# The concept of learning goals will always be in my head"-Aligning and Applying Learning Goals in Participatory Design in a School Context

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# “The concept of learning goals will always be in my head” - Aligning and Applying Learning Goals in Participatory Design in a School Context

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## ABSTRACT

In this paper, we explore applying learning goals in participatory design (PD) practice as an approach to mutual learning in a school context. The paper is based on experiences from master students in interaction design, who were instructed to define learning goals for children participating in PD activities that they organized in a school context. Based on the results of this study, we suggest a number of strategies for aligning and applying learning goals in PD in school contexts in practice: Debrief the results from the children’s reflections with the teachers, Scalability in regard to time and context, Adjust to age, Collaborate with the teacher to define specific learning goals, Formulate learning gains for the teachers, and Develop support materials.

## CCS CONCEPTS

• **Human-centered computing** → **Participatory design**.

## KEYWORDS

participatory design, children, learning goals, CCI, school

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## 1 INTRODUCTION

Participation of users in the design process is a cornerstone in participatory design (PD). One approach to participation is that of mutual learning, i.e., where the designer and the users learn from each other in the design process [9]. This means that the designer has to both teach and learn in the development process. Robertson et al. argue that mutual learning is supported by embedding the design process in the practices of the participants, using various methods and tools from PD, so that the users can envisage the new technology and the embedded practices [24]. Mutual learning is difficult and hard work, but as pointed out by Bratteteig, a successful process of mutual learning can give rise to new possibilities for design [9]. She also argues that the mutual learning process can involve teaching activities and that these should be planned using principles from pedagogy such as defining learning goals. This is in line with Barendregt et al. [1] who argue that we should legitimatize participation for both children and adults by addressing learning opportunities, especially in the school context. In PD, the traditional focus of the mutual learning process is on the technology and context which the technology is designed for, but as pointed out in a few studies [1, 8, 15, 18, 26], there are also learning opportunities for the individual regarding for instance skills and content. Bossen et al. state that a result from PD can be ‘user gains’, which may be indirect (“their voices have been heard in the design process”) or more direct (“such as personal skills and areas of competence, improved quality of work or life, and influence on the workplace”) [8]. Accordingly, Barendregt et al. proposed to explicitly design PD activities involving children as learning activities by 1) determining the possible learning goals for the child participants, 2) communicating the learning goals to the children, and 3) aligning the design activity with the learning goals, incorporating moments of reflection. Building on the approach proposed by Barendregt et al. [1], in this paper, we report on the experiences of master level students in interaction design who were coached to apply these steps for the incorporation of learning goals in PD with children and align the design activities accordingly. The contribution is a number of strategies for aligning and applying learning goals in PD activities in a school context.

## 2 BACKGROUND

One of the fundamental principles in PD is the importance of mutual learning and the development of shared understandings between designers and other participants [25]. However, the personal benefits that participants can gain from PD are relatively unexplored [8, 14]. McNally et al. investigated the sustained benefits for children in participatory design projects [18], Schepers et al. distilled user gains for vulnerable children in a long-term project [26], Börjesson et al. investigated teachers gains from PD activities [7]. Barendregt et al. argue for legitimate children’s participation in PD activities in schools, by making the learning opportunities explicit to the participants [1]. They suggest that PD activities can be made more meaningful by addressing learning opportunities. Legitimate here refer to that the design activities must create a meaningful frame

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that reflects the cultural expectations belonging to the participants everyday lives [16], e.g., in a school context, the children would expect to learn something from an activity they participate in. Taking learning opportunities as a point of departure in order to define the PD activity, these learning opportunities could be related to: specific content, e.g., technology, general skills, e.g., presenting, or design skills, e.g., brainstorming. When the learning opportunities have been identified, the next step is to clearly communicate them as learning goals to the participants. Finally, the design activities need to be aligned with the learning goals and moments of reflection should be incorporated, e.g., by discussion sessions, briefing, etc. By defining and making the intended learning opportunities of the participants explicit, there is a stronger connection to the traditional values of Scandinavian PD, and specifically mutual learning [1].

