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Using performative objects to foster creativity in an education setting to tackle complex challenges

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Abstract

Creativity is often seen as something that occurs primarily during the ideation phase of design processes. However, this article argues that there is significant potential in enhancing creativity in the early stages and that this can contribute to youth learning and tackling complex challenges. Using a Danish educational setting as a starting point, the article illustrates how using performative objects in teaching situations fosters creativity in the early stages of a design process. The article concludes that creativity is not merely an individual skill but a social practice and process, where using performative objects creates a conducive context for creativity.

Keywords

creativity, performative objects, creative contexts, education, complex challenges

Introduction

> *'...the more time a subject spent in defining and understanding the problem and consequently using their own frame of reference in forming conceptual structures, the better able he/she was to achieve a creative result (Christiaans, 1992). Defining and framing the design problem is therefore a key aspect of creativity.' (Dorst & Cross, 2001, p. 431)*

Today's challenges, such as climate change, food shortages, and inequality, require new approaches and competencies that foster creativity and the ability to act (EVA, 2020). These challenges are complex and addressing them requires understanding "competing underlying values and paradoxes" (Carcasson, 2016). Several authors highlight that creativity is one of the most essential skills for success in the 21st century (Glaveanu et al., 2020; Gray, 2016; Rahimi et al., 2024). There is no single or straightforward solution to today's challenges. Lambert (2017) argues that complex political, social, and environmental issues require creative solutions and societies. However, there appears to be a gap in the literature regarding how creative methods can be explicitly designed to evoke and support mindsets that foster tackling complex problems (Pearson, 2022). This article will discuss, guided by the research question: How does facilitation and staging of objects support creativity and contribute to developing competencies to tackle complex problems among youth in an educational setting? The research question is investigated through performative objects and staging creative contexts, focusing on the early stages of a participatory design process. We define performative objects as non-human actors that support a creative context and facilitate negotiations and reflections within collective action.

Scholars recognize the value of citizens' contributions to the co-creation of knowledge in a process that is not only practical but also collaborative and empowering (Duea et al., 2022). In

more traditional design processes, creativity occurs when the designer realizes and recognizes something significant, making creativity an outcome of the designer's insight (Dorst & Cross, 2001). However, in participatory design, everyone affected by the situation can contribute creatively to the design process (Bratteteig & Wagner, 2012). Creativity within participatory design is considered one of its essential virtues, alongside collaboration, curiosity, empowerment, and reflexivity (Steen, 2012). Although Steen (2012) describes these as separate entities, they are highly interdependent.

While creativity is vital in design processes, more research is needed on the contextual and social significance of fostering creativity among participating actors. The early stages of a participatory design process are often quite ambiguous and challenging to navigate due to various potential obstacles and the differing needs of participants (Sanders & Stappers, 2012). Traditionally, in participatory design, this navigation relies on standard qualitative research methods (such as interviews and observations) rather than explicitly creative activities. We argue that creativity has the potential to support navigation in the early stages of design, facilitating a more open-ended and collective exploration of complex challenges.

Although many researchers argue that everyone is creative to some extent, and the CERI (OECD Centre for Educational Research and Innovation) highlights that many people engage in creativity daily (OECD, n.d.), Sanders and Stappers (2012) suggest that creativity primarily belongs to childhood and is not prioritised in adult life. This could be problematic, as addressing complex challenges requires creative solutions and a population that is confident and capable of engaging in creative activities. One way to foster creative confidence and mindsets is through the school system, where exercises and methods that promote creative contexts and negotiation skills can be taught. However, to advance this effort, it is essential to understand and discuss how to define and conceptualise creativity, how creativity is currently approached in school settings, and what aspects need strengthening or support.

Creativity as interactive and collaborative processes

Creativity is a fluffy concept to define (Lambert, 2017). Generally, creativity is understood as the ability to generate new and valuable outputs and open new perspectives (Cudowska, 2018). It brings imagination and valuable outcomes for both individuals and society. However, a crucial factor in fostering creativity is providing a necessary foundation of information and education (Suciu, 2014).

Since creativity is strongly connected to generating new ideas, it is often associated with the later stages of the design process. However, we believe that creativity is also valuable in the early stages, where understanding and defining a problem take place. Dorst and Cross (2001) argue that a deeper understanding of a problem through conceptual structure formation increases the likelihood of achieving a creative outcome. A brief literature review supports this argument, which will be elaborated on later. Figure 1 illustrates the findings of this review. Little attention has been given to using creativity in the discovery phase, where the focus is on exploring problems and challenges.

