Original Research

"I Think You Should Make All Museum Exhibitions with This Approach": Benefits and Challenges in Co-creating an Exhibition at a Science Museum with Young People

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Abstract: This study examines the benefits and challenges of involving young people aged 12–22 years as co-creators of an exhibition at a science museum in Aarhus, Denmark. Using mixed methods, the study showed how the young people experienced personal development as their participation fostered both educational and social impact while museum curators gained insights into the perspectives of the young people, resulting in a more relevant exhibition for the target group. However, the museum curators must be willing to share power and leave room for the participants' input throughout the process, which was challenging at times while also ensuring the exhibition met formal requirements. This affected the young peoples' sense of being co-creators and their experience of co-ownership of the final exhibition. For co-creation to be successful, both parties must be acknowledged as experts with knowledge of different things, as both the process and the final product are crucial to achieve value creation.

Introduction

Recently, museums have increasingly employed participatory approaches in the development of exhibitions (Simon 2010; Mygind, Hällman, and Bentsen 2015; Bønnelycke, Sandholdt, and Jespersen 2019). Inviting the public to participate in exhibition design as collaborators, co-designers, or co-creators has received considerable attention as it can be a tool to ensure inclusion, relevance, and legitimacy of exhibits (Simon 2010; Lervolino 2018; Domšić 2021).

Involving the public in the development of exhibitions is not a new practice at museums, but this has typically included testing and evaluating established elements (Lynch 2011). Traditionally, museums practiced communication and learning as an authoritative one-way transmission. Museums acted as authoritative institutions to provide knowledge to the public (Bandelli, Konijn, and Willems 2009; Lynch 2011; Bønnelycke et al. 2021). Toward the end

of the twentieth century, this top-down dissemination approach was criticized for portraying the public as lacking both knowledge and agency, resulting in a call for a democratization of museums (Bjerregaard 2020; Bønnelycke et al. 2021).

The turn toward engaging with museum audiences as collaborators, co-designers, or co-creators fosters a two-way conversation. Thus, museums have become a site for dialogue between equal partners where legitimate knowledge is not only offered by experts (Bønnelycke et al. 2021). These new tendencies have changed the perception of museums as mirrors of the world, and museums are now agents contributing with new perspectives in society (Bjerregaard 2020). When implementing public participation from the early stages of the exhibition development, the exhibition becomes a process of *knowledge-in-the-making* (Bjerregaard 2020) rather than a platform for disseminating already established and curated insights.

Participatory approaches may lead to access to specialized and lived knowledge from certain groups of people (Hodson, Svanda, and Dadashi 2023). Greffe (2012) highlighted how museums can include audiences that have been underrepresented in museum contexts, e.g., young people. Studies show that being involved can lead to empowerment and confidence among participating individuals and communities (Azzarito 2016; Flewitt et al. 2018; Burke et al. 2021). Similarly, institutions can use this knowledge and perspectives to gain insights that may enrich the quality and relevance of the outcome (Smit 2013; Azzarito 2016; Lervolino 2018). However, studies have also highlighted challenges in public involvement. A potential source of conflict that is mentioned frequently is the question of power and hierarchy. If unexpected boundaries and restrictions are set in the creation of a product, it can influence the motivation of the participants and their sense of agency (Mygind, Hällman, and Bentsen 2015; Bønnelycke, Sandholdt, and Jespersen 2019; Zeylikman et al. 2020; Crabbe, Husok, and Kraehe 2022).

Despite an increased focus on participatory methods in museum exhibition design, the possibilities and challenges in practice are still under-researched (Bønnelycke, Sandholdt, and Jespersen 2019). More studies are needed to gain insights into the complexity of participatory approaches, when and how it is useful, and the value it generates. The contribution of this study is based on co-creation of the exhibition *The Body as Data* at the Steno Museum in Aarhus. The Steno Museum is a part of the Science Museums at Aarhus University, which includes three museums in Aarhus. In the following we examined (1) what young people gain from involvement in a co-creation process of an exhibition at a science museum and (2) what benefits and challenges this involvement entailed for the museum curators.

