Appendices

MASTER THESIS

MARIT VAN GRINSVEN

Table of contents

Playfully fostering sustainability at the Green Kids' Museum Kenya — project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date 10 - 02 - 2022 — 20 - 07 - 2022 end date

INTRODUCTION **

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

The Intergovernmental Panel on Climate Change estimates that human activities have caused approximately 1.0°C of global warming. Besides, if it continues at the current rate, it is likely that global warming is going to reach 1.5°C between 2030 and 2052. This change in temperature will probably cause changes in the climate system and increase climate-related risks to, for example health, food security and water supply [1]. Article 6 of the UNFCCC stipulates the commitment of parties to promote education, training, access to information, public awareness and public participation on climate change [2].

According to the Global Climate Risk Index of 2020 Kenya was in 2018 in the top 10 of countries who were most affected by impacts of weather-related loss events, due to climate change. These events will become more frequent or more severe over time [3]. Therefore Kenya's Green Economy Plan, calls for the promotion of quality inclusive education as a strategy for enhancing sustainable livelihoods [4]. By educating children about sustainability the children will be capable of contributing to healthy and sustainable ways of living as they will build resilience and capabilities that equip them as active and informed citizens [5]. Currently, at primary schools, Education for Sustainable Development is included in the Competency based Curriculum.
The Green Kids' Museum Kenya will reinforce this journey of learning by means of an interactive children's museum in Kenya, it will be the first interactive children museum in Kenya, more so in East Africa. The museum invites children to learn about sustainability by means of informative and engaging exhibits.

The museum is still in the development stage. The main themes of the museum exhibitions have been determined and the corresponding learning objectives have been defined. The different rooms will cover the topics of Biodiversity & Ecosystems, Consumption & Waste, Energy & Resources, Climate Change and the Power of one.

To scope down, the project will focus on one of themes of the museum: Energy & Resources. Kenya is becoming a pioneer in terms of Green energy [6]. By emphasizing the successful progressive attitude, this theme can be communicated in a rather positive way. This leaves more room to focus on the interaction between the exhibit and the children, rather than conveying the urgency to change in a beneficial, yet gentle way (which might be required for other themes, such as consumption & waste or biodiversity). The learning goals for the theme Energy & Resources are the following:

- define energy.
- identify through images 3 sources of energy.
- recognize images of a healthy environment.
- label clean and dirty energy sources appropriately.
- contrast various energy sources.
- Illustrate clean energy sources.
- consider the effect on the environment of dirty energy

space available for images / figures on next page

introduction (continued): space for images

image / figure 1: Impression of how the Green Kids' Museum Kenya should evokes kids interest [7]

image / figure 2: Inspiration of Museon and their exhibition on sustainability "One Planet" [8]

PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

Some of the primary school aged children in the Nairobi metropolitan might have encountered some of the consequences of the global climate change, such as changing weather patters, droughts or extreme floods. However, as the Green Kids' Museum is the first interactive children museum in Kenya, they are probably not yet familiar with the exploratory and interactive way of guiding through a museum in order to learn about this topic. Besides, the available literature regarding the interaction with installations in a museum among primary school children in Nairobi is limited.

The client and also founder of the Green Kids' Museum Kenya, Evy van Weezendonk, is an enthusiastic and proactive social entrepreneur. Her life- and work experience have resulted in a unique skill set of visionary thinking, business sense as well as a hands-on attitude [9]. However, she does not have the expertise to design an installation that incorporates the educational value, play value, and cultural background of Kenyan middle class children age 9-11 (and their families) in a way that fits within the overall intention of the room and with that, the rest of the museum. Therefore, this graduation project will explore how an interactive exhibit can foster an empathic attitude towards the sustainable learning goals set by the Green Kids' Museum Kenya through play based learning methods, taking into account the cultural background of the primary school aged children in the Nairobi metropolitan. The cultural background is relevant for consideration as it will influences the children's (and their families) perception and interaction with the museum.

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, ... In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

Design an interactive installation that triggers children of primary school age in the Nairobi metropolitan area who visit the Green Kids' Museum, to engage with the theme Energy & Resources in a playful way, in order to gain an understanding and insights into clean and dirty energy.

As an end result an interactive demonstrator will be created as a means to illustrate the connection created between the primary school aged children in the Nairobi metropolitan area who visit the Green Kids' Museum and the theme of Energy & Resources, in an exploratory and playful manner.

The creation of the interactive demonstrator will be guided by the audience research conducted by means of literature review, interviews and analysis of museums. The literature review will provide insights on the psychological aspect in order to support creating an understanding of the sustainability learning goals and on designing playful elements for children that facilitate engagement with the topic. The interviews will function as a more qualitative research in order to get insights into the target group as well as the cultural aspect of the project. Lastly the museum analyses help to gain insight and inspiration of elements that can be fruitful for the Green Kids' Museum.

The project will mainly focus on exploring how an interactive exhibit can facilitate play based learning for Children of primary school age in the Nairobi metropolitan area with regard to the theme of Energy & Resources. Building a completely finished and financially viable product is therefore not necessary.

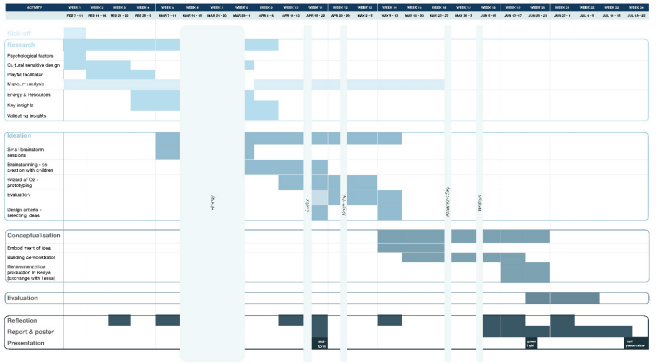
Initials & Name M.S. van Grinsven Student number 4611929

Title of Project Playfully fostering sustainability at the Green Kids' Museum Kenya

PLANNING AND APPROACH **

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 10 - 2 - 2022 20 - 7 - 2022 end date



In order to reach the design goal the planning consists of four phases: Research, Ideation, Conceptualization & Evaluation. The research phase will be used as a means to get insights into the target audience.

Because it is not possible to travel to Nairobi an alternative way of research needs to be conducted to get an impression of the culture. This will be done by first forming and next discussing my cultural view among local people in Nairobi by means of an online interview. The client mentor Evy is currently living in Nairobi, she can help by validating this view and getting me into contact with locals. A small video of myself will be made in order to introduce myself and ask local experts for their help, to create a personal connection on a distance.
For the ideation phase, co-creating with children is desirable to get some first ideas and insights, a remote way of doing this is used by Westerhof in his master thesis [10] he used What's app to get in contact with Kenyan kids. Using the Wizard of Oz prototyping technique some small ideas can quickly be tested with Dutch children, keeping the cultural perspective, as researched in the first phase, in mind.

The first ideas will be further explored, selecting the most promising one. This idea will be further developed in the conceptualization phase, focusing on building the demonstrator. In the evaluation phase the demonstrator will be tested with children in the Netherlands, keeping the cultural view gained in the first phase in mind.

Each phase will be concluded with documenting the key-insights and my progress. Besides every other week I will reflect on my work and adjust the planning accordingly.

Initials & Name M.S. van Grinsven Student number 4611929

Title of Project Playfully fostering sustainability at the Green Kids' Museum Kenya

Personal Project Brief - IDE Master Graduation

TU Delft

MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, ... Stick to no more than five ambitions.

First of all within my master I have gained a special interest in museums, as I believe they are a good tool to function both as a leisure activity and have an educational purpose. I aim for creating awareness through experiencing a phenomenon in a playful way, in order to make the most impact on children. With my graduation project I want to learn more about designing for museums . This way I can also experience whether this is indeed the design area I want to continue working in after my masters at IDE.
As a perfectionist I sometimes have troubles with creating prototypes or materials that don't meet my own standard. To me this means I often hesitate to start the ideation phase and stay in the research phase. With this project I want to challenge myself and experiment with researching through prototyping. This way I will immediately start creating ideas with the help of the Wizard of Oz approach and lower the threshold.
Besides, I have always had a special motivation to involve the target group of my designs in the process of designing. In my electives I focused on gaining experience in getting empathy, talking about sensitive topics and discovering underlying needs. With my graduation I want to test my ability to immerse myself in the culture of the Nairobi primary school children through observing, asking a lot of question and trying things out and use this to design with and for them within the boundaries of distant and online research techniques.

[1] Masson-Delmotte, V., Zhai, P., Pörtner, H. O., Roberts, D., Skea, J., Shukla, P. R., ... & Waterfield, T. (2018). Global warming of 1.5 C. An IPCC Special Report on the impacts of global warming of, 1(5).
[2] UNFCCC. (n.d.) Education and Training under Article 6. Retrieved February 10, 2022 from https://unfccc.int/topics/education-and-outreach/workstreams/education-and-training
[3] Eckstein, D., Künzel, V., Schäfer, L., & Winges, M. (2019). Global climate risk index 2020. Who Suffers Most from Extreme Weather Events? Weather-Related Loss Events in 2018 and 1999 to 2018. (Report No. 20-2-01e). Germanwatch e.V. https://www.germanwatch.org/sites/default/files/20-2-01e%20Global%20Climate%20Risk%20Index%202020_16.pdf
[4] Goverment of Kenya. (2016). Green Economy Strategy and Implementation Plan 2016 – 2030. Retrieved February 10, 2022 from https://www.greengrowthknowledge.org/sites/default/files/downloads/policy-database/KENYA%29%20Improving%20Efficiency%20in%20Forestry%20Operations%20and%20Forest%20Product%20Processing%20in%20Keyna_0.pdf
[5] Davis, J. (2010). Early childhood education for sustainability: Why it matters, what it is, and how whole centre action research and systems thinking can help. Journal of Action Research Today in Early Childhood, 2010(April), 35-44.
[6] Begisheva, A. (2018, January 24). Kenya becomes a pioneer in green energy. KfW. https://www.kfw.de/stories/environment/renewable-energy/kenia-green-energy/
[7] [Young black girl looking at a science exhibit, close up]. (n.d.). Retrieved November 23, 2021, from https://www.greenkidsmuseumkenya.com
[8] [Spel in de opstelling over onderwijs] (n.d.) Retrieved November 23, 2021, from https://www.museon.nl/nl/aanvullende-informatie-over-one-planet
[9] Evy van Weezendonk (n.d.). Info [LinkedIn page]. LinkedIn. Retrieved February 8, 2022, from https://www.linkedin.com/in/evy-van-weezendonk/
[10] Westerhof, M. (2021). Playful learning through designing toys: Developing a design education toolkit for a non-profit organisation in rural Kenya. [master thesis, Delft University of Technology]. Education Repository. http://resolver.tudelft.nl/uuid:8ae09e82-28bb-4000-b7da-0613b1e3d0a2

FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.

Initials & Name M.S. van Grinsven Student number 4611929

Title of Project Playfully fostering sustainability at the Green Kids' Museum Kenya

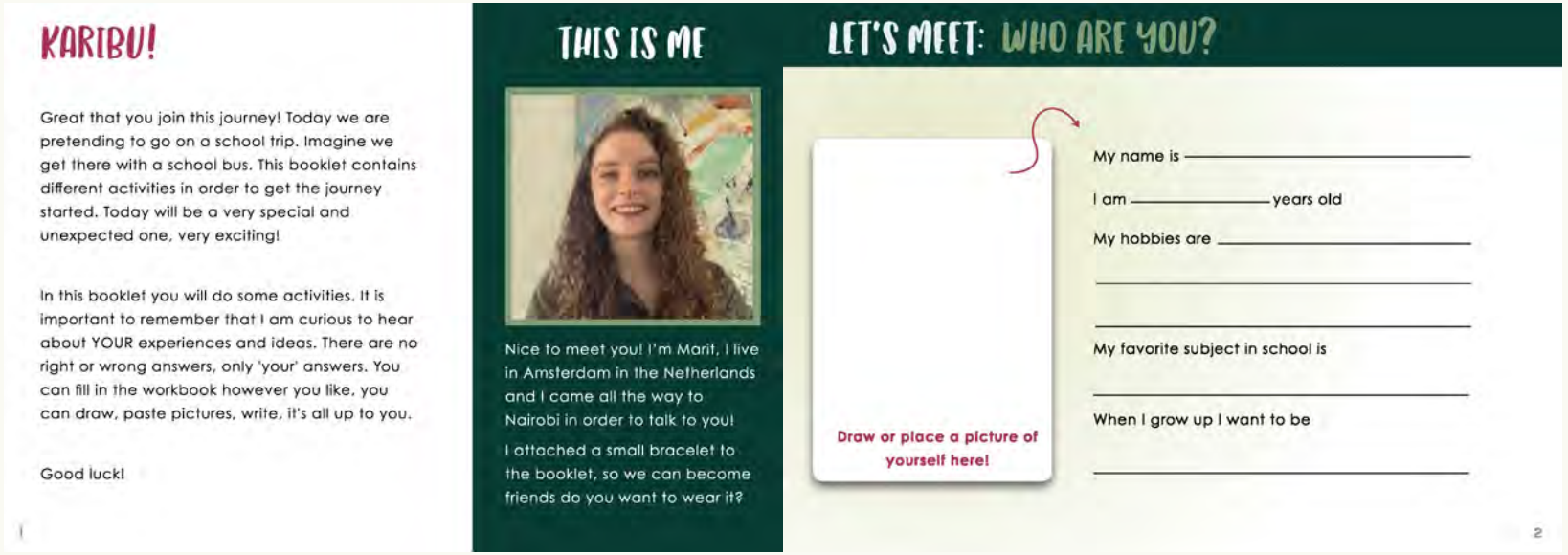
Appendix B Booklet

Impression of the booklet

Impression of the creative session with the children in Nairobi

Goal

Easy to start exercise to feel confident about filling in the rest of the booklet. The basic information can be used to compare the results.



