Role-playing games as an educational tool

Adapting and evaluating the CoPalCam roleplaying game on the issue of palm oil with secondary school students

Bachelor Thesis

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Abstract

The problems in today's world are numerous, often global, and pose immense challenges to sustainable development. A recent, international response to encounter these problems was the elaboration of the Agenda 2030 for Sustainable Development, i.e. an agreement on 17 Sustainable Development Goals, signed by all members of the United Nations. One of the key enablers within Agenda 2030 is education with a focus on Education for Sustainable Development.

At the same time, the Zürcher Lehrplan 21 aims at integrating Education for Sustainable Development as a relevant educational goal and developed competencies to be acquired for doing so, i.e. the future educational concept in Zurich, where the focus on this thesis is laid on. Accordingly, students should be empowered to reflect on their own actions and understand the connection of social, economic and environmental issues.

These new competencies might also imply new ways of teaching. A promising method for the implementation of Education for Sustainable Development in class might be roleplaying games, i.e. different forms of playing are used to simulate real systems and learn about them. Role-playing games should be motivating, and enable the students to learn through own experience – in accordance with Kolb's experiential learning theory.

This study explored the opportunity of role-playing games in a classroom setting with looking at the so-called CoPalCam game, i.e. a role-playing game modelling the supply chain of palm oil in Cameroon. It was developed within the scope of OPAL, a project aiming at shaping a path towards a more sustainable palm oil production.

In order to test the feasibility of the CoPalCam game for secondary schools in Zurich, an adapted, German version was developed. The rules and structure of the game were adapted and written in German. In a second step the game materials were redesigned. Thirdly, the new game version was performed with five different secondary school classes in the area of Zurich with a total of 83 students. Finally, the game sessions were evaluated based on both short questionnaires, filled out by both students and teachers, and observations during the game sessions.

The evaluation showed that the new game version is well suited for educational purpose on the secondary school levels in Zurich for students aged 12 to 15. All teachers were motivated to use the role-playing game again in class. The students enjoyed playing the game and were active during the actual gaming phase. The students' engagement during the debriefing was rather low and needs to be improved.

Learning advancement with respect to the omnipresence of palm oil in cosmetics, and the awareness of the link of deforestation, child labour and the palm oil production could be observed.

It was not possible to conclude much about the networked thinking due to this game, as the main evaluation tool, the student questionnaire, proved to be only partially appropriate.

However, due to exceedingly positive feedback, the adapted game will be further used within the scope of "Edible Research", i.e. a project providing hands-on learning activities on food systems and agroecology for students aged 12 to 15 in schools of Zurich.

1 Introduction

The problems in today's world are numerous, often global, and pose immense challenges to sustainable development (United Nations, 2015). Climate change and other global issues require a conversion of our way of thinking and acting (UNESCO, 2017).

A recent, international response to encounter these problems was the elaboration of the Agenda 2030 for Sustainable Development: In 2015, all members of the United Nations committed to reach 17 Sustainable Development Goals (SDG) and 169 targets by 2030 (United Nations, 2015).

Within Agenda 2030, education (goal 4) with a focus on Education for Sustainable Development (goal 4.7) is both an integral part of sustainable development and one of the key enablers to reach most of the SDGs (UNESCO, 2017). In order to empower learners to contribute to a sustainable development, education systems must teach competencies such as critical reflection on personal actions while taking all social, economic and environmental consequences into account (UNESCO, 2017).

In Switzerland, most cantons will soon implement an adapted educational program called Lehrplan 21. In Zurich, the implementation will take place in several steps, beginning in 2018. In 2019/20, the Zürcher Lehrplan 21 will be implemented for secondary school level (K. Z. Bildungsdirektion, 2017). In Zurich, the secondary school level (Sekundarstufe) follows the primary school level (Primarstufe). It lasts three years (students aged 12 to 15) and is divided in two or three sections (depending on the municipality) A, B and C, where A is the cognitively most demanding section (K. Z. Bildungsdirektion, Volksschulamt).

Even though Lehrplan 21 was elaborated independently from Agenda 2030, it contains many of its crucial elements. One of the major changes compared to the current educational program will be the focus on interdisciplinary competences and the concept of Education for Sustainable Development as relevant educational goal (K. Z. Bildungsdirektion, 2016). "Bildung für Nachhaltige Entwicklung" (BNE) is much inspired by UNESCO (2017) and relies on the contribution of the entirety of both disciplinary and interdisciplinary competencies (éducation21, 2016a). For seven interdisciplinary topics, such as politics, democracy and human rights or natural environment and resources, a concept was developed on how to implement them in discipline-specific teaching (K. Z. Bildungsdirektion, 2017).

The underlying principles and the competences to be acquired for Education for Sustainable Development are illustrated in Figure 1.



Figure 1: BNE-Principles (left) and BNE-Competencies (right). Data and Figure based on éducation21 (2016b)

These new competencies might also imply new ways of teaching. éducation21 (2016b) provides different teaching materials and project ideas, whereas other educational tools might exist.

A promising method for BNE-implementation in class might be role-playing games, as these games theoretically address most of the above-mentioned principles and competences (Figure 1). Ulrich (2003) illustrates the potential of role-playing games within the scope of Education for Sustainability by means of a slightly different list of required competencies. Furthermore, games ideally are motivating, and can thus be a means to encounter motivation and disciplinary problems (Klabbers, 2009).

1.1 Definitions

The terminology concerning role-playing games is rather confusing (for more information see e.g. Ulrich (2002); Crookall (2010)). The international term Gaming Simulations (in German: Planspielmethoden) represents a collective term for many different forms of playing, e.g. computer simulations, behaviour-orientated role-playing games with and without computer-based simulations and haptic board games (SAGSAGA, 2017).

In this study, *role-playing game* (and *Planspiel* in German) will be used as synonym for *Gaming Simulations* or *Simulation & Gaming*.

Role-Playing games use different forms of playing in order to simulate real systems and their corresponding rules. In doing so, by means of simulating different scenarios, system processes can be reproduced and examined that one would or could not perform in reality, e.g. disaster situations. They particularly offer the opportunity to experience long-term effects of different decisions and to discuss about an optimal use of limited resources.

An essential part of Gaming Simulations is the fact that players take the roles of real stakeholders in the game. By giving the players certain freedom of decision-making, alternative behaviours and decisions as well as their consequences can be observed (SAGSAGA, 2017).

Klabbers (2009) describes a typical game session as "magical circle", which consists of a micro-cycle within a macro-cycle (Figure 2). It consists of the following steps: Briefing, playing of game and debriefing.



Figure 2: The Macro-cycle of a game-session after Klabbers (2009)

Briefing

All necessary information concerning the content and the rules of the game are provided.

Micro-cycle: gaming phase

The players carry out the tasks provided according to their roles. Usually, several rounds are played all following the same pattern. In doing so, players can learn from their experiences from previous rounds and directly apply the acquired knowledge.

