



ANNEXURE

A

WATER CALCULATIONS

WATER MANAGEMENT MODEL

A WATER RESOURCE INFORMATION (YIELD, m³)

A1 RAIN WATER HARVESTING DATA

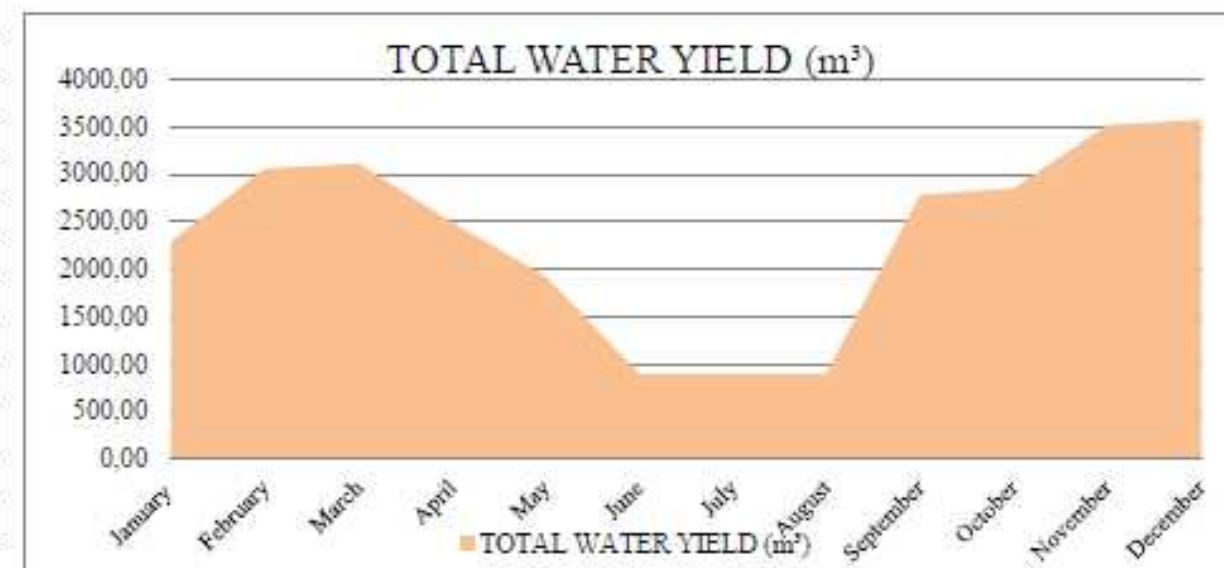
DESCRIPTION	AREA (m ²)	RUNOFF COEFF. (C)
Roof structures	6928,44	0,9
Road and Parking	7711,3	0,8
Movement ramps	100	0,6
Paved Courtyards	104,2	0,7
Lawn	12815,7	0,1
Wetland	3363,3	1
TOTAL AREA (A)		31022,94
WEIGHTED C		0,55

A3 TOTAL WATER YIELD

MONTH	AVE RAINFALL, P (m)	CATCHMENT YIELD (m ³) (Yield = PxAxC)	ALTERNATIVE WATER SOURCE (m ³)	TOTAL WATER YIELD (m ³)
January	0,13	2275,56	13,00	2288,56
February	0,09	1454,31	1600,00	3054,31
March	0,09	1505,64	1600,00	3105,64
April	0,05	889,69	1600,00	2489,69
May	0,02	325,08	1600,00	1925,08
June	0,01	102,66	800,00	902,66
July	0,01	102,66	800,00	902,66
August	0,01	102,66	800,00	902,66
September	0,07	1180,56	1600,00	2780,56
October	0,07	1248,99	1600,00	2848,99
November	0,11	1916,26	1600,00	3516,26
December	0,12	1967,59	1600,00	3567,59
ANNUAL AVE.	0,70	13071,66	15213,00	28284,66