The Exhibition *The Body as Data*

The exhibition *The Body as Data* opened in 2021 and is co-created primarily with a selected group of high school students as well as primary school pupils, hereafter referred to as young people. The exhibition focuses on mental health, data sharing and online identity, and the

target group is primary school pupils aged between 12–16 years who visit the museum on school excursions. The exhibition *The Body as Data* is the latest part of the exhibition called *Dear Difficult Body*, which opened in 2011. The goal of the exhibition is to make the visitors aware of how contexts and surroundings affect and shape perceptions of the body. The newly co-created section was developed as part of the research project called "Giving Young People a Voice." The aim of this project is to rethink science communication about mental health, data, and use of technology by collaborating with young people to develop several digital and interactive communication products. The exhibition is one of those products. The exhibition consists of three areas. First, the visitor is given a historical perspective on data collection in Denmark through a video and a display of different objects, such as a 1600s list of births and deaths from a church just outside Aarhus, one of the first public data collections in Denmark. Other elements like the implementation of civil registration numbers for all Danish citizens and a blood bank with heel blood samples from all newborn babies are displayed. Next, the visitor enters an area focusing on the sharing of data and data discrimination communicated by two animated videos, a poem, and a marionette doll. The last area consists of a drawing exercise where visitors can illustrate what they share and do not share about themselves on social media. Involving young people as co-creators in the early stages of the development of the exhibition was a new initiative at the museum.

Materials and Methods

Workshop Participants

The young people who participated in the development of the exhibition through different workshops were current or former students at the Academy of Talented Youth (ATY). ATY is a two-year talent program for students in high school. The ATY unit of the central Denmark region is a partner in "Giving Young People a Voice." The students were aged between 17 to 22 years. They were slightly older than the target group of the exhibition but were asked to look back in retrospect and imagine what they would have liked to experience when they were the age of the target group for the exhibition. More than three hundred primary school students aged between 12–16 years participated in one of the workshops to involve the target group for the exhibition. The workshop was scheduled at the museum as a part of a national theme week for the pupils involved.

Design and Procedure

The development of the exhibition was inspired by a design thinking process approach. Design thinking can be defined as "a systematic and collaborative approach for identifying and creatively solving problems" (Luchs 2016, 1–2). Design thinking is people-oriented, and ideas and products are created based on needs, experiences, behaviors, and perspectives of a

specific target group (Luchs 2016; McLaughlin et al. 2019). The design thinking process consists of three key phases: inspiration, ideation, and implementation (Brown 2008). In the inspiration phase, the design problem or opportunity is identified by observing and engaging with the target group. Ideation is the phase of generating, developing, and refining ideas. Implementation involves the introduction and application of solutions. Prototyping is a key element of this phase along with obtaining feedback from the target group that may lead to adjustments (Tschimmel 2012). Despite this division into phases, the process is non-linear. The phases can overlap, be conducted in parallel or out of order, and be repeated at different stages in the design process as problems surface (Luchs 2016). The non-linear process encourages iterative exploration and a continuous focus on improvements and refinement of the problem to secure the understanding of the needs of the target group (McLaughlin et al. 2019). This approach resulted in six workshops with the young people between October 2020 and May 2021. An overview of the workshops is illustrated in Figure 1.

Workshop 1: Inspiration

Where: The Steno Museum.

Participants: 7 former ATY students.

Aim: Brainstorming and idea generating topics and themes.

Workshop 2: Inspiration/Ideation

Where: Aarhus University and online.

Participants: 140 ATY students, 5 former ATY students from WS1 as facilitators.

Aim: Brainstorming upon ideas, categorizing them, and translating them into a template.

Workshop 3: Ideation/Implementation

Where: Online.

Participants: 5 ATY students.

Aim: Pre-testing of a drawing exercise (an element in the exhibition). Feedback on the element.

Workshop 4: Ideation/Implementation

Where: Online

Participants: 300+ students from eighth grade in primary school.

Aim: Pre-testing of the drawing exercise on the target group. Feedback on the element.

Workshop 5: Inspiration/Ideation

Where: Online.

Participants: 5 ATY students.

Aim: Brainstorming on the term "data discrimination" and how to implement the theme in the exhibition.

