A role-playing game to learn and exchange about real-life issues

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Name of Activity Wetland Education game (WEdu)	**Total time** One scenario takes on average 15 minutes (consisting of 1-5 rounds), a game workshop lasts 1–3 hours depending on the players, their decisions in the game, the rules they establish, and evaluation.
Overview Players need rice and fish to feed their family; they can do rice farming and fishing, use fertilizer, and transform natural marshes to farmland. However, the marshes are crucial as wildlife habitat, for fish reproduction, and as water reservoir, impacting also rice harvest. During the course of the game, players can play through different management rules, and learn about ecosystem links.	Materials/room Game board, and household sheet for each of the 8 players, tokens representing fish, rice, fertilizer, and money, biodiversity, and natural vegetation; further, the water barometer and biodiversity table (Figure 2 & 3). A facilitator is needed to run the game, to represent the market, update the game board, and guide the discussion, debriefing, and if applicable the evaluation.
Number of people Eight players along with a facilitator.	**Target groups & Age** Developed for natural resource users in the Alaotra as discussion and learning tool; also suitable for pupils as from secondary school.

Learning outcomes
Increased knowledge about sustainable resource use, and the potential as well as consequences of different management scenarios in the Alaotra region.

Increased knowledge and understanding about the importance of the marshes for fish reproduction and water availability.

Enhanced awareness regarding the dependencies of system components and possibly the skills to translate the conceptional simulation to real-life situations.

Improved awareness regarding the impact of individual decisions on the whole system.

Enhanced critical thinking and solution-oriented, collective decision-making.

PART I: Context and methodology

How gaming helps bridge science and local knowledge

It is widely known that knowledge produced by science rarely satisfies the information needs of practitioners and decision-makers on the ground[1]. Companion Modelling, or ComMod[2], is a participatory modelling approach that bridges this researcher-practitioner divide by enabling stakeholders, each with their own value systems, world-views, and aspirations, to elicit mental models of the system at hand. This allows the co-construction of a common representation of their socio-ecological system or a specific issue. Its adaptive process allows researchers to identify together with stakeholders the main problems, actors, resources, dynamics and interactions that are relevant to the system under analysis and planning[3]. ComMod is based on an iterative and incremental process of creating conceptual models from field evidence and stakeholder statements, with restitution to knowledge providers, and has been tested and applied in a variety of settings in Europe, Africa, America, and Asia on topics such as forest utilization, water management, pest control, cattle farming and fishery[4]. By enabling the elicitation and integration of multidisciplinary knowledge, it creates a platform for discussions, shared learning, and the creation of collective understanding for meaningful multi-actor and integrative engagement.

A widely accepted assumption is that people who have knowledge and understanding of their environment will take actions to prevent environmental degradation and destruction[5]. However, knowledge about and positive attitudes towards the environment alone do not prompt pro-environmental behavior[6]. To move from understanding to action we need to engage, include, and hand over responsibilities to stakeholders. Gaming does just that by allowing players to explore and test the system that they are part of, and to visualize and experience the impacts of their decisions. Educators can use local knowledge to jointly develop meaningful educational material, tailored to specific contexts by accounting for local perceptions, attitudes, values, and traditions.

The Wetland Education game

Following the ComMod approach, the Wetland Education game (WEdu) was developed as a research tool to exchange and learn about sustainable resource use in the Alaotra region of Madagascar[7] has a detailed account on tool development of a predecessor of the WEdu). The many issues that the region is facing are some of those being observed across the globe, including overexploitation, ecosystem destruction, as well as a growing population. A key example is the destruction of marshes around Lake Alaotra for agricultural production, reducing the habitats of endangered species such as the Alaotran gentle lemur, *Hapalemur alaotrensis*[8]. These growing pressures on the natural system in turn negatively impact local communities (e.g. reduced crop yields), creating a vicious circle of continuous environmental degradation[9].

Breaking free of this circle entails the development of practical solutions that consider both conservation and development needs, requiring the involvement of local stakeholders. The WEdu creates a space where this type of collaboration is possible, through mutual learning and collective exploration of potential solutions. Stakeholders are not told how to 'win' the game, but it is through a process of self-directive learning that they explore their own values and priorities. The WEdu was developed in close collaboration with relevant actor groups and builds upon both local and scientific knowledge, leading to a strong sense of ownership of the game by participating stakeholders. WEdu is an open role-playing game, allowing the self-establishment of rules. It deliberately models a highly simplified version of reality (Figure 1), to allow actors to focus, think critically and learn about the interlinkages and dynamics within

the system. This simplicity facilitates adaptions and modifications to fit different learners and other environmental contexts (e.g. replace rice by maize or potato, or marshes by forest, and increase complexity by adding further components).

