake of hands, giving hugs, … depending on culture) and is very important to laying the foundation of a good relationship. The relationship was further established when the second author described where he was from, showing it on the map and so on" (Hamidi, Saenz and Baljko, 2014, p. 80). "When conducting intercultural collaboration projects, the key ingredient is trust. We believe the success of our project was because of the trusting relationship that the children had developed with the second author who has worked with them on art projects for several years. We cannot overemphasize the importance of collaborating with someone who is situated within a culture in these projects. During the workshop, whenever there was need for clarity or direction, the children would defer to the second author who they knew and trusted. At the end of the workshop, they clearly enjoyed showing their final designs to her. In cases where collaboration at this level is not possible, at least having a local Human Access Point (HAP) is essential. In the field of Information and Communication Technologies for Development (ICT4D), HAP refers to a trusted member of the community for which the project is to be designed for [13]. Not only can a HAP provide invaluable feedback and suggestions on the design, but perhaps more importantly he or she can mitigate the trusting relationship with the community that is essential for any effective collaboration" (Hamidi, Saenz and Baljko, 2014, p. 83).
Collaboration	No, children main (solo?) designers.
Motivating and stimulating	"Cultural and personal relevance: … We involved the children in the brainstorming that led to the activities of the workshop and observed consistent signs of pride and attachment in them not only towards the final outcome but to the collaborative process of the workshop as well" (Hamidi, Saenz and Baljko, 2014, p. 83). Technology: "capture and sustain the children's attention throughout the workshop" (Hamidi, Saenz and Baljko, 2014, p. 83).
Diverse data sources	Children's designs and finished creations.
Provides useful design information	Problem definition, requirements, ideation: "to facilitate the design and creation of digitally augmented art works" (Hamidi, Saenz and Baljko, 2014, p. 78), but this approach could be used for designing technology.
Maximised children's involvement	"viewing the children not only as design partners but actually as the main designers and the adults as facilitators or technical informants on how the children's ideas can be executed" (Hamidi, Saenz and Baljko, 2014, pp. 78–79).
Principles and heuristics	
Appropriate adult design team roles	Facilitators.
Interpreter	Implied but not discussed.
Be guided by the children	"In discussing possibilities for activities and projects during the workshop, we considered many artistic practices from carpet weaving to papier-mâché to mural painting. These were communicated to the children throughout the workshop and they chose which theme to focus on" (Hamidi, Saenz and Baljko, 2014, p. 79). Reflection activity intended to "give a chance to the children to lead a dialogue and describe their activities and achievements to the adult facilitators" (Hamidi, Saenz and Baljko, 2014, p. 80).