Debriefing 1 + 2

The gaming phases are completed with analysing phases. The outcomes of all the players' decisions are collectively discussed in a plenum. In a first step, the gamed process is reviewed (debriefing 1). A second step aims at conceptualizing the new experiences (debriefing 2).

According to Zürn (2015), a commonly used structure of the debriefing takes into account the following points:

- Emotions: How do you feel?
- Events: What happened?
- Experiences: What did you learn?
- Every day life: What consequences does it have for your daily life?

After the debriefing, the participants usually step out of the "magic circle". However, depending on the setting, one might repeat it with e.g. changed roles (Klabbers, 2009).

A popular and often cited theoretical basis for learning by means of role-playing games is Kolb's experiential learning theory (see e.g. Wu, Yan, Kao, Wang, and Wu (2016); Zürn (2015); Ulrich (2006)). Kolb (1984) points out that direct experience is crucial to effective learning. In accordance with Lewin (cited in Kolb (1984)), he suggests that this way of learning could be described with the experiential learning cycle (ELC).



Figure 3: The experiential learning cycle according to Kolb (1984) and Ulrich (1997)

Ulrich (1997) stresses the importance of role-playing games within the field of experiential learning and illustrates the link between them: Firstly, the ELC corresponds to the individual rounds within the gaming phase of a role-playing game. Participants experience (CE), they evaluate directly whether their decisions were appropriate or not (RO), they possibly develop new strategies (AC) and finally they test them in the new round (AE).

Secondly, the ELC can be applied on the whole role-playing game: Participants experience during gaming phase (CE), in the debriefing they firstly express their feelings and experience (RO), and afterwards evaluate the significance of that in a wider context (AC). Ulrich (1997) postulates that the gained insights are then applied in real life (AE).

While many researchers in the field agree on the importance and power of role-playing games (see e.g. Ulrich (2006)), not much literature exists about how successful role-playing games as educational tool actually are. Several studies indicate that role-playing games favour learning success over other teaching methods, e.g. Wu et al. (2016); Brom,

Sisler, Slussareff, Selmbacherova, and Hlavka (2016); Akimov and Malin (2015). The empirical evidence is small, however.

1.2 History of role-playing games

A global perspective suggests that games are an important part in human culture, have a long history (much before Christ), and appear all over the world (Klabbers, 2009). It is documented that the Prussian used war games to test different strategies and tactics. War games together with the mathematical game theory (from 1940s) stimulated the emergence of new ways of gaming and simulations. Since the 1950s and 1960s, many new forms of games in various fields, such as social studies, urban and land use management or education, arose (Klabbers, 2009).

Nowadays, numerous areas in both education and research increasingly use different forms of gaming or simulations. For instance, most management or marketing courses rely on these methods to a certain extend (Crookall, 2012).

Amongst others, the so-called ComMod network was founded with the purpose of developing and promoting scientific research based on the Companion Modelling approach, which is a participatory approach using role-playing games as one of the primary tools (ComMod, 2017). The Companion Modelling aims at producing knowledge for both researchers and local stakeholders and supporting negotiation concerning transformations in the system (Étienne, 2014). The ComMod network is active all over the globe, working on environmental issues like agriculture, biodiversity or forests (ComMod, 2017).

The field of application for educational purpose is broad (see Ulrich (2017), Managementsimulation (2017) or Development (2017) for some interesting examples in German speaking educational landscape). Role-playing games are used at university level for introducing new topics or disciplines as well as enabling interconnecting different fields towards the end of studies. In middle school, they are applied in various subjects like economics or politics. Furthermore, many companies rely on role-playing games for further educational purpose as they support team formation or development of new strategies (SAGSAGA, 2017).

The German "Bundeszentrale für politische Bildung" (Bpb) provides an interesting overview over the current offer of different games and simulations in German language tackling mainly politic issues: 294 different games for secondary school level and adult educations can be found of which 212 are role-playing games and with 24 of those concerning environmental issues (Bildung, 2017).

However, it seems that role-playing games as an educational tool are not prominently represented in Swiss curriculum: Zürcher Lehrplan 21 does not mention them (K. Z. Bildungsdirektion, 2017), neither does "Praktischer Umweltschutz Schweiz" (PUSCH), a foundation supporting teachers with environmental education. PUSCH indeed promotes some playful teaching concepts, but only marginally and not exactly as understood above (PUSCH, 2017). On the contrary, éducation21 mentions several "Planspiele" or "Rollenspiele" as educational tool on its webpage (éducation21, 2017).

1.3 Oil Palm Adaptive Landscapes (OPAL)

One project using role-playing games in research is called OPAL, started in March 2015 at ETH Zurich led by Prof. Jaboury Ghazoul from Ecosystem Management and Dr. Claude Garcia from Forest Management and Development. This project aims to improve oil palm cultivation in different parts of Asia, Africa and Latin America.

Apart from Switzerland, the project is active in the palm-oil producing countries Cameroon, Colombia and Indonesia. Amongst others, role-playing games are being built and used both to understand existing realities in the palm oil production in the abovementioned countries and to explore alternative pathways towards a more sustainable palm oil production. Until today, however, it is only in Cameroon that a role-playing game was fully developed and tested in the field so far (OPAL, 2017).

1.3.1 Palm oil production in Cameroon

Palm oil is cultivated in tropical regions around the globe (Hoyle, 2012). With an annual production of 50 million tons and a proportion of 39% of global vegetable oil production, it has become one of the most important vegetable oils, and is used in foods and cosmetics. Since palm oil is accused to be a major driver in deforestation in many regions, its production has been widely criticized (see e.g. Greenpeace (2017)). Most of the palm oil is produced in Indonesia and Malaysia (87% of global production) (Hoyle, 2012).

Cameroon belongs to the major palm oil producers in Africa. With an estimated total production of 253'000 tons of palm oil in 2014 it is the fourth largest producers in Africa after Nigeria, Côte d'Ivoire and the Democratic Republic of Congo and the world's 13th largest (FAO, 2014).

The developed CoPalCam game models the supply chain of palm oil in Cameroon from harvest of the palm fruits to the sale of crude palm oil at the market. It aims to give both researchers and local stakeholders a better understanding of the supply chain, where both a large industry and numerous artisanal mills are important. This knowledge could then contribute to a sustainable development of the palm oil production in the field.

Claude Garcia from ETH together with Eglantine Fauvelle (CIRAD), Patrice Levang (IRD) and Emmanuel Ngom (MINADER) coordinated the development of the game, which was tested in France first, and then validated together with local stakeholders in different locations in Cameroon (OPAL, 2017).

Until today, the game was applied not only in Cameroon, but also in the Netherlands and Switzerland for both research and educational puproses (OPAL, 2017).

One of the outreach activities in Switzerland was its application in an educational context. The game was played with several high school classes (students aged 15 to 18) from the French Lycée in Zurich with the aim of promoting awareness of the palm oil issue on gymnasium level (OPAL, 2017).

