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Niels-Peder O. Hjøllund, Martin Thun Klausen og Lasse Remmer

Exploring and crossing boundaries in education – tinkering as an approach to breaching children's formal and informal learning processes

Abstract

This article explores the integration of tinkering as an approach to learning and teaching in the context of two Danish public schools. Tinkering, traditionally associated with informal learning, is examined for its potential to widen participation, and align with informal learning processes within a formal educational setting. The study, part of the larger Tech&Play project, investigates the characteristics of tinkering in formal learning settings and examines the roles of children and teachers in tinkering processes.

The article introduces the Positioning Wheel, a reflection tool, to understand the roles and positions of children and teachers in experimental learning practices. It combines this with the Facilitation Field Guide developed by the Tinkering Studio to create a pedagogical and didactical framework. The findings indicate that tinkering encourages diverse participation and engagement, particularly in cross-curricular and thematic approaches. However, challenges arise in sustaining the tinkering approach within longer lesson plans and subject-specific contexts.

The study suggests that while tinkering enhances motivation and flexibility in formal learning, further experiments are needed to fully explore its potential within the formal education system. The Positioning Wheel proves useful in analyzing the positioning of learners, emphasizing the importance of dynamic roles in pedagogical practices.

Keywords

tinkering; formal learning; education; positioning wheel; experimental learning

1. Introduction

This article describes and analyzes a study where tinkering has been utilized as an approach to learning and teaching in the setting of two Danish public schools. In the study, teachers and consultants have been exploring and designing learning activities with tinkering as a mode of teaching. We argue that in a formal learning setting tinkering can be used to widen the scope of participation for pupils and a way of working more in line with informal learning processes.

The study has been undertaken as part of a larger development and research project that has revolved around playful approaches to technology and technological comprehension. Technological comprehension was first introduced in Danish schools as an experiment from 2019-2021. It has not yet been fully implemented as a subject or as part of subjects in schools. More information can be found via this link: https://www.emu.dk/grundskole/teknologiforstaaelse). In this context playful approaches are many faceted and depart from research and development work done in both Danish and international settings (e.g. Jørgensen et. Al., 2021; Skovbjerg, 2016; Zosh et. al., 2017). Specifically in this article we view playful approaches as an approach that experiments with form and materials and as an approach that is less controlled by the teacher and more relies on collaboration between participants. Some research and development work has been done within tinkering. Especially in an American context work has been done to understand the phenomenon and how it relates to learning settings (e.g. Petrich et. al. 2013, Resnick & Rosenbaum 2013). Some of the dominating ideas on tinkering as a concept originate from the US and are often used in STEM contexts (Science, Technology, Engineering, and Mathematics) where scientific phenomena are explored through tinkering (Thimotheou & Loannau 2019).

An overwhelming portion of the research conducted has focused on activities in informal educational contexts, outside of regular school settings, such as afterschool activities, museums, libraries, summer camps, etc (Thimotheou & Loannau 2019). The word ”tinkering” or ”to tinker” is used in many different arenas. Especially within formal science education, the term ”tinkering” is used to refer to repairing something or fixing something that is broken. This means that many articles do not delve deeper into the concept of tinkering itself but use it solely as a colloquialism, referring to the early ”tinkerers” who tinkered with things (Thimotheou & Loannau 2019). The concept of tinkering, as a learning process, is very vaguely described, and it is difficult to find models or frameworks that describe tinkering as a purposeful learning process or as an educational process. Tinkering is often linked to design processes in makerspaces, where a given complex problem must be solved, and therefore not to a learning process through which one acquires knowledge, skills, attitudes, and/or values (Vossoughi & Bevan, 2014).

Although the concept of tinkering is vaguely defined in the context of education and learning, a lot of the ideas often refer to an understanding of learning theory that is in line with constructivism (Piaget, 1968) and constructionism (Papert, 1980). With this outset we would like to contribute to an understanding of how tinkering can play a role in the formal learning setting. Therefore, our study has taken its outset in the following questions.