A2 RECYCLED / ALTERNATIVE WATER SOURCE

MONTH	GREY WATER		AQUAPONIC SYSTEM		TOTAL / MONTH (m ³)
	WEEKLY YIELD (m ³)	MONTHLY YIELD (m ³)	WEEKLY YIELD (m ³)	MONTHLY YIELD (m ³)	
January	100	400,00	300	1200,00	1600,00
February	100	400,00	300	1200,00	1600,00
March	100	400,00	300	1200,00	1600,00
April	100	400,00	300	1200,00	1600,00
May	100	400,00	300	1200,00	1600,00
June	100	400,00	100	400,00	800,00
July	100	400,00	100	400,00	800,00
August	100	400,00	100	400,00	800,00
September	100	400,00	300	1200,00	1600,00
October	100	400,00	300	1200,00	1600,00
November	100	400,00	300	1200,00	1600,00
December	100	400,00	300	1200,00	1600,00
ANNUAL AVE.		4800,00		12000,00	16800,00



B WATER DEMAND

B1 LANDSCAPE IRRIGATION DEMAND (m³) X

DESCRIPTION:	LAWN (m ²): 12815,7		AGRI (m ²): 1478,4		PLANTING (m ²): 800		TOTAL MONTHLY IRR. DEMAND
MONTH	WEEKLY IRR. (m)	MONTHLY DEMAND (m ³)	WEEKLY IRR. (m)	MONTHLY DEMAND (m ³)	WEEKLY IRR. (m)	MONTHLY DEMAND (m ³)	
January	0,015	768,942	0,025	147,84	0,005	16	932,782
February	0,015	768,942	0,025	147,84	0,005	16	932,782
March	0,015	768,942	0,025	147,84	0,005	16	932,782
April	0,015	768,942	0,025	147,84	0,005	16	932,782
May	0,01	512,628	0,025	147,84	0,005	16	676,468
June	0,01	512,628	0,025	147,84	0	0	660,468
July	0,01	512,628	0,025	147,84	0	0	660,468
August	0,015	768,942	0,025	147,84	0	0	916,782
September	0,015	768,942	0,025	147,84	0,005	16	932,782
October	0,015	768,942	0,025	147,84	0,005	16	932,782
November	0,015	768,942	0,025	147,84	0,005	16	932,782
December	0,015	768,942	0,025	147,84	0,005	16	932,782
ANNUAL TOTAL		8458,362		1774,08		144	10376,442

B2 AQUAPONIC FARM WORKERS X

MONTH	PERSONS/DAY	WATER/CAPITA/DAY (l)	DOMESTIC DEMAND (m ³ /month)
January	30	11	10,23
February	30	11	9,24
March	30	11	10,23
April	30	11	9,9
May	30	11	10,23
June	30	11	9,9
July	30	11	10,23
August	30	11	10,23
September	30	11	9,9
October	30	11	10,23
November	30	11	9,9
December	30	11	10,23
ANNUAL TOTAL			120,45

B3 EVAPORATION LOSS (For 'open' reservoirs)

MONTH	EVAPORATION RATE (m/week)	EVAPORATION RATE (m/month)	TOTAL LOSS (m ³ /month)
January	0,04	0,16	538,1552
February	0,035	0,14	470,8858
March	0,025	0,1	336,347
April	0,02	0,08	269,0776
May	0,015	0,06	201,8082
June	0,01	0,04	134,5388
July	0,01	0,04	134,5388
August	0,02	0,08	269,0776
September	0,03	0,12	403,6164
October	0,035	0,14	470,8858
November	0,035	0,14	470,8858
December	0,04	0,16	538,1552
ANNUAL TOTAL	0,32	1,26	4237,97

35mm - 45mm/week in summer



B5

TOTAL WATER LOSS & DEMAND

MONTH	TOTAL DEMAND (m ³ /month)
January	2662,27
February	2479,71
March	2460,46
April	2354,76
May	2069,61
June	1947,91
July	1986,34
August	2377,19
September	2489,30
October	2595,00
November	2556,57
December	2662,27
ANNUAL TOTAL	28641,3642

C WATER BUDGET

 TANK CAPACITY (m³):