Workshop 6: Implementation

Where: Online

Participants: 10 ATY students

Aim: Validating and testing the different elements of the exhibition. Final feedback and decision-making.
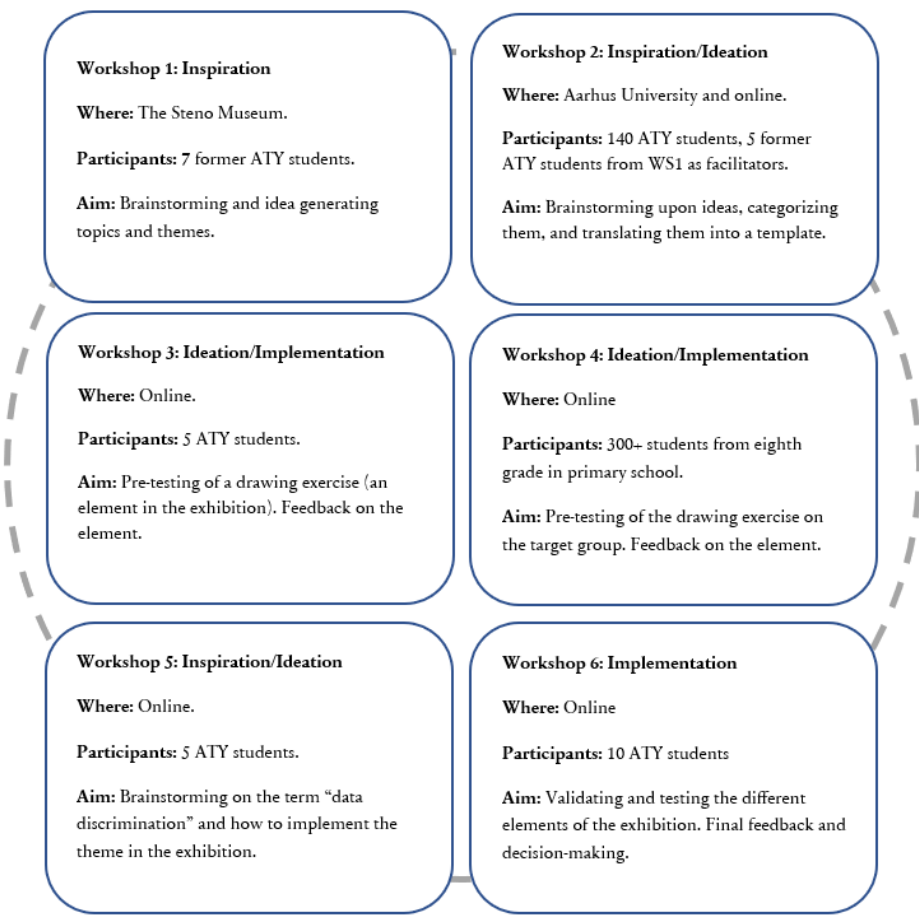
Figure 1: Overview of Workshops 1-6

Workshops 1 and 2 were part of the inspiration and ideation phases and focused on the young peoples' immediate thoughts and discussions about data and data sharing. In Workshop 1, seven former ATY students participated, while 140 ATY students participated in Workshop 2. The questions and exercises in Workshop 1 were kept broad and open to get the students' perspectives and ideas relevant to the exhibition limiting framing or bias from the museum curators. Workshop 2 was an extension of the brainstorm from Workshop 1. The exercises were still broad and open in Workshop 2, yet the students were asked to enter their ideas into a template, made by the museum curators, to make their ideas concrete and to consider five certain elements in relation to the exhibition. This included which emotions should be evoked, what the eye-catchers should be, what knowledge they wanted to disseminate, the message of the exhibition, and the main essence of their idea.

Workshops 3, 4, and 6 focused on refining, testing, and validating elements and prototypes of the exhibition based on the previous workshops, final feedback, and decision-making. These workshops were a part of the ideation and implementation phases. In Workshop 3, five ATY students participated; in Workshop 4 more than three hundred primary school pupils participated; and in Workshop 6, ten ATY students participated.

Workshop 5 was also a part of the inspiration and ideation phases and revolved around getting the young peoples' input on the term "data discrimination." The young people shared their notion of the term and what it meant to them; afterwards, they were introduced to a definition of the term by the museum.

The involvement of the young people in the workshops was based on a co-creation approach. Views on who should be engaged in the different stages of the project along with when and what it takes to be defined as co-creation vary considerably (Sanders and Stappers 2008). Sanders and Steppers (2008, 6) have broadly defined co-creation as "any act of collective creativity, i.e., creativity that is shared by two or more people." Within museums, Govier (2010, 4) defines co-creation as "acting in collaboration with users to create something new." Simon (2010) distinguishes between four forms of participatory practices within museums based on who defines the project and makes the decisions: contribution, collaboration, co-creation, and hosting. Co-creation refers to a process where the museum stakeholders and the target group work together from the start to define and implement the project (Simon 2010).

The creation of *The Body as Data* exhibition was conceived as co-created in the sense that the young people were involved from the beginning to identify the problem and were invited to participate in every step of the process from brainstorming and developing themes to giving feedback and participating in decision-making. The overall topic of the exhibition was decided beforehand by the museum, but workshops and exercises were designed to leave room for the students to shape the exhibition. Some of the students took on the role of facilitators during Workshop 2 and thereby contributed to data collection. A few students worked as museum guides after the opening of the exhibition and thus also participated in

the dissemination of the project. A mix of methods was applied to examine how the young people and the museum curators experienced the co-creation process.