- What are the characteristics of tinkering in formal learning settings?
- What are the roles of children and teachers in tinkering processes?

2. Method of the study and the interventions

Our inquiry is part of the research and development project Tech&Play, that is funded by the Lego Foundation and the Danish University Colleges. The project was started as an extension of the project Play@Heart. It has been running from the middle of 2022 and is expected to terminate in December 2024. The project investigates different ways of engaging playfully with technology and technology comprehension in schools in Denmark. In our study, pedagogical consultants and researchers from University College Copenhagen and teachers from two public schools have tried tinkering approaches to open more possibilities for participation for children. Focus of the study has been on learning processes and positioning of teachers and children when using tinkering as an approach in school.

By employing ideas from design research (Gravemeijer & Coob 2006, Christensen et al. 2012) different aspects of tinkering have been tested to study and reflect on the learning processes in the given context of the formal learning setting. The idea here is to test designs that are developed in collaboration between teachers and consultants. Designs have been developed using the ELYK model (Christensen et al. 2012).

The model follows a four-stage approach, where the first stage is building domain knowledge. The second stage is designing learning processes and approaches that test the tinkering approach. The third stage is testing these approaches in practice. The fourth stage is reflection among the participants followed by redesigns of the learning processes. The approach of employing design research in education, takes on two different paths. Where one focuses more on development of curriculum, we follow the idea of approaching design research in education with a stronger focus on learning processes (Prediger et al. 2018).

Concretely the study was performed by consultants and teachers at two different schools. Three experiments were designed in collaboration between the consultants and the teachers. One experiment revolved around language teaching in 9th grade in lower secondary school (udskolingen). The aim of this experiment was to support students in becoming more daring in their use of English language. It was tried out across several lectures. The two other experiments revolved around constructing programmable robots in a 5th and 6th grade. In the experiment in 5th grade the children from one school designed, built, and programmed robots with the aim of being able to draw different shapes and lines on paper.

In the experiment 6th grade children from another school worked with constructing programmable machines for a thematic week on the future of a city. Through these experiments teachers tried to think more in line with the framework that will be presented in section 3 in this article. After the experiments, interviews with the children were conducted. (e.g Brinkmann & Tanggaard 2015, Kvale & Brinkmann 2009). This way the team of teachers and consultants got the children's and youngsters' view on what they thought tinkering is and how it worked for them in their learning processes. The analysis in the article will take its departure in the framework described in the next section of the article. Combined with the interviews of the children and youth, we will discuss perspectives on how the tinkering approach can be used in a formal learning setting. We will point to some of the positive perspectives, but also point to issues arising when you try to integrate an informal approach into the formal setting of school.

3. What is tinkering and how does it relate to learning?

Tinkering has long been related mostly to informal learning settings and free time activities for children and youth (Marsh et al. 2017). The idea of tinkering as a mode of inquiry and production has been mostly associated with the maker movement and thought of as a way of working in a less focused way with investigating and repairing concrete things. Even though tinkering can be and has been seen as something that does not necessarily entail an approach to learning or as something that incorporates aspects of learning it is an approach that, according to Mitch Resnick (Resnick, 2017), has a long history and introduces both a making aspect as well as a thinking aspect.

»Tinkering is not a new idea. From the time the earliest humans began making and using tools, tinkering has been a valuable strategy for making things. But in today's fast-changing world, tinkering is more important than ever. Tinkerers understand how to improvise, adapt, and iterate, so they're never hung up on old plans as new situations arise. Tinkering breeds creativity« (Resnick, 2017 p. 136).

Following this we argue that tinkering is an approach that is in line with constructionist learning approaches as a way of approaching children's adaptation and incorporation of concepts and competencies. This learning approach argues that by actively engaging in construction of knowledge and by incorporating activities and testing both existing knowledge and trying out new ideas, learners will, through this process, arrive at new and deeper understanding of concepts, the world, and their own position in it (e.g Piaget, 1968; Papert, 1980).