Goal

Get insight into what kind of places are considered as exciting, elements that make it exciting can be used as inspiration for the recommendation(s).

PREPARATION WHERE SHOULD WE GO?

The teacher has not yet decided where the trip is going. Where would you like to go?

Step 1. Show on this page where you would like to go and maybe the teacher will choose your destination!

A bit like this!

Maybe a forest?

or a playground?

A museum?

What about the moon?

3

4

Goal

Get insight into their preferences. Especially the favourite toy can function as an inspiration for the recommendation(s). The different ways of play can be distinguished from the selected toys.

PREPARATION PACK YOUR BAG

What a good suggestion, let's go there! We will leave early in the morning, so we need to quickly pack our bag.

Step 1. Cut out the items you would like to bring and place them in the backpack. The teacher wrote a note with items he recommends you to bring :

Step 2. Do you still miss something? Please add it to the bag.

Some inspiration

5

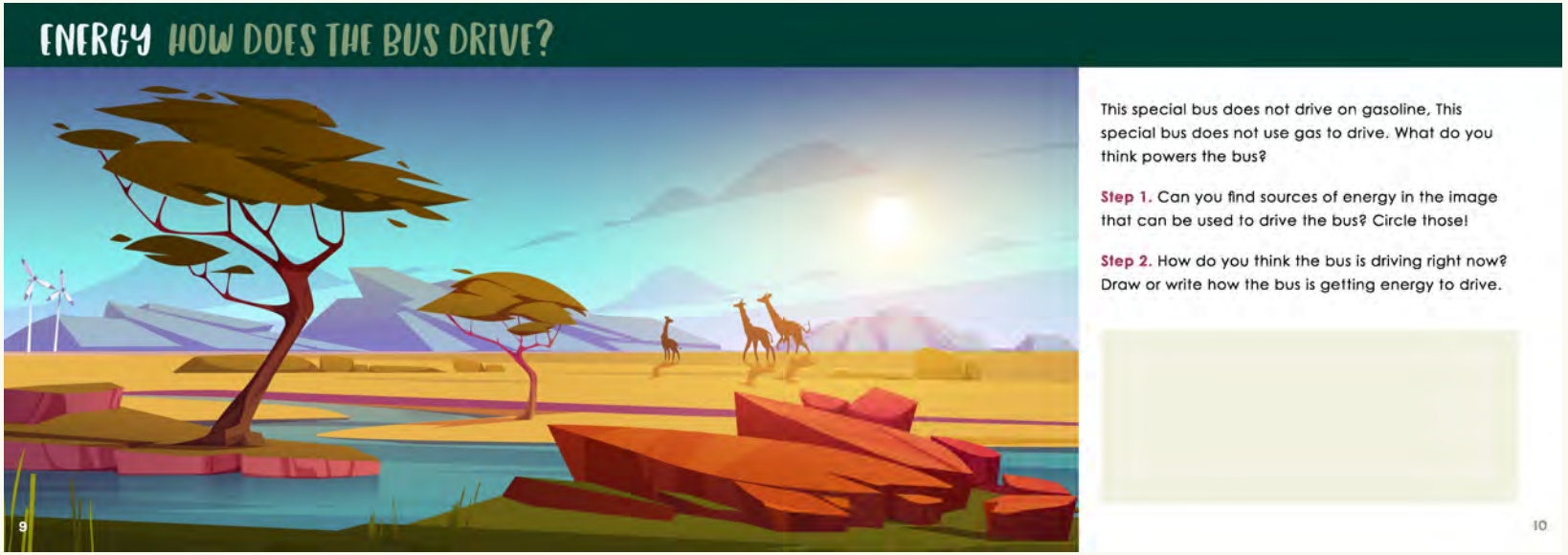
6

Goal

Get insights into what they think can make something which is boring more exciting. This can function as inspiration as how to make the learning experience in the museum playful.

Goal

get insights into what the children already know about energy & resources and what they still need or want to learn in the museum.



ASANTE!

Great job! We are not yet at our destination. We will first make a pit stop at the Green Kids' Museum! This museum can explain more about how this special bus can drive on different sources of energy. Maybe you can tell them about your great idea of how the fantasy bus is driving us!

Would you please give the booklet to me (Marit)? Then we can have a look at the museum together!

ANY THOUGHTS?

Do you have anything to say, tell or ask?

Write it down below!

Marit van Grinsven - +31620196290
Design for Interaction - Delft University of Technology
Graduation project Green Kids' Museum Kenya

TEMPLATES PACK YOUR BAG

TEMPLATES PACK YOUR BAG

TEMPLATES PACK YOUR BAG

6

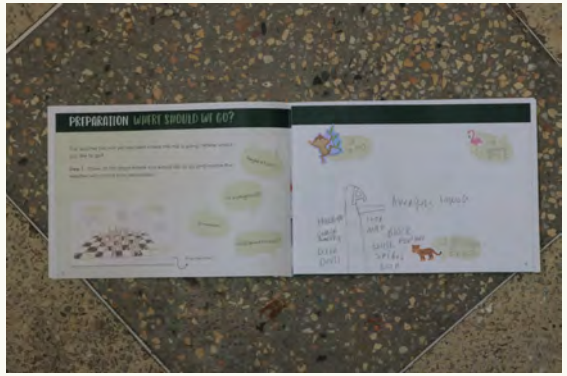
TEMPLATES PACK YOUR BAG

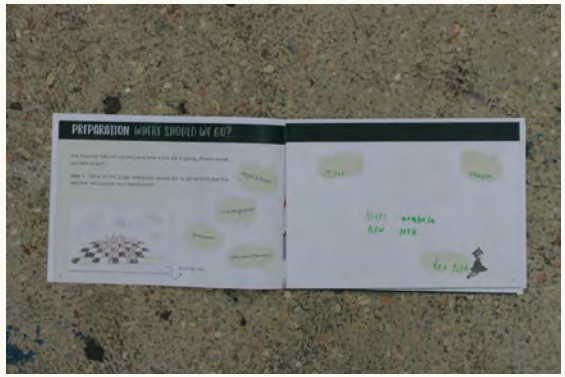
6

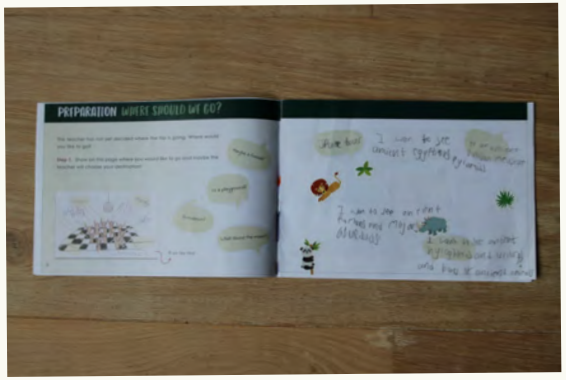
Appendix C Booklet results

Introduction and Let’s meet

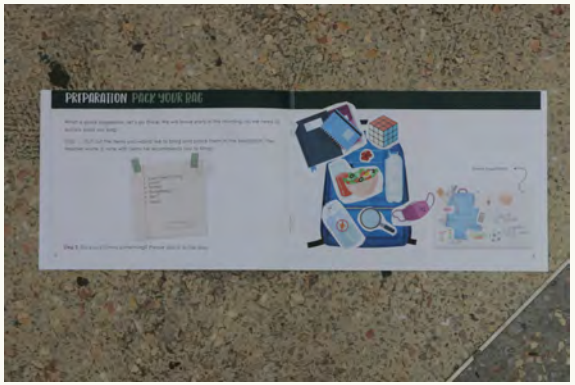
Personal information about participants







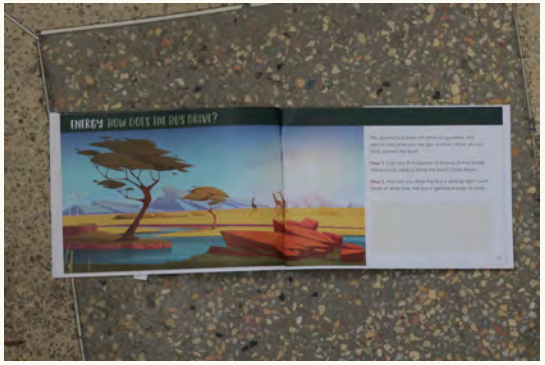
Preparation, where should we go?
Personal preference as to where the participants would like to go on a school trip

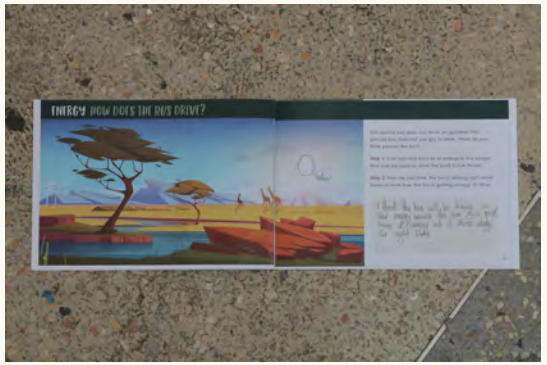


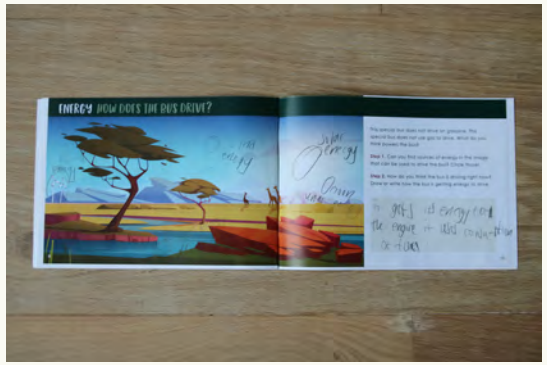
Preparation, pack your bag
Selecting toys and tools one would bring with them, to indicate their prefered type of play

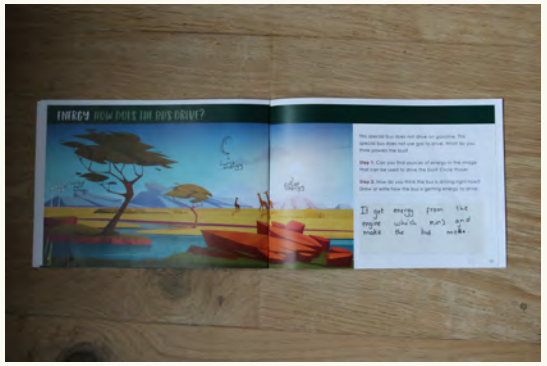
On the bus, let's have fun

Personal Indication of what makes a boring situation fun, which can be used to make the learning experience more exciting.

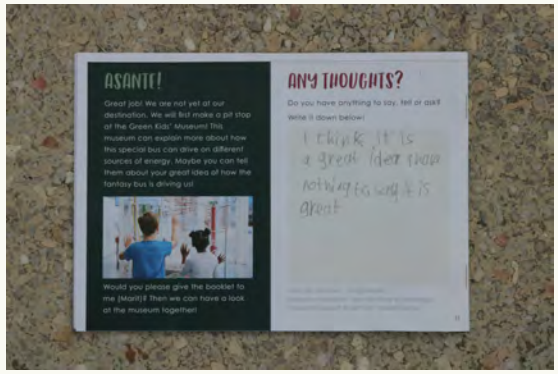








Energy, how does the bus drive?
Assess the current knowledge on the topic of energy & resources and detect learning objectives for the museum.



ASANTE!

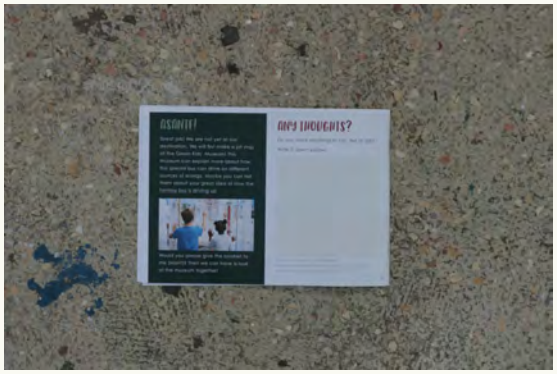
Great job! We are not yet at our destination. We will first make a pit stop at the Green Kids' Museum! This museum can explain more about how this special bus can drive on different sources of energy. Maybe you can tell them about your great idea of how the fantasy bus is driving us!

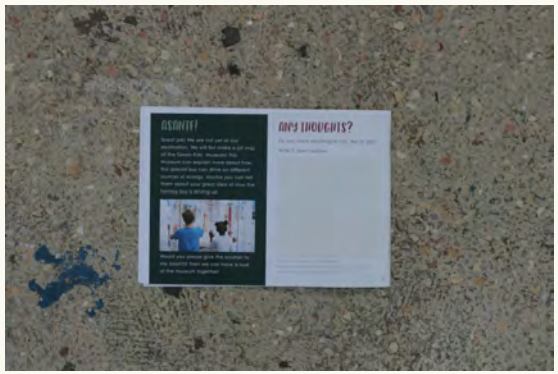
Would you please give the booklet to me (Marit)? Then we can have a look at the museum together!