Observations

In each workshop, observations were made by at least one researcher from Aarhus University to document the process. The observations were based on a semi-structured observation guide with a focus on three themes: (1) outcome from and dialogue about the topic, (2) exhibition as a format for communication, and (3) involvement of the young people. All three themes provided insights into the co-creation process and value creation. However, the focus was mainly to explore the third theme, as this revolved around the collaboration and dialogue between the young people and the museum stakeholders and thus how the involvement impacted the process. The observations were documented in writing and put into a template based on the observation guide.

Questionnaire

Following Workshop 2, all 140 participants were asked to complete a feedback questionnaire. The aim was to evaluate the workshop and get the young people's early-stage perspectives on the co-creation process. The questionnaire data were completed in Survey Exact. Some of the questions were open-ended, and some were limited by response options. The questionnaire was sent by email immediately after the workshop, followed by one follow-up email two weeks later. The questionnaire response was anonymous. A total of 91 of the 140 participants completed the questionnaire. The questions revolved around expectations and motivation, learning outcomes, and general feedback.

Interviews after Workshop 2

Following Workshop 2, interviews were conducted with multiple stakeholders: four ATY students, four facilitators (former ATY students), three museum stakeholders, and one staff member at ATY. The aim of the interviews was to get more in-depth knowledge from the ATY students as a supplement to the questionnaire, while the process was still in the early stages. Furthermore, the aim was to get insights into the other stakeholders' perspectives on the workshop.

During Workshop 2, the students who would participate in an interview wrote their name and contact information on a list and were contacted to make an appointment for the interview. All interviews were based on semi-structured interview guides with an overall focus on outcome and learning from the workshop and experiences with the collaboration and co-creation in the workshop. Interviews were completed online using the Zoom platform between December 2020 and January 2021 by two researchers at Aarhus University. Interviews lasted between twenty to sixty-one minutes.

Interviews after the Opening of the Exhibition

After the co-creation process had ended and the exhibition had opened, a second round of interviews was conducted with three former ATY students, two museum curators, and one staff member from ATY. The aim of these interviews was to get insights into the overall experience of the co-creation process from different perspectives as well as thoughts on the final product.

All five former ATY students who facilitated Workshop 2 were invited to be interviewed, and three accepted. Two of them were interviewed together. Each of the interviews were based on a semi-structured guide directed against the specific stakeholder. The interview guides generally focused on the experience of the young peoples' influence on the exhibition; reflections involving young people as co-creators, including possibilities and challenges; and value creation. Interviews were completed online via Zoom between June 2021 and August 2021 by two researchers at Aarhus University. Interviews lasted between twenty-seven to fifty minutes.

Ethics and Data Analysis

Oral consent for the interviews and observations was obtained from participants. Regarding the questionnaire, participants were provided with information about the project and explicitly informed that their completion of the questionnaire was perceived as consent to participate. Additionally, all students enrolled at ATY willingly provided written consent to actively participate in multiple research projects. All participants have been anonymized.

All interviews were recorded and transcribed verbatim in preparation for subsequent analysis. We compiled all written material from the observations, open-ended questionnaire responses, and interview transcripts. We applied Brinkmann and Kvale's (2015) approach to qualitative analysis with meaning condensation. This approach involves multiple steps and is used to analyze and interpret data to identify and extract key meanings and themes. The analysis was conducted by three researchers to ensure rigor and increase reliability. All data were coded and analyzed using the qualitative software program NVivo 1.5.

Results

The Young People's Perspectives

Motivation and Experiences of Personal Outcome

Overall, the students expressed that they found it interesting, inspiring, and motivational to be involved in designing and developing a museum exhibition. The questionnaire showed that 68 percent of the respondents found the activities in workshop 2 to be motivational and engaging to either "a great extent" (23%) or "a satisfactory extent" (45%). Some emphasized that they found it motivational to be able to influence and contribute to a concrete and real project as opposed to fictive projects.

Several of the young people who were interviewed said that they found it meaningful to be involved in developing the exhibition because the subject was relevant to them. One student said: "I think it was super cool. After all, the exhibition is about us young people and how social media affects health and how young people feel. So, it made sense to get first-hand sources. Then you get input from people you might not normally talk to" (Participant 1, interview after Workshop 2).

The three students who were interviewed after the opening of the exhibition also emphasized that it was important for them and their experience of being co-creators that they could see their contribution reflected in the final exhibition. They had participated in the co-creation process to different degrees and in different stages of the process. They all expressed that they could see themselves and their ideas reflected in the exhibition. One of them said:

> Specifically, I remember that we had a funny idea with a doll or a mannequin…We had many different variations of that idea. Then it was just fun to come in and see how the mannequin was used in the exhibition…I thought it was fun to see the concrete, material things that we'd talked about from the beginning. It made me think wow, I've been a part of this. (Participant 7, interview after opening of the exhibition)

They all expressed that seeing the final exhibition gave them a sense of pride and a feeling of being heard. The staff member from ATY also highlighted how he found the dialogical approach between the museum curators and the young people very positive as they were involved in several stages of the development of a concrete element. Three students emphasized how the co-creation process created value for them personally. One of them shared how the participation in the project had led her to start a project together with a friend focusing on how to involve young people more in society in general. She also stated how the different workshops had made her more interested in how museum exhibitions could be done differently.