Whereas the constructionist approach does not as such call for certain activities, it does call for a more learner-centered approach that combines well with the tinkering approach in that Resnick and Rosenbaum points to tinkering as an »*approach [that] is characterized by a playful, experimental, iterative style of engagement, in which makers are continually reassessing their goals, exploring new paths, and imagining new possibilities*« (Resnick & Rosenbaum 2013, p. 164).

We point towards the importance of formal learning being also driven by learner intentions and by an approach that opens the space for participating in more diverse ways and through a wider range of activities. This does not mean that learning in school can and should be only constituted as separate active interactions with materials. It must also constitute a whole, where activities go hand in hand with thinking and reflection. As Presicce (2017) points out tinkering is not merely activities; they are closely tied with the constructionist approach to learning.

»Obviously, tinkering is not opposed to thinking. Tinkering is a way of thinking, making, and interacting with phenomena. It's both a pedagogy and a playful disposition in approaching a problem or designing an artifact, that follows an explorative process guided by whim, imagination, and curiosity« (Presicce, 2017).

We view the tinkering approach in formal learning setting as one that puts the learners' process at the center stage. It opens more possibilities for learners to drive their learning in a direction that motivates and calls for a curious inquiry into what a given material and

phenomena entails. Thereby tinkering can help build knowledge as part of the process of meddling with the phenomena.

As one of the children in our interviews puts it »*Tinkering is figuring out how it works, making it better, opening it up, looking at it*« (interview, 5th grade student).

By making the learning experience and inquiring into how things work, the children build knowledge by investigating and reflecting on what they experience as opposed to building knowledge by being told how things are. This also differentiates the tinkering approach from a more instructional approach to education. It thereby calls for a stronger reflection, both by child and adult on what kind of roles and positions come into play.

To help this process, we employ the use of the positioning wheel to understand and dive into what kind of roles and positions come into play in the process. The positioning wheel works with roles and positions for both children and adults. In the next section we will give an overview of the wheel and the utilization of it.

3.1 The Positioning Wheel

The positioning wheel is a pedagogical reflection tool developed by Christensen and Klausen (Christensen & Klausen 2018) to help teachers and children reflect on what roles and positions come into play as part of working within experimental learning practices (Christensen & Klausen, 2020). As they suggest their article, when working with different approaches in a formal learning context we: »*Need to develop dynamical positions in pedagogical practice when children are supposed to take part in experimental learning practices – and learn in collaboration with other children*« (Christensen & Klausen, 2020 p. 32, our translation).

In our study the wheel has been used as a tool for reflection among participants, when discussing the setup of experiments and as a tool in the postprocessing of experiments. It has been a way of getting participants perspectives on if and how the experiments have pushed their practice.

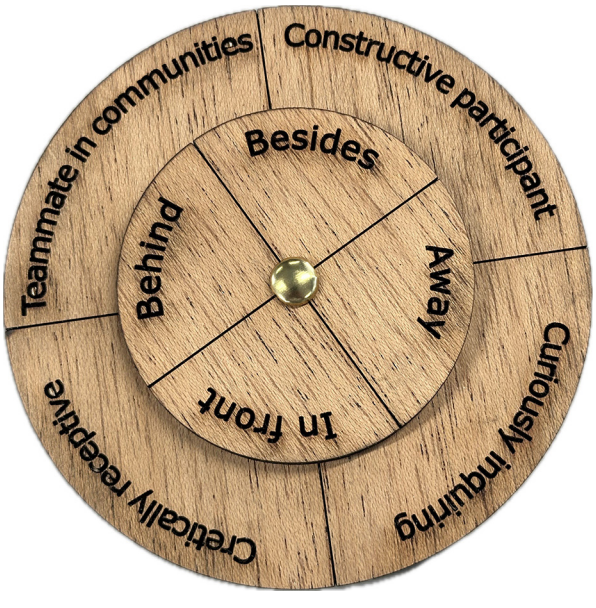
The wheel consists of two discs that can be combined in different ways. At the outside of the wheel there are four different pedagogical positions and at the inside are four different roles for teachers. The four positions on the outside are as follows: *Curiously inquiring, constructive participant, teammate in communities, and critically receptive*. These four points to the different positions a pupil can take in working with others in a practical collaboration. When *curiously inquiring* you are investigating things, assumptions, and perspectives on a given task, material, or piece of context. When being a *constructive participant,* you are creating new ways of viewing things or applying knowledge in a practical manner. Being a *teammate in communities* refers to the process of taking an active part in the learning community and thereby also interacting with the other members of the community. The last position *critically receptive* refers to the process of listening and thinking with the community and so could be viewed as a position where one is not necessarily active but listens and maybe receives feedback from peers.

The four roles on the inner disc are inspired by the work of Basil Bernstein (1996), especially the three positions, in front, besides, and behind are often viewed as different pedagogical approaches, for the teacher to approach the learning situation (Bayer & Chouliaraki 2001). We would here like to stress that the translation of the roles from Danish to English can be problematic. In the Danish language there is an action associated with the wording ‘gå foran’ etc. in English this action does not necessarily shine through. We have decided not to use the

translation 'go in front', but simply the wording 'in front'. The positions do, as explained in the text, have a connotation of an active and reflected choice of position.

Where the *in front* role can be seen as an instructional approach to the teacher's role. The *besides* role we see as a participating approach, where the teacher takes part in the community and maybe sometimes pitches in with guidance. The *behind* role we view as an approach where the teacher stays behind the learners and intervenes as little as possible, and even follows the ways which the learners take. The *away* role is added as an underpinning of the teacher's option not to take part in the community at all. Here the teacher will go away and leave the community of learners to their own devices.

Figure 1 : Klausen og Christen 2018



Our translation. The categories correspond in position to the Danish wheel.

In our study we have tried to use the positioning wheel, but also combine the ideas from this with some specific characteristics that have been developed by Bevan et al. (2014). The positioning wheel has been of importance to the reflections done as part of revising the designs of the different experiments. When learners engage in a tinkering process a reflective approach by the teacher is necessary, since it is easy to fall back into the role of a teacher that knows and has answers to all questions. Therefore, further development of the positioning wheel aimed at tinkering and children's positions in tinkering processes have been of importance. The idea of the positioning wheel is to engage teachers and pupils in a reflection process, diving into what happens in the learning process. When focusing on positionality and, as described in the introduction, the way play has a role in the project where this study was conducted, the more student centered, and experimental approaches of tinkering and play can be important aspects in formal learning. What we try to do with this approach is to open the playing field for new possibilities of participation and approaches in schools (e.g. Zosh et al. 2018).
According to Bevan et al. (2014) tinkering as an approach can bring some new dimensions to the front in learning. The dimensions they point to are engagement, initiative, social

scaffolding, and development of understanding. Within these dimensions there are several indicators that we can notice as the learners work with tinkering.

What Learning in Tinkering Looks Like

Learning Dimension	Learning Indicator During tinkering activities, learners …
Engagement	• spend time in activities • display motivation or investment in activities
Initiative and Intentionality	• set their own goals • seek and respond to feedback • persist to achieve goals • take intellectual risks or show intellectual courage
Social Scaffolding	• request or offer help to solve problems • inspire or are inspired by new ideas or approaches • make physical connections to the work of others
Development of Understanding	• express a realization through affect or utterance • offer explanation(s) for a strategy, tool, or outcome • apply knowledge • strive to understand

Figure 2: Bevan et. al. 2014 p. 32

Even though not all the above dimensions and indicators necessarily show themselves, our analysis suggests that the interviewed children experience that some of their peers tend to come to the front when working with tinkering approaches.

On the one hand, the learner's experience in working with tinkering approaches is important to look at and understand. The above model, showing dimensions and indicators can help us analyze these. On the other hand, the way teachers facilitate the tinkering process also plays a role in the learning experience. The Tinkering Studio in San Francisco, California (2015) has developed a facilitation guide that can shed some light on how teachers can work with tinkering in a learning setting. The illustration below shows the steps that they believe are necessary to undertake facilitating a tinkering process.

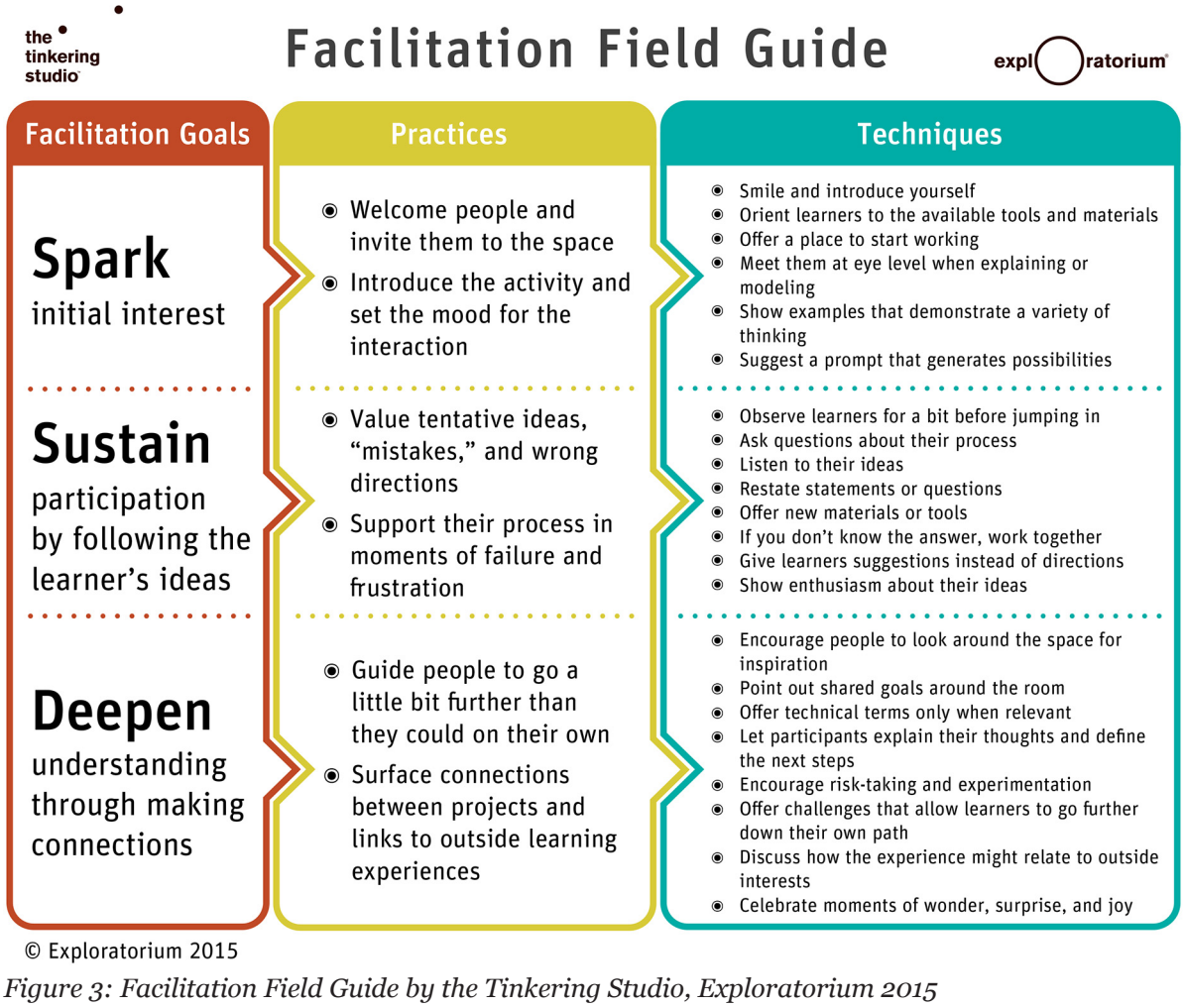


Figure 3: Facilitation Field Guide by the Tinkering Studio, Exploratorium 2015

What this guide focuses on is a three-step process that makes learners work with their own interests and focus, in that process leads them towards a deeper understanding of a given phenomenon. As Sebastian Martin the Research and Development lead at the Tinkering Studio puts it in an interview we did with him in November 2023: »*Tinkering is thinking with your hands. Learners follow their own idea. Learners choose what they want to learn*« (Hjøllund et. al, November 2023).

He also points out that tinkering is a »*Direct experience with a phenomenon, and with materials and tools in front of you*« (Hjøllund et. al, November 2023). According to Sebastian Martin, tinkering is not led by the facilitator or teacher. It is an experience, that develops the learner's understanding of a given material or phenomenon. As an adult facilitating these processes, one must be aware of the more informal and unintended learning that can take place. Sebastian Martin points to the idea that »*Learning can happen for the educator as well as for the learner*« (Hjøllund et. al, November 2023).

By building on the ideas of the positioning wheel and combining this with the facilitation field guide developed by the Tinkering Studio, we work with a framework combining the roles and positions of teachers and children with the ideas of a facilitator aspect, that goes from spark, through sustain, to deepen. By combining these views, we look at and try to understand how and what children experience when working in more informal processes in the school setting.

4. Finding and discussion

The findings in the study points to the ways in which teachers traditionally position pupils and children as first and foremost learners, who must adjust to very specific ways of learning. By this we mean that the dominant approach in schools often has the teacher as the one who knows and the children as those who are to be taught. This can be the case indeed, but often learners will have different ways of learning and different ways of participating. When we approach school as a 'same for all' approach, we can end up in a situation where many children do not necessarily play an active role in the learning process.

What the tinkering approach does to learning processes is to open up the playing field and engage pupils and children in a different manner than is normally seen in a Danish school context. The experiment in the 9th grade shows that the pupils approach language in different ways when using a more playful and tinkering-like approach, as has been the case in the experiment conducted in the 9th grade. The teacher points to the fact that youth are normally »*…very aware of what perfect English is, because a lot of the things they consume, in regard to entertainment is in English*« in line with this the youth can have a hard time expressing themselves, while others are watching and listening. This lends itself to the general idea that youth are socially very aware of how others view them regarding social positioning and culture. (e.g. Buckingham, 2008; Hjøllund, 2017 chapter 6). The way that their outside school culture blends with the classroom has implications on their social courage in class and therefore has some effect on their learning processes and how they interact with each other inside the class. When introducing a fortune teller as a spark (figure 3) for the learning experience, the pupils play around with language in a different setting than normal. A fortune teller is a folded paper toy that works by folding the paper and drawn upon the sides. It can be colors or small sentences, that tells you to do certain things. For more elaborate description, see: https://scoutlife.org/hobbies-projects/funstuff/166945/how-to-make-a-paper-fortune-teller/.

The fortune teller toy had colors on the outside and by spelling colors the students gently led into collaborating with each other on the subject matter. On the inside of the fortune teller there were different questions that related to the subject matter of the day's lesson.

»It's usually not something that you use in class, but something that you played with when you were younger. I think it's like a fun way to do something that otherwise would have just been on paper and written down« (interview, 9th grade student).

The interviewee points to the alternative ways of using materials and approaching the subject matter as something that gives a new view on how to work with language class.

Analyzing this through the lens of the positing wheel, we see that the initiation of the activity, or spark, sets up the learners to be *teammates in communities, curiously inquiring*, and *critically receptive*.

What happens when the teacher uses a more playful and tinkering like approach is that the young people tend to be more courageous in trying out language, as some of the social and learning barriers are less distinct.

Also, in acquiring new materials, learning spaces and subject matter, the tinkering approach proves powerful, as the approach lowers the barriers for participation. This points to the idea that tinkering and playful approaches open the field for participation in a wider sense than is normally seen in the formal learning setting. The tinkering approach takes aspects of informal

learning and situates this as a natural part of formal learning. As one of the interviewees puts it:

»I just get happy about it. I feel like a kid again« (interview, 9th grade student).

Even though the above quote points to a setting, where youth are set up for a playful and playlike experience, the tinkering approach is not without difficulties. In a formal learning setting it can be difficult to bring forth the *sustain* phase of the tinkering approach. Moving from an activity where the students use the fortune teller to play with language to an activity where the students must define terms on a worksheet, one could argue that the teachers still position themselves very much *in front*, because of the predetermined phases in the lesson. In our view this points to some of the shortcomings of utilizing tinkering as an approach in formal learning.

The tinkering approach does work well within shorter activities, where the teacher lets the students play around with parts of the subject matter, but it is difficult to plan for tinkering in longer lesson activities, as there is always a given content that the formal schooling that result in a predefined outcome. What this means is that it is difficult for teachers to leave children and youth to their own devices for longer periods of time, due to constrictions in lesson plans and schedules. Where the experiment with the youth in 9th grade shows some promises of a tinkering-like approach, it also shows the difficulties of incorporating given subject matter into an approach that has learners' interest and their own goal setting as a central feature.

The other two experiments of the study show some other aspects of tinkering, that have interesting implications for what the approach highlights when utilized in a formal learning setting. Both these experiments were done as part of more cross-curricular activities. Where the experiment in fifth grade was done to give children an introduction to programming and robots, the experiment with the sixth graders was done as part of a thematic week that was more focused on working with a phenomenon, than working with specific subject matter content. As one of the children points out: »*The whole way of learning was different, a bit more of doing something yourself instead of being given assignments*« (interview, 6th grade student). By working in a more cross-curricular way and within a theme, rather than with a specific subject, there is an opening for working more in line with some of the basic aspects of tinkering. The thematic work lends itself to the idea that you approach a phenomenon and play around with it through iteration, following imagination and trying out different aspects. (e.g. Resnick 2017, Presicce 2017).

While working within the freer frame of a thematic approach the children experience and work with aspects of tinkering, they tend to describe the work as something that is less controlled and fun. As one of the children said: »*It's fun to work this way because it's more free and more independent, and you can try out things*« (interview, 5th grade student). The boy points to one of the central aspects of working with a tinkering approach. The idea that you try out things and see where the different tries take you. Here the children work with setting their own goals, investing time, and displaying motivation. These aspects can be seen as indicators pointing within the learning dimensions of engagement and initiative that Bevan et al. 2014 points to as part of tinkering. The learning dimension of social scaffolding can also be observed in the work of the children in the experiments. One girl points to that when they worked with drawing robots she says:

»We find a good distribution between us when we work together. When we know what we want to do, we each take responsibility for our part, and we share ideas along the way. We were good at listening and dividing tasks« (interview, 5th grade student).

In this she points to central aspects of the social scaffolding (see figure 2), by specifically addressing that they share ideas along the way. As well as pointing toward social scaffolding aspects she also points to indicators under the learning dimension of initiative and intentionality. As she says in the interview, they actively seek and respond to feedback, and they persist to achieve goals.

Another aspect of tinkering that the children point to is the idea that you do not necessarily have to have a set goal at the outset. As one of the children said: »*I like tinkering because you don't have to come up with an idea before you start. We invent and create something*« (interview 5th grade student). Here he points to what we see as a central aspect of tinkering. When working with a tinkering approach it is the phenomena and materials at hand that lead you to think of ideas and set goals.

This aligns with a constructionist approach as set forth by Papert (1980). It is the experimentation with materials and the matter that moves your thinking and learning. In this way, the process of learning becomes more of an experimental matter than a straightforward process that leads you from point A to point B.

It is not as such a fixed matter where you go and how you get there. The phenomenon that you are working with can take you in many directions, so you must be open to where it takes you and work iteratively.

Viewing the experiments through the lens of the positioning wheel we find that these experiments shed light on how children are actively working with the four positions of the wheel when the tinkering approach is utilized. They point out how they are switching in between the different aspects. At one point they will work as *teammates in communities* as we saw the girl point to, by dividing tasks in between them. They are also positioned as c*uriously inquiring* when they try out different things in their process. They are positioned as *constructive* participants when they give each other ideas of how to move forward. Lastly, they are through these processes also being positioned and positioning themselves as *critically receptive* when receiving feedback from peers and the teacher.

5. Conclusion

What we have tried to show throughout this article is how tinkering can be incorporated as an approach in the formal learning system. The study finds that tinkering as an approach can be integrated into formal learning, but that it is not without issues. Tinkering integrates well when working in a more thematic direction and less subject specific. This means that in thematic work in school, tinkering can be a strong tool. It positions the children in a way that leans toward a more free exploration, where they can try out ideas and work with more purpose-oriented aspects of formal school. What we also find is that tinkering is harder to incorporate in more subject specific contexts.

These contexts are very controlled in the sense that it is by the outset specifically decided what the subject matter is. Here the tinkering approach can, as we pointed to in the discussion, work well as small learning activities but has some problems when working within a longer lesson plan. Our study of trying to integrate the tinkering approach in formal learning settings, does

show some promises in the way that especially the children point to heightening of motivation and a more flexible way of working that they find engaging. In our investigation we also point to the aspects of how the positioning wheel can be a useful way of analyzing the positioning of children in the learning context.

Our study, though small in context and scope, points towards some of the promising perspectives of incorporating tinkering in a formal setting, but more experiments are needed to further explore all the potentials of tinkering in the formal learning setting. This article and the findings can be a tool for teachers starting work with more experimental approaches to learning. We point toward some of the things that the teachers need to consider, when working with less closed learning processes. Reflecting on roles and positions is an important part of opening the learning processes towards a more student centered and open-ended teaching. In our study and in this article, we have tried to show how tinkering can be used in formal a formal learning setting. As mentioned, we believe that the approach studied can contribute to formal learning and to teachers approach toward a more open-ended learning process – but it is also clear that more research and development is necessary to fully integrate tinkering as an approach in formal learning. In some ways the tinkering approach needs to be adjusted, so that it can work within a formal setting. Similarly, the structure of formal learning and the roles and positions of teachers and students need to be adjusted.

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Biographies

Niels-Peder Osmundsen Hjøllund is a senior consultant and researcher at the University College Copenhagen. He is senior researcher, and part of the project management team in the Play@heart project. He has a background in research and development work with a focus on children, youth, and their use of technology and media. Niels-Peder has a PhD from the University of Copenhagen in information studies, where he has researched the influence of social media on teaching practices and how information literacy can be viewed through the lens of psychoanalysis. For the last eight years he has worked with and researched technology comprehension in public schools and professional development within both technology comprehension and playful approaches to learning.

Martin Thun Klausen is an educator and researcher at University College Copenhagen, where he is an integral part of the Future Classroom Lab. With a focus on playful learning, Martin has been deeply involved in projects such as Play@Heart and Tech&Play, which emphasize innovative educational spaces, technological understanding, and experimental practices.
With a background as a trained primary school teacher and 18 years of experience in the school system, Martin brings a wealth of practical knowledge to his academic pursuits. He holds a master's degree in ICT and Learning, where his research focused on creativity, meaningfulness, and dynamic roles and positions in education.

Lasse Remmer is an educator and researcher specializing in educational technology and future classroom practices. He works at the Future Classroom Lab at University College Copenhagen, where he plays a key role in developing and implementing new teaching methodologies. Lasse is actively involved in the experimental subject "Teknologiforståelse" and promotes hands-on learning through Playspace and Makerspace initiatives in schools. In the Play@Heart and Tech@Play projects, his focus is on integrating playful approaches to technology comprehension, fostering creativity, and enhancing students' engagement with digital technology. He holds a master's degree in ICT and Learning, where his research focused on New Nordic Tinkering in formal education.