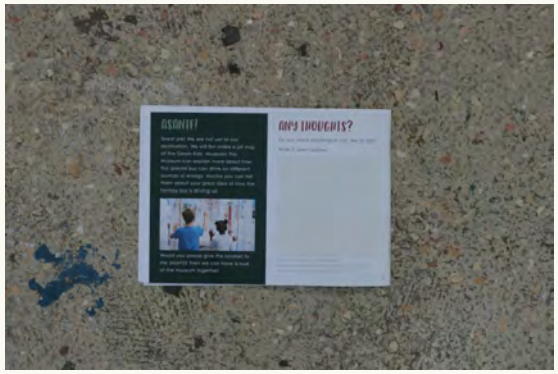
ANY THOUGHTS?

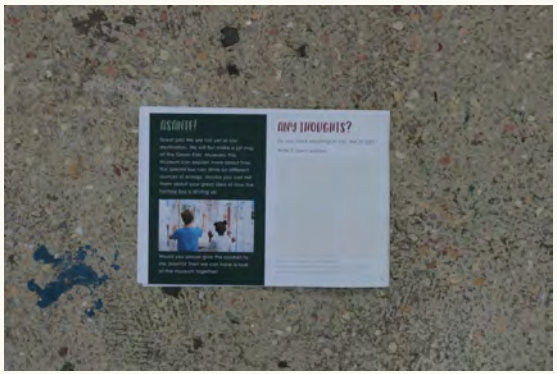
Do you have anything to say, tell or ask? Write it down below!

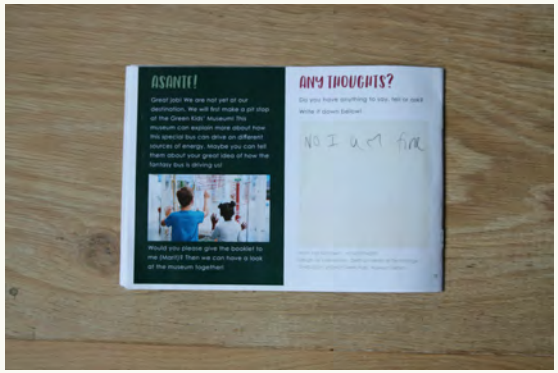
I think it is
a great idea thaw
nothing to say it is
great











ASANTE!

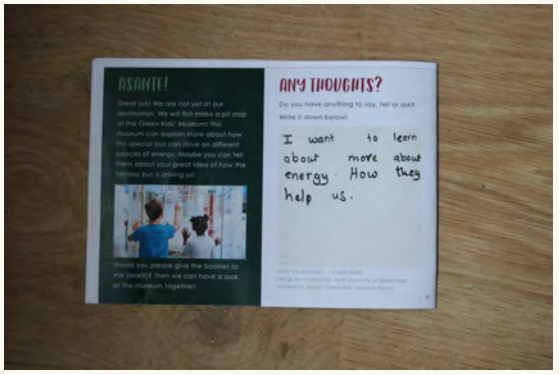
Great job! We are not yet at our destination. We will first make a pit stop at the Green Kids' Museum! This museum can explain more about how this special bus can drive on different sources of energy. Maybe you can tell them about your great idea of how the fantasy bus is driving us!

Would you please give the booklet to me (Marit)? Then we can have a look at the museum together!

ANY THOUGHTS?

Do you have anything to say, tell or ask? Write it down below!

No I am fine



ASANTE!

Great job! We are not yet at our destination. We will first make a pit stop at the Green Kids' Museum! This museum can explain more about how this special bus can drive on different sources of energy. Maybe you can tell them about your great idea of how the fantasy bus is driving us!

Would you please give the booklet to me (Marit)? Then we can have a look at the museum together!

ANY THOUGHTS?

Do you have anything to say, tell or ask? Write it down below!

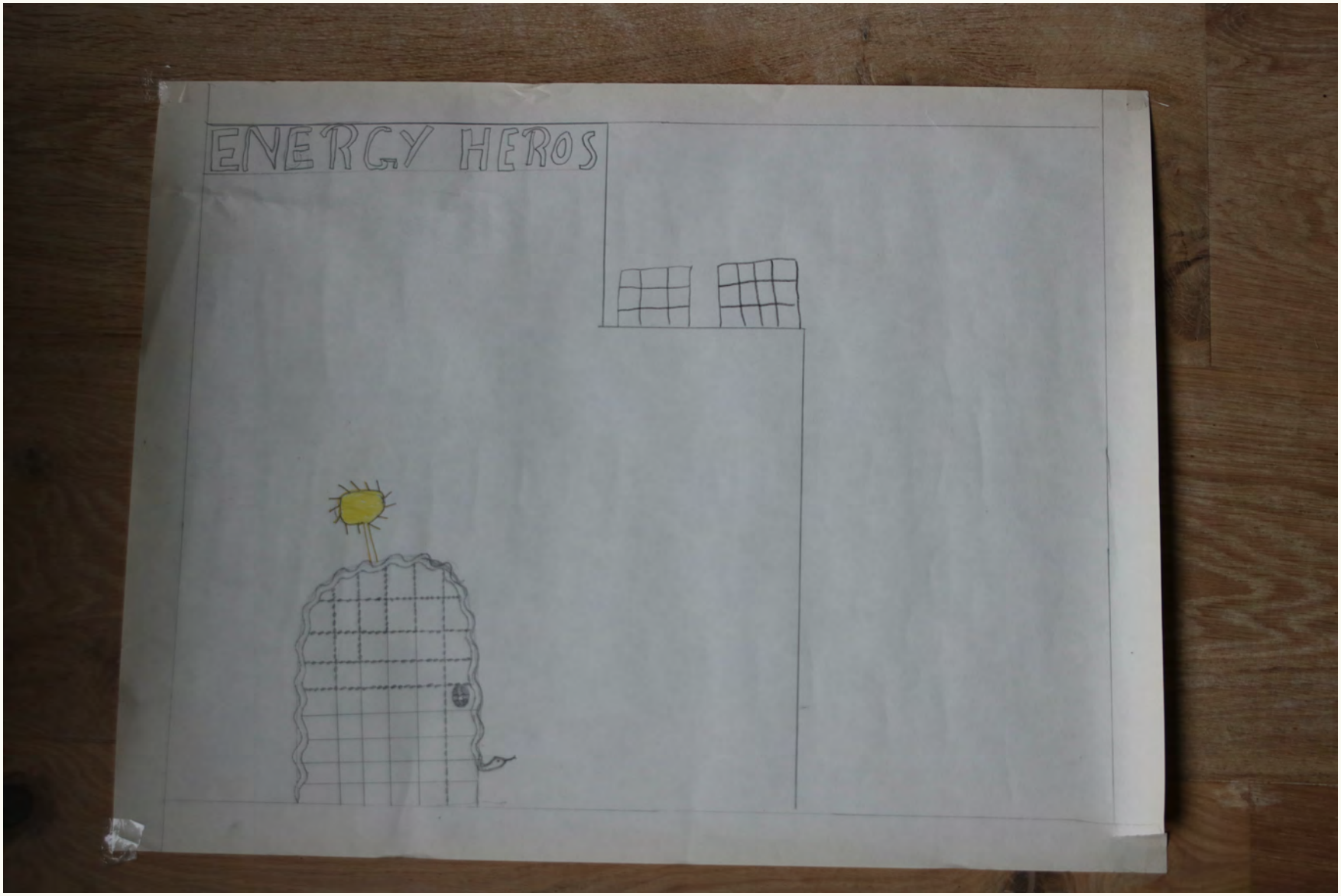
I want to learn
about more about
energy. How they
help us.

Thanks and final thoughts

Thanking the participant and asking for any additional thoughts to share.

Appendix D Drawing the museum

Boys of Jaffery Academy Nairobi, as they were seated on opposite sides of the table part is upside down



Girls of Jaffery Academy Nairobi, there was not enough time to completly finish the drawing

Kids of Ranger Nicolas living in the forest

Appendix E Interview parents

Interview parents

Graduation project - Green Kids' Museum Kenya

Marit van Grinsven

Introduction | 5 min

Introduction | 5 min

Welcome. Thank you for helping me. For my graduation project at Delft University of Technology, I am designing a project for the Green Kids' Museum Kenya. The first interactive museum in East Africa that teaches children about sustainability through play. With this interview I would like to learn more about your expectations for such a museum as a parent. The interview will take about an hour. Remember, you can't do anything wrong and please say if something is unclear or confusing, I just want to better understand your perspective so the more you tell the more insights I get. I would like to ask you if it is okay if I record the interview and take pictures during the interview as also mentioned in the (previously sent) consent form.

- Have you read the consent form?
- Do you have any further questions?
- The footage will be used in my report, which is visible online for other students? I can make your unrecognisable if you prefer.
- Do you give permission for this?

Thank you very much!

I am Marit and for today I will interview you. I will also take some notes during the interview. Let's start the interview.

Part 1. Introducing questions | 5 min

Personal info | 5 min

1. Can you please shortly introduce yourself?
   1.a Occupation
   1.b Kids, age
2. Parent, (dis) like
3. Activities

Part 2. Going on a trip | 15 min

Making trips | 5 min

4. Go on trip
5. Favourite trip
6. How know enjoyable

Last trip | 10 min

7. Last trip
8. Decision
9. Journey
10. Enjoyable
11. Better

Part 3. Future Museum | 30 min

Looking for | 15 min

12. Imagine, the Green Kids' Museum just **opened it's doors**, would you **consider** going there? Why (not)?
13. Journey
14. Considerations
15. Decision
16. Interactive, familiar
17. immediately start playing or anticipate?

Sustainability | 10 min

18. Perspective educate sustainability
19. Personally involved
20. Level children
21. like to be taught

Role as a parent | 5 min

22. Role
23. How to facilitate

Part 4. Closing | 5 min

Thank you | 5 min

Okay, those were all the questions. Do you have anything to add? (>valuable insights)

Thank you very much for your time. I have gained valuable insights from the conversation.

Give a small thank-you gift

Would you like to receive an update on the research at the end of the project (around the end of July)?

Thanks again!

Appendix F Interview teachers

Interview teacher

Graduation project - Green Kids' Museum Kenya

Marit van Grinsven

Introduction | 5 min

Introduction | 5 min

Welcome. Thank you for helping me. For my graduation project at Delft University of Technology, I am designing a project for the Green Kids' Museum Kenya. The first interactive museum in East Africa that teaches children about sustainability through play. With this interview I would like to learn more about the current education on sustainability, so the museum can reinforce this journey. The interview will take about an hour. Remember, you can't do anything wrong and please say if something is unclear or confusing, I just want to better understand your perspective so the more you tell the more insights I get. I would like to ask you if it is okay if I record the interview and take pictures during the interview as also mentioned in the (previously sent) consent form.

- Have you read the consent form?
- Do you have any further questions?
- The footage will be used in my report, which is visible online for other students? I can make your unrecognisable if you prefer.
- Do you give permission for this?

Thank you very much!

I am Marit and for today I will interview you. I will also take some notes during the interview.
Let's start the interview.

Part 1. Introducing questions | 5 min

Personal info | 5 min

1. Can you please shortly introduce yourself?
   1.a Class
   1.b Kids, age
   1.c Hobbies
2. Teacher, (dis) like
3. Activities in class

Part 2. Sustainability | 15 min

Sustainability | 15 min

4. What is taught
5. How much attention
6. Level children, examples
7. Which aspects
8. How is it taught > what does (not) work
9. Room for improvement/ expansion

Part 3. Going on a trip | 15 min

Making trips | 5 min

10. Go on trip
11. Favourite trip
12. How know enjoyable

Last trip | 10 min

13. Last trip
14. Decision
15. Journey
16. Enjoyable
17. Better

Part 4. Future Museum | 20 min

Looking for | 15 min

18. Imagine, the Green Kids' Museum just **opened it's doors**, would you **consider** going there? Why (not)?
19. Journey
20. Considerations
21. Decision
22. Interactive, familiar
23. immediately start playing or anticipate?

Role as a teacher | 5 min

24. Role
25. How to facilitate

Part 5. Closing | 5 min

Thank you | 5 min

Okay, those were all the questions. Do you have anything to add? (>valuable insights)

Thank you very much for your time. I have gained valuable insights from the conversation.

Give a small thank-you gift

Would you like to receive an update on the research at the end of the project (around the end of July)?

Thanks again!

Appendix G Consent form

Information Consent form

Research for the Graduation project for the Green Kids' Museum Kenya

This research is done as part of the master Design for Interaction at Delft University of Delft. This research is done by Marit van Grinsven.

Purpose of the study

The purpose of this research is to get insights into how an interactive exhibit can facilitate play based learning for Children of primary school age in the Nairobi metropolitan area with regard to the theme of Energy & Resources

Procedures for withdrawal from the study

The participation is voluntary, if there are questions you, or your child, do not want your to answer, please indicate this. The interview can be stopped at any time. Stopping the research has absolutely no consequences for you. If you want to cancel the participation, you can contact the researcher.

Usage of data

During the study, the researcher will collect information (in the form of written notes, photos, and/or audio recordings) regarding the discussion. The information will be available to the research team. The data will be registered anonymously. The results of the research could possibly be disseminated in a project report or presentation. These results are only anonymous data, so you will not be recognizable on the screen.

If you have any questions regarding the study, you can contact:

Marit van Grinsven

Tel: +31620196290

Email: M.S.vanGrinsven@student.tudelft.nl

If you decide that your child can participate in this study, we would like to ask you to sign a consent form. You can sign this before the interview commences.

Thank you for your participation.

TU Delft

Consent form for Graduation Green Kids' Museum Kenya

In case of an under age participant the form needs to be filled in by a care-keeper.

