

Contextual Mathematics Through Pervasive M-Learning Technologies for Developing Countries

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Outline

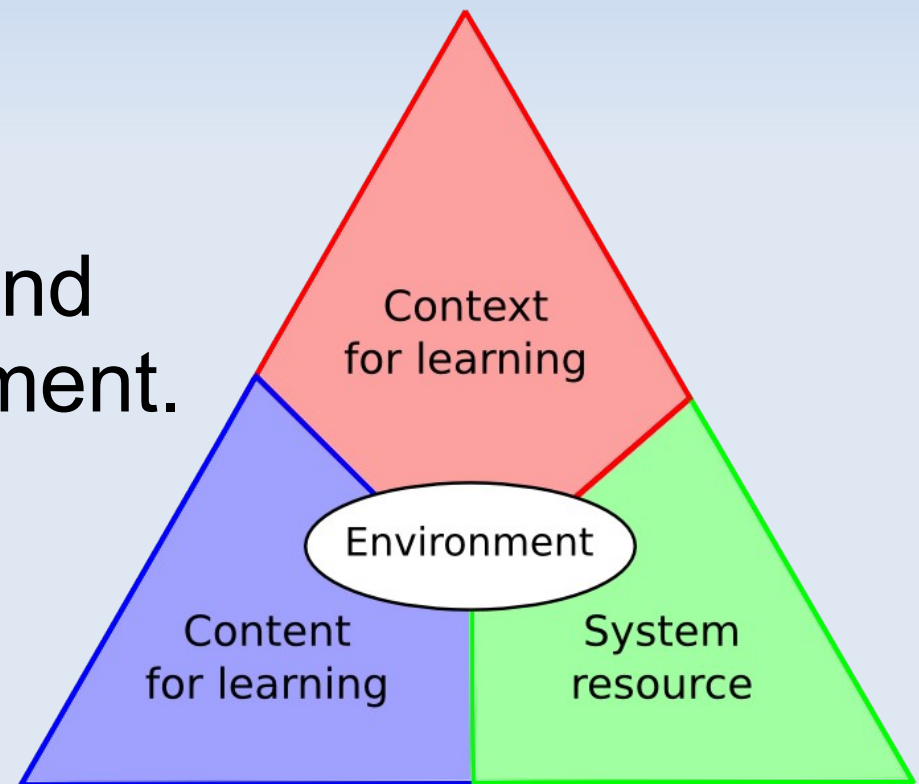
- Pervasive computing and pervasive m-learning
- Previous work:
 - SciMyst
 - TekMyst
- Math4D & MathMyst
- Conclusions

Pervasive computing

- Wireless, embedded, networked computing devices all around us.
- Smart furniture, smart buildings, smart objects, smart clothes, smart cars and even smart dust.
- Sensors → context-awareness.
- Importance of surrounding objects → interaction
- Also referred to as *ubiquitous computing*, *ambient intelligence*.

Pervasive M-Learning

- Learning facilitated by a mobile device in a context-aware learning environment.
- No time and location constraints.
- Utilisation of knowledge and properties of the environment.



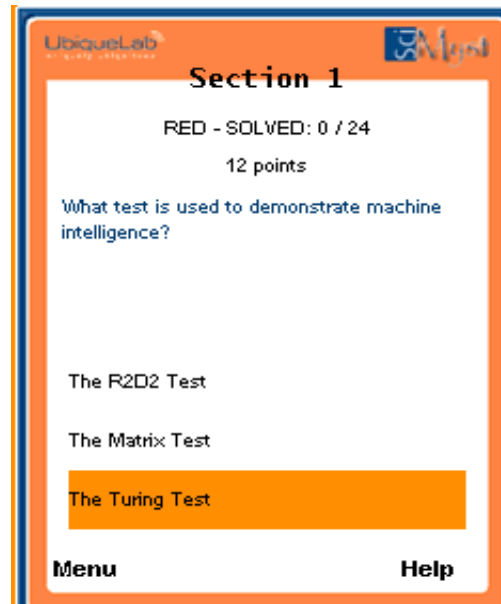
SciMyst

- A multilingual pervasive mobile adventure game with multiplayer characteristics.
- Presented at the SciFest 2007 & 2008 in Joensuu
- Aim: engage and motivate visitors of the festival to explore the environment in a novel way.
- Players use their mobile devices to adventure through a real world game environment by solving intriguing enigmas related to the surrounding objects and phenomena.
- Different types of enigmas: from *multiple choice* enigmas to more activating *take-a-picture* or *find-a-picture* enigmas.
- Suitable for players of all ages.