Designers familiarising themselves with children's culture	"importance of … incorporating relevant cultural and social elements" (Hamidi, Saenz and Baljko, 2014, p. 77). "From the beginning, we aimed to incorporate artistic and cultural elements familiar and relevant to the children in the workshop" (Hamidi, Saenz and Baljko, 2014, p. 79). "We highly recommend that workshop facilitators make an effort to familiarize themselves with the culture of the region within which they plan to work and try to design culturally relevant activities…. From the outset, we wished to find a way to help the children appreciate their own culture and find value in the art and craft that they have inherited from their community" (Hamidi, Saenz and Baljko, 2014, p. 83).
Flexibility	"Of course, as with any activities planned with children, we had several backup plans, including working on cardboard robot models or futuristic gadgets, in case we could not identify other ideas successfully" (Hamidi, Saenz and Baljko, 2014, p. 83).
Continuity between sessions	Day 2: choosing and refining drawings from the day before.
Keeping up momentum within sessions	Struggled towards the end of the workshop. "This was because they became restless and tired at the end and slowly lost interest. The workshop sessions were long and although we had breaks, some of the children, especially the younger ones became tired towards the end of the day. While 5 of the 7 children who did not finish their drawings were among the younger participants (5 to 8 years of age), at least 4 younger participants in the same age range did finish the work and stayed active until the end of the workshop" (Hamidi, Saenz and Baljko, 2014, p. 82).
Supported autonomy and children's control	Some of the children didn't want to work to the workshop theme, "something that we did not encourage but allowed if they insisted" (Hamidi, Saenz and Baljko, 2014, p. 81).
Tailor activities to children's abilities	And to children's circumstances. Relatively low-tech (LEDs and batteries) to be "sustainable" with the children's environment.
Decision points	
Adequate time Frequent design sessions	Two day workshop, four hours per day. Adapting the workshop to the time available.
Physical resources	"we initially used drawings as design proposals or interpretation of materials in the presentation, at the end, they turned into interactive artifacts and became one of the main outcomes of the workshop" (Hamidi, Saenz and Baljko, 2014, p. 78). "We used drawings in three capacities: as interpretations of concepts (e.g., technology, art festival, …), as proposals for digitally augmented artifacts and as functional digitally augmented paper artifacts" (Hamidi, Saenz and Baljko, 2014, p. 79). "importance of… using technology appropriately" (Hamidi, Saenz and Baljko, 2014, p. 77).
Setting and location	"The workshop was held in a large room with a lot of sunshine and fresh air. The children sat on a large common table and were each given paper and simple crayons. Other than the first author's personal computer and a projector, no other computers or displays were available" (Hamidi, Saenz and Baljko, 2014, p. 79).
Activity patterns	
Brainstorming	Ideas for topics.
Children as experts and teachers	Peer tutoring: Helping each other when learning about electricity.
Children designing or creating individually	Suggested, but not made clear.
Critiquing and evaluation	Children commented on each other's finished artworks.
Exploration	"importance of… planning concrete outcomes" (Hamidi, Saenz and Baljko, 2014, p. 77).
Fantasy	Fantasy creatures.
Iterative development	Yes.
Prototype creation	Created artworks (iteratively) and then augmented the final versions.
Reflection	On art festivals run by second author in previous years.
Training children to facilitate involvement	Training children about technology, electricity, etc.: "we had to provide scaffolding in the form of interactive presentations throughout the workshop" (Hamidi, Saenz and Baljko, 2014, p. 78). "An interactive presentation on technology and its relationship to us: After talking about the art festival and the drawings the children made of their favorite parts, we conducted an interactive media-rich presentation on technology and its relationship to us. We used a style of presentation that uses a lot of metaphors, humor and personal stories. We have found that this technique, which we refer to as poetic presentation, allows for the engagement of diverse populations and age groups. During the presentation, we first explored the question of what is technology" (Hamidi, Saenz and Baljko, 2014, p. 80).
Communication patterns	
Discussion and conversation	Yes, as part of workshop.
Novelty and surprise	The LEDs and electrical augmentation was novel.
Presentations	Not one-by-one presentations, but a show-and-tell display where all the artworks were visible.
Sensitisation and contextualisation	Through reflection.
Emergent phenomena	

Ownership of product	The creations were entirely the children's, and they were proud and wanted to show them off. Children were involved through entire designing and making process.
Social experiences	Within workshop? Possible, but not discussed.
Other notes	
Children's non-design learning	About electricity and technology.

11.28 Urban Co-Design

Main source for analysis: (Walsh, 2018)

Theme or Pattern	**Urban Co-Design** (Walsh, 2018)
Children involved	School aged children, details not provided. Focus on recruiting children of colour and children from lower socio-economic areas in final year of project .
Goals	
Equality between adults and children Respect for the expertise of all participants Collaboration or elaboration	Initially modelled on Cooperative Inquiry.
Motivating and stimulating for children	Provision of a snack. Trying to better fit in with children's (and parents') daily lives.
Providing useful design information	Four sessions over four weeks progressed from "open-ended and generative to evaluative at the end." (Walsh, 2018, p. 437). Moved rapidly through design phases.
Maximising children's involvement	Children as design partners? Trying to better fit in with children's (and parents') daily lives.
Principles and heuristics	
Appropriate adult design team roles	Parents joined design team as design partners in school-based 4-week program.
Decision points	
Design team size	Design team size fluctuated, as participants were not required to attend – depended on participants' availability and interest.
Adequate time	Reduced number of sessions to lesson requirements on children & parents.
Setting / location	Schools. Library – provided better access to children in lower socio-economic area.
Physical resources	Cardboard prototyping. Augmentation with RFID.
Activity patterns	
Icebreakers & transitional activities	As with Cooperative Inquiry.
Training children to facilitate involvement	Pointedly not; nor was there time for them to get used to designing through long-term involvement.
Prototype creation Low-tech prototyping	Children created prototypes.
Prototype critiquing	Adult researchers formalised children's prototypes for use in next session.