Please tick the appropriate boxes	**Yes**	**No**
Taking part in the study		
I have read and understood the study information dated [__/__/____], or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	☐	☐
I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	☐	☐
I understand that taking part in the study involves an audio-recorded interview, written notes and photos.	☐	☐
Use of the information in the study		
I understand that the information I provide will be used for reports and presentations.	☐	☐
I understand that personal information collected about me that can identify me, such as [e.g. my name or where I live], will not be shared beyond the research team.	☐	☐
I agree that my real name may be used for quotations.	☐	☐
I agree that photographs of me may be used for sharing purposes		
a. if my face is portrayed in an unrecognizable manner	☐	☐
b.if my face is shown in a recognisable manner.	☐	☐

Signatures

_____	_____	_____
Name of participant [printed]	Signature	Date

I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

_____	_____	_____
Researcher name [printed]	Signature	Date

TU Delft

Appendix H Contextmapping - statement cards

Stepping out of comfort zone

Risky experiences provide excitement, seeking thrill

"First I was really scared but then I asked them to make my lifejacket extra thight... and then I went and it was really fun!"

Repeating successes

Wanting to experience fond memories again

"Last schooltrip we went to the national park and then to a waterpark. .... That was really fun so I want to do that again."

An imagined experience makes for enthousiasm

Fantasising about the experience provides excitement

"When will the museum open? Because I want to my parents if we can go to the grand opening."

Seeking subversion

Wanting to break social norms and rules

"What is that [pointing at booklet]
That is the dog I stole at the dog park haha"

Collaboration leads to new insights

By discussing the topic together interesting outcomes emerge

"I think the bus drives on solar power.
But then it can't drive at night?!
....
Oh I know it should be both solar and lunar power!
Then it can drive both at day and night!"

Feeling relatable

Giving normal people superpowers > relatable

I really like Hawkeye. Not a lot of people like him, but I do because he is just a normal guy with an arrow [acts out shooting an arrow]. Anyone can be him.

Feeling of fellowship

Wanting to satisfy the needs of friends

"What are you doing in the bus?
We are having a food fight!
Oh that will be a mess!
Yes but my friends would love that and they are always throwing with food

Being captivated

Forgetting one's surroundings talking about favourite topics

Observation
When talking about Anime and Adventures the boy is completely in his own world, acting out what they do and not aware of the other children

preferring practical approach

Trying things out to figure out how something is working

"How do you think the museum can best teach you more about energy? Do you prefer to read about it, see images or ...?
I would like to do things"

Creating similarities

Previous experiences determine view on it, know what to expect

"I have been there [New York] before and it was fun so I want to go again."

Feel like being taken serious

Seeing the real deal to know how it really happens

"I would like to see real solar panels.
Why is that?
Than you can see how it really works"

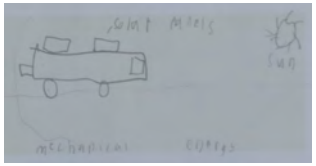
Feel validated and try out

Use of more exclusive material

"What is this [pointing at drawing]?
A telescope
What can you see with it?
Than you can see the sun shine on the solar panel.
So you can understand how it works?
Yes!"

Go more in depth than just the basics

Basic understanding of energy is present



Provide room for experts on topic

Even more complex energy systems are known

"How would you use the water as a source of energy?
Just with uhmmm ... the tides, the water comes and goes through a fan."

Allow for different kind of visitors

Preferring reading

Talking about dinosaurs and history
"How would you like to know more about these things?
I would like to read about it."

Different interests should be met

History

"You want to explore a lot of history related places, right?
Yes
How come?
I like history because it is so old."

Seek adventure

Discover something new or unknown

"I like to go to new places I have never been before. [...] It is like an adventure and I always get so excited."

Fantasy

Imagine what it is like to be something else

"Do I need to draw myself with or without hijab?
What you prefer
[...]
I drew myself with pink hair, not that I have that but I like it, pink is my favourite colour.

Expand experience

Investing in ones interest at home, beyond where you are expected to do it

"I love art. At home I have a lot of supplies like pencils, paint ..."

Imitation of everyday life

Making museum part of collecting energy

Wirtten on drawing: "The meuseum should put windows or holes [...] so that the sun can come in."

FInding details

Zoom in on small details

"What would you bring?
This [pointing at magnifying glass]
So you can search for ancient objects?
Then I can better look at it"

Looking for humour

Making jokes to create a pleasant experience

"I think the bird is carrying the monkey.
Haha I like that, you got some humour!
I like funny things."

Competition

Creating a contest with friends as opponents

"I like to play games.
Me too, do you prefer to play alone or together?
Together with friends?
What makes that so fun?
Than we can have a competition! I am very competitive."

Looking up to authorities

Being influenced by parental interests

"You want to go rally driving?! That sounds really dangerous!
Yes but my dad really likes it and it is really cool"

Desire to nurture

Wanting to take care of a dog

"I really like dogs
Do you have one?
No but I wish I did"

Looking for help to solve a challenge

Practising skills with the help of others

"I can't solve it [A rubics cube] but the friend of my brother can and he will teach it to me"

Allowing improvement

By investing time and effort one can improve

"So you like solving puzzles?
Yes! and also playing games.
What do you like most about it?
You can get better at it"

Creating excitement with beauty

By creating a beautiful door one will be curious to explore

"That is a pretty door you are drawing.
Yes because they [visitors] need to be excited to enter."

Leaving room for individual exploration

Investigating the situation first

Observation:
This girl is a bit more on her own. She first answers the questions quietly for herself and later she is willing to share her thoughts with the group.

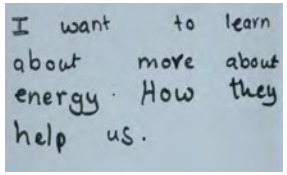
Feeling of being in control, manageable

If the learning experience comes easily it is experienced as more enjoyable

"Some [subjects] just come naturally so it is easy and then it is also a nice subject, but if it is hard than you find it less fun "

Wanting to get better

Interest in improving one's knowledge



Feeling powerful

By giving children the task of making a change (hero) they feel of value

"I think we should call it energy heroes.
Yes then we can all be heroes by learning about energy!

Fantasising about experience

Imagining what the experience would look like

Observation
The girl is pointing in the room explaining what the museum should look like according to her.

Relating consecutive events to learning process

Starting with an experience kids would like to do and refering that to the learning experience

"Maybe we can have a waterslide. [...]
How can you learn about energy here?
Maybe if you get into the pool the water moves and you can see that it revolves in energy?
What about wheels start turning and that makes lights go on?
Yes I like that! ... or discoballs!

Sympathy

Sharing emotional feelings of other visitors

So how do you go up in the windmill? With stairs!
What kind of stairs, something like a ladder?
No it should feel really safe so everyone can enjoy going up? Oh so not to scary but very sturdy? Yes!

Exploration by experiencing

Wanting to make sense of the object or situation by experiencing it

How would you like to learn in the museum?
Hmmmm
Would you like to read or hear or ...?
I like seeing and reading.
....
I just want to experience it for myself

Seeing consequences of actions

By visually creating a connection between the action and learning goal, one can relate to it

I would like a cycling track. [...] What about the energy here? Maybe the faster the cycle the more energy you have. Yes that is true so, maybe we can light up the track more the faster you cycle? Yes that is cool!

Feeling of being free

Preferring an open space, less guided but more intuitive on preferences

Would you like the museum to be inside or outside?
Outside that's more open and you can enjoy the sun... Oh and at night you have stargazing.

Creating fellowship

Creating a space to be together like a community

"I would like to have a podium. [...]
It can be a place where everyone comes together."

Empahisis on understanding essence

Wanting to make sure the essence of the experience is understood by everyone

"I can read about it. But for my friend if you tell him he will understand what you are saying, but if he needs to read it he doesn't get it. So I think we should have someone explain it to him"

Concluding exiting

Concluding learning experience with a playful aspect

And how would you go down [from the windmill]?
....
With the stairs [questionable]?
Yeah .... or hmmm maybe we can have a slide down, that is more fun!

Aesthetically pleasing experience

Looking for beauty

I like multicolour I think that will be beautiful. [...] It will create some scenery"

Feeling of being in control

Wanting to make sure he has done all the things he want

"I would like to have a viewing point so you can see the whole museum [...] then you can have an overview and see what you missed."

Relatedness to topic

Personal connection with topic creates a strong reference point

Have you ever heard of using poop as energy?
Oh yes biogas right?
Yeah that is right?
I heard my uncle talk about it once."

Require inclusive design

Making sure everyone can experience at their own level

Voor mij is het belangrijk dat alle leeftijden er van kunnen genieten [...] Bij de een zal er wat meer diepgang in zitten dan bij de ander, maar zelfs de jongere kinderen pikken mee wat ze kunnen.

Sensation of senses

Creating excitement by stimulating senses

Ik wil dat kinderen hun zintuigen kunnen ontdekken.
[...]
Het gaat om de combinatie van spelen en ontdekken.

Plat at its core

Making sure kids enjoy themselves

"Het moet vooral een leuk schooluitje zijn [...] Zo van leren kan ook anders."

Create diversity in ways of learning

Matching the way children prefer to learn so that everyone can get the most out of it

Elk kind leert anders, daar moet ook rekening mee worden gehouden. De een luistert graag dus audioeel, de ander is meer visueel dus die ziet dingen liever en weer anderen zijn kinetisch ingesteld dus die willen het ervaren."

Relatedness among students

Creating a mutual point among students about topic

Het zou voor de school een startpunt zijn om enthousiasme te krijgen voor een bepaald onderwerp vanuit een gezamelijke ervaring. Of juist een eindpunt om te vieren wat we hebben geleerd.

Unconscious learning

Make students feel like they are playing instead of learning

Ik denk dat de kracht zit in het onbewust leren. Op school moeten ze echt leren en dat vinden ze vaak leuk maar soms ook stom en dit moet echt voor iedereen leuk zijn.

Connecting to the perception of the child

Making sure the experience fits within the world of experiences of the child so they can relate to it

Het moet in de belevingswereld van de kinderen passen.

Focusing on achievements

Having a positive attitude to make the child feel proud of learning experience

Het moet vooral ook niet te academisch [...] Je hebt nooit gefaald!
De focus moet liggen op "ik heb vandaag dingen ontdekt en geleerd"."

Seeking thrill

Being doubtful about taking risks, although being excited

I would like a zipline, that is very cool.
Would you want to go with the zipline?
Hmmm I don't know is it scary?

Emphasis on nature

Getting feeling of being in nature

Between the boys:
"Where are the trees?
Oh yeah we still need to have some nature, let's draw trees everywhere.
Is this okay?
Yes."

Higlighting important aspects

Important things need to pop out to make sure people see them

There should be a fence.
Okay let's draw a fence!
[...]
How will you get in, do we need a gate?
Yes
How does the gate look like?
Big and blue."

Encourage reflection on personal

All age groups have some sort of idea about energy once encouraged

Observation
Even the boy of 6 knew already that the sun and wind can function as a source of energy with a bit of encouragement.

Giving guidance to trigger a change

Aware of the importance of sustainability but not yet taking action

Duurzaamheid is natuurlijk een erg belangrijk onderwerp en we zijn ons er ook wel bewust van, maar ik vind wel dat wij als school er nog meer mee kunnen doen, de actie moet zegmaar nog komen.

Deliberately reflecting on learning

Consciously mentioning what children have learned in order to stimulate the learning process

Wij zorgen altijd voor een reflectiemoment om kinderen er bewust van te maken van leermomenten. [...]
De leraren gaan in het spel mee en dan benoemen ze wat de kinderen geleerd hebben. Om zo de connectie van onbewust naar bewust leren te maken.

Take by the hand

Slowly and clearly explain what is going to happen, setting expectations

"You really need to explain to them what it is they are going to do and what is expected of them."

Inclusive expression

Provide tools to make sure each kid can express them in a way they want

There should be room for expression [...] Each child is different but they all need to get the room to express themselves in a way that fits them.

Need to take seriously

Sustainability

Sustainability is really important and I think we as a school should support that.

Simple tasks

One by one not making it too hard

It is important to be very clear. [...] Don't ask too much all at once.

Leave room for kids to leave own input

Teachers are sometimes unaware of knowledge kids

I didn't know you [students] knew so much about energy already, good job!

Relaxation

Schooltrips are a relief from mental (school) work

Last time we went to the waterpark [...] Schooltrips are mostly just for fun.

Up to children

Let them play on their own, no interference of parents

During the day, most of the time all the children of the neighbourhood just play together [...] Just in the middle of the houses we have a little area for them to play.

Nature experiences

Taking kids to more nature related experiences

Sometimes we go to Karura forest or the park. ... Oh and we have also been to Nairobi National Park together.

Parents part of learning experience

Parents are involved in the learning experience of kids

Nowadays parents are expected to help their children with school [...] Everyday I spent around an hour in the evening to help my son with his homework.

Reflecting sense of pride

Being proud of energy sources in Kenya

"We have geothermals, they provide around 30% of all national energy [said proudly]."

Reach people

Visual representation of values and goals

"We have quotes and drawings on the wall to inspire people.
Are they also meant for children?
Yes for everyone."

Starting with children

Supporting children to change the future, submission

I believe it all starts at the education of children. By teaching them what is right and wrong we can build a better future together.

Word of mouth

Spread word of mouth advertisement

If I tell my perspective to everyone I know, they can spread it among the people they know. That way you can reach a lot of people and together work on something great.

Reference to climate change

Awareness about climate change but not yet very active towards it

[Talking about weather] "It is hot right? Yes it is, normally it is rain season now right? Yes, but you know climate change, it starts coming later and later."