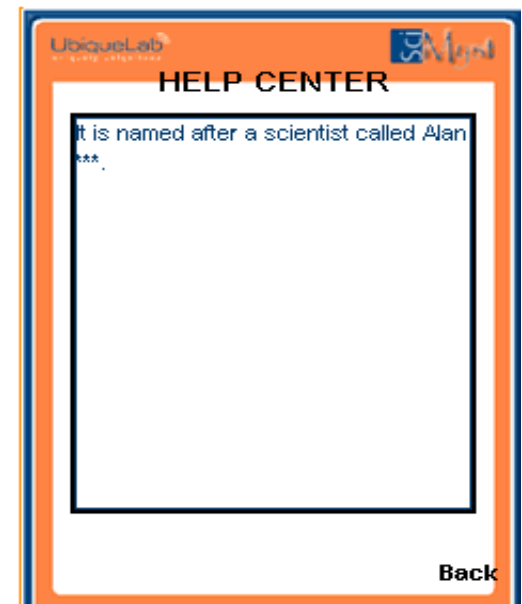
SciMyst (2)

- Help feature has been implemented in multiplayer mode
 - Social interaction among players and NPCs
- Game arena is divided into sectors.
 - Moving from one sector to another done by *smart tags* (barcodes, RFID)
- Game has three modes:
 - Basic – no time limitation, reduction of points from wrong answers.
 - Battle – countdown counter and penalty points for wrong answers. To be played after the basic mode, as the *final battle*.
 - Record impressions: player takes photos and adds comments. These *impressions* are then shown on the website.
- Common goal of all players: beat the ever-growing ignorance!
- Real-time [website](#) integration

SciMyst (3)



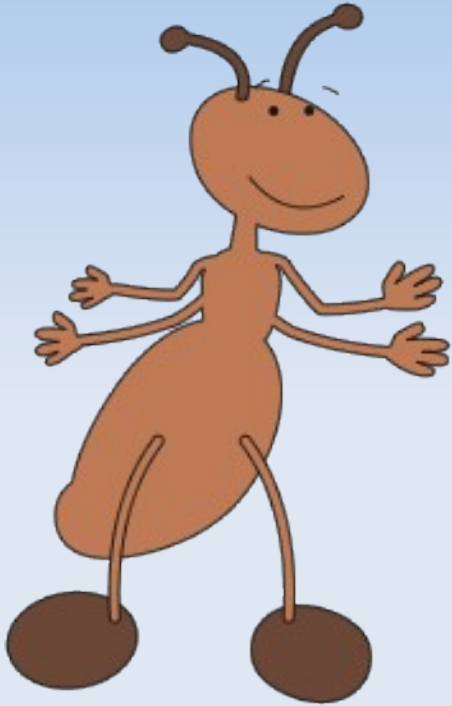
a)



b)