4090

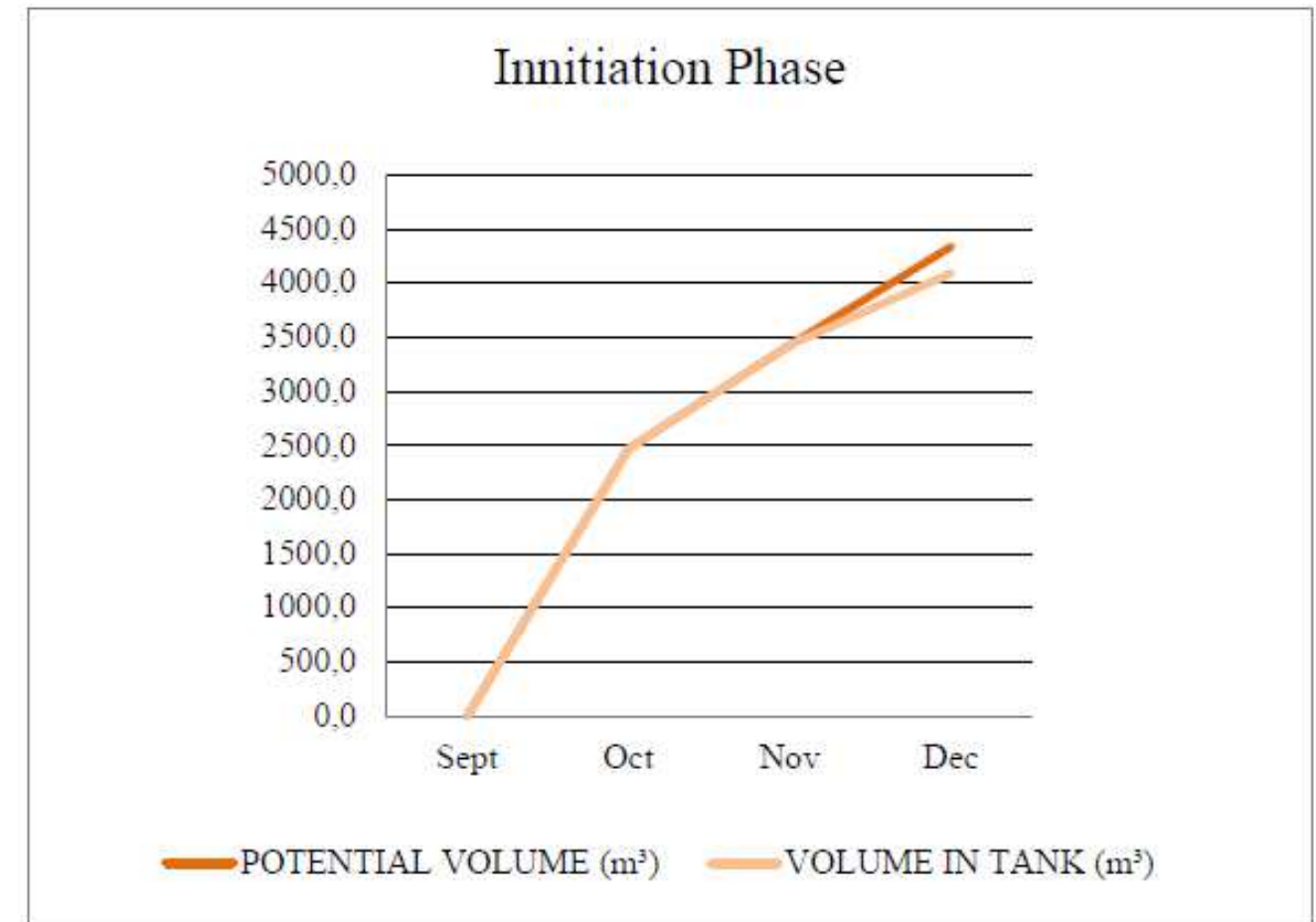
 MIN VOLUME (m³):