Community perspective

Being part of a community and looking out for each other

"We all look out for each other.
[...]
If I bring some sweets for my son, I bring them for all the kids in my section."

Wrong priorities

Planting trees as a sustainable activity without much knowledge

I go to schools to educate them about the environment and to plant trees together.

Reflecting enthousiasm

Parents who take their kids and explain their knowledge serve as a good bridge between knowledge and kids

Observation:
Some parents enjoy to pass their knowledge and enthousiasm about a topic on to their children.

Let kids play at their own

Leaving exploration up to the kid, not interfering

Observation:
Some parents prefer to sit by the side and talk to other parents while their kids are playing or exploring a place.

Focus on keeping nature

History of the forest represented in the nature

To me the nature is most important. [...] We should not cut down trees. For example, this tree took 60 years to grow this large; by cutting it down, you take away a piece of history of the forest.

Educating children

Seeing value in teaching children

I think it will be good to teach people about the importance of preserving the forest.

Explaining need

Investing in educating people can result in a change of attitude

There used to be a lot of logging in the forest by the people of Karura [...] We started talking to these communities to educate them about the importance of the forest and why logging is bad. Because of this, it happens way less then it used to.

Being scared

Not sure about the pittfalls of the museum

I am afraid that soon there will be interested parties who will come and destroy the forest by building because the museum attracts a lot of visitors.

Stimulating Naturalisation

Letting nature take its course

This forest is how it should be. We have plenty of wild animals. [...] We let nature take its own course. We people are just visitors.

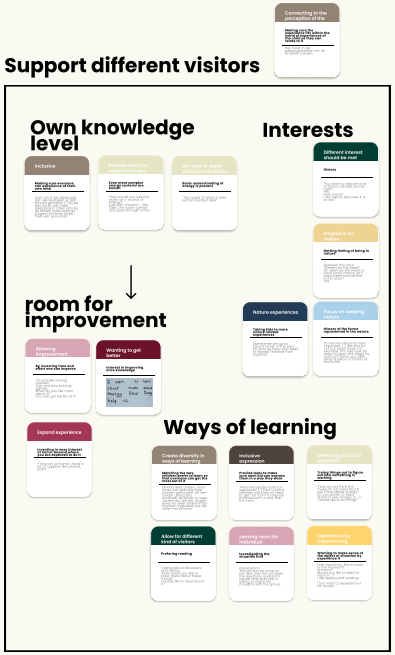
Forest community

Feeling of a community within the forest

As a ranger, I come into contact with up to 200 people every day. [...] I know almost everybody and that's what's so nice about the forest, it really feels like something we all share.

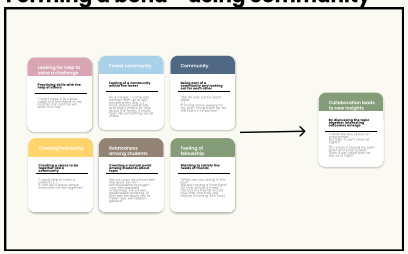
Appendix I Contextmapping - clusters

Support different visitors

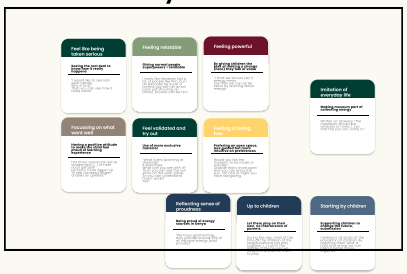


Creating an adventure

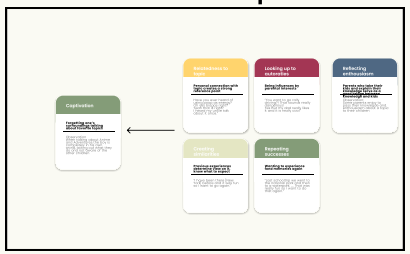
Forming a bond - using community



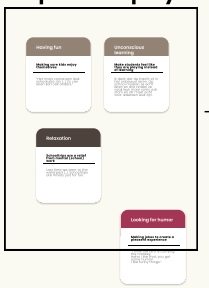
Value kids - they are in control



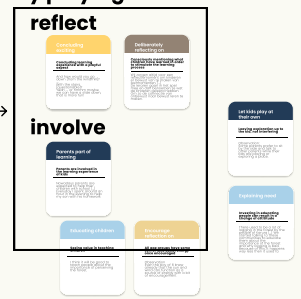
Personal relation with topic



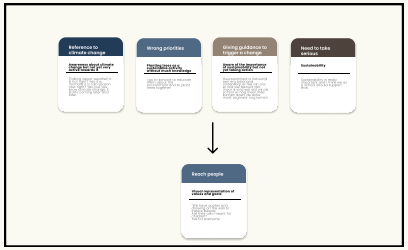
Empahis on play



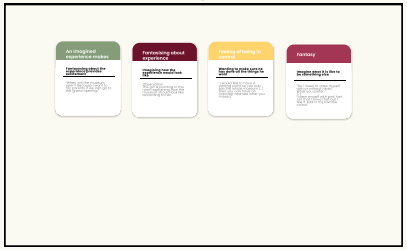
By playing learn



Activation



Leave room for intepetation



Clear story

Beauty results in anticipation

Appendix J Contextmapping - knowledge

Starting the journey it is important to recognise the visitor by acknowledging their knowledge level, interest and preferred way of learning. Before starting the play phase it is important to provide the visitors with a simple clear task in order to get them started. Next, the kids can begin their adventure of play-based learning. To trigger the target group their interest, the aesthetics of the installation are of importance, as the children are more eager to get involved if they appreciate the installation. During the adventure it is important the kids are in control, they determine what they want to do and at what level. In order to support this adventure the installation can support the feeling of the community, by creating a personal connection with topic and by leaving room for interpretation. At the end of the adventure it is important to have a reflective moment in which kids can get a break from all the impressions but also look back at what they learned during their adventure. The journey will be concluded by activating all visitors to become sustainable.

Appendix K Culture Onion model

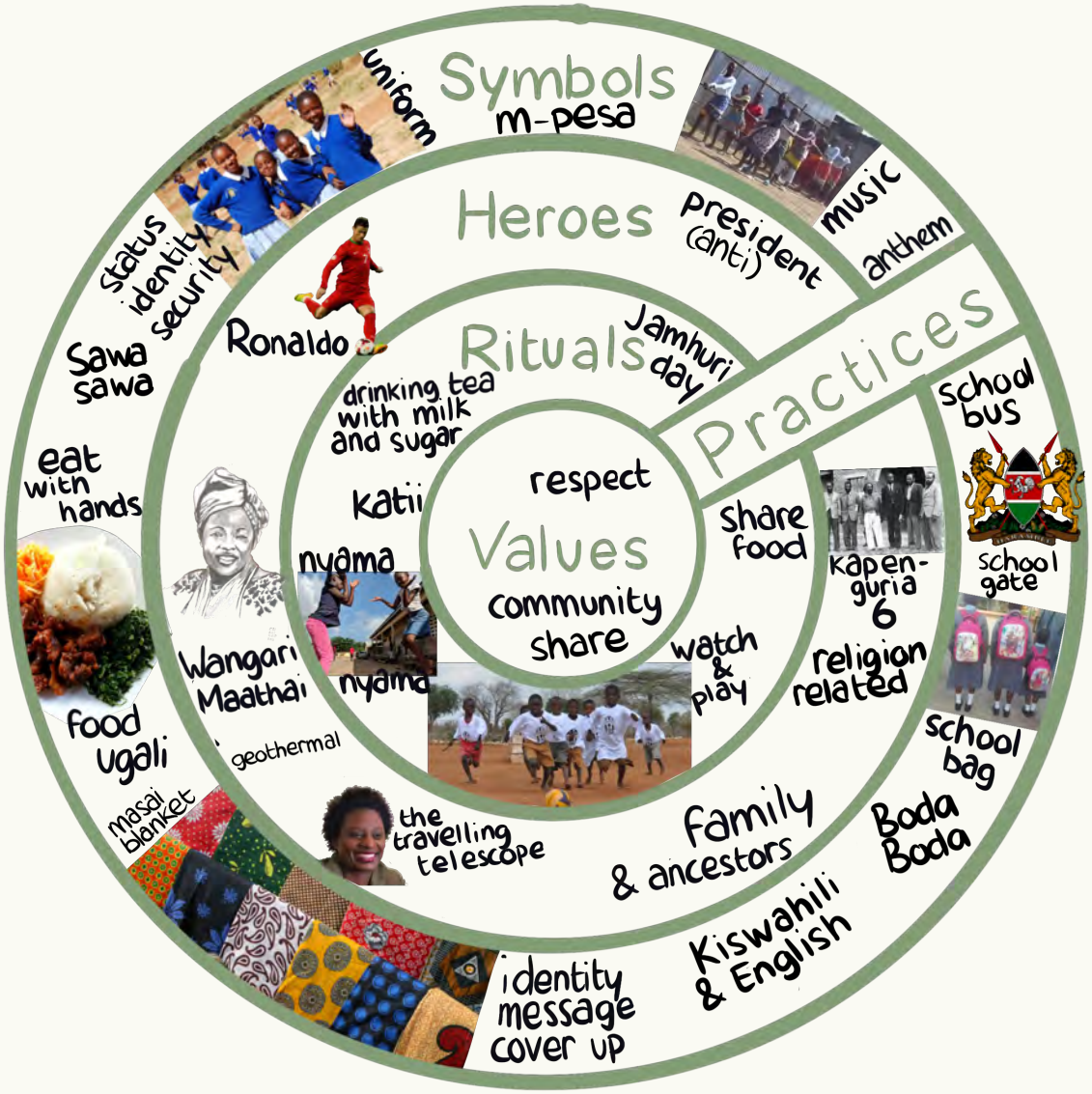
This onion model presents the practices of the learning child in Nairobi. The core values they carry with them are respect and sharing mainly within their community.

Rituals they follow are playing football (mainly for boys), drinking tea and playing games or dancing together during the break at school or just after school.

In terms of heroes, they look up to famous football stars such as Ronaldo, but their family and ancestors also play an important role.

Symbols that are specific to Kenyan children are their school uniforms, which exude a form of status, identity and security.

For Kenya, eating Ugali with the hands and the Masai blankets are another important symbol. As well as the boda boda and m-pesa that are used daily.



Appendix L Nairobi trip visits

In order to get an impression of the kind of play-based learning experiences that are currently available in Nairobi, research has been conducted into the various school trips/excursions that can be done within the city. This is a subjective examination by the head researcher based on a single visit, her insights are highlighted.

The information provided on almost all trips is rather factual and mundane. Figure 1 shows an example of one of the signs on the safari walk. It shows that, although the font appears playful, there is a lot of text on the signs. Observations showed that the signs are not read by any child and hardly any adult. The same applied to the other museums. At the Sheldrick Elephant Nursery, where the narrative is told by a ranger, this is also done in a very monotonous way, with the facts being enumerated.

At many of the places that were visited, one or a few "interactive" elements were encountered. Figure 2 shows a picture of the Giraffe Center where a typical interactive element can be seen as it is present in several museums. The element consisted of three containers with a hint glued on top, that allows you to guess what is in the box (Figure 3).

Figure 1: Information board at the Safari Walk

Figure 3: Representation Interactive element at Giraffe Center with on the left the text on top of the box and on the right the information inside the box

Figure 2: Interactive element at Giraffe Center

Figure 3 shows a picture of the National Museum. By turning the wheel, one receives a question concerning money. The answer to this question is displayed under the same colour box, hanging on the wall. It is remarkable that the interactive element only determines the question, but is not linked to the activity. In addition, this element is very much out of tune with the rest of the museum; this style (both colour and visuals) is not used anywhere else, which may cause confusion among visitors.

Also present in the National Museum was a scale with which one can compare their weight to that of an animal (Figure 4). Many vitors stood on the scales to see their weight, which indicated that this element stimulates engagement. However, the scales did not work properly, meaning it is not possible to link one's weight to an animal.

At the entrance and exit of the Safari Walk there were two interactive elements, one of which is shown in Figure 5. The observations showed that a number of children were enthusiastic about the turnable disks, but soon lost interest (probably because of the large amount of text on both sides of the disk). Hence, the potential of the children's engagement is present, but the implementation of information can be improved.

Finally, there was a mural showing three sharks, with the question "what is your height in shark? Figure 6 clearly shows that the whole wall is covered with graffiti. It is therefore important to consider to prevent the museum from being vandalised. Furthermore, all three sharks are the same with no additional information indicating the size of a shark. The learning aspect was missing in this interactive element.

Figure 3: Wheel at National Museum Kenya

Figure 4: National Museum with on the middle left the scale to measure your weight in animal

Figure 6: Shark on wall at the National Museum Kenya

Figure 5: Flippable disks at the entrance/exit of the Safari Walk

Appendix M Museum visits

Visiting Micropia

Wall with all kinds of micropia on objects/air

I liked the personal connection this gave, although selecting the different areas was a bit challenging

This was one of my favourites, gave me the idea of an exhibition in which you can manipulate factors and you will see how the world will change (just by turning, slowly changing the environment)

Most parts looked like this with a telescope under which you find the micropia and next stamp of the micropia you saw.