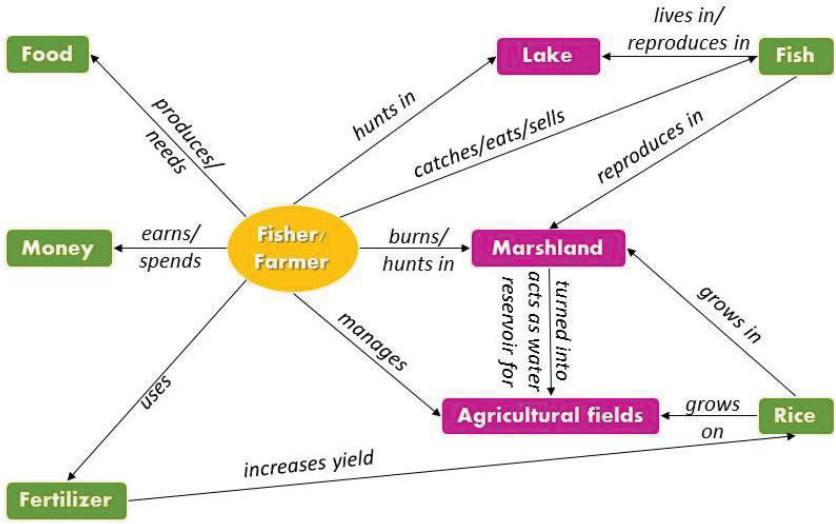

Figure 1. Conceptual model of the WEdu game; simplified model of Reibelt et al. 2017a.

This mind map served the gamification process: actors (orange) turned into players, resources transformed into tokens (green) and zones (pink), and interactions (arrows) and dynamics (verbs on arrows) represent the game rules and game steps (Figure 2).

PART II: Implementation

Playing the game

All eight players in the game represent natural resource users, who can fish and farm. A player's goal is to survive, and the group as a whole can only do so by creating rules in response to their learning. A facilitator accompanies the game to support the discussions and establishment of new gaming rules, to update the game board after each round and to lead the debriefing. In case of evaluation needs, additional team members are recommended. Game evaluation consists of recording and observing the decisions and discussions during the game and/or debriefing. The total time needed to run a game workshop is 1-3 hours depending on the

players, their decisions in the game, and the rules they establish; usually one scenario takes about 15 minutes, but a repetition with alternative rules is required to ensure holistic learning.

To play the game, the following items are needed: game board and household sheet for each player (Figure 2), tokens representing fish, rice, fertilizer, and money (Figure 3), biodiversity, and natural vegetation; further, the water barometer and biodiversity table (Figure 2).

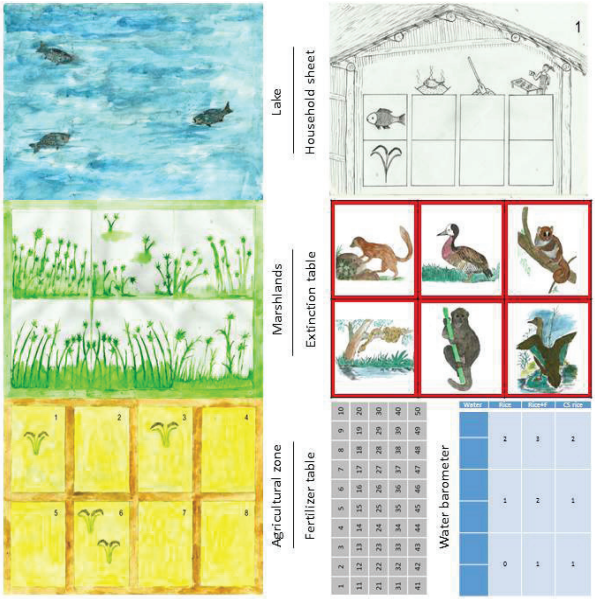

Figure 2. WEdu game components.

The game board consists of three zones: lake (blue), marshes (green, six patches), agricultural zone (eight patches, one per player, indicated by player number). The water barometer indicates the output of rice harvest according to players' chosen treatments and water availability. The fertilizer table serves as a visualization tool to show the cumulative use of fertilizer on the game board: after each game round, the players shift their fertilizer tokens onto the table. The extinction table also serves for discussion purposes. Each player has his/her own house (indicated by the player number), where respective tokens can be placed. Drawings by Bernard T. Ranaivoson and Andry F. Rakotondranisa (Madagascar Wildlife Conservation).