2470

C1 WATER BUDGET

INNITIATION PHASE

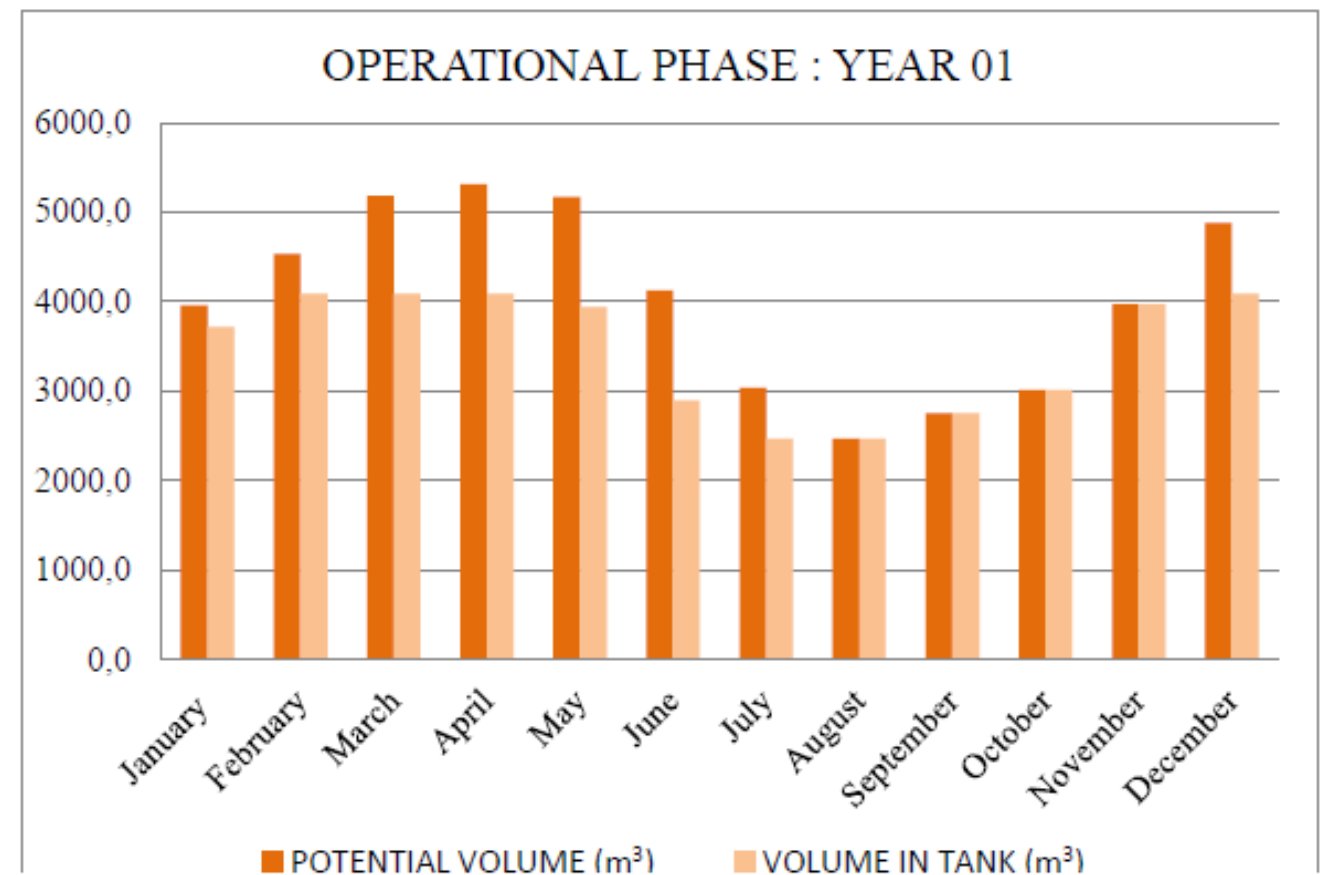
MONTH	YIELD (m ³ /month)	DEMAND (m ³ /month)	MONTHLY BALANCE	POTENTIAL VOLUME (m ³)	VOLUME IN TANK (m ³)
Sept	2780,6	2489,3	291,3	0,0	0,0
Oct	2849,0	2595,0	254,0	2470,0	2470,0
Nov	3516,3	2556,6	959,7	3429,7	3429,7
Dec	3567,6	2662,3	905,3	4335,0	4090,0
	12713,4	10303,1	2410,3		