The questionnaire results showed that the workshop provided learning for most of the young people. When asked whether they could use some or more parts of the content from the workshop in their everyday life, 67 percent answered either "yes, certainly" (19%) or "yes, I think so" (48%); 57 percent answered one of these options when asked whether they could use some of the workshop content in their daily schoolwork. Some respondents reported that they had learned new terms and gained a larger understanding of what data is and how it is used. The workshop had made some of them reflect on what kind of data they share, which they would keep in mind next time they provided consent to something.

Several of the young people, both in the interviews and in the questionnaire, highlighted the group work during the workshops as something they enjoyed. They found it valuable to be able to speak with peers about social media and data. They expressed that people were open and willing to talk, which paved the way for an honest and open-minded conversation about the topic. One student said that they talked about what was troubling them in relation

to body types and ideals and how it was rewarding to hear the other students' perspectives and experiences. The student further expressed how some social media themes are tabooed, and it was good to be able to talk to others to challenge these taboos. This gave them a feeling of not being alone, which some of the primary school students also expressed after testing one of the exhibition's elements.

General Benefits of Co-creating Museum Exhibitions

The three students interviewed after the project ended also gave their perspective on the general outcome of co-creating museum exhibitions. One of them expressed how he found the process valuable for both the young people and the museum but also for the product itself:

> I think you should make all museum exhibitions with this approach…I also think it is a strength for the exhibition afterwards. Every time I show students around in the museum I can say: This exhibition is made by young people just like you, and then they can sit there for two seconds and just think: Okay, someone like me made this, then it's probably also something where I have to listen extra carefully. (Participant 6, interview after the opening of the exhibition)

The three students highlighted that the involvement of young people made the exhibition more relevant and fostered a feeling of the exhibition being targeted at you as a young person. The students believed this would make young people more eager to go and see the exhibition. Two of the students said that they found it a strength that many different students were involved in the process of developing the exhibition as it provided a broader perspective. One of them said: "I really think that it is an advantage that those involved are someone who doesn't know anything about it at all, so that it is not just the same thoughts and ideas that repeat themselves" (Participant 5, interview after the opening of the exhibition).

Challenges in the Process

Some students expressed that they would have wished for more insights into the process to be able to follow what happened in the different workshops, such as who and how many were involved. One participant said:

> We participated two or three times, but the rest of the time we didn't even know what was going on. And you didn't need to know much either, just knowing that now they've had a new team of ATYs in for something else, or now they've started hiring someone to sit and draw the sketch of how the exhibition should be; here is the sketch we are working with right now. Just something like that where you sort of do something so that everyone feels that they are still part of it. I think that was something that could be done differently in the future. (Participant 6, interview after the opening of the exhibition)

The three students interviewed after the opening of the exhibition stated that this could have been beneficial to increase the sense of co-ownership and the feeling of it being a joint project and thereby promote engagement. The staff member from ATY also expressed that he beforehand had hoped that everybody who had participated would perceive their experience as having created an exhibition. However, this perspective was not shared by everyone.

In the questionnaire, several students reported how they would have liked feedback on their concrete ideas and more information on how their input in Workshop 2 would be used. One of the respondents wrote: "The young people should know that their contribution matters. The most motivating thing is knowing that what you do means something to others" (Respondent 1). Similarly, they would have liked a clarification of expectations regarding their future role. In the survey, 31 percent answered that they found the activities to be motivational and engaging to either a "moderate degree" (26%), "some degree" (2%), or "not at all" (3%). Some wrote in the comments that they had a hard time figuring out what the workshop would lead to. Additionally, some expressed that they would have wanted to be involved in more parts of the project. One student hoped for an invitation to the opening of the exhibition.

This aligns with reflections from one of the students who were interviewed after the exhibition had opened. She said that it could be challenging to reflect the viewpoints from so many people in one exhibition. Although she stated that it was a strength, there is also a risk of chaos: "When you invite people to participate, you need to be aware in every step of the process, why do we do it, and what do we want to achieve?" (Participant 7, interview after opening of the exhibition).