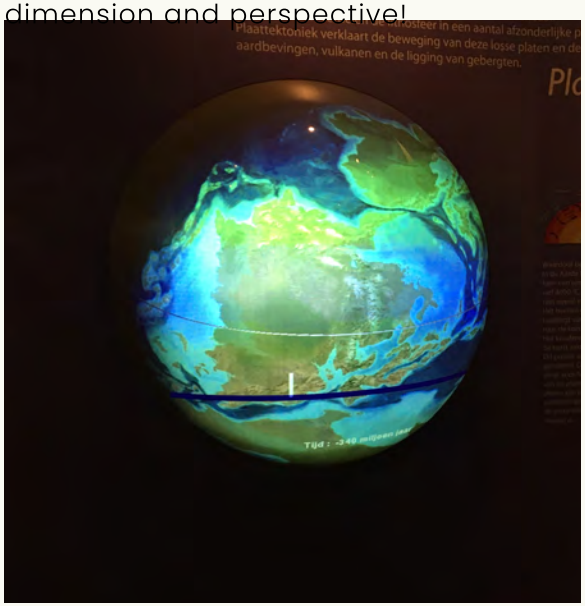
Visiting Micropia - key take aways

- All kids (and some adults too) really enjoyed the stamp card, actively looking to get all stamps. One kid was a bit confused as he wanted the stamp on a different spot and didn't get that the template already did that for him. The round shape however worked intuitively, so maybe just a small dot which you need to align in a circle would already work to improve it. Besides I personally felt there were a bit too many stamps, in the end I couldn't recognise which micropia I had collected. Lastly I would make the stamps stick out a bit more, for example by a glow in the dark micropia on the top (so you can also better see which one you get). Currently some were really hidden on a not very logical spot.
- There were a few digital/technological installations which weren't working. For myself but also for others this was (visibly) frustrating. It needs to be taken into account that if things don't work, especially multiple, this is what is remembered and also is seen as a lack in the experience.
- Some videos you could play were really helpful to me and I can imagine also for the children, as they explained really well what micropia are with easy to understand language and funny images. However those videos were pretty hidden away on the touchscreens, were as default information (as in a lot of text) is seen. I didn't see any of the kids in the museum play a video, which is a shame.
- During this visit it caught my eye how much the parents/guardians of the children influence the kids' experience. They really help the children understand the exhibition or they just quickly go through the museum. They also guide the kids to certain exhibitions.
- There was not really a route (or multiple routes) to walk. All installations were spread in the room, therefore you had to be cautious to see if you had been to all installations.
- The telescopes were made in a way to be easily adjusted for kids, besides on the screen next to it parents could check what they saw. The telescope really gave a sense of being a scientist, looking for micropia. Some people however did not feel comfortable touching the telescope with their skin, missing out on most of the exhibit.
- There was a clear starting point, similar for everyone. I was at a point in time which was pretty quiet, but I wonder if there will be a line of people there if there are more visitors.

At this installation it was possible to see ants up close (no barriers, just a sign to not touch them and them being red ants so the possibility to get bitten). I think this would also be a great addition for the Green Kids' Museum, seeing it real life makes the experience very rich and exciting.

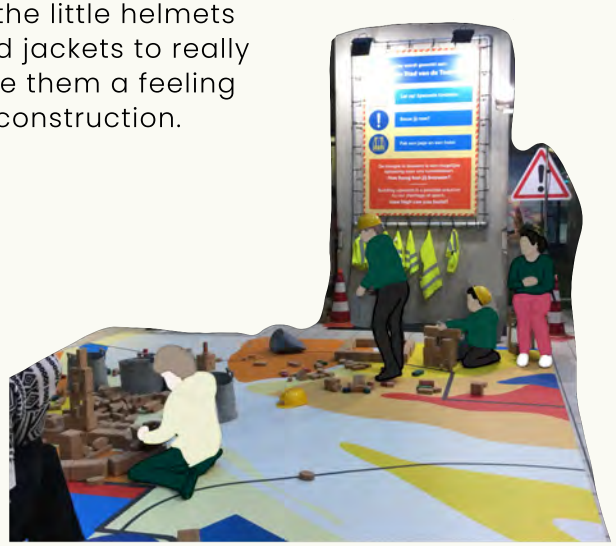
Visiting Museon

With the help of half a sphere and a projector, the globe was illustrated, something which really gave it some dimension and perspective!



This puzzle required placing the right block on the right spot in order to get more information about a city. It reminded me of a project I have done for ITD in my master's!

The enthousiasm of the kids building and playing was really inspiring, you saw that they had fun and enjoyed being in the museum. I liked the touch of the little helmets and jackets to really give them a feeling of construction.



With this installation kids could make a meal using 'interesting' ingredients such as worms.

I really liked this room, in which I was also very surprised by how much the kids could already accomplish at their young age. They made interesting constructions with gears (which if it didn't work they understood how to solve, making me realise they really knew how it worked). Making an electric circuit was also a favourite item, although this was a bit harder. But even trying myself I had some struggles with it, maybe a bit more explanation would help!

Visiting Museon - key take aways

- I was a bit overwhelmed with all the different themes and rooms, at some point it was just a bit too much. For some rooms I didn't see the relevance to the museum or didn't really understand what it was about.
- There was a lot of written information, which to some extent really helped parents to explain to kids what it was about, however it often was a bit too much. Most people didn't read anything or just a small portion of it.
- The One Planet exhibition downstairs was really inspiring, also very relevant for the Green Kids' Museum. The part that stood out to me was the technical corner in which kids could build constructions with gears and build electric circuits. I was pleasantly surprised with how much kids could already build/make. It gave me the feeling they really understood how it worked as they were trouble shooting and solving the problems they faced.
- Just like Micropia, the collection of answers seemed like one of the favourite activities for children. Sometimes (also from my side) there was some confusion as to how it worked, but this was often solved quickly. For the final result one had to insert it into the calculator, something I didn't immediately see was an option. I haven't seen many people insert their cards but this can also be due to them not being done with filling in the answers.
- There were a lot of buttons that could be pressed by kids, which many did! However I have seen many times where kids pressed the button but left pretty quickly afterwards, not really keeping their attention. Whereas the building downstairs was more hands-on and occupied kids for a long period of time.
- I think it is okay to have only a few (but good) exhibits which really grasp kids' attention instead of many small ones.
- As an idea I would like to have more of a route through the museum, making sure you see all exhibits. There can be multiple to make sure not everyone is starting at the same point. This can for example be based on age or on interest. I think this is a unique opportunity for the Green Kids' Museum, also connecting the rooms with each other with the route, entering a new theme but understanding its relevance.

Visiting Naturalis

Something I thought was really well incorporated in this museum, and I was kind of missing in others, is the way in which not only the installations but also the exterior and the objects guiding the route are really part of the experience itself as well. I also see a unique chance in regards to this for the Green Kids' Museum.

Not only visually but all senses were stimulated in the museum. In every room, sounds were used to reinforce the atmosphere and feeling of the theme.

Such as the wall that symbolises the different layers of soil with fossils in between.

Where the stairs are built in a way that it looks like a mountain and you are slowly walking up.

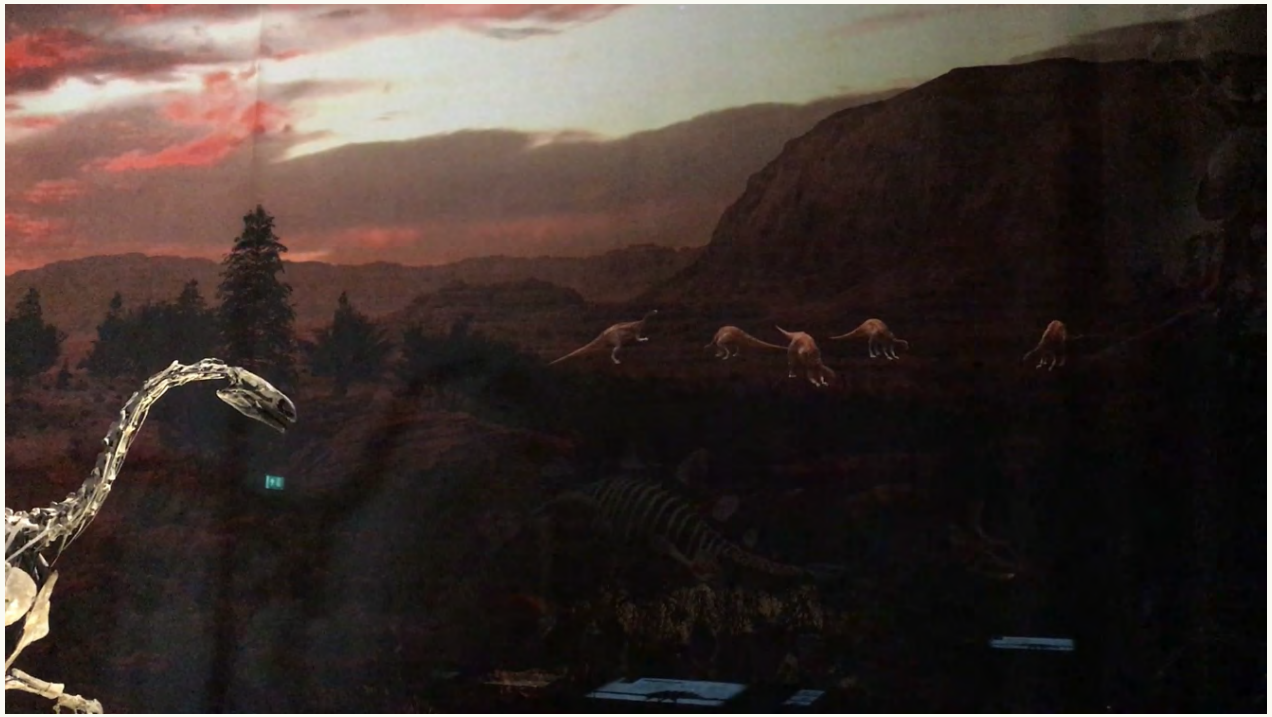
In this room a projection of water was used to set the scene. A fun observation (but a well thought out choice) is that underneath the water the underwater animals are placed.

Something that I was also very impressed by is the respect with which the museum is created. Not only does the temple add to the atmosphere of the exhibition, but it is also a temple that was built and sacred in Japan.

Visiting Naturalis

These binoculars played a film to give an idea of what the Netherlands used to look like in the days of the mammoths. By moving the binoculars, you could actually determine where you were looking in the film. The images also corresponded to what was displayed in that area. So if the binoculars pointed to a Sabre-tooth tiger and mammoth, in the clip you could see how a mammoth scares the tiger away. Then the link to the Netherlands now was made by showing how the place currently looks (many highways).

In the theme room The Death, they showed the end of life of animals. There were some light-hearted elements as well. For example this bumper with all the flies stuck to it.



One of my favourite things was in the Dino exhibition. Behind the skeletons of the dinosaurs, a view of what we think the world of dinosaurs must have looked like was given on a canvas. For example, a T-rex suddenly emerged from the bushes, or in the distance you could see dinosaurs eating from tall trees. They used sounds as well, which made it feel like you were in Jurassic Park and gave it an exciting yet tense feeling (especially for children). The nice thing about the mesh fabric that is used is that the projection is visible from both sides. It therefore functions both as a wall but also gives the viewer a better understanding in an efficient way.

Visiting NEMO

Almost all installations were digital instead of analog, which to me (at least in some cases) was a bit disappointing. When I was younger I really liked the two installations with water where you could really physically see the effect of what you did. I am not sure if they made this choice because it fits better with the target group, whether it is more convenient or just a preference.

I liked the spinning wheel on which people could insert triangular pieces. It was nice to see that at the end of the day it was almost completely filled in. It gave a sense of pride that all visitors collaborated together to create it and I contributed as well. This correlates with the idea I had about showing how much energy was generated by all visitors.

Appendix N Examples guidelines

Differentiation

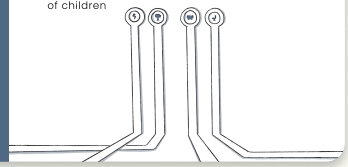
Support different kind of visitors

Every child is different, they all have their own knowledge level, interests and preferred way of learning. A museum attracts many different visitors and although it is not possible to match all installations to all types of visitors, all children should have the opportunity to express themselves with at least one of the installations. Hence, it is important to have a variety of installations with a diversity in perspective, approach and required experience.

"Every child learns differently, and that needs to be taken into account. One likes to listen, so audible, another is more visual so they prefer to see things and yet others have a more kinetic approach so they want to experience things."
Teacher

Implementation

- Indicate different trails through the museum based on different interests of children



1

Autonomy

Feeling of being in control

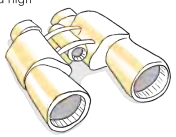
The children must feel that they are in control of their experience. This will enhance the learning process as the visitor is intrinsically motivated to engage in a play activity. Meaning the child must be at the centre of the installation, rather than the supervisor. Furthermore, the feeling of being in control is closely related to self-confidence of the child's own choices. To ensure that the children can start their journey of discovery with confidence, without constantly worrying about missing out, the museum can provide an overview of the various installations. This enables the children to make a well informed decision about the exhibits that appeals most to them.

"I would like to have a viewing point so you can see the whole museum [...] then you can have an overview and see what you missed."
Boy age 10

"Some [subjects] just come naturally so it is easy and then it is also a nice subject, but it is hard that you find it less fun."
Girl age 11

Implementation

- Provide an overview point, for example with a high viewpoint
- Provide a map



2

Processing

Leave room for reflection

Give the children the opportunity to take a break between all the impressions. A museum can be overwhelming. It is important to allow children to take a break and let them catch their breath. A moment of rest also helps to reflect on what they have learned, increasing the learning experience.