C2 WATER BUDGET

YEAR 1

MONTH	YIELD (m ³ /month)	DEMAND (m ³ /month)	MONTHLY BALANCE	POTENTIAL VOLUME (m ³)	VOLUME IN TANK (m ³)
January	2288,6	2662,3	-373,7	3961,3	3716,3
February	3054,3	2479,7	574,6	4535,9	4090,0
March	3105,6	2460,5	645,2	5181,1	4090,0
April	2489,7	2354,8	134,9	5316,0	4090,0
May	1925,1	2069,6	-144,5	5171,5	3945,5
June	902,7	1947,9	-1045,2	4126,3	2900,2
July	902,7	1986,3	-1083,7	3042,6	2470,0
August	902,7	2377,2	-1474,5	2470,0	2470,0
September	2780,6	2489,3	291,3	2761,3	2761,3
October	2849,0	2595,0	254,0	3015,3	3015,3
November	3516,3	2556,6	959,7	3975,0	3975,0
December	3567,6	2662,3	905,3	4880,3	4090,0
ANNUAL AVE.	28284,7	28641,4	-356,7		



ANNEXURE B

REALITY STUDIO GAMES

Report written by

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Why games?

Why we created games to collect information

Games as icebreakers

The pre-game workshops have been conducted to introduce the children to the students and to get to know each other. The two games conducted at the ECD and the Mydo Youth Centre were also tested out for further development and refinement. The pre-game workshop is definitely a useful tool as icebreakers to ensure dedicated participation in future.

Gamification & conversations

All the games have a gamification aspect designed into the game to add to the excitement and overall enhancing the children participation. The gamification we used was a point system, timers and groups.

The groups added a competitive dynamics in the group and the conversations they had with each other were rich and insightful.



Figure 27: Children participating in the water game (Zorn, 2021)



Figure 28: Community member (Zorn, 2021)



Ideation process

Initial game ideas

We intended to conduct more games with the children but only got time to do two games which were the Melusi plate game (tested nutrition) which was altered for the two different age groups. The Shades of water game (tested knowledge regarding reuse of water) which were only conducted with the Mydo Youth Centre children. This game is more advanced where the children needs an understanding of what the different types of water is. The third game is Follow the food game which tested the children's understanding of where different food comes from.

Choosing two games

The team decided to work only with the Melusi plate game and the Shades of water game. The Follow the food game was not implemented due to the high complexity to understand abstract concepts. This game also required full facilitation and in our previous games conducted we became aware of the language barriers and the lack of translators. The team also decided not to implement the third game due to time constraints.

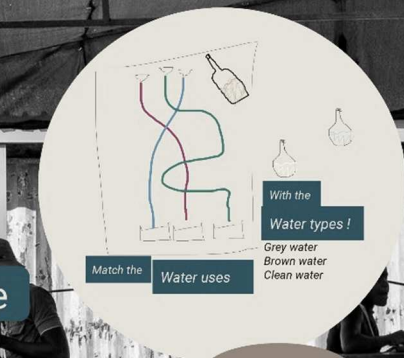
Melusi Plate game



5-6 years

7-14 years

Shades of water game



7-12 years

Follow the food game

10-14 years



Secret Food Mission: Improve the Food system

Designing games

Designing a Food Game and a Water game

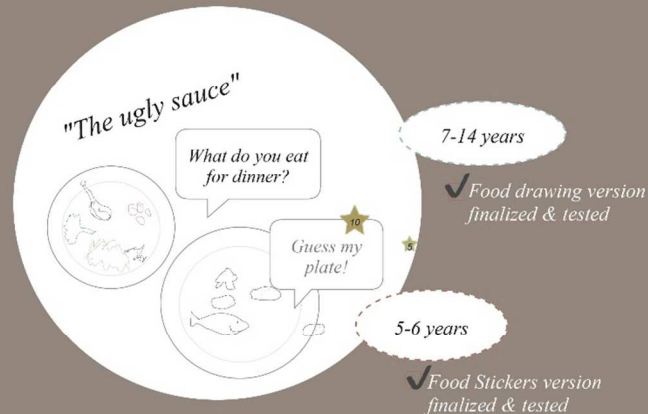


Figure 30: Plate game at MYDO (Zorn, 2021)

Plate game workshops

Playing the game at MYDO - with 7-14 year olds!

First game at Youth center

Just a day after the testing of our test game we had our first game session with the kids and youth and the plan was to have 4 kids in each team each guessing on each others plate similar to our test game on the previous page and ask all 3 questions. However we were overwhelmed by how many children wanted to play the game and so we had to adapt on site by making 2 bigger groups of around 8 children and changing the the dynamic of the guessing and the size of the teams.