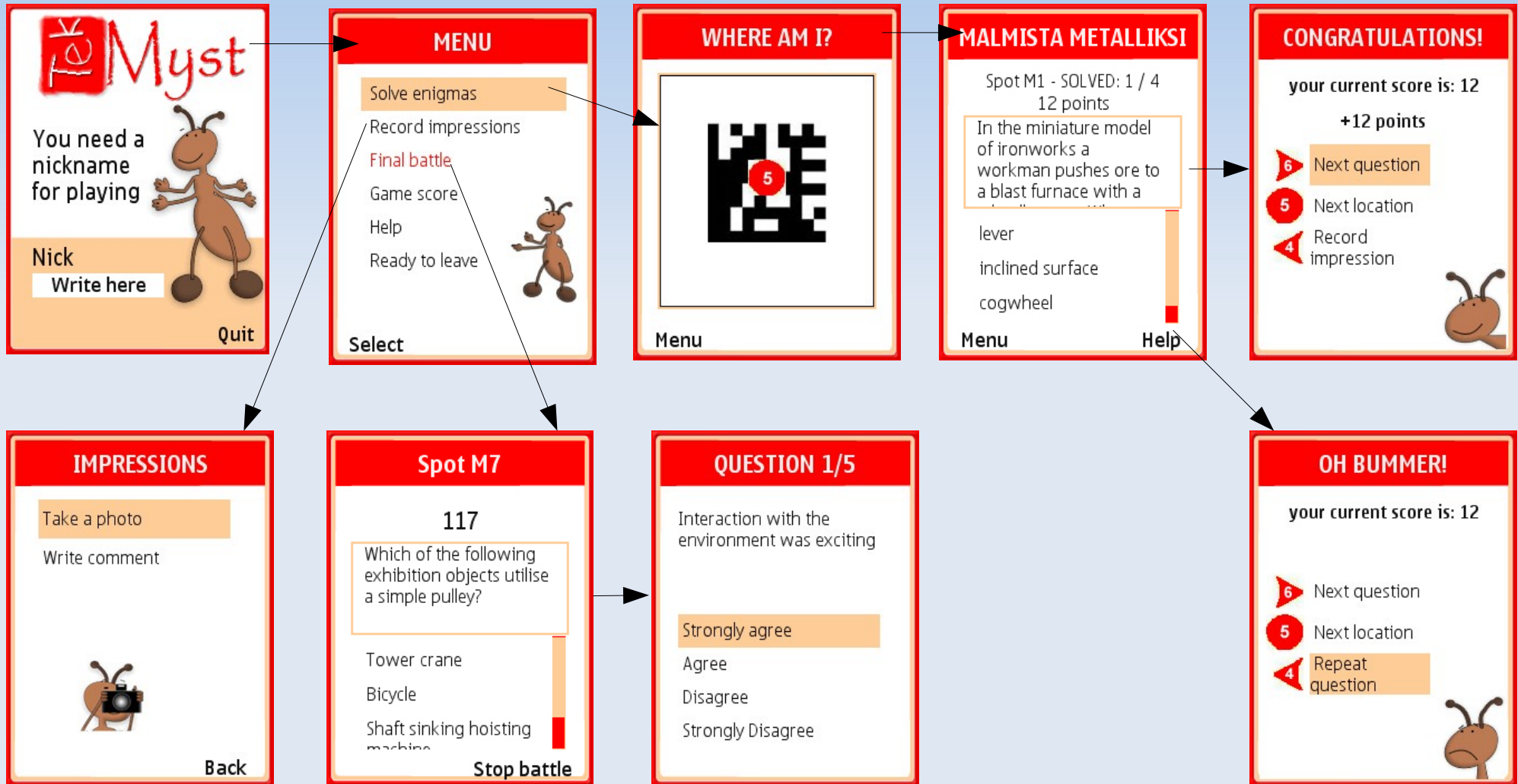
- a) multiple choice enigma.
- b) context help for the enigma.

TekMyst

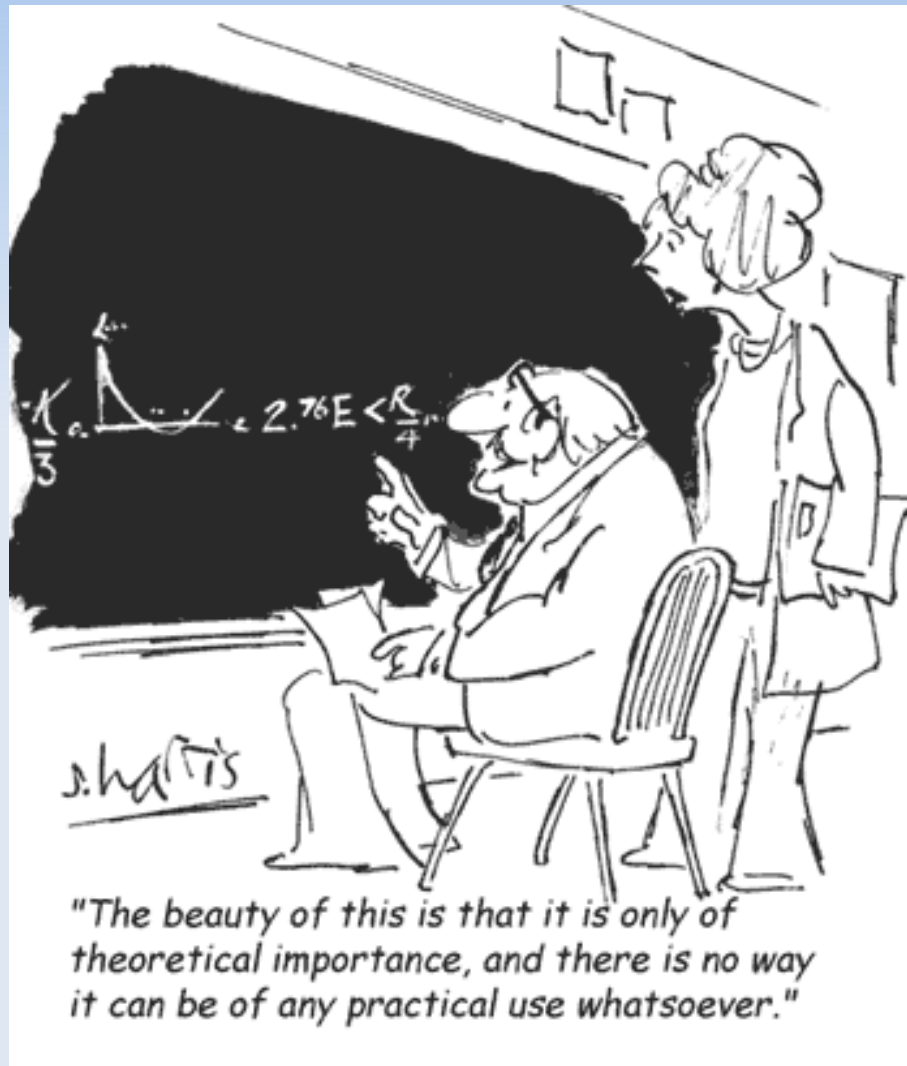


- Enhanced version of SciMyst for the Museum of Technology in Helsinki.
- Aim: an alternative way to gain knowledge at the museum.
- Intriguing story about ants and sharing knowledge.
- Was tested recently from 25th to 31st August 2008.
- [website](#)

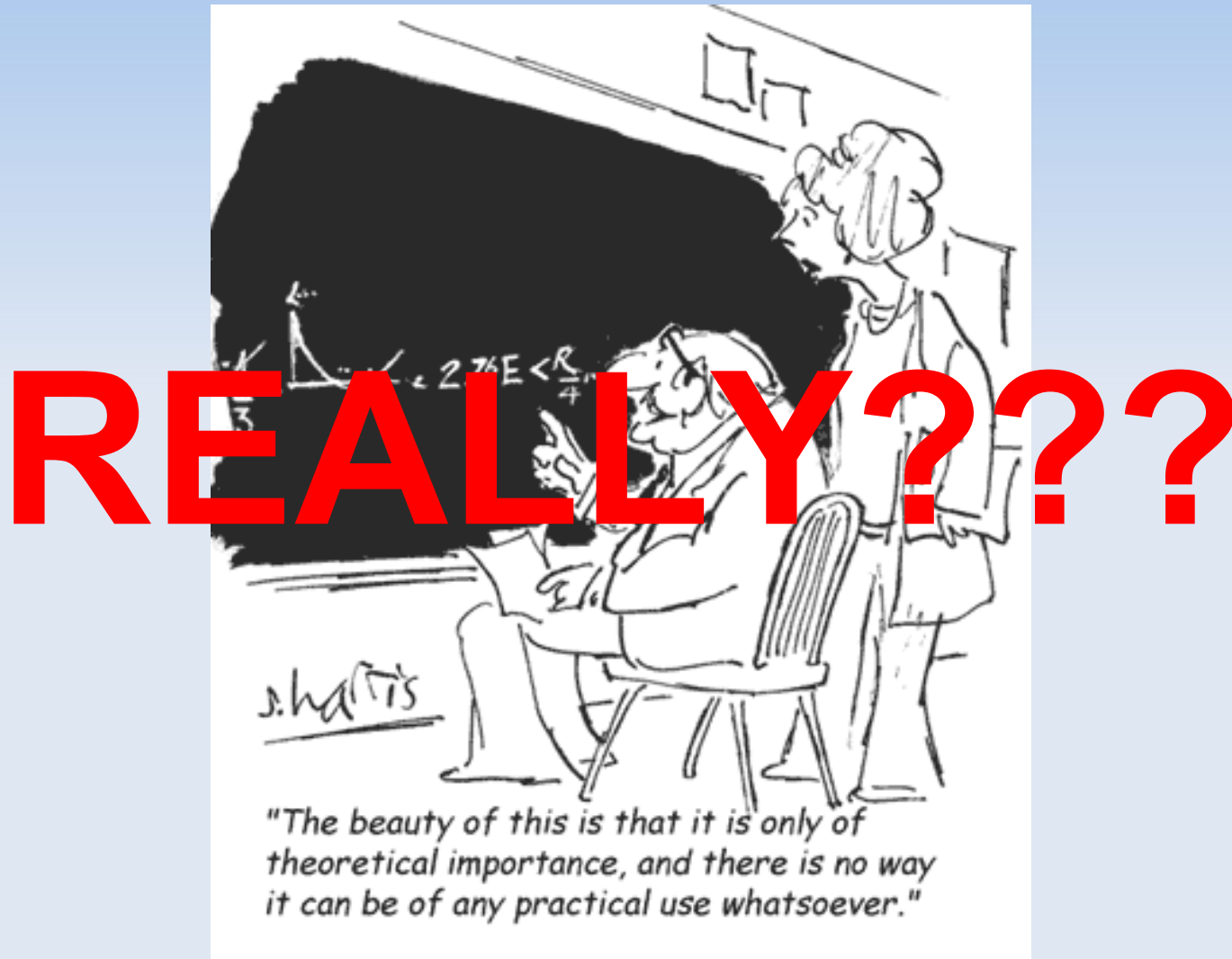
TekMyst (2)



Math4D



Math4D



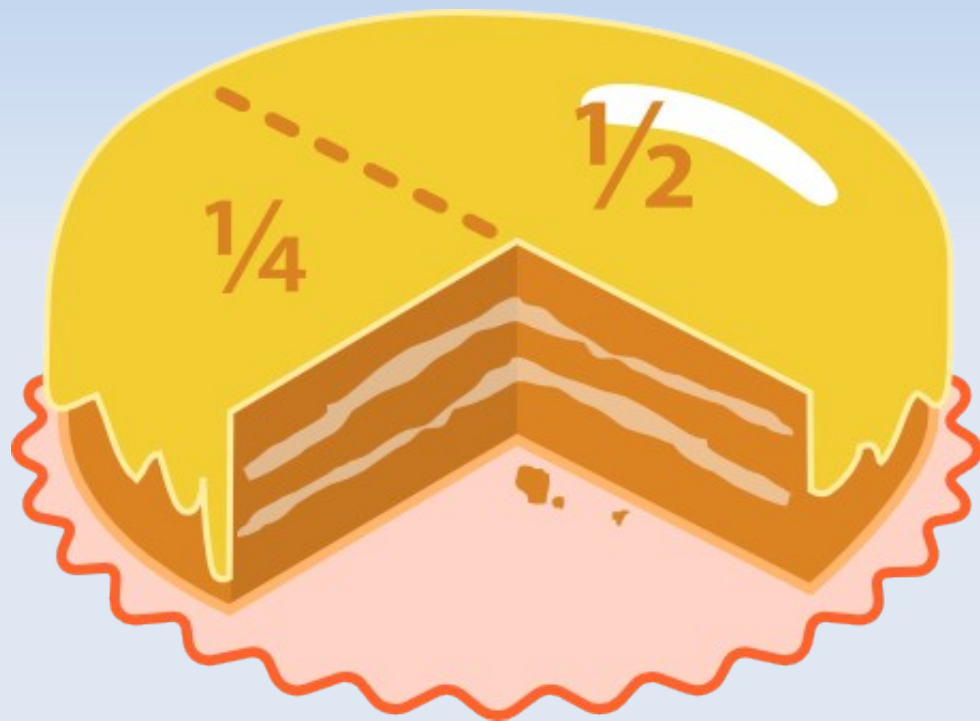
Math4D

- Despite the common phenomenon of **math anxiety**, math is still a vital skill in e.g.:
 - Every day life
 - Working
 - Household finances
 - Trading
 - Scientific and technological development
- How about learning *contextual math* through everyday problem solving practices?
 - **Ethnomathematics** → recognition of mathematical relevance of the surrounding environment and culture.

Proposal: MathMyst

- Seeks to join ethnomathematics with pervasive m-learning.
- Uses the same backbone system as other *Myst apps.
- Should work with cheap, low-end mobile devices with limited processing and memory capacities.
- Context-sensitiveness allows delivery of practical math problems and related information for any situation.
- User's cultural and educational background, existing skills, learning style and speed, and personal preferences are considered as well.
- Utilise text, images, sound and/or video.

MathMyth example: fractions

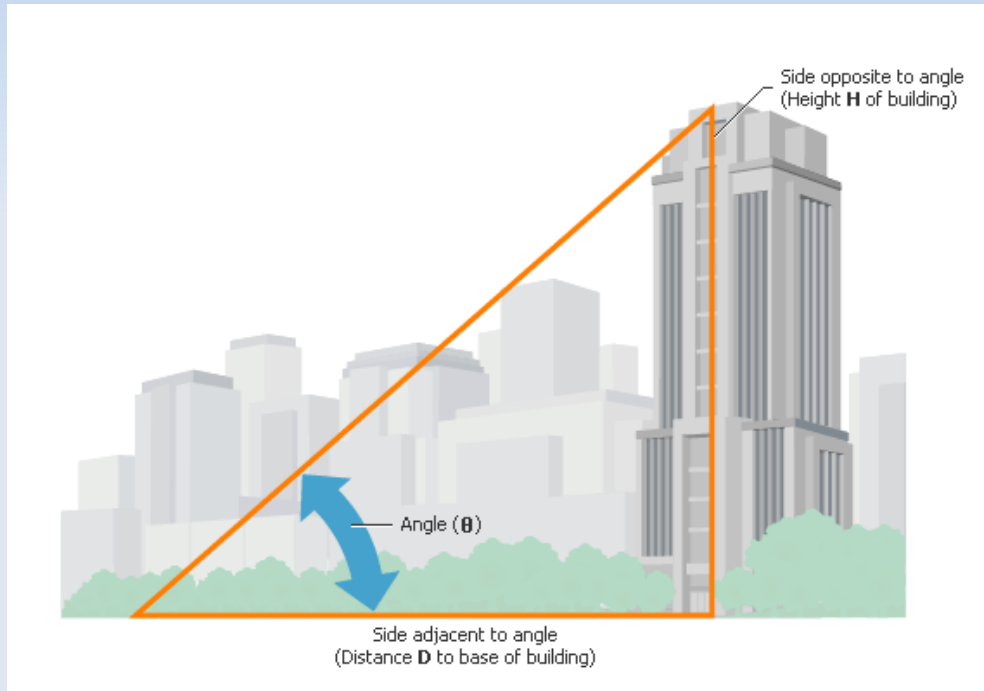


Western context

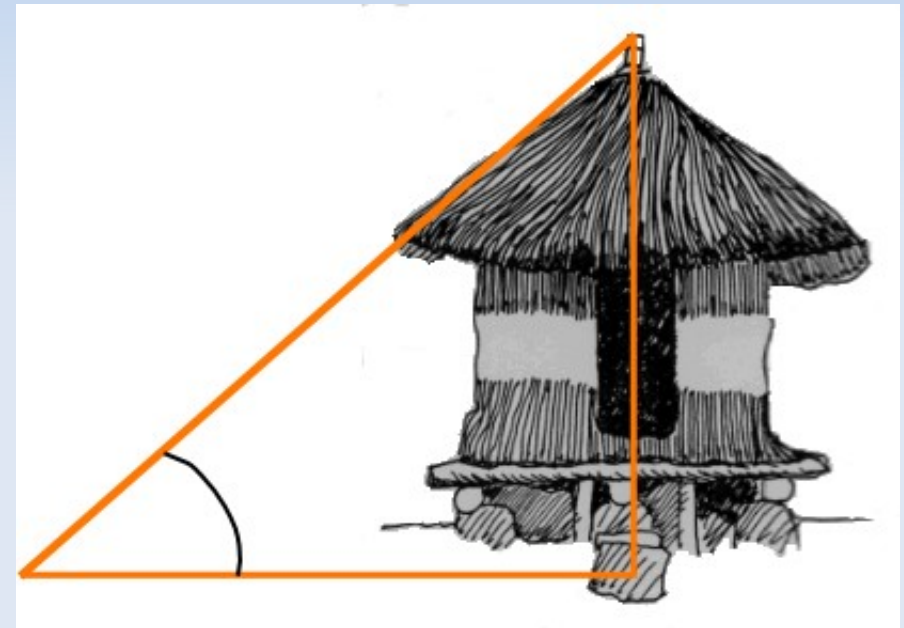


African context

MathMyth example: trigonometry



Western context



African context

MathMyth example: arithmetics



Western context



African context

MathMyth example: probability



Western context



(Mancala game)

African context

MathMyth example: fractals



(Castel del Monte, Italy)

Western context



(Logone-Birni, Cameroon)

African context

MathMyst through participation

- Participatory design methodology is the key for implementation of a usable system that meets the requirements of the end-users.
 - Exploratory workshops, user-centred design
- Research *with* people rather than *on* them.
- End-users are firmly present in design, implementation, test and deployment phases.
- Local educators are also needed for contextualising the theories and examples.

Conclusions

- Pervasive m-learning technology + ethnomathematics = enhanced and independent, everyday math learning practices.
- Contextualised tasks → less abstraction → better understanding.
- Scientists + educators + end users = usable product that meets the needs of the people.
- Finally, we must make sure that this piece of ICT won't be more harmful than useful.

Thank you