Some of the students also highlighted practical challenges in the co-creation process. As the museum exhibition was a part of a bigger exhibition, the physical framework was decided beforehand. This limited the young peoples' influence on the final exhibition, as not all their ideas were possible or realistic. However, they expressed that they thought good compromises were made to implement the ideas in another way. One student mentioned that he got the impression that some of the elements in the exhibition were primarily decided by the museum. He suggested that to strengthen the feeling of co-ownership and co-creation, extra workshops could have been held, as was done with certain elements in the exhibition. He said: "You could ask: "If we are going to incorporate a historical hallway, what should it contain?" (Participant 6, interview after opening of the exhibition).

The Museum Curators' Perspectives

The Young Peoples' Influence on and Benefits of the Co-creation Approach

The three museum curators who participated in the first two workshops all expressed that they experienced motivated and committed students. Already at this point they found the involvement of the young people valuable as the young people contributed with new perspectives and inputs. Both museum curators interviewed after the opening of the

exhibition said that the involvement of the young people had a huge impact on how the exhibition turned out. One said: "The conceptual idea of what this exhibition was supposed to look like has completely changed. Our original conceptual idea was to portray selling or giving data online like prostitution. We thought that was hilarious. But the young people didn't. They didn't get it" (Museum Curator 1, interview after the opening of the exhibition). She further stated: "It was a good thing we didn't end up with that idea. Because then people—especially our target group—would have come in and thought 'what is this all about?'" She elaborated:

> The first question we asked the young people was "what is data?" And they said totally different things than we had expected—than what we would have said. That made us aware that it is important to define what data is. If we just say "data" they imagine something else than we do. Again, we wouldn't have been aware of this if we hadn't involved them from the beginning. Then we would have just continued with our own concepts. (Museum Curator 1, interview after the opening of the exhibition)

Following Workshop 2, one museum curator also stated that she found it beneficial to involve the target group as early as possible because it could change the focus of the exhibition. Several of the museum curators expressed how co-creation can be challenging but in a good way. One said that it was an obligation in this process to solve it in collaboration with the young people: "It is a different challenge, and I find that funny" (Museum Curator 4, interview after the opening of the exhibition). She also stated that she found the co-creation approach a way to take the people they do exhibitions for more seriously—to do it *with* them instead of solely *for* them. Regarding the approach of involving many different students, one museum curator expressed that she found it a strength to involve a small group of people from the beginning to the end of the process and to involve bigger groups in single workshops or activities providing new perspectives.

Challenges in the Co-creation Process

Even though the museum curators generally found the co-creation process to be valuable in the development of the museum exhibition, they also pointed to several aspects to be aware of and things that could have been done differently during the process. First, as the co-creation approach was a new way of working for the museum, several of the museum curators highlighted that it required some getting used to. It required the curators to be willing to welcome the young peoples' input and ideas and not just let them test their already established ideas. Following Workshop 2, two of the museum curators said that they had a hard time picturing how the exhibition would end up because it was dependent on ideas from the young people. The results were thus unknown, and museum curators had to cope with that.

Both museum curators who were interviewed after the exhibition had opened highlighted how the co-creation process was limited by practical aspects. One of the curators emphasized that there were certain frameworks they had to comply with such as space available and whether wheelchairs could fit in the corridors. Some of the ideas the young people came up with had to be reworked to make them fit these frameworks. They stated how they had an obligation to include objects in the exhibition as a museum. In the first brainstorm, the young people did not include objects in their ideas at all. Then museum curators thus had to introduce this aspect to the young people. Likewise, the young people wanted to design the exhibition as a linear route, but museum curators told them that museum guests rarely go through an exhibition this way.

One of the museum curators said that some of her colleagues had been skeptical of involving the young people so early in the process as it could potentially challenge the museum curators' role as experts. However, she found that it instead just changed the function of their role as experts. She said:

> We can easily have this desire to create a hierarchy that says: I know a whole lot, and the student doesn't know very much. And then I maintain my position as the knowledgeable one by maintaining the student as the ignorant one. And what we do here is to say: We know different things. We know a lot about data and discrimination. They know a lot about what it means to be young. Let's try to see what happens when the two things meet. So, it becomes a more equal way of entering a collaboration. (Museum Curator 1, interview after Workshop 2)

She stated how the museum curators still had a say in the co-creation process. She elaborated:

> There are some who will misrepresent user involvement as us giving the users what they want. And I don't think we should…We also have a message. It is science communication…It wasn't the case that they had to make an exhibition themselves for our money. But involving them has given us an awareness of what triggers young people. What do they find provocative? What do they think is crazy? How would they like to contribute? How would they like to be met at a museum? (Museum Curator 1, interview after the opening of the exhibition)

Besides challenges regarding roles, two museum curators also mentioned time as a challenge. One of them said: "It requires more time when you can't just fix it yourself…There is a lot of logistics in arranging for the young people to come in. After all, those children or young people go to school" (Museum Curator 4, interview after the opening of the exhibition). This challenge caused the museum curators to make some of the final decisions to be able to finish in time. Furthermore, the process was challenged by the COVID-19 pandemic, which prevented physical meetings. One of the museum curators said that she

would have wished for the young people to be more involved in the final arrangement of the exhibition and that they could have found better solutions to come across this.