Second game - smaller group

We did a second game session with a smaller group of kids taking into account the learnings from the first session - and organized a very relaxed game session outdoors with 7 kids that also gave us the chance to have deeper conversations and really get to know the children, hearing their stories and understanding their lives better.



Figure 33: Children guessing the food drawn by the opposing team in the plate game at MYDO (Zorn, 2021)



Figure 29: Stickers for plate game at ECD (Zorn, 2021)

The plate game

Our initial ideas of the game were to simply ask three main questions to the children: What they eat for dinner, What is the most nutritious food they can imagine and What is their dream meal look like. Each question would be organized as a game session with stickers to put on ones plate, then after each session we would discuss the answers or record them in some way. And ideally something fun would happen, but at this stage we had not come up with something to make it fun.

Two variations for different ages

After the initial idea of the food sticker game was developed we asked ourselves how to make it more fun, especially for the older children and so we tried to gamify it even more and developed a game where the children would draw and guess what was on each others plates. But to make it as simple as possible for the younger children we later developed the initial ideas of the food stickers game as a second variation of the game.



Figure 34: Introduction to the plate game (Zorn, 2021)



Figure 35: Discussion after the game "circle of trust" (Zorn, 2021)



Figure 36: Photos of children taking part in the plate game (Zorn, 2021)

Stickers game at ECD - with 5-6 year olds!



Figure 31: Water game (Zorn, 2021)



Figure 37: Children 'dishing their plates' during the plate game at the ECD (Zorn, 2021)

Planning the workshop

We saw in our first drawing workshop with these children that there was a need for visual aid to help the children communicate what food they ate at home. Therefore we developed the stickers version of the plate game. The plan was to have 3 different questions and have each child go alone to the stickers buffé table to not influence each other too much - and then be grouped into tables of smaller groups to have some kind of playful and fun process of guessing. We decided to eliminate the game or guessing process as it'd be fun enough to just pick stickers for this age group.



Figure 38: Children showing their dinner plates (Zorn, 2021)

The water game

The initial idea of the water game was two different games. One being a simple icebreaker where the kids would stand in a line and pour water to each other with the goal to spill as little as possible. In the end no icebreaker game was needed, Our final game was fun enough and we did not have time to try this out.

The second idea was developed further and also simplified and built based on easily accessible material. The main concept was to have the kids pour different types of water and having it go to different potential uses of water - to understand their knowledge of how each water type could or could not be (re)used.

Game process & wall structure

The game process was also designed and developed in detail and the gamification of the initial idea of putting each water type in the "right place" had to be made more fun. So we came up with the idea of having a wall and then one person on each side working together and having to communicate what water was poured and where they think it shall go.

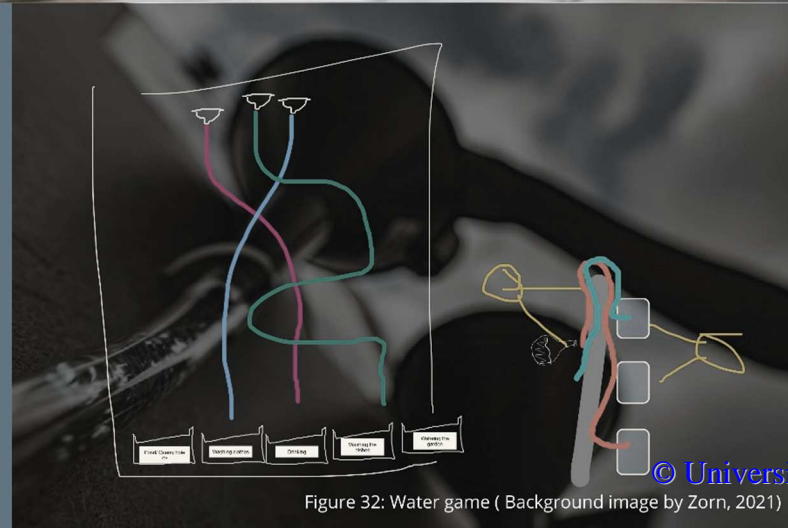


Figure 32: Water game (Background image by Zorn, 2021)

Reflections and learnings

The main insights around the game was to simplify it to just one question as the process of playing this game with 24 children needed time and each child needed to fully understand the questions and food stickers. The teacher played a vital role to make sure the kids understood the task and gave us the right type of data. It was time consuming to design, print and cut out all the stickers but it was worth it when seeing the children's big smiles and realizing that they understood the task thanks to visual aid and great support from the teacher.