11.29 Web Design Day project

Main source for analysis: (Read *et al.*, 2002)

Theme or Pattern	**Web Design Day project** (Read *et al.*, 2002)
Children involved	8-10.
Goals	
Equality between adults and children	Attempted to foreground children's input as informants, with the adult role being facilitation; however, children needed and expected "more active intervention from the adults" (Read *et al.*, 2002, p. 57). School environment seems to have reinforced norms of adults in charge, providing information and instructions.
Respect for the expertise of all participants	Participants' different levels of knowledge affected expectations (own and others') of abilities to contribute. Design team members gaining knowledge during design day did alter the way they contributed.
Acceptance of ideas as worthy of consideration	Planned emphasis on children's ideas; adults as facilitators, not contributors.
Build relationship/trust	Children all knew each other well, because they all attended the same "small village school".
Collaboration or elaboration	Between children. Children reportedly found it difficult, possibly because it was unfamiliar.
Motivating and stimulating for children	Varied. Older children did not find it stimulating, and were difficult to motivate. Younger children were very motivated.
Adequate support for children's abilities and communication level	Adult "facilitators" ended up being more involved due to the support children needed.
Diverse data sources	Video recording, still photos, adult debrief, academics' reflections & survey, design session artefacts including paper prototypes. Note taking was difficult – children found it distracting when adult design team members took notes.
Maximising children's involvement	Planned to be Facilitated Design: "'Facilitated design' puts the emphasis onto the domain expert both to initiate ideas and to take the lead in realising the design, with the design expert being in a facilitating role." (Read *et al.*, 2002, p. 58), but ended up varying across day and design teams between informant, partner and designer roles.
Principles and heuristics	
Support and be guided by children's autonomy	Attempted, with intention that adults would be facilitators. Greater adult support required than initial expectations, but emphasis still on children's ideas.
Flexibility	Major change required to adults' planned role. Rearrangement of groups based on insufficient number of researchers.
Appropriate adult design team roles	Adults intended as facilitators only, but became more involved in response to children's needs and expectations. Parent helpers.
Decision points	
Design team size	Original plan: groups of about 5 children (chosen by teacher before design sessions began). On the day: groups of 5 to 11 children.
Adequate time	Single one-day workshop, intended to fit in a school day.
Setting / location	School hall, school environment – influenced children's expectations of the day, reinforced power norms. Single room for all participants meant the area became noisy.
Physical resources Low-tech resources	"Materials such as paper, pencils, pens, scissors were provided and were stacked up on a separate table." (Read *et al.*, 2002, p. 55).
Activity patterns	
Icebreakers	"After the introductory talk, each group ran an icebreaking session…" (Read *et al.*, 2002, p. 55).
Training children to facilitate involvement	Design teams looking at brochures with relevant information, examples of existing websites. Design team members gaining knowledge during design day did alter the way they contributed.
Teamwork	Children working in teams; difficulties reported.
Brainstorming	"After the introductory talk, each group ran … a brainstorming session about what they wanted on the web site." (Read *et al.*, 2002, p. 55).
Reflection	By adults, after design day.
Prototype creation Low-tech prototyping	Paper prototyping.
Prototype critiquing	Possible, but unclear: "During the last quarter of an hour, all the children and adults looked at the work that the groups had produced in the day." (Read *et al.*, 2002, p. 56)
Communication patterns	

Discussion and conversation	Difficult for children: “Maintaining concentration during group discussion, being able to listen to others ideas, and finding effective ways of making group decisions were observed to be difficult for some of the children, particularly the younger ones.” (Read *et al.*, 2002, p. 59)
Communicating design session aims	“The working day began with one of the academics explaining to the children what the day was about. Part of this introduction included an explanation of some of features that web sites have – for example text, pictures, sound, and video – with an emphasis on the fact that different people have different opinions and preferences.” (Read *et al.*, 2002, p. 55)
Sensitisation or contextualisation	Design teams looking at brochures with relevant information, examples of existing websites.

11.30 YoungDeafDesign

Main sources for analysis: (Korte, 2017, 2018; Korte, Potter and Nielsen, 2017b; Korte and Thompson, 2018)

Theme or Pattern	**YoungDeafDesign** (Korte, 2017, 2018; Korte, Potter and Nielsen, 2017b; Korte and Thompson, 2018)
Children involved	3-5 year old Deaf children.
Goals	
Respect for the expertise of all participants	Interactions between adults and children often indicative of respect. Communication gap greatest barrier.
Acceptance of ideas as worthy of consideration	Focus on exploring young Deaf children's ideas, as communication gap makes it difficult to gain understanding of thought processes.
Build relationship/trust Keep the situation natural Icebreakers	Familiar adults, familiar location. Parents' encouragement helped. Most effective way of building trust was time & familiarity with sessions (keep the situation natural). Simple icebreakers helped. More complex icebreakers could not be explained to children.
Collaboration or elaboration	More likely between adults and children than between children. "Adoption" of design artefacts common.
Motivating and stimulating for children	Design activities chosen to align with children's demonstrated interests, cultural relevance. Expressive materials.
Adequate support for children's abilities and communication level	Multiple communication channels, adults familiar with children's signing & non-verbal patterns.
Diverse data sources	Note-taking observers, reflective debriefs, video recordings (faulty), design artefacts.
Providing useful design information	Primarily problem definition, requirements gathering & ideation.
Maximising children's involvement	Informants.
Principles and heuristics	
Support and be guided by children's autonomy Exploration	Children's chosen activities reveal information about interests and abilities. Design session activities based on children's interests. Communication gap encourages following children's lead. Allows children to explore materials, topics, etc.
Flexibility	Required for: Design session aims, activities, information. Deaf children change activities frequently.
Keep up momentum	Changing activities to keep children interested.
Continuity of design sessions	Frequent sessions good. Different design team members attending each session weakened continuity.
Appropriate adult design team roles Specialised adult assistants	Researcher, teacher aides as support assistants / interpreters, parents as support assistants / interpreters.
Tailor activities to children's abilities	Designer familiarised selves with Deaf culture to assist in this. Tailoring improved throughout sessions, as designer got to know children, their abilities, their preferences.
Be aware of non-verbal communication	Majority of communication non-verbal + keysign. Enactment & play. Some non-verbal communication very clear, e.g. moving away from activity uninterested in.
Designers familiarising themselves with children's culture	Deaf culture – language (Auslan), communication norms, school norms.
Decision points	
Adequate time	Individual sessions' lengths should be based on particular issue to be explored, balancing against different children's attention span for different activities.
Design team size Teamwork Social experiences Peer tutoring	Small design team (1-4 children per session). High ratio of adults to children = greater support for each individual child, less frustration. Children preferred to work individually, or rarely with an adult. Some emergent social interaction between children – usually showing off artefacts/activities, sharing materials, demonstrating how to use materials / do activities (peer tutoring).
Physical resources	Expressive materials – stickers, tapes, drawing implements, individual "journals". Cameras, laptop for high-tech prototypes.
Setting/location	School classroom – familiar to children, easy to access.
Activity patterns	
Training children to facilitate involvement	By all adult design team members, often on demand OR to introduce particular material / topic to children. Caused trade-off with acceptance – adults trained children when they were using materials wrongly.

Designer journals	Given to children. Used as working area for flat creations. Did not promote reflection as hoped.
Iterative development	Asynchronous & emergent elaboration – children building on other design team members' creations.
Prototype creation	Low-tech artefacts could contribute to prototypes. Communication gap made communicating idea of prototyping difficult.
(Prototype) Critiquing / evaluation	Non-verbal "evaluation" data in extreme reactions; lacking nuance.
Communication patterns	
Implicit tasks	Facial feature stickers (unsuccessful), mask shapes (partially successful).
Problem demonstration / possibility demonstration	Children often copied activities they saw adults / other children doing, especially re: creation of design artefacts. Demonstrating a problem (e.g. blow up a balloon through a straw) created interest, promoted problem solving.
Presentations	Informal presentations within design sessions & to valued adults outside design sessions (teachers, teacher aides, parents).
Questioning in the now	Questions prompted (non-verbal) responses. Questions + multiple suggestions / potential answers more likely to elicit (non-verbal) responses → Did not seem to "lead" children?
Facilitating communication	Gaze, joint attention very important. Deaf children understood & used gaze / joint attention when they where trying to communicate with adults, would move & repeat communication.
Novelty and surprise	New materials & artefacts, "violating expectations" → communication, ideas.
Emergent phenomena	
Fantasy Spontaneous games	Emergent. Storytelling, role playing, enactment (fine line between signing and enactment). Spontaneous games emerged from children's interactions with design artefacts, adults, other children.
Children's ownership of design artefacts	Claiming & keeping design session artefacts. Informal presentations.
Children's ownership of design sessions	Children being able to signal end of design sessions.