"We always provide a reflection moment to make children aware of learning moments. [...] The teachers join in the play and afterwards they name what the children have learned. To make the connection from unconscious to conscious learning."
Teacher

"Between all the impressions, it is sometimes difficult to let children take a break, for example to eat a sandwich. [...] It is useful if the museum allows these kinds of moments of rest."
Dutch parent

Implementation

- Create peaceful resting points at areas where there are few new impressions

3

Exploration

Enable discovery

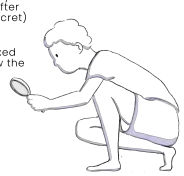
Children enjoy discovering new places and objects. With regards to a museum installation children are mainly interested in exploring elements and manipulating those to achieve the desired result of the child. This discovery process can be an immersive experience for the child in which they are challenged with cause and effect. By reaching the desired result of the child they might feel proud by their competence in discovery.

"I like to go to new places I have never been before. [...] It is like an adventure and I always get so excited."
Girl age 9

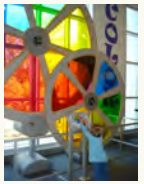
"I would like a cycling track. [...] What about the energy here? Maybe the faster the cycle the more energy you have. Yes that is true so, maybe we can light up the track more the faster you cycle? Yes that is cool!"
Boy age 10

Implementation

- Let something only become visible after completing a (secret) play activity
- Do not make a fixed solution but allow the visitor to decide



4



Community

Emphasis on the feeling of fellowship

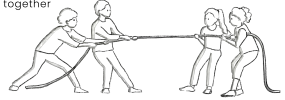
By supporting children in interacting with peers, they are more likely to reach new insights. Discussing and arguing over a topic or challenge stimulates creativity and the ability to solve problems. In addition, children can encourage peers to become more involved with an installation or topic. The interaction among children will result in a feeling of fellowship, which can ultimately lead to a sense of commitment to the museum and its goal.

"I would like to have a podium. […] It can be a place where everyone comes together." Boy age 10

"As a ranger, I come into contact with up to 200 people every day. […] I know almost everybody and that's what's so nice about the forest, it really feels like something we all share." Ranger

Implementation

- Let visitors build upon efforts made by previous visitors
- Encourage competition
- Establish a common goal to be achieved by working together



5

Competence

Challenge abilities

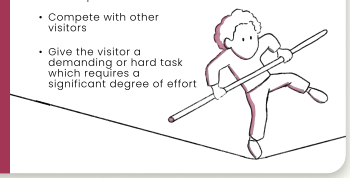
Children like to improve and expand their skills. By giving them the opportunity to test their abilities with a specific task, they are prompted to take up the challenge and practice it several times in order to improve. By repeating a specific task and experimenting in order to progress, the learning curve is enhanced. Besides, by improving and reaching personal goals the child will get a sense of pride.

"So you like solving puzzles? Yes! and also playing games. What do you like most about it? You can get better at it." Girl age 10

"I can't solve it. [A rubics cube] but the friend of my brother can and he will teach it to me." Girl age 10

Implementation

- Score tasks on which they can improve
- Compete with other visitors
- Give the visitor a demanding or hard task which requires a significant degree of effort



6

Recognition

Clear & simple introduction

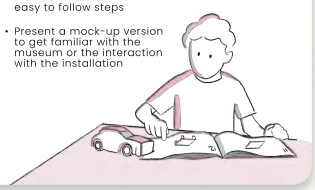
It is important to give children the confidence that they can handle the play activities of an installation and the museum. By starting with a simple, easy task, the child is gently prepared for what is to come, after which they can progressively engage in more advanced play activities. This simple task can also allow for a more open mindset as it reduces some of the visitor's nerves about the installation or museum by indicating that they can experiment, interact and play.

"It is important to be very clear. […] Don't ask too much all at once." Teacher

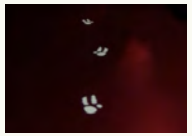
"You really need to explain to them what it is they are going to do and what is expected of them." Teacher

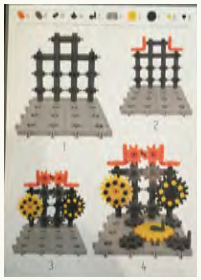
Implementation

- Provide a tutorial with easy to follow steps
- Present a mock-up version to get familiar with the museum or the interaction with the installation



7





Thrill

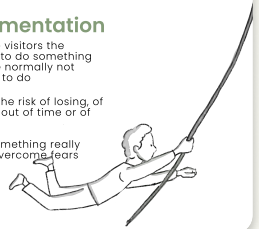
Allow children to take risks

Taking risks is foundational for learning and development as it supports children to learn to trust themselves, understand their capabilities, recognise limits and identify when to ask for assistance. Taking a risk can leave a lasting impression on a child. First, they experience suspense and sensation, followed by the pride they feel in their achievement after taking the risk. These intense emotions lead to a memory they will remember.

"We called it the 'Deadly jump' […] First I was really scared but then I asked them to make my lifejacket extra tight… and then I went and it was really fun!" Boy age 11

Implementation

- Give the visitors the chance to do something they are normally not allowed to do
- Create the risk of losing, of running out of time or of height
- Make something really scary, overcome fears



8

Stimulation

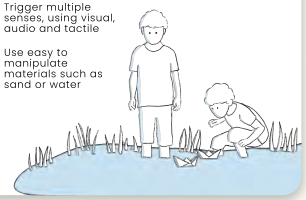
Trigger the senses

Children need to be able to experience the installation in order to fully immerse themselves with the topic and become part of the created world. This immersion in an installation is enhanced by stimulating the senses of a child, like hearing, seeing and touching. Besides, by allowing the children to be able to touch and manipulate elements of the installation to create their own play activity, the play-based learning experience is enhanced.

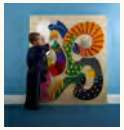
"I want children to discover their senses. […] It's about the combination of playing and discovering."
Teacher

Implementation

- Trigger multiple senses, using visual, audio and tactile
- Use easy to manipulate materials such as sand or water



9



Acknowledgement

Reflect everyday life

Children are seeking the experience of everyday life. They want to feel that they are taken seriously by being allowed to experience the real deal, like handling specialised equipment, supplies and materials. Allowing children to explore and experiment with these resources instils a sense of pride, as they experience a unique opportunity to step in the shoes of an expert and handle their activities. Besides, by confronting the children with the materials and methods that are also used in everyday life they become more aware of the world around them outside of the museum.

"I would like to see real solar panels. Why is that? Than you can see how it really works"
Boy age 9

"Is a windmill big? […] I want to see how big it is."
Boy age 10

Implementation

- Let children pretend to step in the life of an expert
- Present real materials and equipment

10

Pleasure

Utilise humour

Using humour can increase the engagement with an installation and it opens the way for play. Children often use humour to make an activity playful. In addition, humour can help to make sense of an experience, thus boosting the learning process. Besides stimulating the play-based learning experience, laughter, which is often the result of humour, also has many benefits, such as reducing stress, improving the mood of the child and enhancing creativity.

"I think the bird is carrying the monkey. Haha I like that, you got some humour! I like funny things."
Girl age 9

Implementation

- Show bizarre things
- Make something unexpected

11

Beauty

Aesthetics promote involvement

Aesthetics can play a significant role in catching the child's attention. If a child sees something they experience as beautiful, they are more likely to approach and explore it. By using the aesthetics of the child in the installations, the child can be provoked to engage with the installation.

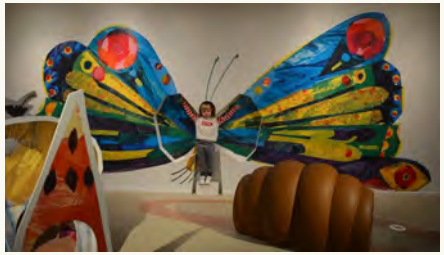
"I like multicolour I think that will be beautiful. […] It will create some scenery."
Boy age 10

"I want a big blue door […] It is beautiful. I think people will want to enter it now."
Boy age 6

Implementation

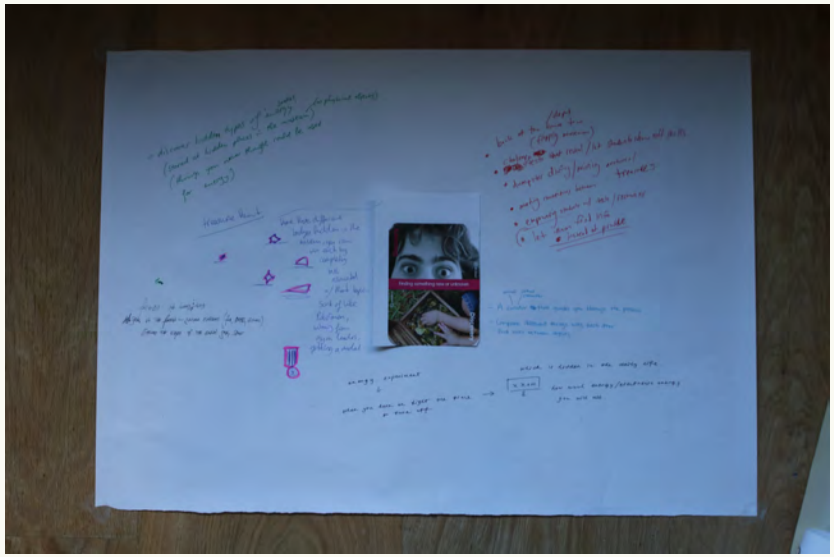
- Consider scale, colour and texture
- Make something unique, like a mythical creature

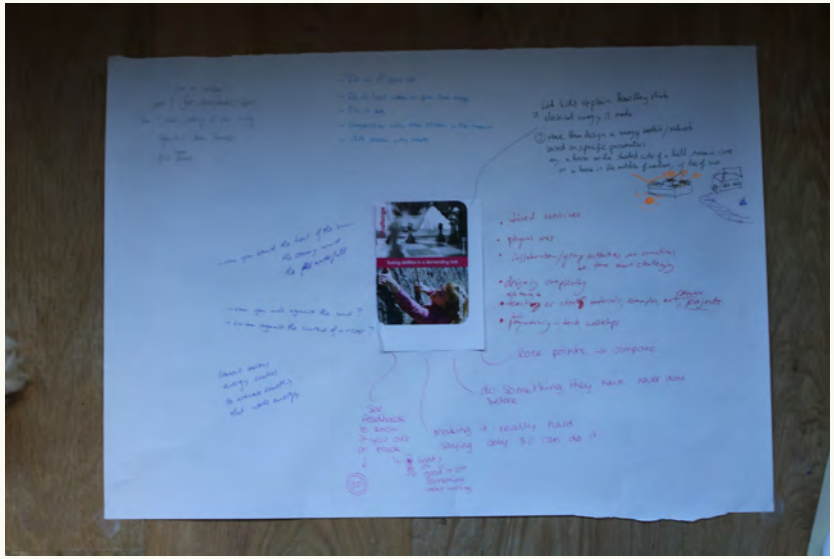
12

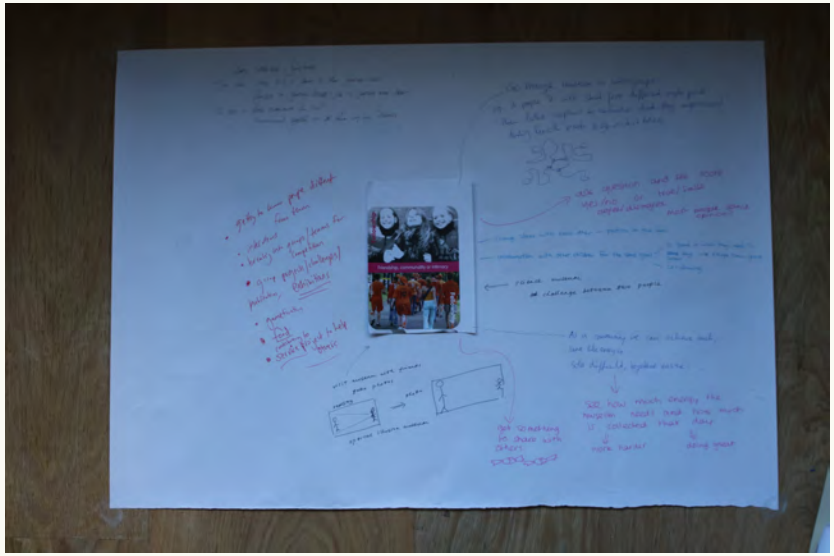


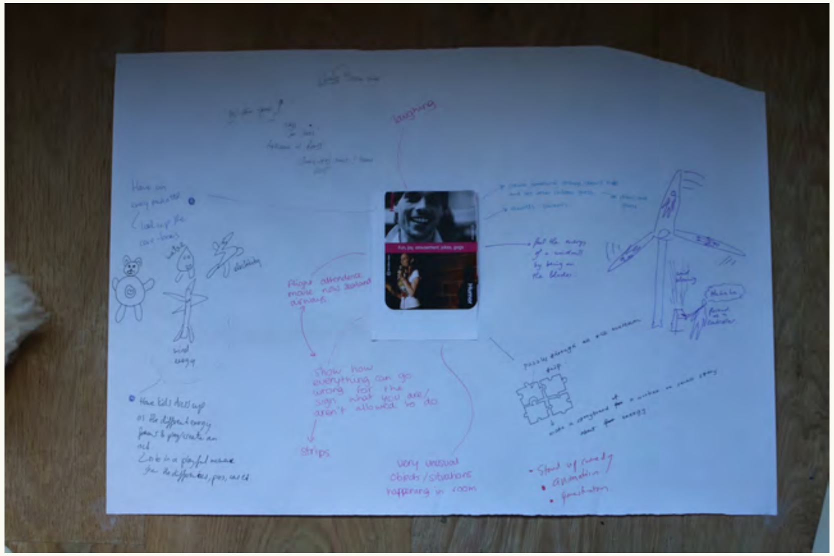
Appendix O Brainstorming session MuseumFutures Lab

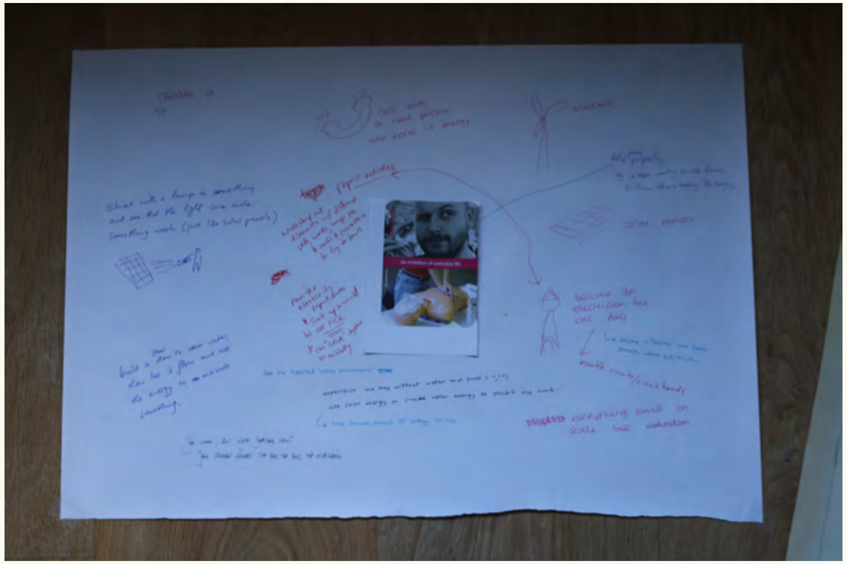
In a creative session organised during a MuseumFutures Lab meeting, use was made of the 7 PLEX cards. On the basis of these cards, which correspond to the guidelines in this project, a short brainstorming session was held, in which the participants were asked to think for two minutes about how the card could be implemented in the setting of the Green Kids' museum. After the two minutes, the Plex Cards were passed around, so that everybody received a new card. This enabled the participants to elaborate on the ideas of others. After all participants had a short brainstorming session with all 7 PLEX Cards, the creative session ended.

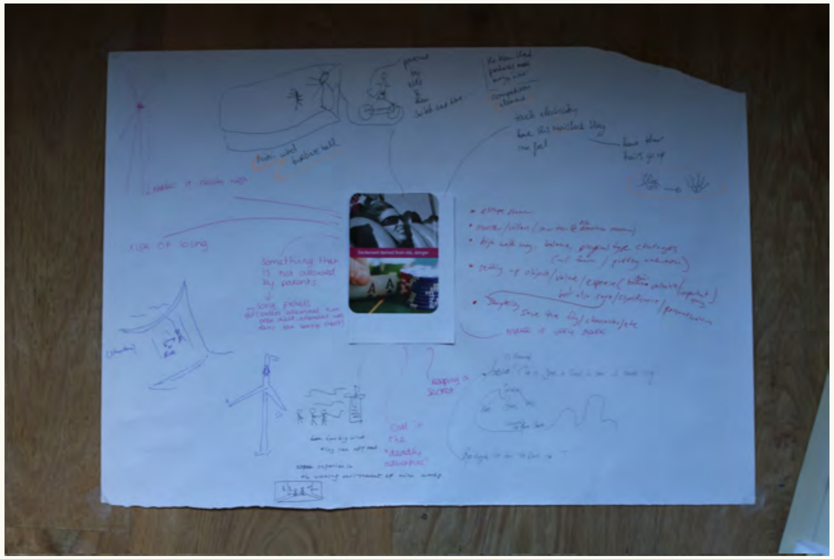


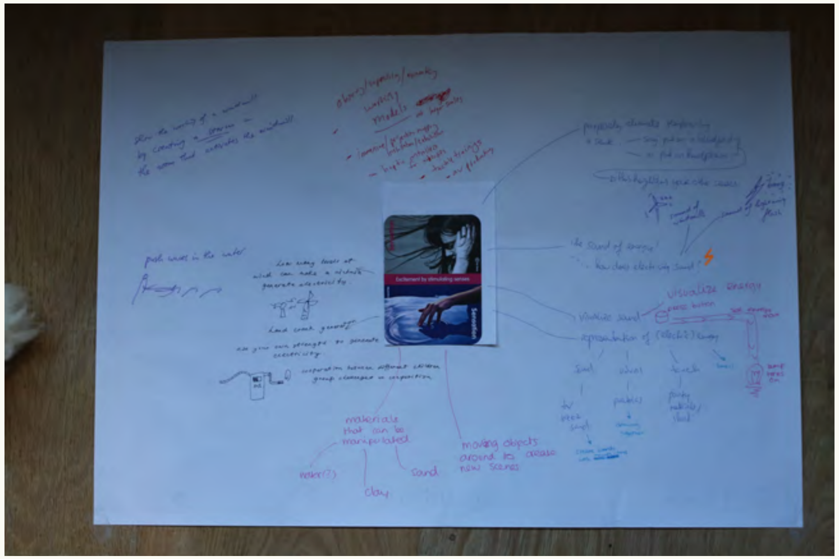












Appendix P Evaluation plan

Evaluation plan

Graduation project - Green Kids' Museum Kenya

Marit van Grinsven

Research questions

1. In welke mate ervaren de kinderen de installatie als een playful experience?

2. In hoeverre begrijpen de kinderen wat er van hen verwacht wordt met de installatie?

3. In welke mate nodigt de installatie kinderen uit om to explore van, experiment met and reflect op de toepasbaarheid van renewable energie?

Test information

De test is er op gericht om het concept Geotricity te valideren en eventuele recommendations te formuleren.

In totaal wordt er met FIXME aantal kinderen getest in groepjes van 3 tot 4. Eerst krijgen de kinderen een korte uitleg om een indruk te geven wat er van hen verwacht wordt en om enige spanning weg te nemen. Vervolgens zal de kinderen gevraagd worden om het prototype uit te proberen. Na de test volgen er enkele vragen aan de kinderen om zo meer inzicht te krijgen in hun ervaring. De test zal worden uitgevoerd in de school van de kinderen: "het Atelier", een omgeving waarin zij bekend zijn.

Materials

1 Tafel
1 Projector
1 Camera
5 elementen
2 huisjes
2 lampjes aangesloten op Arduino
1 laptop
1 fotocamera

Overview test set-up

1. De kinderen worden per drie- of viertal opgehaald en naar de locatie van de test geleidt. Persoonlijke spullen wordt gevraagd achter te laten in het klaslokaal.
2. De kinderen krijgen een korte uitleg en krijgen de mogelijkheid vragen te stellen.
3. Vervolgens mogen de kinderen gaan interacten met het prototype, die bedient/ aangepast wordt door de onderzoeker.
4. Na het testen van het protoypen worden de kinderen enige vragen gesteld over hun ervaring.
5. De kinderen worden bedankt voor hun tijd en weer teruggeleidt naar hun klaslokaal.
6. De onderzoeker noteert belangrijke inzichten van de test.

1. Ophalen kinderen

De kinderen worden in drie of viertallen opgehaald. De groepsgrote is zo gekozen dat de onderzoeker genoeg ruimte heeft om vragen te stellen en de de projectie handmatig aan te passen, terwijl er ook nog altijd ruimte is voor het evalueren van de interactie tussen de kinderen, een belangrijk aspect van het concept. De groepjes worden gemaakt door de leraar/lerares, om er voor te zorgen dat de kinderen zich comfortabel bij elkaar voelen maar ook een juiste dynamiek hebben, iets wat gezien wordt als wat de leraar/lerares goed kan inschatten.

2. Introductie (5 minuten)

Hallo
Druk > Springen
Respect
NEMO
Taak kinderen
Vragen
Installatie

Hallo! Ik ben Marit en hoe heten jullie? Bedankt dat jullie mij willen helpen! Ik kijk er naar uit om te testen, jullie ook? Hebben jullie er een beetje zin in?
Hebben jullie nog spullen bij je?
Ja: Leg die maar daar neer.
Nee: Helemaal goed.

Als de kinderen erg druk zijn: Oke laten we even springen, en nu als een kikker en nu nog even een olifant na doen! Oke helemaal goed dan kunnen we nu echt beginnen.

Allereest wil ik zeggen dat het belangrijk is dat we het leuk hebben samen, maar dat we ook rekening moeten houden met de andere klassen, snappen jullie dat?
Ik ben benieuwd, zijn jullie wel eens in NEMO geweest? En wat vonden jullie daarvan? Oke, nou ik heb iets ontworpen wat in zo een museum kan staan, maar dan helemaal in Kenia. Vandaag gaan jullie een simpele versie daarvan testen om te kijken of jullie het leuk vinden. Dat is een belangrijke taak dus hopelijk gaan jullie mij goed helpen, anders zitten de kinderen in Kenia straks met een stomme instalatie opgescheept!

Dan voordat we kunnen beginnen, vinden jullie het goed als ik dit opneem, dan kan ik terugluisteren wat jullie gezegd hebben. > start recording.

Als jullie willen stoppen, een pauze nodig hebben of iets anders willen zeggen dan kan dat altijd.
Hebben jullie nu al een vraag?

Oke nou stel je voor je komt NEMO binnen en je ziet deze installatie staan wat ga je dan doen?

3. Concept (10 minuten)

De kinderen zullen het prototypen testen. Omdat het ontwikkelen van een volledig werkend prototypen buiten de scope van het project valt wordt er met een simpele versie gewerkt.

Via een laptop wordt er een projectie op de tafel gemaakt. Door middel van een camera kan de onderzoeker zien wat de kinderen doen. Met behulp van Figma wordt op basis van wat de kinderen doen de projectie aangepast.

Vooraf wordt er geen uitleg gegeven over het concept om zo een realistisch beeld te geven van hoe het in museum er uit komt te zien. Om toch een idee te geven van de werking wordt een van de elementen op de tafel gezet, iets wat in het museum vaak ook het geval zal zijn.

Tijdens de test worden geen aantekeningen gemaakt, zodat de onderzoeker niet afgeleidt wordt van het bedienen van de projectie en om de kinderen niet het idee te geven dat zij worden beoordeelt. Wel wordt er extra aandacht besteed aan de opmerkingen en interactie die de kinderen onderling hebben. Belangrijke inzichten worden direct na de test genoteerd.

4. Vragen (10 minuten)

Leuk
Begrijpen
Tips/ Tops
In museum
Uiteindelijke doel

1. Wat vond je er van? Vonden jullie het leuk om te doen? Wat maakte het leuk?
2. Kan je uitleggen wat je net hebt gedaan? Begreep je wat je moest doen?
3. Wat vond je het leukste?
4. En wat zou het nog beter maken?
5. Stel dit zou in een museum staan hoe zou dat er dan uitzien?
6. Jullie hebben het nu een beetje uit kunnen proberen, als je langer kon spelen wat zou je dan proberen te bereiken (doel)?

5. Bedankt

De kinderen worden bedankt voor hun tijd en naar het klaslokaal geleidt. Zij krijgen aan het einde van de test ook een flyer mee met de vraag of zij in een filmpje willen spelen over het concept.

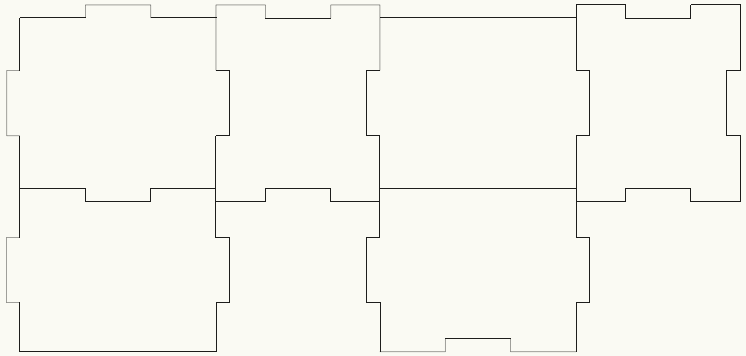
Data analysis

The collected data will consist of:

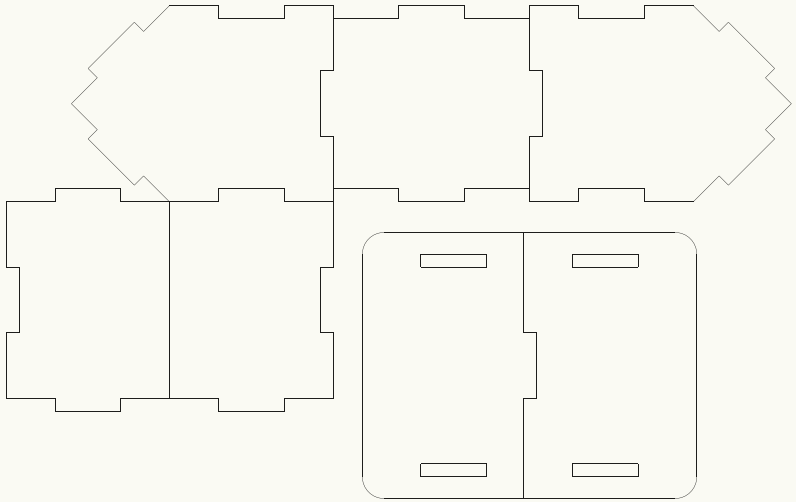
- recording of the test
- collected notes of the most striking insights according to the researcher
- pictures taken during the test

Appendix Q Houses

Laser cutting was used to make the houses for the interactive prototype. Below are the different parts that form the house. The thickness of the material must be as thick as the notches in the walls of the houses, in this case 3 mm



Lasercut file for box shaped house



Lasercut file for house with gabled roof