Water game - take aways

Analysing the water game data



Figure 47: Post-water game discussion and story-telling (Zorn, 2021)

"There is a "Mangash" living in the Quarry hole! The Mangash eats people, we do not go near the quarry" -

Mydo Youth Centre Children



Figure 48: Post-water game discussion and story-telling (Zorn, 2021)

Co-design workshop

Design thinking workshop in collaboration with Play Africa



Figure 51: Mapping exercise during the Play Africa workshop (Zorn, 2021)



Discussion to collect data

The discussion we had afterwards with the children also gave us interesting insights of how they use water at their homes:

- The children like to take baths heating the water with kettles to make it warm
- The cook with water such as pasta, meat, and pap.
- The quarry hole water dam is a very scary place for the children and they believe that the "mangash" will kill their family if they go near the water body. The "mangash" looks like big snake monster.
- The children mentioned that they capture rain water with buckets at home for bathing, drinking and cooking purposes.



Figure 49: Post-water game discussion and story-telling (Zorn, 2021)

Where did the water go?

The children showed overall a good understanding of the different water types. The also show signs of reuse practices as home however these practices can be enhanced.

- The children put the Brown water at the dumping site because that is where the dump goes.
- Rain water have been put at the drinking water.
- Grey water have been reused in the toilets.

Pilot workshop with Play Africa

We did an analysis of all the main stakeholders we could think of and organized them in a circle diagram (below) where the most important stakeholders in our project are closer to the middle. In the first iteration of this analysis we did not even include the NGO which plays a crucial role and later came to be seen as one of our main stakeholders (in their role of building and facilitating new schools/ECD's and Youth centers in the area).

Part 1-2: Empathize & Define

The youth identified different spots on the map and could add emojis here to express their feelings and identified problems around these area. This was a very efficient way to understand the each child's perspective and the children could lead us into defining problems. The children had presented their problems and we could quickly start defining common problems that many children agreed on.

DESIGN THINKING WORKSHOP

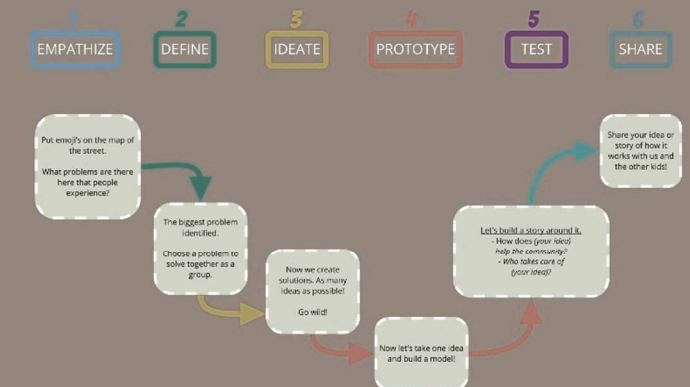


Figure 52: Interpretation of Play Africa method in preparation for workshop (Zorn, 2021)

The main insights and data

The insights of this exercise made it evident that there is more education needed to reuse greywater to water the garden.

Another important insight was that the children capture rainwater but there is opportunities to enhance this practice using a bigger surface such as roof and gutter to capture even more water reducing their trips to the municipal tanks.

	Waste water / Garbage dump	Drinking water	Pond / Quarry Hole	Watering the Garden	Washing the Dishes	Water treatment / Municipality
Brown water	○	○	○	○	○	●
Grey water	○	○	○	○	●	○
Rain water	○	○	●	○	○	○
Clean water	○	●	○	○	○	○

Figure 50: Data analysis of the water game (Background image by Zorn, 2021)



Figure 53: Prototyping exercise (Zorn, 2021)

Part 3-4: Ideate & Prototype

The next phase was the ideation phase as we fastly jumped over the define stage. Here the children starting sketching on ideas, not always directly related to the chosen problem from previous part. The children did drawings which had a lot of depth them.