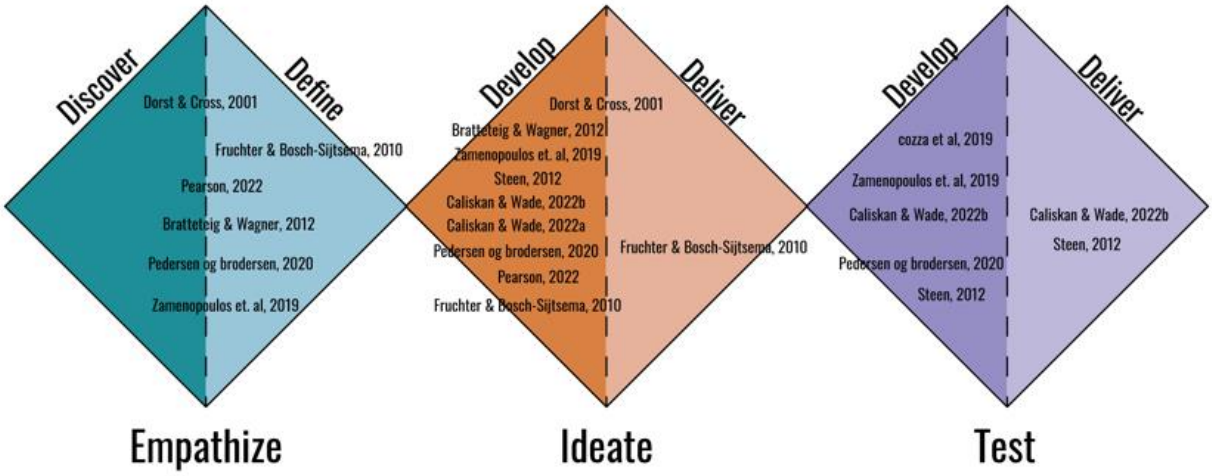

Figure 1. Findings from a brief literature review. The categorization does not depend on the level of participation or on who is participating; it is based solely on how creativity was actively incorporated into each phase. The model is inspired by the design phases in the Double Diamond framework (Design Council, n.d.)

Literature on creativity (Austin, 2003; Bratteteig & Wagner, 2012; Cummings & Blatherwick, 2017; EVA, 2020; Franklin, 2022; Jacucci & Wagner, 2007; Lambert, 2017; Suciu, 2014, Csikszentmihalyi, 1999; Sternberg, 2012) tends to interpret it through three distinct perspectives. Understanding creativity as an individual competence involves viewing it as something a person possesses or a skill that can be developed through practice (EVA, 2020). Suciu (2014) argues that a person's creativity can be stimulated by engaging in creative processes within a supportive environment, having a mentor, and participating in discussion-based games. Csikszentmihalyi (1999) and Sternberg (2012) define creativity as a process through which an individual produces something original. Supporting this, Jacucci & Wagner (2007) state that most literature on creativity has focused on the individual cognitive processes, neglecting the influence of objects and the collective processes of creativity. Austin (2003) proposes another definition, i.e. 'creativity is a long and complex series of interactions' between individuals and the setting in which something new is created. Thus, creativity is created between human and non-human actors. Understanding creativity as processes requires an introduction to the educational area since it is in this arena it is proposed. EVA (2020) concludes that creativity can be described as a co-creative process that enhances other goals, such as student learning. It involves not only thinking creatively but also being able to act creatively. Lambert (2017) emphasises that creativity is rooted in culture and is not merely a function of individual personality, competence, ability, or motivation. It is the intersection of attitude, process, and environment where an individual or group produces something valuable within a social context.

We define creativity as something that arises through a reflective process involving iterative interactions between humans and non-humans. Our observations suggest that creativity does not necessarily stand-alone but develops through collaboration among actors and as part of various actions. Creativity requires a context for imaginative thinking and openness, integrating playful elements and inspirational resources to engage participants and introduce surprise and discovery (Bratteteig & Wagner, 2012). It calls for an environment that encourages alternative

thinking methods beyond traditional settings. Franklin (2022) highlights the need to promote tools and creative techniques that enable people to think and act differently, as fostering alternative understandings of why and how things are — and how they could be — is essential for transformative sustainability agendas. This underscores the importance of cultivating a context that encourages interactions between humans and non-humans.

Fostering creativity in education

This article argues that there is significant potential for integrating and experimenting with fostering creativity in teaching through a participatory design approach and that it needs to be supported using objects. In what follows, we will explore the role of objects when creating creative contexts within an educational setting.

The purpose of the educational system is to prepare future citizens to act in society, i.e., being able to tackle uncertainties and complexities. EVA (2020) argues that fostering creativity is one way to handle such complexities or wicked problems. In recent years, there has been a growing interest in developing students' creativity competencies and supporting creative processes in formal educational settings in Denmark and internationally (EVA, 2020). It is believed that creativity is essential for critical thinking (Abrami et al., 2008), problem-solving (Runco & Acar, 2024), can enhance people's ability to see new relations (Edl et al., 2014) and can contribute to personal well-being and personal development, which all support a democratic society and active citizenship (EVA, 2020). Relating the role of creativity to Bloom's taxonomy, it is the highest level of learning (Rahimi et al., 2024).

Although scholars view creativity as a valuable component in education, there is still a need for broader social acceptance and recognition of its importance in schools (i.e. primary schools and high schools). Murgatroyd (2010) argues, 'Many teachers still teach subjects in a way that resembles how this was done 25 years ago or more' (p. 259). He continues, 'The narrative about schools and change is that they are at the forefront of change. The reality, which can be attested, is that they are not — they look, feel and are almost exactly as they were 25 years ago' (p. 260). One might argue that the school system should evolve to allow for more innovative and creative teaching methods. Cudowska (2018) suggests a need to develop a culture of creativity to enable students to reach their full potential. In Danish high schools, creativity must also be incorporated into the examination process. EVA (2020) concludes that fostering creativity can be challenging because it is a diffuse and ambiguous concept, making it difficult to evaluate and define creative competencies. To address this, this article demonstrates integrating creative contexts, as an active part of teaching and education, supports students' engagement and learning when working with complex challenges.