In the final interviews, the two museum curators were presented with the young peoples' wishes for more insights into the process, more feedback, and a clarification of expectations. Both museum curators acknowledged this. One said: "Before you start, I think you need to make a plan for how you are going to communicate with the participants throughout the project" (Museum Curator 4, interview after the opening of the exhibition). She agreed on the importance of giving feedback, as it is a way of acknowledging their input. The other museum curator added that if she had the chance to go back in time, she would have made a more fixed meeting schedule. She expressed how they had been worried about sending too many emails to the students, yet this had been a misinterpreted consideration.

Discussion

Value Creation for the Young People

This study points to several gains and challenges for both the young people and the museum curators when involving young people to participate as co-creators in the development of an exhibition at a science museum. In line with findings from other studies involving young people in a co-creation process (Tzibazi 2013; Azzarito 2016; Flewitt et al. 2018; Burke et al. 2021), the current study showed how the young people experienced a sense of empowerment through the allocated agency and the feeling of co-ownership of the final exhibition. Studies have shown how young people acquire new skills and knowledge by being involved as co-creators, which may benefit them in the future (Flewitt et al. 2018; Domšić 2021; Crabbe, Husok, and Kraehe 2022). A study examining a heritage exhibition project with young people conducted a survey before and after the project to get an insight into the impacts of the project for the young people (Domšić 2021). It showed that the most powerful impacts were achieved in the category of personal development, especially in the field of knowledge, skills, and interests. Although we did not conduct a questionnaire study prior to the project, our findings indicate that the young people experienced a learning outcome in relation to both data and social media and how exhibitions are developed. They expressed curiosity, astonishment, and personal reflections on online behavior. The two students who started a new project after the co-creation process are examples of how participating in the exhibition development fostered new interests. The findings indicate that participating in projects like this may be a way to discover new career goals for the young people, as argued in other studies (Azzarito 2016; Crabbe, Husok, and Kraehe 2022).

By participating in the development of the exhibition, the young people had the opportunity to voice their perspectives in a setting they normally did not have any access to. It created a space and an opportunity for the young people to share perspectives with their peers. Engaging in the co-creation process thus not only resulted in an educational impact,

but also had a social impact as it led to experiences of being seen and having feelings acknowledged and normalized in relation to social media and online behavior. This relates to why several of the young people expressed that they found co-creation to be a good way to develop museum exhibitions. Having young people as co-creators of the exhibition can also create a space for the visitors of the exhibition to feel mirrored and a part of the community. As expressed by one of the young people, it was a different experience that evoked other feelings than if peers had not been involved in the development. Thus, it potentially had an impact for the receivers of the final product. In a study on a collaboration between a science museum in London and ten young transgender people, Lervolino (2018) also found how the participants experienced both personal and collective validation and recognition by being engaged in the development of a museum exhibition.

The value the young people experienced when participating in the exhibition development could have been improved by more communication during the process and clarifying expectations from the beginning. This seemed to be especially important when participants were only involved in some of the workshops. Other studies also underline the importance of aligning expectations. If expectations of the participants and the museum curators in relation to roles and contributions are unclear, clash, or change during the process, it can affect participants' motivation and their experience of the value they gain from participating in the process (Bønnelycke, Sandholdt, and Jespersen 2019; Crabbe, Husok, and Kraehe 2022).

It is important to note that in this study, most study participants were ATY students. ATY affiliation may indicate that students have more resources, academic ability, and motivation. The experience of value creation could have been different if a different group of youth had been included. However, this challenge is widely recognized and acknowledged in public engagement activities (Bultitude 2014; Jensen and Buckley 2014).

Implications for the Museum Curators

The young people were first-hand sources providing viewpoints, opinions, and lived experiences that the museum curators would not otherwise have had access to or been able to represent legitimately without the young peoples' participation. This aligns with the most common reason for engaging young people in co-creation processes. The young people are seen as experts on their own lives, having access to community-specific knowledge. They are thus engaged because of the knowledge they possess or have access to (Mygind, Hällman, and Bentsen 2015; Baker 2016; Azzarito 2016; Flewitt et. al. 2018; Lervolino 2018; Bønnelycke, Sandholdt, and Jespersen 2019; Burke et. al. 2021). This knowledge secured relevance of the content of *The Body as Data* exhibition, which is crucial to attract a young audience (Crabbe, Husok, and Kraehe 2022; Charman 2020; Zeylikman et al. 2020; Bønnelycke, Sandholdt, and Jespersen 2019).

Instead of designing the exhibition based on already established insights, the insights were gathered along the way and the exhibition design thus became a process of knowledge-

in-the-making (Bjerregaard 2020). Approaching exhibition design based on a process of knowledge-in-the-making relates to the idea of museums as laboratories or experiments. Bjerregaard (2020, 1) argues that an exhibition "has the potential to create *research surplus*; through the making of exhibitions we are liable to *learn more* about the topic of the exhibition." He points out that if exhibitions are seen as research, it cannot be planned how they will develop and what is relevant. Focus is instead on finding out what comes out of engaging with certain groups in the process (Bjerregaard 2020). This requires museum curators to manage the unpredictable.

When involving young people as co-creators, the role of the museum curators and the traditional hierarchy of knowledge change. As mentioned, some of the museum curators were skeptical of the involvement of the young people so early because it could challenge their role as experts. Following Simon's (2010) definition of co-creation, the museum curators and the target group work together to develop an exhibition. Consequently, both the museum curators and the young people were experts in developing the exhibition, but the division of roles and expertise was negotiated and developed during the process. As discussed in other studies, acknowledging the participants' knowledge as legitimate and of equal value, is crucial for the co-creation to be successful and valuable for both parties (Tzibazi 2013; Mygind, Hällman, and Bentsen 2015; Bønnelycke, Sandholdt, and Jespersen 2019).

Some of the challenges arising regarding power and the young people's sense of agency were related to the co-creation process being subject to limitations and requirements. Several authors have argued that the participatory process is itself potentially more important than the product it leads to, as it is the process that fosters empowerment and personal development for the participants (Govier 2010; Lynch 2011; Black 2018 in Domšić 2021). However, as Domšić (2021) highlights, prioritizing the participatory process before the product can cause problems in traditional museum contexts where the exhibit's quality is equally important, and there are certain standards and requirements that the final product must live up to. This caused some of the participants in this project to experience a lack of power and agency. Crabbe, Husok, and Kraehe (2022) also found that when participants are confronted with certain unyielding boundaries and restrictions defined by the museum, their sense of agency dwindles. There is thus a balance between having experts ensure professional standards and at the same time respecting the young peoples' perspectives, ideas, and wishes when entering a co-creation process with a museum (Domšić 2021). As highlighted by one of the participants and the staff member from ATY, this balance can be maintained by involving the young people several times in the development of an exhibition element. However, a limitation encountered in this study arose from the COVID-19 pandemic, which necessitated the transition of some workshops from physical sessions to an online format. Consequently, this posed limitations on the ability to engage participants during the final stages of the process, as it was not possible to invite them to physically visit the museum and actively participate in the concluding phase.

Conclusion: Recommendations for Future Co-creation Projects in Museums

The findings in this study show that involving young people as co-creators potentially creates value and is beneficial for both the participants and the museum. We believe that it is crucial for legitimacy, representation, and relevance of an exhibition to involve the target group and the citizens relevant for the exhibition in the development and design process—not only in evaluations and feedback. Yet, there are certain matters to be aware of when initiating a co-creation process to support meaning, value creation, and impact for all parties involved. Based on the findings in this study, we offer some recommendations and takeaways for future co-creation projects in museums.

We argue that for co-creation to be meaningful, the participants should be able to benefit from the involvement in the process. This implies an acknowledgment of the participant's knowledge as equally important as the museum curators' and that the museum curators are willing to share power and agency with the participants from the beginning until the end of the process. To increase value creation for both parties, we recommend that the reason and objective for involving the participants is clear from the beginning and explicitly communicated to the participants and all museum curators involved. A clarification of expectations, feedback, and an ongoing communication and dialogue between the museum curators and the participants is crucial for the motivation of the participants and their feeling of being co-creators. Similarly, inviting the participants to the opening of the exhibition can enhance their feeling of co-ownership. A co-creation process is time demanding, so enough time and resources should be allocated to obtain a successful result.

When co-creating exhibitions, the traditional structures and procedures within museums get challenged. This restructuring offers the museums a new role in society as they can generate new insights and knowledge during exhibition development and thus become an agent that contributes to research and new perspectives in society. By providing the young people with a platform to voice their viewpoints and experiences, the museum also contributes to letting young people become agents within museums and thus in society.

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Informed Consent

The authors have obtained informed consent from all participants.

Conflict of Interest

The authors declare that there is no conflict of interest.

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