Figure 54: Prototyping exercise (Zorn, 2021)

Part 5-6: Test & Share

The final part of the workshop was testing and sharing ideas. But here the testing (in which we had in mind to work with storytelling as a way to test ideas was simply not something we had the time for. Sharing though was great fun and and important part of each of the steps.



Take aways

Co-design - take aways

Take aways from the Play Africa workshop



Figure 55: Drawing exercise (Zorn, 2021)

Method & Adaptations

For the workshop, we designed a black and white map, drawn upon a satellite picture of Melusi and Dwar's Avenue. When printed it reached around 1x1 meters.

On this map, a main task for the kids was to put out emojis and for pointing out different thoughts connected to space. By using different emojis, it was possible to connect different spaces to different feelings, thoughts and attitudes.

The map also offered a sort of gamefied quality, connecting to the earlier workshops on Mydo and in the area.

Drawings and stories behind

The youth and kids got the opportunity to draw - as well as making models out of play do, sticks and paper, during the workshop.

There was a variety of ideas! Some participants proposed new fences or plantation of trees, while others proposed Melusi to be transformed into a diving centre, to solve the problem of floodings.

Also some quite serious problems connected to the space were identified, shown here beneath.

Problems identified by children

Among the problems identified by the kids can be mentioned:

- too many cars
- fear of being hit by a car
- fear of unknown cars and persons
- bad connection to the nursery/other side of the street
- fear of snakes



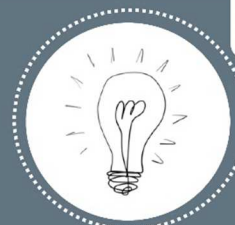
Figure 56: A model built by one of the participants (Zorn, 2021)

The main insights and data

There were many take aways and important insights from the Play Africa.

Among the most important where:

- Many youth/kids do not like the cars and the road, because of fear of being hit by a car.
- Many youth fear kidnappings, and this is also connected to a negative view of the nearby road.
- There is a fear of trees and vegetation, because of fear of snakes - and a conceptual connection between greenery and snakes. At least this was the case for the trees at the nursery. Because of this, the youth do not enter the nursery.



Take aways:

ANNEXURE

C

ETHICAL CLEARANCE



Figure 56: A sketch by one of the participants (Zorn, 2021)

Reference number: EBIT/259/2020

Dr C Combrinck
Department: Architecture
University of Pretoria
Pretoria
0083

Dear Dr C Combrinck

FACULTY COMMITTEE FOR RESEARCH ETHICS AND INTEGRITY

Your recent application to the EBIT Research Ethics Committee refers.

Conditional approval is granted.

This means that the research project entitled "Urban Citizen Studios: Public Interest Design" is approved under the strict conditions indicated below. If these conditions are not met, approval is withdrawn automatically.

Conditions for approval

Conditional approval on the understanding that:

- Applications from each student (including application forms and all necessary supporting documents such as questionnaire/interview questions, permission letters, informed consent form, researcher declaration etc) will need to be checked internally by the supervisor. A checklist will need to be signed off after the checking.
- All of the above will need to be archived in the department and at the end of the course a flash disc / CD clearly marked with the course code and the protocol number of this application will be required to be provided to EBIT REC administrator.
- Any personal and demographic data (eg gender, income, education) have provided the motivation that is acceptable based on the supervisor's evaluation.
- Students using organizations data not publicly available or collecting data from employees have the permissions in place.
- No data to be collected without first obtaining permission letters. The permission letter from the organisation(s) must be signed by an authorized person and the name of the organisation(s) cannot be disclosed without consent.
- Images and observation of people will require consent. Images and observation of minors are prohibited.

This approval does not imply that the researcher, student or lecturer is relieved of any accountability in terms of the Code of Ethics for Scholarly Activities of the University of Pretoria, or the Policy and Procedures for Responsible Research of the University of Pretoria. These documents are available on the website of the EBIT Ethics Committee.

If action is taken beyond the approved application, approval is withdrawn automatically.

According to the regulations, any relevant problem arising from the study or research methodology as well as any amendments or changes, must be brought to the attention of the EBIT Research Ethics Office.

The Committee must be notified on completion of the project.

The Committee wishes you every success with the research project.

Prof K.-Y. Chan

Chair: Faculty Committee for Research Ethics and Integrity
FACULTY OF ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY