

Primary school children and teachers discover the nature and science of planets Earth, Mars and Mundus

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Universiteit Utrecht

Faculty of Geosciences

Research group
River and delta morphodynamics



Motivation

- *Science is organised curiosity; children learn by doing, like scientists* (Gopnik 2012 Science); *so primary education should be organised curiosity.*
- But this is not the case. Far from it! Our aims:
 - + spark children's curiosity + motivation to learn and discover
 - + help teachers develop self-efficacy in science education

Program at primary schools

- Necessary and sufficient conditions:
 - + daring directors and teachers at pathfinder schools
 - + open-minded scientists, avoiding jargon, connecting to daily life
 - + science hubs at universities: www.wetenschapsknooppunten.nl
 - + eventually: curriculum change, national exams change, and national school assessment change
 - + no-brainer: use planets, pancakes, a game and the sandbox



www.EXPEDITIONMUNDUS.org

- Design:
 - + De Praktijk: science communication and education
 - + De Jonge Akademie of the KNAW / Royal Netherlands Academy of Arts and Sciences
 - + PI Maarten Kleinhans
- Principles:
 - + puzzle and role-playing classroom game
 - + sources of information distributed in classroom
 - + *most* disciplines of arts and sciences
 - + find answers to research questions (on card)
 - + more difficult questions yield more points
 - + collaboration and competition



Questions

Difficulty level	Arithmetic/math	Physics & earth sciences	Life sciences	History / culture	Language	Total
Basiclevel	6	11	15	12	6	50
Level 1	8	12	17	6	8	51
Level 2	6	10	8	15	18	57
Level 3	2	3	14	8	6	33
Total	22	36	54	41	38	191

Are vliegende moerasslangen (online at night), or are they active during the day?

Which region of Mundus is least suitable for plants?

These are droppings. Which organism do they come from?

Mundians have one particular number that they consider very special and that they use as decoration. Which number is that in our number system?

Sources



Experiences

- Other science aspects:
 - + peer review through the teacher in the role of editor
 - + higher-level questions require 'published' answer cards for simpler questions
 - + pupils often specialise and recognise the risk
 - + pupils often compete for points and collaborate for progress and recognise the tension
- How to use:
 - + contains manual tested by teachers
 - + read-aloud story for younger pupils
 - + use in teacher team meeting
 - + 1 hour is sufficient but the game can well be repeated and increased in difficulty



Dissemination

- 1500 to secondary education schools (1st year)
2000 to primary schools
100 to teacher education
- English version free online: www.expeditionmundus.org
 - + translations in progress: German, Hebrew, Japanese
 - + translation guidelines and licence agreement online to safeguard quality
- Effective price: € 30 per game, first years funded by SNS REAAL Fonds and Royal Netherlands Academy of Arts and Sciences



Investigating water and sand

- couple sandbox experience to the delta we live in: sense of place

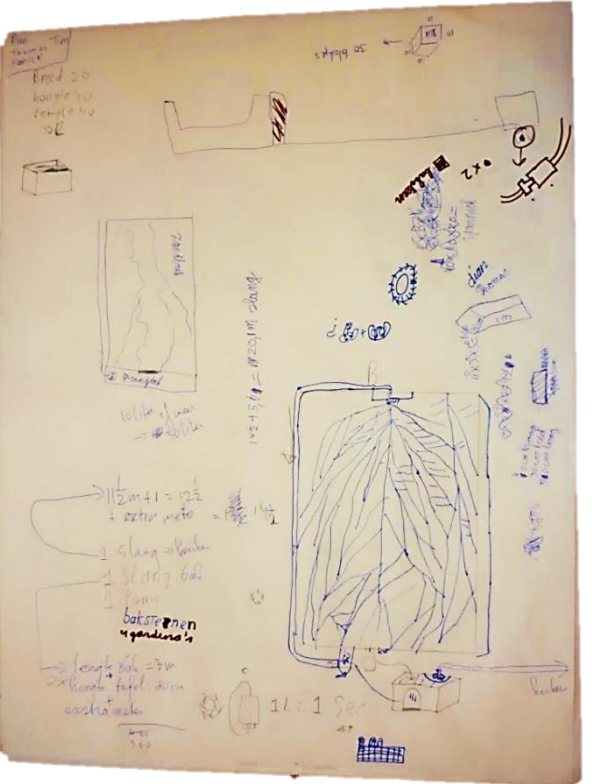


Phases in the project at primary school De Klokbeker

- design the sandbox, design the water cycle and design to prevent spilling
- first water: first discovery! water needs a slope to flow
- collective experiment: river with delta, or alluvial fan, or dike breach
- unpeel questions and start individual experimentation



"unpeel your questions"



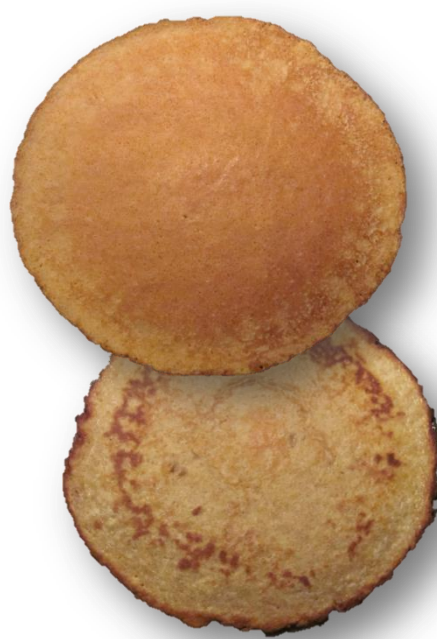
Further dissemination

- Youtube and other movies for teachers
- Books for teachers and for scientists on didactic aspects focussing on attitude and with various other examples
- Summerschool Junior (400 pupils)
- Klokhuis national science television for children
- experiences:
 - + combination URL and IRL is stronger
 - + collaboration with social scientists and science hub is effective and fun for all partners



Empirical cycle explained with pancakes

Step in empirical cycle	Example inquiry: Expedition Mundus	Example experiment: pancakes
1 Wondering, problem, questions	B19: Which town on Mundus is at the highest altitude?	Why do we put egg in pancakes?
2 Activate foreknowledge, abduce hypotheses, deduce testable consequences	Fig. 2B: The town that is drawn the largest is the highest. Alternative: rivers flow downhill, consequences	To make pancakes firmer, to cause binding, because egg stiffens when heated.
3 Methods: design the experiment, including a control and measurement methods	Look for sources with towns and information on elevation.	Bake pancakes with and without egg in otherwise the same conditions.
4 Conduct the experiment	Find the highest town and find its name.	Feel and taste the differences.
5 Draw conclusions	The answer is checked by editor: 'Nuki-wom is at the highest altitude.'	(In experiments, teachers should not give answers. The reader may try this at home.)
6 Present or publish the result	If correct, the answer card is published on a paper with the name of the pupil on it.	Tell the class about the results; make a poster or a projected presentation.
7 Contextualise, put results in broader perspective and raise new questions	Answer cards are new sources to answer more difficult questions and develop a world image of Mundus.	Refer to other food items with egg in them.



De Praktijk
natuurwetenschappelijk onderwijs

SNS REAAL Fonds