The approach presented by Barendregt et al. [1] resembles the principles of constructively aligned teaching. Constructive alignment is an approach to teaching and is composed by aligning three main components - learning goals, teaching methods and assessment tasks [5]. Learning goals describe what a student is able to know, do and be by the end of education, and are formulated from the student's perspective [21]. An example of how to apply a constructively aligned approach to teaching in CCI is provided in the paper by Eriksson and Torgersson [12], where a set of intended learning goals were used as the basis for the course design. The authors argue that once the intended learning goals have been settled, the focus of the rest of the course design process becomes to define tasks and material that ensure that the students fulfill the outcomes upon completing the course. For assessment, they suggest focusing on what has been learnt and to what extent the students have developed their knowledge and understanding within the subject in accordance with the intended learning outcomes rather than judging the novelty and quality of the designs [12].

Muller et al. have developed a taxonomy of PD practices [20] which shows that PD activities can range from the designer fully participating in the world that belongs to the users, to the users participating directly in the design activities. In this paper we focus on PD activities with children in their own school context, where the teacher is present together with the designer. According to Muller[19] there is a hybrid realm between the two distinct work domains of the software professionals (in this paper the student designers) and the end-users (in this paper the children and teachers). Muller has coined the term Hybrid Practices for practices that "turn out to occur in an uncertain, ambiguous, overlapping disciplinary domain that does not "belong" to either the software professionals or the end-users" [19]. Doing PD with children in their school can be considered a hybrid practice. Even though the activity happens physically in the natural context of the children, the designer influences what is going on just by being present in this context.

In the school context, the children and teachers have a common understanding of the activities they usually perform and about their behavior and roles in those activities [22]. However, in the case of a designer entering the child's context to do a PD project, misunderstandings about what roles the participants should have and what the activity really is about are likely, as power moves between different actors and social positions and is negotiated between children, designer, and teacher [10]. For example, teachers present during a design workshop with children may think that their role is to guide the children towards a solid solution, while the designer is merely interested in the spectrum of ideas the children may have. Learning goals have the potential to act as a mutual language between designers and teachers and children, and that can help settle the expectations on roles and outcome of activities.

## 3 METHOD

The research reported on in this paper is partly based on research through students [13], and partly by researchers. The students were all enrolled in an international master level course about designing children's technologies. One of the criteria in the course is to involve children in design activities at least three times, comprising user research, co-design and evaluation. Early in the course, the students were taught in theory about child development, ethics and ethical consent, design methods in Child-Computer Interaction, and for the design activities with children they were specifically instructed to define learning goals and align activities according to the approach described by Barendregt et al. [1]. This means that they could to some extent build upon the experiences and challenges by other students when defining and working with learning goals in design, as reported in [1]. The students had to define learning goals for each of the three encounters with children.

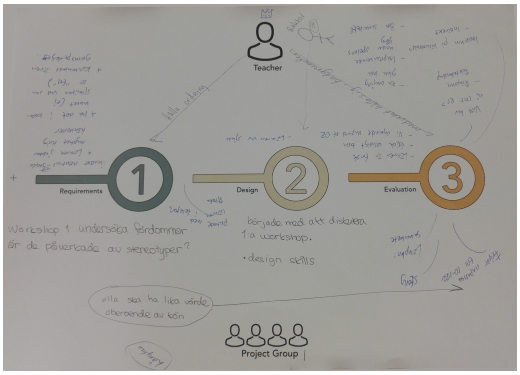


**Figure 1: Visual support during the interviews**

The students had weekly supervision with a university supervisor, and upon completion, the groups presented their projects to the class, and authored a written report about their project. After the student projects ended, we invited the project groups to voluntarily be interviewed about their practical experiences of involving children in the design process and working with learning goals. Four of the twelve student groups agreed to take part in the semi-structured interviews (G1-G4). The interviews lasted for about 30 minutes each and were recorded upon consent from the participants. The interview questions for related to four main themes: Working with learning goals, Formulating learning goals, Communicating learning goals to the children, and Adapting the activities towards learning goals. Two of the groups were interviewed by one of the supervisors, while two groups were interviewed by the course responsible, who had not been supervising the students. During the interviews, a visual outline of the project process (see Figure 1) was used as a prompt for the discussion.

### 3.1 Ethical procedure

The groups were taught about ethical procedures with children in the course, and all the groups developed written consent forms under supervision of the university teachers. The consent forms were handed over to the participating children's parents by the schoolteachers. Although all children were allowed to participate, the students only incorporated data from children whose parents had given their consent. Informed consent was gained orally from the children at each design session. The children participated in different forms of activities, including photo capturing, design workshops and observations. Transcriptions of notes and interviews were anonymized by the students, and photos were captured without children's faces. No incentives were given to the participants.

The students volunteered to take part in the interviews. The authors have asked all of the university students for consent for including their experiences in this paper prior to the interviews, and this has been reaffirmed by the students afterwards.

| Nr | Context | Age | Aim | Design |
|---|---|---|---|---|
| 1 | Primary school | 10-12 | Understand and challenge children's views on gender roles, norms and stereotypes | Collaborative game |
| 2 | Primary school | 7-8 | Encourage collaboration through digital storytelling | Collaborative tabletop storytelling |
| 3 | Preschool | 3-4 | Teach basic logic and programming to very young children | Collaborative robot game |
| 4 | Primary school library | 6-12 | Improve the space of the library through digitalization | Geography game with information seeking |

**Table 1: Overview of participating student groups, contexts, age of the participating children, aim and design projects.**

### 3.2 Analysis

The recordings from the student interviews were analyzed by researchers, who extracted and transcribed all the passages that focused on working with learning goals. The recordings were also complemented with information from students' written reports, and from informal interviews with the university supervisors. Collaboratively, the authors then clustered the quotes and passages into larger overarching themes.

## 4 RESULTS

### 4.1 Working with learning goals

The students received focused supervision to explicitly address learning goals during their design activities, however, there was still some initial confusion, i.e., some students explained that they initially formulated learning goals for themselves rather than for the children. One of the groups (G3) that worked with very young children said that while working with learning goals may not have benefited the children directly, it had other advantages:

> "It changed how we thought and planned for the session, we had to adapt activities to the goals. It changed our way of thinking in terms of how clear we are about what we are doing with the children and not just what we say."

One group (G2) described how formulating learning goals based on the curriculum for the school helped them in the process of gaining access to the school they worked with. In the initial meetings with the deputy principal and teachers from the school, the students felt that it helped the school staff to relate to what the group was aiming to accomplish and to find a suitable group of children.

G1 had some difficulties in the beginning in trying to understand the concept of learning goals. Yet, they became more positive once they had agreed upon a set of learning goals that suited the project. In relation to their collaboration with children, they argued that:

> "We do not come and take up their time without them getting something in return"

Another group (G4) that involved children in the school library, as opposed to the classroom, had a more negative attitude towards working with learning goals:

> "To me it felt more like an obstacle because of the limited time, it felt hard to involve the children to learn something in 5 min. We were focused on extracting as much information as possible."

In the library setting, the design sessions were not structured or moderated by teachers. The students therefore needed to compete for the children's attention with, e.g., break-time, book-loans, and other activities, making the time for encounters short. It is possible that the time for encounters might have had an influence on working with learning goals overall, and likely more so if the students lack prior experience of working with learning goals and children.

Finally, working with learning goals is a matter of practice, which takes time for a designer to get used to. Nevertheless, once said hurdles are overcome, it is possible that learning goals can become a natural part of design processes for students who are trained. Group G2 explains that they are moving towards working with learning goals as part of their design process, but are maybe not there yet, and group G3 concluded:

> "The concept of learning goals will always be in my head"

### 4.2 Formulating learning goals

Overall, the learning goals were of a high quality because they were either developed in accordance with or inspired by the school curriculum, or they were developed with some support from the

Developmentally Situated Design cards developed by Bekker and Antle [3]. Examples of three learning goals formulated by G2 for an encounter and workshop with the children in school were: *to keep focus*, *practice collaboration* and *storytelling*. Additionally, while the students in the study by Barendregt et al. [1] struggled with separating the learning goals for the children from their own research goals, in this study the students were much better at identifying separate learning and research goals. One example of clearly separated research and learning goals is from one of the groups that did not participate in the interviews, but who developed a game to teach children how to program:

- Research goals: 1) Get to know the children and build rapport, 2) Gain an understanding for how well the children understand programming concepts.
- Learning goals: 1) Familiarize with concepts in programming games, 2) Understand a sequence of commands, 3) Identify and learn basic programming concepts, 4) Be able to verbally explain logical thinking.

Another group (G2) explain that defining learning goals in the initial stages e.g., to gain access to a school, can often be done independently by the designers. However, later on in the process teachers may be invaluable, to make sure that the learning goals are adapted for the children you are going to work with:

> "You can look at the curriculum, but that doesn't mean that the class works exactly like that"

The same group mentions that involving the teacher more, was the one thing that would change for next time, as the teacher has specific knowledge of the children, which the curriculum does not.

G3 formulated learning goals in line with the computational thinking curriculum: e.g., programming, understand logic, learn collaboration, and to understand that they are part of a design process. The teacher was not involved in defining the learning goals from start but were invited to provide feedback on them before the third workshop. Her feedback was that some learning goals were too complex to understand for the children, why she gave feedback such as why or how are they useful. Another group (G4) made an initial interview with the school librarian, that influenced how they formulated their learning goals. The librarian talked a lot about the implementation of digitization strategies at the school, which resulted in the learning goal of searching for information. G1 also reflected on their process:

> "We refined the learning goals with every planning document we did."

## 4.3 Communicating learning goals and aligning activities

Communicating the learning goals explicitly to the children was experienced as a bit problematic to the students. For instance, G1 took an active stance in not communicating the learning goals to the children in their first workshop, in order not to influence them. The group was working on gender roles, norms and stereotypes, and defined learning goals based on the national primary school curriculum:

> "We did not want the children to focus on this, but keep it implicit. However, this learning goal was explicit in the consent form that the parents had received, so perhaps they knew it from their parents."

The group did not have any reflection session afterwards with the children, and only discussed with the teacher what the children had learnt from the design activity. This led to some confusion when the children were handed diplomas with the title "Norms and Values" after the activity, since they had no idea that they had been working with this. Based on this experience and feedback from the teacher, the group started the next workshop with a discussion about the first workshop and described the purpose of the coming activity. For the third workshop, they were able to communicate and evaluate the learning goals together with the children. The children's reflections concerned the factual knowledge they had gained. The teacher was certain that defining the learning goals had helped, since the children now choose characters that were not primarily based on gender but interests. G2 gave another reason to choose not to introduce the learning goals to the children:

> "If we go formal and told them, it would be less fun for them. They [the learning goals] should not be that transparent."

Instead, they focused on presenting the activities:

> "You have to be clear about your purpose, and can the users learn something, can we give them some benefit, even though we did not say that to them."

Group (G4) chose not to present the learning goals explicitly to the children, but for their third and final activity they told the children that they would play a geography learning game. They did however, choose to not say anything about their learning goal connected to design. When asked if they think that the children understood the learning goals formulated for the three activities they say:

> "For the last one - yes, there was a clear theme. For the first two – no. if we would have been explicit about the learning goals they would not have cared. It was fun for 5 min and that was it."

In contrast to group G4, group G3 state that:

> "Learning logic was so much part of the game that it was unavoidable."

This group also says that it was clear to the children that they were taking part in a design process, but that due to the low age of the children, it was really difficult for them to concentrate and listen when the group explained the goals and purpose, even less to understand. In retrospect the group suggests:

> "Maybe a visual presentation [of the learning goals] would help."

The groups tried to follow up on the learning goals after their activities to some extent, incorporating moments of reflection, as suggested by Barendregt et al. [1]. For instance, one group used exit tickets with questions to help the children reflect on their learning, e.g. "Today I have learned:". The children answered for instance "New ways of thinking", "coming up with ideas" and "more about programming", which illustrates that the activity fulfilled both the research and learning goals formulated by the group.

Another group (G2) asked the children after the activity what they thought the goal and purpose of the activity was, what they had learnt. They made us of a Smileyometer [23] for the children to reflect on how fun the different activities had been. The children answered that they had learnt communication, to collaborate, and tested technology. However, the goal of the activity was understood as completing the task given by the narrator in the game, rather than connected to learning. The group also noted that:

> "Children did not reflect on the activity, but rather on the other children's drawings."

This was also mentioned by other groups, e.g., group G4 that noted about the children's reflection that:

> "They did not focus on the activity but on what the others had written on their post-it's."

Similarly, another group (G3) state that during the reflection the children talked about what they thought about the technology, not what they had learnt. Due to their low age, they were tired and lost focus after playing games in the activity. However, the teacher was really helpful in reflecting on behalf of the children. A final useful insight from the teacher was also pointed out by these students:

> "The teacher said that we should have just one or two learning goals that we communicate to the kids."

## 5 DISCUSSION

Robertson et al [24] have noted that mutual learning appears to be less explicitly discussed in PD papers these days. In this paper, we build further on Barendregt et al. [1] who suggest defining learning goals for the participating children as an approach to mutual learning in PD. As such, the design activities should be aligned accordingly. We extend previous work such as e.g., Bratteteig [9] and Barendregt et al. [1] by suggesting a number of strategies for how to apply this in practice. These strategies are based on an analysis of examples of interaction design students' experiences from applying learning goals when working with children and teachers in PD activities in schools. The strategies are:

*Debrief the results from the children's reflections with the teachers afterwards.* In the children's reflections after the activity on what they have learned, it has been hard for the children to reflect beyond the explicit factual knowledge that they have gained, or the actual technology. The teacher can complement the children's reflections, based on their deep knowledge of the children. So it is recommended to debrief with the teacher after the activity has ended, to discuss how the activity was aligned with the learning goals and what the children actually learned.

*Scalability in regard to time and context.* We can see from the analysis that the amount of time given for the activity has an influence on the practice of adding learning goals to PD. In the examples, we see one group (G4) standing out from the others in that they consider the learning goals mostly as an obstacle. The group ran their activities in a school library, and therefore only had 5-10 minutes with the children, and at the same time competed with many other activities in the school library during the break. While the three-step model by Barendregt et al. [1] is useful, it might not always be feasible to implement all three steps with the children, due to e.g., the available time with the children or contextual factors.

*Adjust to age.* The variation in age of the children gave rise to different experiences. The students who involved preschool children in their design (G3) had a harder time applying the learning goals in practice. So in order to communicate learning goals to younger children, it is recommended to keeping the learning goals to a minimum (one), and also add some visual support to aid the younger children's understanding. It was also experienced that age influences the final reflection activity, as younger children have a higher chance of losing their focus after an activity.

*Collaborate with the teacher to define specific learning goals.* Formulating learning goals can help with gaining access to children and can initially be formulated from the curriculum. However, more specific learning goals that are adapted to the people you intend to work with should be defined in collaboration with the children's teacher. Learning is an individual activity, as each of us learns at a different pace and have different cognitive abilities [28], and the teacher know how to adopt the learning goals to the specific constellation of children, subject and context.

*Formulate learning gains for the teachers.* Based on our analysis, and in extension to formulating learning goals for the children as suggested by Barendregt et al [1], we suggest that designers should also consider formulating learning gains for the teachers. There is a great potential for the teachers to learn methods and techniques from e.g., design thinking or design-based learning [4]. As such, the design activities could be aligned to become professional development for the participating teachers [7]. In an interview with students, the school librarian pointed to the importance of collaborative and creative learning, due to today's changing role of teachers. When incorporating design and technology into the classroom, the teachers have to manage and switch between the roles of the classroom teacher, a facilitator of the activities, and being a coach for each student group, supporting their design process through dialogue and reflective questions [27]. This is in line with how one of the groups reflected on the importance of children understanding that they are not only consumers of technology, but that they can also design and build with it themselves [11, 27]. As Bødker et al. [6] have suggested "PD work is not only about project achievements, but also about putting an organization in a position where experiences may be used beyond the project's end".

*Develop support materials.* As a means for actually supporting the teacher as well as the children to reach the learning goals defined for the design activities, we suggest designers to develop support materials and visual learning goals. This can be used by the teacher to better prepare the children and themselves for the upcoming activity with the designers, as well as for being able to apply and sustain what was learnt after the designers have left. One of the teachers worked actively with the relationship between the children and the design group between the visits, which were one week apart. She did that by talking with the children about the last activity, helped the children reflect about what they learned, reviewing photos, and trying out the analogue prototype the group left behind. The same teacher was also able to use the design activities in her own teaching.

Finally, we suggest all CCI researchers to critically consider "who participates with whom in what?" [20] when preparing learning goals for the participants and aligning the design activities accordingly. Designers working with children in education may

sometimes be tempted to draw the children completely into their world because of the ease of gaining authority, thereby missing the opportunities for mutual learning that may arise from truly hybrid practices. However, truly hybrid activities towards the middle of Muller et al.'s model [20] may be the most beneficial for mutual learning, especially between the teacher and the designer [2]. By working with teachers on preparing design activities with children and sharing the responsibility to carry out the activities with the children, the designer can empower teachers to make use of the project experiences later on.

### 5.1 Limitations

There are several limitations of this paper. Firstly, the design projects were performed by design students rather than professional designers, which comes with its own weaknesses [13]. In spite of the active coaching by the university teachers to incorporate and communicate learning goals and adapt the activities to these learning goals, it could be that learning goals were most likely not the students' main focus, due to the many new things they must learn during such a course. However, our interviews with the students indicated that they were quite conscious and reflective about working with learning goals. Secondly, the data is limited, partly because joining the interviews was voluntarily why the data is based on experiences from only 18 students, but also in the sense that it is based on the experiences from students from the same national and educational setting, why further application of the results in different contexts would be beneficial. Finally, it would also be useful to directly inquire the children about their expected as well as perceived user gains, similar to Kinnula et al.[17].

## 6 CONCLUSION

In this paper we have presented students experiences from working with learning goals in PD sessions with children in a school context. Based on the experiences a number of initial strategies for working with learning goals when doing PD with children were formulated: Debrief the results from the children's reflections with the teachers, Scalability in regard to time and context, Adjust to age, Collaborate with the teacher to define specific learning goals, Formulate learning gains for the teachers and Develop support materials. It is our hope that the presented work can be useful for designers when doing PD in schools and also that the presented experiences can be useful for educators involved in teaching CCI.

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## 7 SELECTION AND PARTICIPATION OF CHILDREN

The school and teachers were responsible for selecting children for participation. Informed consent forms were distributed to the parents by the school, and informed consent was reaffirmed by the children at each session. All children were allowed to participate, but data from children without consent was excluded. The children participated in different forms of activities including design workshops, prototype tests, and observations.

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