The role of objects in creative processes

In design processes, especially participatory design processes, it is common to involve various materialities to enhance tangibility and participation (Brandt et al., 2012). One may say that objects are just as important as participants when fostering participation and creativity (Pedersen & Brodersen, 2020a). One may say that objects are just as crucial as participants when fostering participation and creativity (Pedersen & Brodersen, 2020a). Pedersen & Brodersen (2020b, p. 73) argue, that the designer 'conceptualize activities whereby objects are circulated between actors during design events such as ethnographic field studies or workshops as frontstage activities, because this is where design efforts become visible to non-designers

and begin to perform in a collaborative way'. These materialities (physical or online 'things') are named and performed differently in literature, like devices, objects, prototypes, artefacts, probes, representations, tools, models and non-human actors. They can be staged and act in different ways in a design process: as boundary objects, intermediary objects, performative or even transformative (Brandt et al., 2012; Bratteteig & Wagner, 2012; Caliskan & Wade, 2022; Carlile, 2002; Pearson, 2022; Pedersen, 2020; Pedersen & Brodersen, 2020; Sanders & Stappers, 2012; Zamenopoulos et al., 2019). Often, objects in participatory design support empowerment processes and assist citizens in shaping their environment (Zamenopoulos et al., 2019). Therefore, the role of objects is also potentially contributing to transforming power. Following this, Pedersen & Brodersen (2020) argue that objects bring the opportunity to raise the voice of people who do not have one. This can be translated into educational settings, where teachers work with different distraction and ambition levels.

Caliskan & Wade (2022) claim that devices are the necessary link to bridge actors and networks, having a formative role in the assemblage of actions. When a designer creates things and puts them into action, it automatically takes a role in negotiating networks. Because objects have a strong agency in their presence, they can contribute to the making of action (Caliskan & Wade, 2022). The authors do not focus on creative devices but on devices that can create agency in negotiation processes. However, we believe it is essential to consider objects' role in fostering creativity in educational settings, highlighting the importance of clearly defining objectives when developing creative environments.

Sanders and Stappers (2012) advocate for developing "make-tools" because they allow for a deeper exploration of experiences, bringing tacit and latent knowledge to light. They argue that this depth cannot be achieved solely through "do-tools" (observation techniques) or "say-tools" (interview techniques). "Make-tools" are designed to enable and encourage participants to create tangible expressions of their feelings, engaging them in a creative act related to the subject being studied. For "make-tools" to be effective, they should vary in abstraction, content, openness, aesthetics, and form, allowing participants the freedom to express themselves. An example of a creative "make-tool" could be design games (Vaajakallio & Mattelmäki, 2014), which support creativity in all stages of the design process.

Facilitating an environment that enhances students' natural learning abilities is essential for fostering creativity (Cudowska, 2018). However, little research has been conducted on this topic, highlighting the need to explore the role of context in creative development and to determine how best to support teachers in adopting this role. EVA (2020) emphasizes that it is crucial for teachers to receive support in becoming sources of inspiration for creative work, thereby fostering a safe and curious classroom culture.

Reflection and understanding problems and solutions in new ways are essential to creativity. According to Carlile (2002), boundary objects can make knowledge understandable across different actor worlds; more importantly, they can transform knowledge into new forms. Moving beyond boundary objects, some objects can also act as intermediaries. Such objects can cross various knowledge worlds and mediate negotiations between actors by providing a shared or novel reference point. These objects are flexible and capable of representing concerns and translating meanings between actors to facilitate progress in the design process (Boujut & Blanco, 2003). Inspired by these insights, we argue that objects can perform

independently, not only as intermediaries between actors, and that this performativity can help foster creativity.

Franklin (2022) argues that objects can only be regarded as creative or as fostering creativity when confronting people who respond to the object's role. This is essential for supporting the development of a creative space; that is, the object itself does not need to create creativity, but rather, the interaction between the object and people fosters creativity. This idea is supported by Cozza et al. (2020), who describe how shaping a design cannot be attributed solely to people but also requires conceptual tools that enable systemic thinking. It is necessary to establish connections between individuals, groups, and objects to enhance creativity, with the objects serving as the 'glue' in this process (Fruchter & Bosh-Sijetsema, 2010).

In summary, we conclude that objects can be performative and foster creativity, enabling youth to tackle complex problems. Objects can act, be negotiated, and be translated; most importantly, they do not need to foster creativity directly, but creativity can emerge through the interactions and negotiations between objects and people. Building on these conclusions, this article explores how fostering creativity through the use of performative objects can contribute to developing competencies among youth to tackle complex problems.

Methodology

A brief literature review of articles was conducted as part of writing this article. Articles with titles that included terms like "creativity", "participatory design" and "objects" were selected. These articles were analysed to identify how objects were used to foster creativity and where they were in the design process.

The empirical material used in this article is based on a course of study in a Danish high school in Copenhagen. The course of study is part of the EU-funded research project YouCount, which was conducted by one of the authors. The case involved 17 students who acted as co-researchers, having a role in exploring ways to create a more youth-friendly, sustainable local environment. As a part of the collaborations, the students were divided into five research teams, where they needed to discover, define and solve a local-based challenge.

The examples draw on a methodological framework that combines citizen social science (Albert et al., 2021) with participatory design to foster sustainability action competence (Winther & Søgaard Jørgensen, 2024).

The study is twofold; the researcher carried out a participatory design research project studying how to engage youth working with complex challenges while facilitating a participatory design process into which the youths were invited and where they were to carry out participatory design activities. The research carried out is part of the researcher's doctoral project. Thus, the researcher had a double role while teaching and facilitating the different exercises (elaborated in what follows), i.e. as a researcher and a teacher. This double role sometimes meant that the researcher intentionally focused more on the students and their learning than making in-depth notes and observations, maybe leaving some data uncovered.

During the study, several methods usually used within the participatory design field were taught and facilitated to the students (Figure 2).