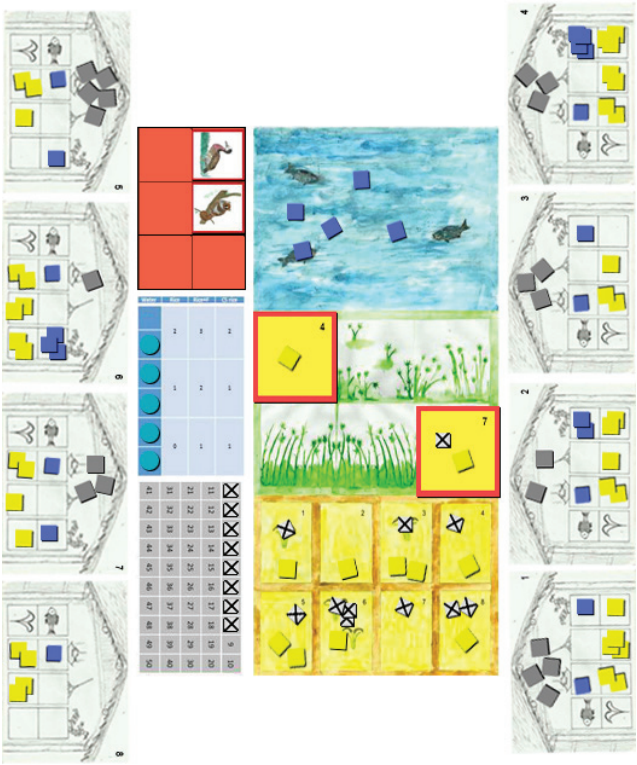

Figure 3. WEdu setting and tokens. Rice (yellow), fertilizers (x), fish (blue), money (dark grey).

When a player decides to plant rice in the marshes, a marsh patch is burned (indicated by a red rectangle placed on a yellow background). The previously hidden wildlife is then placed in the extinction table (e.g. two patches have been converted, thus, a duck and a lemur have gone extinct).

The lake contains 28 fish tokens at the start. Players can fish as much as they want by simply taking the tokens from the board (Figure 3). Players then decide on their rice farming: where and how to plant, whether to use fertilizer, which they can obtain from the market (represented by the facilitator) by paying with their game money (starting capital is 4; rice costs 2, fertilizer 1). Once players have made their decisions, the facilitator updates the water barometer: for each burned marsh patch, one water token is removed, impacting the future rice output (Figure 3). Based on the water barometer, the facilitator adds rice tokens to the farmed fields (number depending on water level, use of fertilizer,

and zone as indicated in the water barometer), representing the rice production. Fish reproduction is illustrated through each remaining patch of marshland providing reproduction ground for one fish but at most half of the remaining fish in the lake reproduce (e.g., if 6 patches of marsh and 10 fish in the lake remain, 5 fish will go to a distinct marsh patch each and reproduce; if there are 2 marsh fields and 10 fish, still only 2 fish will reproduce). Fish quintuple and go back to the lake. Players can then collect their harvest and shift the fertilizer tokens from their agricultural field to the fertilizer table (Figure 3). This serves as a discussion tool during the debriefing regarding environmental impacts, or the difference between chemical fertilizer and biological compost. Each player decides how to distribute the products in his/her household: first column is food (mandatory for "surviving" are 1 fish and 2 rice), 2nd column is seeds for future production, and 3rd column is sale to earn money (rice for 2, fish for 4 money; Figure 2). The decisions are then implemented. After each family is fed (i.e. by returning tokens to the facilitator) and excess products are sold, the next round starts.

Once a resource is depleted, or players can no longer feed their families, the facilitator stops the game to start a discussion about the problem that arose and how to circumvent it in the future. The game restarts from the initial conditions after players establish an additional gaming rule.

Final remarks

Role playing games are an excellent tool to experience different real-world scenarios in a short amount of time. Presenting stakeholders with scenarios where unanticipated threats take place allows them to develop their adaptive capacity by reflecting on their response strategies. There are several key outcomes during such a game workshop. One is that participants learn the interconnectedness of their system components. Another is the realization that their personal decisions have an impact on the bigger picture (e.g. on the whole landscape, or their livelihood). A core component of this serious gaming approach is the debriefing; it is the discussion that follows the game that allows exploration and unpacking of what happened during the game. "Learning begins when the game is over"[10], i.e. participants bridge together the virtual experience with the real world. Having a skilled facilitator is therefore crucial to ensure that critical thinking and

real learning takes place. He or she is fundamental in guiding the discussions from the experienced emotions during the game to the real world. This allows comparisons, and most importantly allows the participants to get a glimpse into the future; what it may look like if…?

Notes

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About the Author

Lena M. Reibelt is a biologist by training with a PhD in environmental education. She's further interested in natural resource management scenarios and likes to develop games that allow a better understanding of complex socio-ecological systems and human decision-making. Currently she's focusing on the challenges of saving the Alaotran gentle lemur from the brink of extinction.

Natasha Stoudmann is an environmental scientist by training, with a focus on human-environment systems. She is interested in livelihood studies and the dynamics between decision-making at various geographical scales in driving environmental and social change.

Patrick O. Waeber is zoologist by training, with a focus on primates, and special affinities to forests. He's interested in the interplay of landscapes, wildlife, people and policies, and working on complex system problems using transdisciplinary methods. Project focus is the tropics. His favourite tools are games.