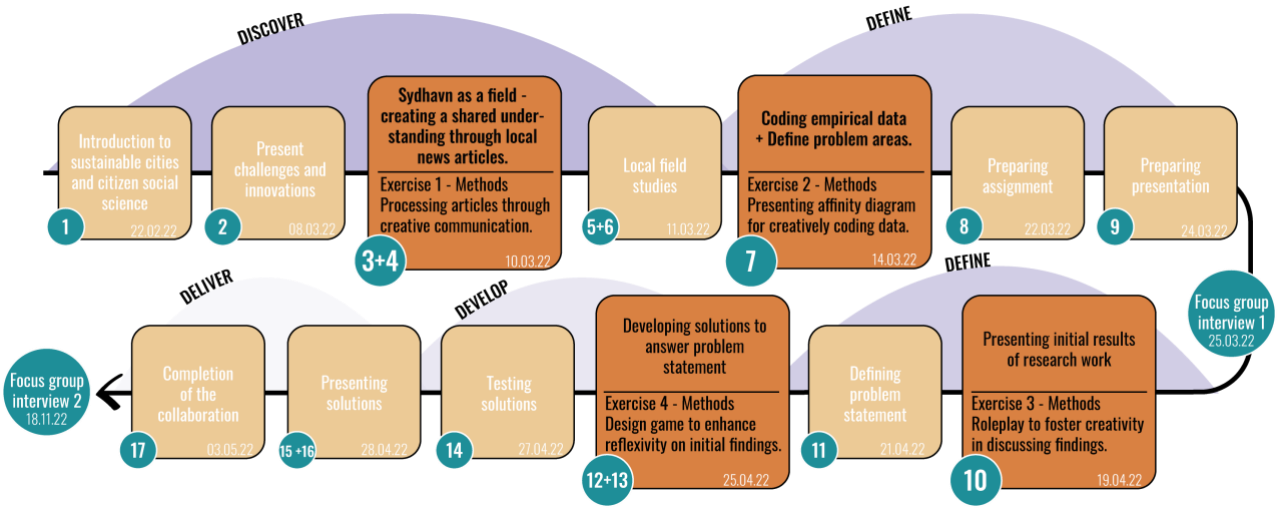

Figure 2. Overview of the high school collaboration. The orange boxes highlight the interactions used in the analysis, including the methods used to enhance creativity.

The figure illustrates the 17 modules facilitated by the researcher, including two focus group interviews. The four highlighted modules are used in this article's analysis.

The researcher facilitated two focus group interviews to evaluate the collaboration with the high school. One interview was conducted during the collaboration and one 6 months after the collaboration ended. At each focus group interview, 3-4 students participated.

Since this article focuses on how creativity can be fostered in the early stages of design processes, the analysis only reflects on this, although the collaboration explored the whole design process.

The examples presented in this article illustrate methods such as field trips and observations (Spradley, 1980), allowing the students to observe and understand the field through their own eyes and feelings. Finding quotes in articles and representing them visually was a method that enabled the students to read a text in depth. Also, the Design Games method (Vaajakallio & Mattelmäki, 2014) was introduced. Here, participants engage in dialogue through various game elements, such as rules and game pieces. Additionally, the students were introduced to the analytical coding tool, the affinity diagram (Beyer & Holtzblatt, 1997; Tomitsch et al., 2020), because it could help them organise their field notes into concrete themes. Lastly, enactment tools (Brandt et al., 2012; Tomitsch et al., 2020) were introduced to the students, i.e. roleplay, since this method encourages participants to embody either challenges or solutions.

The empirical data used as a basis in the examples that follow are based on the participatory observations(DeWalt & DeWalt, 2011) notes and pictures taken by the researchers during interactions with the students, supplemented with insights from the two mentioned focus group interviews with students after the course of study.

Enabling creative contexts in high school settings

In what follows, we outline how creativity is fostered through creative contexts and how the staged objects act performatively to generate discussions and reflections. Four exercises in a

high school setting are analysed. In all the exercises, the researcher staged and introduced the methods to the students, but they engaged with the methods and objects, producing creativity.

Exercise 1: Creative processing of articles for mutual understanding

As a part of the second module in the course of study, each research team received an article related to the local area. The learning objective was for the research team to achieve a shared understanding of the area. It was the students' responsibility to communicate the content of their article to the rest of the class. The researcher did not impose any restrictions or guidelines on how they should present the article, but materials such as pencils, A3 paper, coloured cardboard, etc., were provided. Each team was given a physical copy of the article, allowing them to cut out quotations and pictures as part of their presentation.

By staging an open-ended exercise, a space was created for students to transform the article into a visual format that could be easily communicated and understood by their peers. During the exercise, students collectively engaged with the materials provided, and the open nature of the interaction fostered a context for discussion and interpretation.

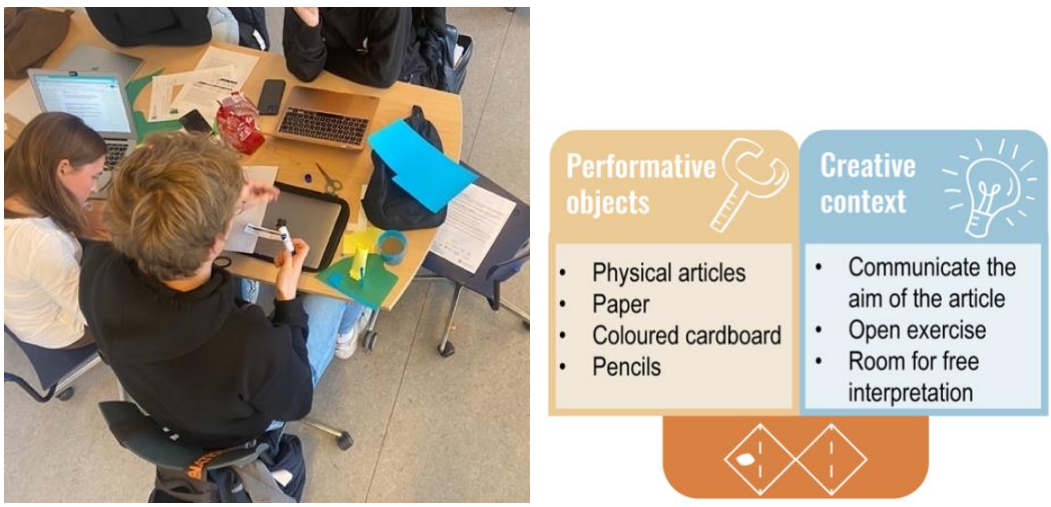

Figure 3. Students interact with objectives to communicate information from articles. And provide an overview of performative objects and creative context.

Fostering a creative context enables collective creation and reflection. Allowing students to develop ideas and act on them immediately increased their engagement with the exercise and the area's challenges.

> *'It was super nice that we had to create and present posters, making it more visual. The fact that we needed to develop it by ourselves made us come up with many cool ideas (Focus group interviews).*

This exercise created a motivating environment for the students: 'I liked that everything was not based on sitting individually in front of the computer. Instead, there was a space for discussion, allowing me to argue for our idea. Because you had already discussed it with your research team, it was easier to discuss it in front of the whole classroom' (Focus group interview).

During the exercise, the performative objects encouraged students to work creatively with written words and challenges in the early design process. This approach allowed them to negotiate, discuss, and engage with the challenges, fostering a shared understanding within and across the research teams. By this, the researcher also initiated a creative space different from what the students are used to. Introducing a creative environment within the school setting was a strategic choice to open the students' creative mindset for future interventions.

Exercise 2: Creativity in early converging phases

Before this exercise, the students went on a field trip to explore the local environment. Different from the first exercise, this exercise investigates how students creatively can work with the empirical data they gained from the field trip.

During the exercise, the students were asked to write down their observations and questions individually, developing several field notes (Spradley, 1980). They had been trained beforehand in coding data using the affinity diagram method (Beyer & Holtzblatt, 1997; Tomitsch, et. al., 2020). Each research team coded their data and experiences from the field trip to identify specific themes to focus on and develop innovative solutions. At the end of the exercise, they presented their defined challenges to the rest of the class. Post-its, blank sheets of paper, coloured pencils, and photos from the field trip were provided to support the students in the coding process.

The physical objects supported a creative context by acting as performative tools, enabling students to engage with and share their field material, make sense of it, and define the challenges they observed in the neighbourhood.

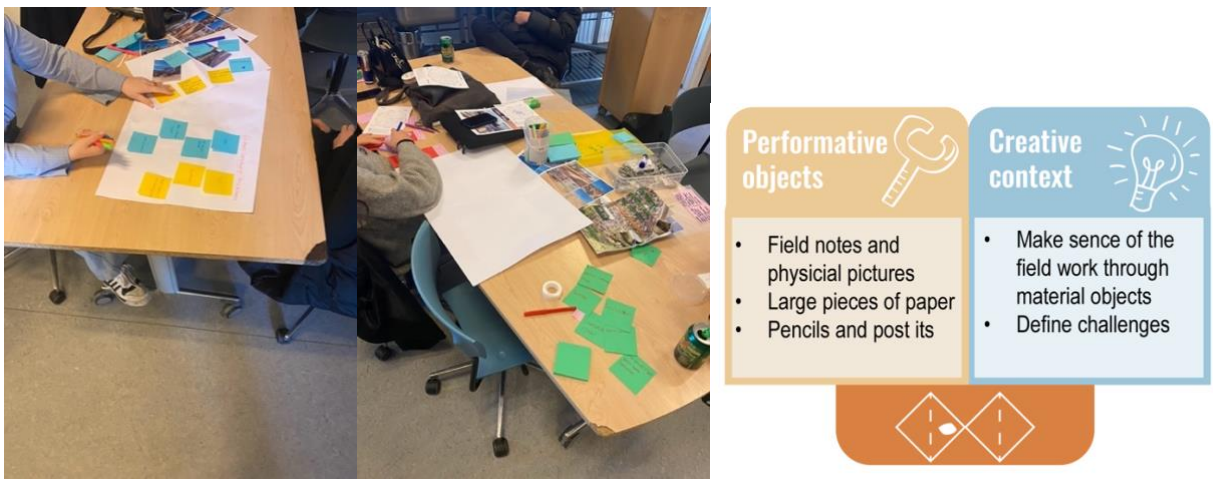

Figure 4. Students process data and interact in a creative context. Overview of performative objects and creative context.

Interestingly, the physical objects allowed students to move beyond traditional academic coding methods, instead using Post-its and pictures on posters. The coding exercise helped students share knowledge with the research team and interpret their empirical material.

This approach demonstrated a transformation in the use of objects as students engaged in discussions about their observations and experiences, creating new knowledge that informed their process of defining challenges.

> *'The fact that we were allowed to create something ourselves was nice, and it made me want to do more because it was both creative and fun. It enabled another kind of activation of the brain. Working creatively is different from writing five pages about something. We were allowed to paint, use colours and create posters. The creative elements motivated me in this project' (Focus-group interview).*

The performative objects that enhance the creative context are physical representations of the empirical material. The affinity diagram method is often used in the design process converging phases, assisting the designer/student in defining problems or refine solutions. Particularly in the early, more ambiguous stages, the affinity diagram supports designers/students in navigating the "fuzzy front end." This method gives a voice to the empirical material, where its physical representation and ongoing adjustments continually "speak" to the students. By working with the empirical data creatively, each photo or quote becomes a point of reflection.

Exercise 3: Roleplay for critical thinking

Opponent roleplays (Brandt et al., 2012; Tomitsch, et. al., 2020) were used to provide presentation feedback. Four role cards, each representing key interests for different actor groups, were developed by the researcher beforehand for the roleplay. The researcher anticipated that the roleplay would foster negotiation and create a fun, creative, and engaging environment in the classroom. The researcher designed the exercise to bring diverse perspectives from the field by incorporating varied values and viewpoints related to the defined challenges. This method allowed students to critically examine their defined problems and reflect on the diversity within the area.

The opponent cards and student presentations enabled a creative context in the project's definition phase, fostering a space for critical reflection and discussion.

Figure 5. Opponent cards for roleplay exercise. Overview of the performative objects and creative context.

The cards encouraged students to ask critical questions; some even performed an act representing their field trip findings. This creative dialogue brought a different energy to the classroom than traditional PowerPoint presentations. This exercise was also mentioned during the focus group interview half a year later than the exercise was performed, showing the potential of enacted creativity.

> *"At one point, we had an exercise where we were different people from Sydhavn, and then someone would present an idea, and we had to ask questions based on who we were—a kind of role-playing exercise shaped by our backgrounds and opinions. We learned a lot from that. It was fun to 'play' people you normally dislike; that was a great element, as I experienced a different kind of teaching. And all the discussions – that was great. I think that's also why we remember it so well now" (focus group interview)*

Interacting with objects and classmates in this way establishes a more relatable framework, which is essential for complex discussions. Moreover, it demonstrates that creativity enhances critical thinking and fosters an ability to view relationships from new perspectives, as argued by EVA (2020).

The opponent cards, as performative objects combined with the roleplay instructions, created a creative context in which students could act differently, broadening their perspectives and enhancing their critical thinking skills.

Exercise 4: Creative gaming for reflection

As a part of the development phases of the students' work, the researcher developed a design game (Vaajakallio & Mattelmäki, 2014) supporting innovation work. The design game consisted of 9 tasks in the four design phases: Discover, Define, Develop, and Deliver. The researcher provided a worksheet for the students to follow to support each task. In this exercise, we focus on the discovery and definition phases, which are understood as the early design phases.

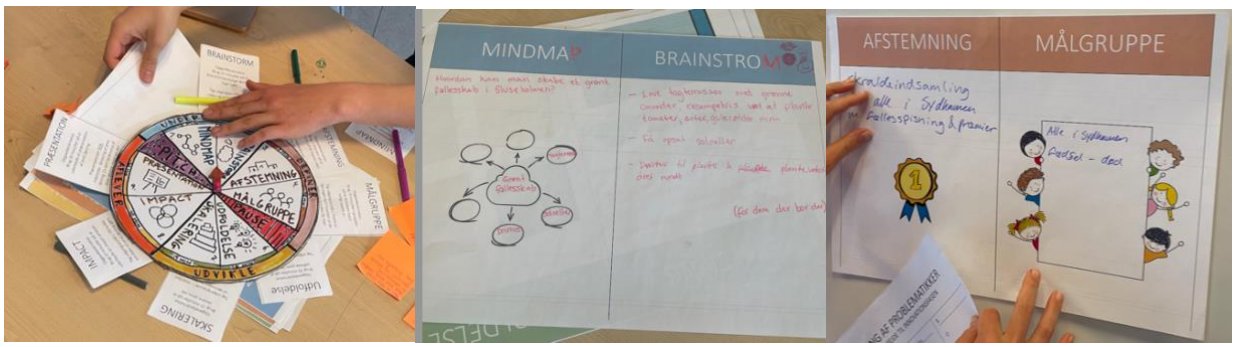

Figure 6. The design game and the four tasks. The four tasks are divided into a discover and define phase.

The design game was used to make the students explore hidden potentials and knowledge without taking their findings for granted before entering the ideation stages of the design process. It was a way to navigate the creative and exploration processes and guide them through all design stages. Through the gaming setup, students are invited into a temporary space where conventional rules and norms are suspended, which allows them to move fluidly

between the past, present, and future. This setup fosters a creative environment where negotiations, interests, ideas, and solutions can evolve.

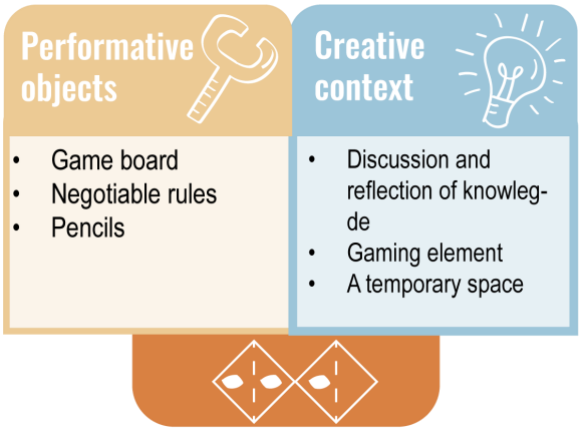

Figure 7. Overview of the performative objects and creative context.

Though the design game was used formally in the development phases of the design process, it nudges the youth to think about the early stages of their design process, negotiating their findings as a part of the innovation phase. The creative context is performed through the gaming element, where the students, through a game board, are navigated through all design stages. With a set time frame, the students were forced to think creatively to solve the tasks given. The worksheets served as a framework to support the youths' design work.

Many students skipped the first task during the game because they felt they had already done this in their previous work. This raised a discussion in class about the importance of revisiting data continuously and zooming out when working on something intensively. The discussion made the students reflect and return to the design game and worksheets. We argue that creativity emerges through playing the game but most notably through the discussions and negotiations developed through the game's stages.

The design game worked overall as intended, where all the students designed different initiatives, creating a difference in the community. Most importantly, the design game fostered a discussion about sustainability and innovation, where the individual student reflected upon their considerations and knowledge gained from previous interactions.

> *"Also, when thinking about skills and tools, I believe our project allows people to make their own mark on it, which could provide many young people with tools they can use professionally. It also fosters a do-it-yourself mentality—how do you achieve something on a small budget? That could benefit many, encouraging creativity while still reaching their goals" ("(focus group interview).*

Discussion

So far, the article has demonstrated the value of creativity in the early stages of the design process, particularly in understanding and defining problems. Drawing on Lambert's (2017) argument that creativity emerges at the intersection of attitude, process, and environment—where an individual or group produces a valuable outcome within a social context—the article

defines creativity as a reflective process involving iterative interactions between humans and non-humans.

Throughout the article, examples illustrate how objects can help negotiate and shape spaces, making theories and methods tangible and enabling students to generate new ideas, perspectives, and critical thinking. Across these examples, some common themes emerge that may inspire further research:

- Engaging in activities collectively and without external interference
- Creating or opening new perspectives
- Emphasising tangibility
- Developing ideas and acting on them immediately

Creating a context where young people can work creatively and collaboratively influences their design process and encourages them to discuss and reflect on sustainable challenges in the early stages of design. The examples illustrate that fostering a creative context through performative objects can reveal new viewpoints and perspectives on familiar issues. This ability to move beyond preconceived notions is especially critical for sustainable transitions (EVA, 2020). Therefore, it is essential to facilitate educational situations where new perspectives and mindsets are nurtured through participatory approaches.

Recommendations for enhancing creativity in educational settings

The four above mentioned points are also to be seen as recommendations for teachers to implement in their teaching. EVA (2020) emphasises that teachers must receive support in becoming sources of inspiration for creative work, thereby fostering a safe and curious classroom culture. We hope this study can serve as an inspirational case for high school teachers and inspire other creative studies at different levels in the educational system. Because we acknowledge that creative processes often require a dynamic space that can sometimes be unpredictable, which can seem unmanageable for a busy teacher (EVA, 2020), we provide a tangible framework below, hopefully making it manageable for educators to implement.

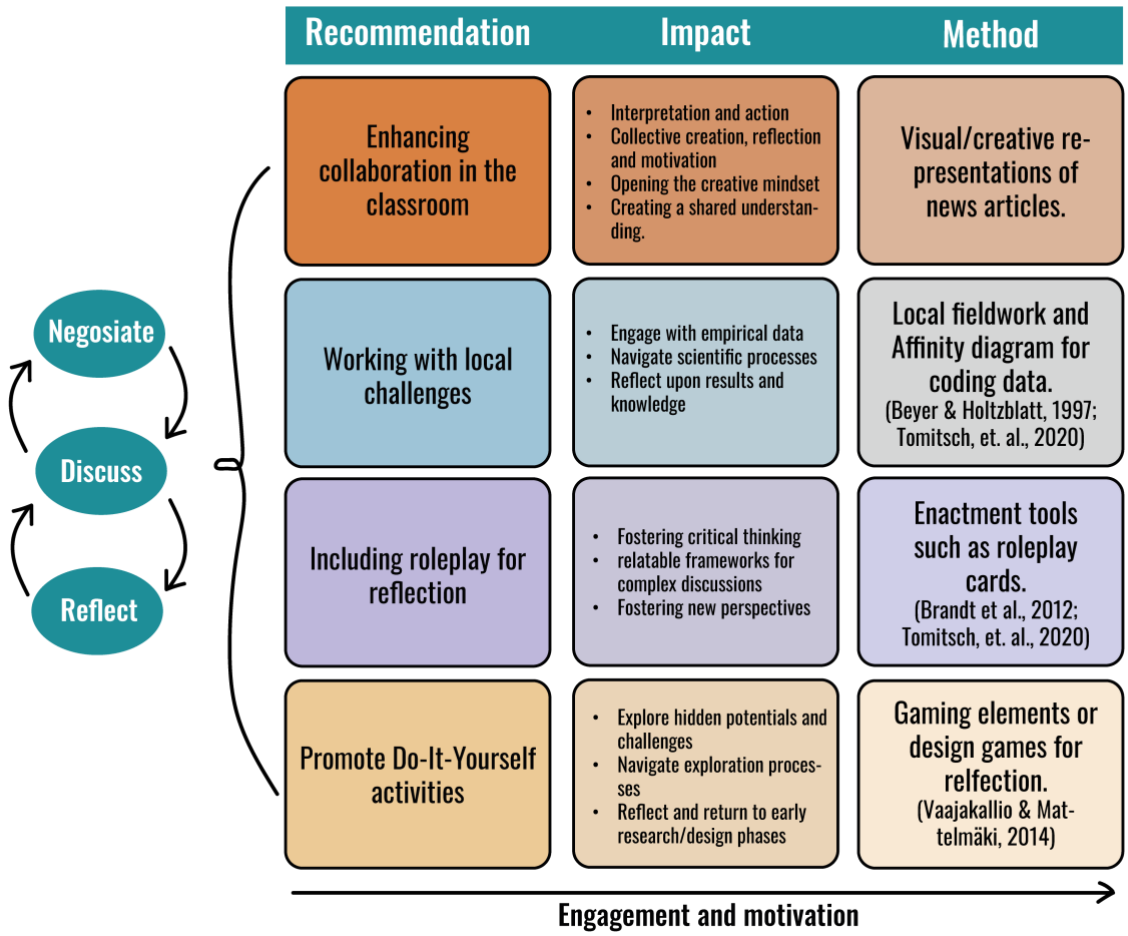

Figure 8. Recommendations for teachers at all levels to inspire creativity in the educational environment.

The framework consists of four concrete recommendations for staging creative spaces in teaching, the impact points of each recommendation, and tangible methods to follow when working with the early stages of design.

Through the research study, we investigated methods staged and facilitated by the researcher to foster creativity among youths, but it would be highly relevant to investigate further the importance of allowing the students to develop methods in the classroom to enhance creativity and motivation.

Challenges when introducing creative methods in an educational setting

Though we through the exercises have shown that there are great potential in using performative objects and participatory design to foster creativity in working with complex challenges in an educational setting, we also see different challenges. Many of the presented methods are staged to be open-ended and foster creativity through their loose frames. Though the methods' intentions are good, performing them in an educational setting was sometimes confusing for the students used to work within very fixed frames: "….This approach can be challenging, particularly in an educational setting where we are accustomed to clear distinctions between right and wrong answers, especially in nature-based subjects. I wish I had

known from the outset of this project that there was no risk of doing something 'wrong' " (focus group interview).

Though much research shows the importance of enhancing creativity in educational settings and contemporary studies show great potential of alternative didactics, the students are used to working within fixed frames, which goes against the nature to work more open-ended and creatively. The quotes highlight a cultural embedded challenge that needs to be solved on a higher level. The challenges introduce a pressing need for more interventions and alternative teaching methods in high schools to make students confident with more creative methods. Therefore, more research is needed to investigate how to challenge the rigid system and secure more creative methods to be a part of the educational didactic and how to make both teachers and students confident in working in creative directions.

The examples shows that the students appreciate an alternative way of tackling scientific questions, where they move away from their traditional "ways of doing" to a more "DIY" mentality. However, the creative aspect made the tasks too broad. "Sometimes I thought the exercises were a bit broad, and knowing what to do and the collaboration's end goal was challenging. Especially in a school setting, you are used to having very fixed structures, and suddenly, when given more freedom, you might become a bit hesitant: Am I allowed to do this? Is this the right thing to do now, or is it a waste of effort?" (focus group interview).

We (both authors) come from a design engineer background and are used to teach design related topics at university. Reflecting upon the collaboration with the high school, we have taken the more independent way of working at the university for granted. High school students are used to being guided through the tasks they are given, whereas at the university, we enable the students find ways of working and understanding the world through different theories and methods. In further research, it would be beneficial to investigate how different educational levels can learn from each other and prepare students for the real world through creative approaches.

Supporting working with complex challenges through creativity

As discussed, the role of physical objects in fostering creativity remains relatively underexplored (OECD, n.d.; Pearson, 2022). This article has examined how performative objects used in participatory processes can create creative contexts in the early stages of design. However, asking how we can further support young people in confidently performing creative activities beyond the educational setting and fostering creative action remains relevant. From the examples and the student's reflections on the impact of the collaboration, we see great potential in promoting creative methods in educational settings. Due to the method's alternative performance and presence in the class environment, it made such an impression on the students that they remembered it 6 months after the collaboration ended.

> *"Just being aware of it, and talking about it—just the fact that I'm talking about it now—means that I'll talk to others about it later, and that's a good development" (Focus group).*

Though the study is relatively small, it shows that staging creative methods can bring long-term critical thinking that can support youth in their future encountering and working with complex

challenges. When individuals can ask critical questions, they can challenge their own and others' perceptions and ideas.

Conclusion

Today's challenges call for innovative approaches that foster creativity, as argued by EVA (2020) and Lambert (2017). This article contends that creativity can support navigation through the early stages of design and research, allowing complex challenges to be explored in an open-ended, collaborative manner. Furthermore, it highlights the significant potential for integrating and experimenting with participatory design in education to foster creativity, enhance creative teaching practices, and encourage reflective thinking—supported using objects.

This article contributes to bridging a gap in the literature by exploring how creative participatory design methods in educational settings can be structured through performative objects to inspire mindsets conducive to sustainable transformation. It includes a discussion of creativity as a reflective process, characterized by iterative interactions between humans and non-humans. Central to creating these creative contexts is the purposeful staging of objectives that enable critical discussions and the generation of new ideas.

It is argued that objects can act performatively by fostering creative contexts through negotiation and engagement, allowing them to be staged and restaged by participants and facilitators. As authors, we see potential in further exploring enactment (roleplay) and gamification tools, as the examples in this article primarily focus on visual objects. While it may not be solely the exercises and alternative teaching approaches that motivate students to engage in sustainability discussions, we believe that performative objects hold promise for initiating creativity in the early stages of participatory design.

Creativity remains a diffuse and complex concept, but this article demonstrates ways to integrate creative contexts as an active part of teaching and education, showing that it effectively supports students' engagement with complex challenges. To further support creativity as a social practice and foster iterative interactions between humans and non-humans, additional research is needed to explore how teachers and the educational system can build confidence in actively incorporating creative and innovative contexts into their teaching.

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