The positive feedback from both teachers and students (OPAL, 2017) let the question arise whether this role-playing game could generally be used as an educational tool, independently from the original project. Regarding the Zürcher Lehrplan 21, this might notably be interesting for younger students.

The idea emerged to integrate this role-playing game in the project "Edible Research" (Edible Research, 2017) which provides hands-on learning activities on food systems and agroecology for teenagers aged 12 to 15 in schools of Zurich. ETH group Sustainable Agroecosystems (Agroecosystems, 2017), which also has an ongoing project on palm oil (IAS, 2017) and the World Food System Center (WFSC, 2017) have the lead in the project.

1.4 Aim of this thesis

Perceiving role-playing games as a powerful educational tool with respect to both a joyful learning experience and effective learning, and believing that this method should be used more often in the educational landscape of Zurich, this thesis aims at further exploring its potential in a classroom setting. The on-going OPAL project with the existing CoPalCam game offeres a great opportunity for doing so: While the game was already successfully applied in both applied research with local stakeholders and teaching context on gymnasium level (students aged 15-18), a knowledge gap still remains with respect to the feasibility and comprehensibility of the game with younger students (aged 12-15). Within the "Edible Research" project, this gap should be closed.

The objectives are to examine whether the CoPalCam role-playing game can also be used as an educational tool in a classroom setting of secondary schools, representing a heterogeneous group of mainly future non-academics. The game's effectiveness regarding the achievement of learning objectives (see below) with respect to the understanding of palm oil supply chains will be examined, as well as the necessary adaptations concerning rules and materials for doing so.

The project team (including me) expects the students to dip into the game and – in accordance with the experiential learning theory (Kolb, 1984) – learn effectively through own experience about the following learning objectives:

- Palm oil is an important vegetable oil, cultivated in basically all tropical regions around the globe and extracted from the oil palm's seed
- Palm oil production involves many different stakeholders
- Many rain forests are cleared for palm oil cultivation
- Many daily products, e.g. biscuits, Nutella, shampoos, soaps, contain palm oil
- Consumer behaviour can have an impact of situation on the ground

Implicitly, we expected the students to internalize and understand these learning objectives interlinked to each other. Within the scope of this thesis however, the understanding of connections could not be evaluated explicitly.

In order to achieve these objectives, a German, adapted version of the ColPalCam game will be developed. The rules and structure of the game are adapted and written in German. In a second step the game materials are redesigned. Thirdly, the new game version is performed with five different secondary school classes on different levels (7th -8th grade, levels A, B, C) in the area of Zurich with a total of 83 students. Finally, the game sessions are evaluated based on both short questionnaires, filled out by both students and teachers, and observations during the game sessions.

2 Methods

This section firstly provides a short description of the original game and its adaptations concerning both structure and materials. Afterwards, information about educational setting and games sessions are presented. Finally, the different evaluation tools are introduced.

2.1 Game description

2.1.1 Original game¹

The game models the supply chain of palm oil in Cameroon from harvest of the fresh fruit bunch to the sale of crude palm oil at the market. It takes place in one or two virtual production valleys. The different stakeholders represented in the game are producers, truck companies, artisanal and industrial mills, secondary processing (e.g. soap industry), and local and international market.

The roles and structure of the game are introduced during the briefing phase (Figure 4). The actual gaming phase consists of several playing rounds, which always follow the same pattern. Usually, three playing rounds are performed before passing to the debriefing.

Each playing round represents a whole year, consisting of a high and low season with three and one harvest rounds respectively.

During each harvest round, the producers can harvest their fresh fruits bunch depending on the number of plantations they manage. The fruits can either be sold at the artisanal mill directly, as they are situated in close proximity to the plantations, or at the industrial mill. For that purpose, a truck as means of transport must be hired.

At the end of each season, the mills produces crude palm oil and sell it at the market (artisanal mills at local market, industrial mill at international market) depending on the received palm fruits and their milling capacities. The market prizes for the industrial mill are fixed throughout the game, whereas the local market prizes for the artisanal mill depend of both the season and the amount of sold crude palm oil:

Depending on how much crude palm oil was sold at the market, the soap industry will import crude palm oil from Malaysia for secondary processing. The level of importations influence the market prizes for the following season. Furthermore, the players have to pay taxes. In addition to that, the producers have the possibility to turn rainforest into new palm oil plantations and send their children work on it (child labour).

¹ There is no official description of the original game model (yet). This description is based on my own knowledge that I gained through own playing experience and personal communication.



Figure 4: General structure of the game

2.1.2 Structural adaptations

Goals of the following adaptations were to consider both the feasibility of the game (it should not be too demanding) without changing the dynamics as they appear in the original game.

Most of the rule adaptions were performed in collaboration with Dr. Claude Garcia, one of the game developers.

Briefing

Photos (Appendix B2) during the briefing were shown to support the introduction about Cameroon, palm oil and the game itself.

Gaming Phase

Stakeholders

The stakeholders played by students are producers, industrial and artisanal mills, and truck companies. The secondary processing is excluded. The international and the local market are simplified as one market. The game master's assistants play it.

Paying taxes (phases 2 and 4)

Compared to the original game no one is excluded from paying taxes (the artisanal mill was released from that). Apart from the industrial mill, all taxes are fixed throughout the game. Thus, the bookkeeping is limited to a single piece of paper, with a reference of the amount of taxes to be paid and space for a control stamp (Figure 5). The industrial mill additionally has to mention the number of purchased palm fruits, and calculate the amount of taxes by themselves (Appendix).

	1. Jahr		2. Jahr		3. Jahr	
	Hauptsaison	Nebensaison	Hauptsaison	Nebensaison	Hauptsaison	Nebensaisor
Kosten	800	800	800	800	800	800
Kontrolle						

Figure 5: Tax sheet for truck rental

After having paid the taxes, one will receive a snack containing palm oil (appendix) to eat. For each type of product (chocolate food, non-chocolate food, maybe cosmetics) an alternative without palm oil should be given away as well.

With doing so, students can be both motivated to pay the taxes and sensitised concerning the omnipresence of palm oil.

Market prizes

Depending on the students' reactions and level of understanding after the first playing round, the game master has the freedom to conceal possible palm oil imports to the players. As a consequence the market prizes for crude palm oil, produced by artisanal mills, might only depend on high and low season.

Debriefing

Instead of talking much about the efficiency of the palm oil supply chain in Cameroon, an emphasis is laid on deforestation and child labour.

The omnipresence of palm oil represents another important subject of discussion. Based on the snacks distributed, different food packaging will be examined together in order to introduce organic and sustainable production, and to discuss the label RSPO (Round Table of Sustainable Palm Oil).

2.1.3 Adaptation of game materials

The CoPalCam-game was designed to be used by stakeholders of the palm oil supply chain. To that end, the original game materials were not designed in a naturalistic way. As the audience of the adapted version are secondary school students between the ages of 12-15 without prior education concerning the topic of palm oil, all game materials were redesigned.

In order to do so, two major ideas were pursued: First, game materials should be as naturalistic as possible. Second, students should be able to physically touch most of the game materials.

While a complete list of materials can be found in Appendix A2.1, Table 1 shows a representative selection of the performed changes.

Furthermore, costumes were distributed to all the students. This should help them take on their role and be recognized in their role by other students. The producers wear *straw hats*, the truck rental workers a *red cap* with an illustration of a car. Mill workers wear *aprons*.

ID-card of smallholder SMALLHOLDER n° 2 Vou are a medium smallholder, you own 2 palon plantations. The seasonal costs to take care of your plantations and your family are 200 F	Original game version	Adapted game version	
SMALLHOLDER n° 2 You are a medium smallholder, you own 2 palm plantations. The seasonal costs to take care of your plantations and your family are 200 F	ID-card of smallholder		
Laminated card	SMALLHOLDER n° 2 You are a medium smallholder, you own 2 palm plantations. The seasonal costs to take care of your plantations and your family are 700 F + 50 F xrb of fresh fruit bunches produced. Laminated card	Produzent Plantagen Steuern pro Saison: B50 Franken	
Diantation card with four fruits (1 fruit ronrosonting 1.2 tons of harvest)	Plantation card with four fruits (1 fru	hit representing 1.2 tops of harvest)	

Table 1: Comparison of original and adapted game material



2.2 Testing the game

Within the scope of an information event for the project "Edible Research", the game idea was presented to participating teachers with the objective of convincing them to test the game with some of their classes.

Four teachers of different secondary school levels in the area of Zurich could be motivated. In total, the game was played five times with five different classes and 83 students aged 12 to 15. The first three game sessions were played within the scope of regular teaching, whereas the last two were performed during a project week.

Date	Time	Duration [min]	Location	School Level	Number of students
May 9, 2017	7.30-10.00	150	Hinwil	7 B, C	14
May 10, 2017	7.30-10.15	165	Urdorf	8 A, B	23
May 16, 2017	7.30-10.00	150	Urdorf	8 A, B	22
June 6, 2017	8.30-10.45	135	Weiningen	7 A, B, C	12
June 9, 2017	8.25-11.10	145	Weiningen	7 A, B, C	12

Table 2: Overview on the five game sessions

2.2.1 Participants

The participating students were players in the game. Each of them took the role of either a producer with one, two or three plantations, a worker in the artisanal or industrial mill, or a truck renter (Appendix A1).

The teachers observed the game with a double objective. First, they should interact in case of possible disciplinary problems. Second, they filled out a questionnaire concerning the game activity.

I acted as game master and led through briefing, micro cycle and debriefing. While playing the game, I always intervened at least once and mentioned the following: Due to pressure from European consumers, the government in Cameroon forbids the industrial mill to accept fruits from plantation responsible for either child labour or illegal deforestation (Appendix A1).

Depending on the number of students, I was assisted by one to three assistants. They took the role of the market, took photos and observed the game taking notes in the gaming phase and especially the debriefing.

2.3 Evaluation

The evaluation of the game sessions was based on the feedback of all participants: Students, teachers, game master and assistants. Questionnaires for students (83) and teachers (5) were used as well as observations during the game and records of the most important game outcomes. From 83 distributed student questionnaires, 82 were used. The answers from one student with very limited reading and writing skills, who was not able to fill out the questionnaire on his own, were not taken into account.

Little literature exists on how to generally evaluate learning advancements using roleplaying games. However, questionnaires appear to be a common evaluation tool (e.g. Kriz and Auchter (2016)). Despite the awareness of numerous literature with respect to the design of questionnaires (see e.g. Willis (2004)), this aspect could only be covered marginally within the scope of this thesis.

2.3.1 Student questionnaire

The student questionnaire aimed at evaluating the students' gaming experience as well as the learning effects of the game.

To test if a learning advancement existed between before and after the game session, the students were asked the following three questions (Figure 7) once before and once after the game:



Figure 6: Three questions asked to the students: Once before starting the game, once right after the game.

For the evaluation, I had to distinguish between the three questions:

The first question had one correct solution (front page: C, A, D, B; back page: 2, 4, 1, 3). The difference between the number of correct answers before and after the game was examined.

The answers for the questions two and three could be easily categorized, as many of the answers were rather similar.

- Categories products: Chocolate food, non-chocolate food, cosmetics, other.
- Categories problems: Deforestation, child labour, harmful to health, other.

For the evaluation, the numbers of nominations per category before and after the game were compared.

In addition to that, there was another question after the game about what they reckon to remember from this game session.

Finally, students were asked after the game how much fun they had during the game, how happy they were with their gaming outcome, and if the material helped understanding their role (Figure 8). However, the second question was not further used, as the evaluation focused on the gaming experience, and not so much on the gaming outcomes.



Figure 7: Extract from student's questionnaire

The questionnaire was designed in a way that should be motivating to fill out for the students: Not too demanding and with the use of familiar pictures (Figure 5) which appeared in the game.

2.3.2 Teacher questionnaire

The teacher questionnaires were filled out during the game and designed to enable the teachers to observe the game in a structured way and give feedback about the participation of the students.

For each playing round the teachers had the same questions about the level of engagement, motivation, level of how demanding the game was and gaming behaviour (Figure 9).

Vollk	ommen	Teilweise	Überhaupt nicht
Die meisten Schüler*innen sind aktiv			———————————————————————————————————————
Die Schüler*innen sind motiviert/ haben Spass			———————————————————————————————————————
Die Schüler*innen sind überfordert in gutem Masse	e gefordert	unterfo	ordert

Figure 8: Extract from teacher questionnaire

In the end, there were some summarizing questions about the three above-mentioned topics, questions concerning the debriefing, the question whether they would play the game again, and some space for additional comments.

In addition to that, to get information about the prior knowledge of the students, the teachers were asked if the following terms were already discussed in class: *rainforest*, *plantation*, *palm oil*, *child labour*, *fair-trade*, *label*.

2.3.3 Observations during the game

Teachers, game master and assistants were all observers to a certain extend. The observations by different persons were discussed after each game session and documented (Appendix B1). These observations were used to discuss the quantitative results from the questionnaires.

2.3.4 Game outcomes

Game assistants noted the most important outcomes of each game session, such as the final amount of money of each player. These results were used to discuss both the variability of the different game sessions and the quantitative results from the questionnaires.

3 Results

This section firstly presents the most important game outcomes of the five game sessions. Afterwards, the findings with regard to the game perception of students, teachers and project team are illustrated. Finally, it shows the results concerning the prior knowledge of the students and the learning advancement of the game.

Summarizing, the five game sessions worked well with respect to the project team's expectations. Furthermore, all teachers involved were motivated to use this game again in classroom (Appendix C2).

3.1 Game outcomes

The outcomes of the five game sessions differed in various aspects, in particular with respect to trading success and to the students' reaction to information about child labour and deforestation (Appendix B1). Furthermore, it was interesting to observe the emergence of new behaviours, e.g. farmer cooperation.

There was a wide distribution with regard to the amount of money the players made throughout the game: One of the industrial mills in session three managed to make 43'620 francs, whereas the truck renters finished in debt several times (Appendix B1). There were both differences between different game sessions and amongst the players within one game session (Figure 10).



Figure 9: Each data point represents a player's amount of money at the end of the game session. For some sessions, not all data is available.

The students' actions differed a lot with respect to the two important issues deforestation and child labour, especially how they reacted to the game master's intervention (2.2.1). Table 3 lists the summary of these results.

Table 3: Overview of behaviour concerning deforestation and child labour during the game. See Appendix B
for more details.

Game Session	Deforestation		Child	labour
	Number of cleared trees	Reaction on intervention	Number of children on plantations	Reaction on intervention
1	0	-	7-8	Immediate reaction: Every child back to school
2, Valley 1	0	-	All (22)	Basically none
2, Valley 2	All (5)	None		
3, Valley 1	2-3	None	6-7	Half of the
3, Valley 2	2-3	None		school. Later on, again more children on plantations
4	1	None	All (22)	Partly child trafficking
5	All (6)	Demand for controls by the government. Start of reforestation program.	All (21)	Child trafficking

3.2 Game perception

The prevailing majority of the students had fun during the game (Table 3). There was little variability between the different game sessions, apart from game session four, where 83% chose the second happy smiley (Appendix C1).

 Table 4: Number of chosen smileys for corresponding questions from student questionnaires. N=82.



On average, the teachers' observations align with the students' assessments (Figure 12).

"Did you have fun?" used to be the first debriefing question. Apart from game session four, where the performance was poor (Figure 10), there was always a loud oral approval by the students.

Furthermore, there were always several students demanding for an extension of the game – which for time-limiting reasons could only be granted in game session two.

During the game, the teachers judged the students to be active, with increasing tendencies towards the end of the game (Appendix C2). In round 3, all teachers made statements in the sense of the following:

"High activity by most of the students" (Appendix B5)

"Trading after the break in a concentrated manner again, and with lots of commitment" (Appendix B5)

After the game, one teacher stated: "*I really saw them being present and active, also in the additional, forth round*" (Appendix B5).

During the debriefing, the level of engagement decreased on average: Most teachers judged the students to be only partly active (Figure 11).



Figure 10: Questions answered by the teachers during debriefing. N=5. Grey crosses: Marked in the same game session.

In general, the teachers judged the game to show an appropriate level of difficulty, with slight tendencies towards too demanding (Figure 12). However, the judgements vary from session to session.

It aligns with the observations of the project team that game session one was judged appropriate, game session five appropriate on average and game session four rather too demanding in that regard. However, the project team judged game session two as too demanding rather than game session three (Appendix B1).

The feedbacks with respect to the game materials were very positive.

Most students considered the materials more or less helpful to empathise with their role (Table 3). Among the teachers, there was a broad consensus that the material was appealing (Figure 12). However, some teachers suggested utilizing a clear presentation prior to the start of the games, illustrating the rules, the prizes and a summary of the most important terms (Appendix B5).

The costumes (hats, aprons) created ambiguous feelings in the beginning: Many students considered it embarrassing to wear them, and many comments like "*Do we really need to wear them?*" appeared. In the end, however, most students wore them and played with it (Appendix B1)



Figure 11: Questions answered by the teachers at the end of the game. N=5. Grey crosses: Marked in the same game session.

3.3 Learning advancement

The studied learning advancement concern the palm oil supply chain, products containing palm oil and possible problems connected to palm oil production. Regarding the problems, there was a broad variability of prior knowledge based on regular teaching (Table 5).

Table 5: Comparison between the different classes of how the topics rainforest and child labour were discussed in regular class before the game sessions, according to the teachers.

Game Session	Rainforest		Child	ld labour	
	Discussed?	Context	Discussed?	Context	
1	Yes	Deforestation, Orang-Utan, <visit Zürich Zoo></visit 	Yes	Football production	
2	Yes	Visit Papillorama	Yes	Industrialisation	
3	Yes	Biology class: Forest	Yes, No	Only briefly mentioned	
4	No	-	No	-	
5	Yes, No	<first day="" of<br="">project week></first>	No	-	

Most students were able to answer the question concerning the supply correctly both before and after the game, i.e. 96% (N=82).



Figure 12: Nominations of different categories of products containing palm oil before and after the game. N=82.

The majority of the students was able to name at least one product containing palm oil, with 2.6 and 3.6 different products on average before and after the game respectively (Appendix C1).

The number of nominations of chocolate food was high both before and after the game, whereas the number nominations of cosmetics increased from 13% before to 45% after the game (Figure 13).

While before the game, 40% did not make a link between possible problems and palm oil production, this number was reduced to 13% after the game (Figure 14).

By far the most commonly named problem was deforestation (Figure 14).

However, that issue was basically only mentioned in the questionnaires of the first three sessions: It was listed 31 times before and 49 times after the game as a problem, out of totally 59 students attending these sessions. This accounts for an increase of more than 30 percent (Appendix C1).



Figure 13: Nominations of different categories of problems connected to palm oil production before and after the game. N=82.

The greatest change between before and after was the awareness of child labour. While only one person mentioned it before the game, more than every third person named it after the game (Figure 14).

Most of the problems classified as 'others' concerned money or the injustice of the prizes and taxes (Appendix C1).

The predominant aspects that students would remember from the game sessions, according to themselves, were linked to money, trading or products containing palm oil. However, some of them mentioned child labour and the fact how the game reflects reality (Figure 15). 24% stated lots of different things. While many of those statements were insignificant, such as "everything", "much" or "nothing", one girl stated, "It was very interesting to see that it can be presented with a game. I think you have thought a lot in doing so. I surely will remember the whole idea of the game" (ID22, Appendix C1).



Figure 14: Students' answers to the question what they would remember from the game session. Classified in five categories: trading/money, child labour, palm oil products, production/link to reality, others. N=82.

4 Discussion

This section covers a discussion of the previous findings including its limitations. First, the feasibility of the game is discussed based on the game outcomes and perceptions. Afterwards, a critical analysis of the learning effects is presented, followed by general limitations of this thesis.

4.1 Practical aspects

It was remarkable how much the dynamics and the game outcomes changed with the different game sessions. A detailed analysis of the game outcomes itself was not focus of this thesis. However, the attempt to identify some major drivers of the attained dynamics could be helpful for the further project.

The enormous variability concerning how much money the players made throughout the game has several plausible explanations, and depended of both the individual cleverness and the external circumstances, whereby two aspects seemed worth to be mentioned:

In game session four, basically all the producers scored badly compared to the other game sessions (Figure 10). The producers were overstrained during the game, and started to pay money for the harvested palm fruits, instead of selling them. As a consequence, many of them were in financial difficulties, which in turn led to an increased proportion of child labour.

In that game session, the game master omitted some crucial information during the briefing concerning the structure of the game, the presentation of the prizes (palm fruits, palm oil, trucks) and negotiation freedoms, and the connection of plantations and rainforests. This, it seemed that the introductory explanations were insufficient.

Another interesting point was the negative correlation between industrial mill and truck companies, i.e. often the industrial mills were successful, whereas the truck companies scored badly (Appendix B1). The missing positive correlation (actually, they depend on each other in the game) could be explained by the observations that often the industrial mill accepted palm fruits that arrived without any truck – which is not possible in reality.

4.1.1 Gaming phase

The results indicated that basically all students enjoyed playing the game and a vast majority was active in doing so. It looked that the levels of fun and activeness were comparable between the games played within the scope of this thesis and the ones played with the French Lycée (1.3.1). While the original CoPalCam game was able to excite the students from the French Lycée, the new game version was capable of doing the same with secondary school students.

However, one remaining question was whether the performed adaptations were decisive for that, or if trading with palm fruits, trucks and money was exciting enough that in any case most students would dip into the game.

As game session four was the only one where both not a majority of the students stated having fun and many students were overstrained (as mentioned above), it looked as if a certain understanding of the dynamics in the game was crucial to both immerse in the game and experience fun.

4.1.2 Debriefing

While the students were very active during the game itself, their level of engagement decreased rapidly in the debriefing. During the game, one was forced to be active by relocating all the time, could eat snacks, and it was fun at the same time. However, the transition to the debriefing was difficult: Even though there were always some students to participate actively in a concentrated and reflected manner, most students became either passive, or the stayed active, but got unfocused.

Some students seemed to be overwhelmed by a sudden performance of intellectual exercises after being engaged in playing. One teacher orally stated that his students were not doing well with answering directly to an unexpected question. He suggested using e.g. crosswords with easy questions about the game as an additional tool to debrief.

Many students were still very talkative in the beginning of the debriefing. Even though the game was subject of their discussion, it was difficult to have one discussion all together instead to several isolated discussion spread over the whole classroom.

It was suggested that supportive materials, such as a picture of the supply chain, could be used in the debriefing in order to have more structure in it.

Two teachers, both teaching cognitively weak 7th graders, mentioned that the game supported eliminating differences between the students due to their school levels. During the game, everybody seemed to be on the same level, and equally strong. However, it seems that if there was not really a difference between cognitively strong and weak student visible during the game, there surely was one in the debriefing: According to my observations, the quality of the comments in the debriefing was higher with the 8th graders.

4.1.3 Level of difficulty

Even though most teachers regarded the game as an appropriate level of difficulty for their students, some games were perceived as not being exactly appropriate, i.e. either too demanding or too little demanding (Figure 12).

However, the teachers' judgements required a critical reflection, as most teachers marked their cross only based on one experience, and hence a comparison is delicate.

The results about prior knowledge and level of difficulty show that not only the school grade or level, but also the prior knowledge and the capacity of focusing on the game, seemed decisive for that.

According to the teachers, the game's level of difficulty seemed most appropriate for the first two classes (levels 7 B, C and 8 A, B). These classes also represent the best prepared: As preparation, they visited Zürich Zoo and Papillorama respectively, where an emphasis on both deforestation and palm oil is laid (Appendix C2). In addition to that,

the teacher's support in game session one during the game was helpful: Sometimes he interrupted in order to make clear that the students understood a not so common term, e.g. *intact* rainforest.

However, this judgement needed to be questioned for game session two. The students enjoyed the game, were very active and according to their teacher demanded on an appropriate level. However, it was difficult to keep the class focused on a specific action. It remained unclear whether that was due to rather talkative individuals, the large class size (23 students) or a lack of appropriateness in the level of difficulty, which might result in the students' inattentiveness.

In game session three, the students were much more calm and obedient, and as a consequence they listened better to both the game master and each other. Even though palm oil was only mentioned briefly in class before, they were able to assimilate the new information and apply it directly. The missing prior knowledge taught in regular class could be compensated with better cognitive strength compared to other classes (level 8 A, B).

The comparison of the last two game sessions was delicate, as many different factors changed. Indeed, on average, game session five showed a more appropriate level of difficulty. However, it was hard to say whether it was because of a better game master (see Appendix B1 for details) or due to the fact that the students had already talked about cacao production, supply chains and child labour the day before.

4.1.4 Material

According to the majority of the students, the game materials were helpful to empathize with their roles. It is hard to say though whether they only appreciated the design of the tokens, or if it really helped them imagining how the reality might look like.

In addition to that, they never saw the original game material. Thus, it is difficult to judge the actual effect of the adapted game materials.

However, I believe that making the tokens naturalistic and detailed would both increase the credibility of the game and make the students automatically pay more attention to the materials.

Summarizing, the previous results supported that depending on the class and the external circumstances, the game might develop different dynamics. This should not pose a problem, as long as some prerequisites are fulfilled: The game master needs to be fully concentrated during the briefing, and flexible in the debriefing, e.g. picking up (missing) dynamics. Teachers might act as supervisors of social dynamics and help linking prior knowledge. Small classes and high prior knowledge favour success of the game.

4.2 Learning advancement

The observed learning advancement strongly depended on the prior knowledge, which seemed to be quite different depending on both topic and class. The expected knowledge gain concerning supply chains was not observed, as the prior knowledge in that regard seemed to be sufficient already. The most important learning effects seemed to occur with respect to the omnipresence of palm oil in cosmetics and the link between child labour and palm oil production.

4.2.1 Products containing palm oil

Since the majority of the students already knew many products containing palm oil prior to playing the game, there was no great knowledge difference before the game and after.

The only significant knowledge gain in that regard was with respect to cosmetics. It seemed as if the reference of that information during the debriefing stayed, maybe because it was surprising news for many.

However, the evaluation of the awareness of the omnipresence of palm oil in nonchocolate foods showed that these questionnaires did not necessarily represent the total knowledge of the students: One might have expected to see a higher increase in nonchocolate foods as *Farmer* bars were distributed. However, it seems that many people did not mention everything they knew. For instance, *Farmer* or *Riegel* were mentioned 6 times before the game, and 13 times afterwards, while after having eaten a *Farmer* together with the information 'this contains palm oil' one would expect everybody, i.e. 82 students, to know that *Farmer* do contain palm oil.

It is thus plausible, that after having eaten several products, most students got to know some additional products containing palm oil. Actually, the results supported this hypothesis: The total number of nominations increased substantially after the game. However, the fact of writing some additional products of the same category, e.g. chocolate product, did not say much about the actual awareness of where palm oil can be found.

4.2.2 Problems connected to palm oil production

The results showed a significant increase in problem awareness. The number of students not seeing any problem within palm oil production was reduced by approximately two thirds, i.e. only 11 students did not state a problem in the questionnaire after the game.

Both deforestation and child labour were perceived as problems at a considerably higher proportion, whereas the nominations of harmfulness to health decreased significantly. This was not surprising, as while the first two issues represented a substantial part of the game, the effect on human health did not. In addition to that, the distribution of palm oil containing snacks rather promoted that eating such food is not unhealthy. However, some nutritional information concerning human health would be interesting to mention in the debriefing. A more surprising result was the difference between deforestation and child labour: While the perception of deforestation as a problem depended very much on prior knowledge, it was not the case for the link between child labour and palm oil production. It seemed that it was easier for the students to empathize with children not going to school than with some cleared rainforest – if that topic was not discussed in regular class yet.

On the contrary, significant knowledge gains with respect to the connection of deforestation and palm oil production could only be observed in classes with a certain prior knowledge in that regard, i.e. all the 8th graders, independently of the preparation in class, and the well-prepared class in game session one.

In game session four, the lack of knowledge gain was comprehensible, as the connection between rainforest and oil palm plantations was not really mentioned. In game session five it was surprising as deforestation was a big issue there. It is hard to say whether the students did not perceive it as a problem, or if while writing they just had rather child labour in mind; child labour was the last topic to be discussed in the debriefing.

Many comments and problems mentioned concerned money and fairness during the game. It seemed that their playing experience was often related to financial problems and unfair playing techniques on the part of the students. Financial problems often led to child labour. It was hard to say though whether some of the students were able to make that connection.

4.2.3 Significance of evaluation

In summary, the evaluation of the questionnaires supported the fact that many students gained additional, factual knowledge with respect to the omnipresence of palm oil and problems linked to its production. These results meet the project team's expectations concerning the reaching of the learning objectives of the students. In this study however, nothing can be concluded about the application of new knowledge acquired by the students within a wider context, nor about the timeframe in which the learning advancement remain.

Accordingly, one might ask whether it was necessary to play that role-playing game to only convey basic, factual knowledge. I suppose that the results from the student questionnaires would have been similar if not more significant if I had used the same two questionnaires before and after a 45min-presentation in which the *structure of supply chain, products containing palm oil* and *identification of advantages and disadvantages of palm oil production* had been presented.

This shows that the student questionnaire was the main limitation of the evaluation as it was not able to evaluate the full potential of role-playing games. In a follow-up project, it would be crucial to lay more emphasis on the evaluation. Firstly, more gaming assistants observing the game should be present. Secondly, sophisticated questionnaires with specific questions about the interconnection of individual issues should be posed. Furthermore, there should be several questionnaires: One before the game, one after the game, and several a little while after the game (some weeks or months) in order to draw conclusions about longer-term learning advancement.

However, even though the student questionnaire could only display that factual knowledge was conveyed, there were some indications that the games brought more effect than this.

More than every third statement as response to the question about what one would remember from the game was linked to either money or trading. Trading is an essential part of both this game and the reality that it mirrors, and it seemed to be a striking experience for many students (Figure 15). Thus, maybe the game enabled some students to embed the palm oil issue within the market-based economy and opened the eyes to different forms of collaborations, e.g. farmer cooperation that happened to appear in the game.

Additionally, at least eight students (Appendix C1) mentioned to reduce their own palm oil consumption or stated to look at packaging from now on. Even though, it was not the goal to convey the students to boycott palm oil, that indicated that some students made the connections between existing problems far from home and their own consumption behaviour.

Another eight people (Appendix C1) said that thanks to this game they learned something about the reality of palm oil and its supply chain. It might be hard to judge to what extend the students learned something, but as one of the teachers mentioned: "Everyone surely gets something out of it!"

4.3 Limitations

Apart from the fact that the main evaluation tool was only partially appropriate, i.e. the topics covered in the student questionnaire were not sufficient, the previous results underlie several methodological restrictions on mainly three different scales: Heterogeneity of different game sessions, structure of questionnaires and finally its evaluation.

In general, the different game sessions were all treated equally. However, all of them were unique to a certain extent. Even though some interesting differences were mentioned in the discussion, there were many factors influencing the outcome of each game session which makes it is hard to judge the reasons for the unique course of all games:

While the first three sessions took place in regular class, the last two sessions were embedded within the scope of a project week. But also the two sessions during that project week differed: Once it was played in the beginning, once in the end. (This was intended in the first place. However, it did not simplify the evaluation).

In addition to that, the classroom, the class size and its behaviour, the provided time to play and the teacher's support changed from session to session.

Moreover, the game was played with classes of different school grades and levels (Table 1). Finally, it should be mentioned that the game was not performed five times equally:

The number of playing rounds, the game master's behaviour (due to learning effect from previous sessions and his form of the day) and the structure of briefing and debriefing (due to feedback from previous sessions) changed a lot (Appendix B1).

One of the goals of the game was to sensitise students about the palm oil issue. Deforestation and child labour might certainly be part of many palm oil production systems, but several positive aspects also exist. In asking the students only a question concerning problems and not about its opportunities, the feedbacks obtained from the questionnaires are skewed in direction of palm oil as problematic resource.

Furthermore, there were some problems about the credibility of some of the questionnaires: It was apparent that several times two students sitting next to each other wrote down exactly the same content (e.g. ID 24, ID 35 and ID 36 or ID 62 and ID 63, Appendix C1).

5 Conclusion

The present thesis suggests that the adapted version of the CoPalCam role-playing game can be used as an educational tool for teaching secondary schools students on the examined school levels 7 A, B and C and 8 A and B.

The studied role-playing game seems to be a promising tool for implementing "Bildung für Nachhaltige Entwicklung" in secondary schools: Even though the BNE-competence "knowledge" (Figure 1) was the only one that could be evaluated within the scope of this thesis, several more, including also BNE-principles, (Figure 1) were taken into account. e.g. discovering learning environment or networked-thinking by interlinking harvest, trade, deforestation, child labour, consumption.

Thus, it could be easily applied within the scope of the Zürcher Lehrplan 21, which is implemented in 2018/19/20 (Appendix A1 suggests several ways on where to integrate it in teaching (Lehrplanbezüge)).

The game provides an opportunity to make students focus for two to three hours on the palm oil topic in an enjoyable environment. At the same time, it enables to convey learning contents concerning the omnipresence of products containing palm oil, deforestation and child labour. However, it is difficult to judge whether that information can be embedded in a wider context or not.

For possible future projects evaluating role-playing games, one should take into account that the present student questionnaires were an only partially appropriate tool for evaluating the actual learning advancement due to the game. On the one hand, questions should concern connections between topics rather than testing mainly factual knowledge. On the other hand, additional questionnaires should be used some weeks and some month after the game session to see longer-term learning advancement.

For that purpose, the collaboration with éducation21 or teaching methodologists from the pedagogical high school in Zurich might be helpful: Their know-how about the stateof-the-art didactics and designing questionnaires for the evaluation might facilitate the implementation of a role-playing game as an educational tool within the existing framework conditions.

Despite many limitations on parts of the evaluation of the results, the game was considered a success by basically all participants. Due to the exceedingly positive feedback from the teachers, the game will be used further on within the scope of the 'Edible Research' project.

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7 Literature

Agroecosystems, S. (2017). Retrieved from http://www.sae.ethz.ch/

- Akimov, A., & Malin, M. (2015). Are classroom games useful for teaching 'sticky' finance concepts? Evidence from a swap game. Retrieved from http://EconPapers.repec.org/RePEc:gri:fpaper:finance:201509
- Bildung, b. B. f. p. (2017). <u>http://www.bpb.de/</u>. Retrieved from <u>http://www.bpb.de/lernen/formate/planspiele/65585/planspiel-</u> <u>datenbank?themenbereich=-1&zeitbereich=-1&altersstufe=-</u> <u>1&suchwort=&spielart=-1&teilnehmerzahl=&submit=Suche+starten</u>
- Bildungsdirektion, K. Z. (2016). Vergleich Zürcher Lehrplan 21 und Lehrplan für die Volksschule des Kantons Zürich (1991).
- Bildungsdirektion, K. Z. (2017). Zürcher Lehrplan 21. Retrieved from <u>http://www.vsa.zh.ch/internet/bildungsdirektion/vsa/de/projekte/zuercher le</u> <u>hrplan21.html</u>
- Bildungsdirektion, K. Z., Volksschulamt. Die Volksschule im Kanton Zürich. Elterninformation. Retrieved from <u>https://vsa.zh.ch/internet/bildungsdirektion/vsa/de/schulstufen_schulen/schul</u> <u>stufen/uebersicht_1.html</u>
- Brom, C., Sisler, V., Slussareff, M., Selmbacherova, T., & Hlavka, Z. (2016). You like it, you learn it: affectivity and learning in competitive social role play gaming. *International Journal of Computer-Supported Collaborative Learning*, *11*(3), 313-348. doi:10.1007/s11412-016-9237-3
- ComMod. (2017). <u>https://www.commod.org/en</u>. Retrieved from <u>https://www.commod.org/en</u>
- Crookall, D. (2010). Serious Games, Debriefing, and Simulation/Gaming as a Discipline. *Simulation & Gaming*, 41(6), 898-920. doi:10.1177/1046878110390784
- Crookall, D. (2012). The founding of modern simulation/gaming. *Simulation & Gaming*, 43(1), 5-14. doi:10.1177/1046878112437916

Development, G. o. F. M. a. (2017). Retrieved from <u>http://www.fordev.ethz.ch/</u> Edible Research (2017). Retrieved from

http://www.worldfoodsystem.ethz.ch/outreach-and-events/dissemination-andparticipation/agora.html

- éducation21. (2016a). Bildung für Nachhaltige Entwicklung. Ein Verständnis von BNE und ein Beitrag zum Diskurs.
- éducation21. (2016b). ventuno 3 BNE-Grundlagen. ventuno.
- éducation21. (2017). éducation21 Bildung für Nachhaltige Entwicklung. Retrieved from <u>http://www.education21.ch/de/home</u>
- Étienne, M. (2014). *Companion Modelling : A Participatory Approach to Support Sustainable Development*: Dordrecht : Springer Netherlands.
- FAO. (2014). Retrieved from http://www.fao.org/faostat/en/ data/QC
- Greenpeace. (2017). Retrieved from <u>https://www.greenpeace.org.uk/what-we-do/forests/indonesia/</u>
- Hoyle, D. L., Patrice. (2012). *Oil Palm Development Cameroon*. Retrieved from IAS, I. o. A. S. (2017).

- Klabbers, J. H. G. (2009). *The Magic Circle: Principles of Gaming & Simulation. Third and Revised Edition*. Rotterdam/Taipei: Sense Publisher.
- Kolb, D. A. (1984). *Experiential learning : experience as the source of learning and development*: Englewood Cliffs (N.J.) : Prentice-Hall.
- Kriz, W. C., & Auchter, E. (2016). 10 Years of Evaluation Research Into Gaming Simulation for German Entrepreneurship and a New Study on Its Long-Term Effects. *Simulation & Gaming*, 47(2), 179-205. doi:10.1177/1046878116633972
- Managementsimulation, Z. Z. f. (2017). <u>http://zms.dhbw-stuttgart.de/das-zms.html</u>. Retrieved from <u>http://zms.dhbw-stuttgart.de/das-zms.html</u>
- United Nations (2015). Transforming our World: The 2030 Agenda for Sustainable Development.
- OPAL. (2017). http://www.opal-project.org/.
- PUSCH. (2017). Umweltbildung in der Schule. Retrieved from http://www.pusch.ch/fuer-schulen/
- SAGSAGA. (2017). <u>http://www.sagsaga.org/index.php</u>. Retrieved from <u>http://www.sagsaga.org/index.php</u>
- Ulrich, M. (1997). Links Between Experiential Learning and Simulation & Gaming Gaming/Simulation for Policy Development and Organizational Change. Proceedings of the 28th Annual International Conference of the International Simulation and Gaming Association (ISAGA). (pp. 269-275).
- Ulrich, M. (2002). Sind Planspiele langwierig und kompliziert? Eine Abhandlung über die Planspielmethodik und die Ausbildung von Planspiel-Fachleuten *Planspiele in der beruflichen Bildung. Abriss zur Auswahl, Konzeptionierung und Anwendung von Planspielen. Multimedia-Publikation. Mit einer Einführung in die Planspieldidaktik, einer aktualisierten Planspielübersicht auf CD-ROM, Beispielen, Erfahrungsbeiträgen zur Anwendung von Planspielen sowie mit einem Internet-Planspielforum.* Bonn: Bundesinstitut für Berufsbildung BIBB.
- Ulrich, M. (2003). Mit Planspielen Nachhaltige Entwicklung erleben! Der Beitrag der Planspielmethodik zur Bildung über Nachhaltigkeit. *DGU Nachrichten, Heft 27/2003*.
- Ulrich, M. (2006). *Komplexität anpacken: Mit Planspielen erfolgreiches Handeln erlernen.* Paper presented at the "Komplexität erkennen - Zukunft gestalten. Ernährungsökologie als integrativer Ansatz für Wissenschaft und Praxis", Giessen.
- Ulrich, M. (2017). UCS Ulrich Creative Simulations. Retrieved from <u>http://www.ucs.ch/index.html</u>
- Education for Sustanable Development Goals: Learning Objectives, (2017). WFSC, W. F. S. C. (2017).
- Willis, G. B. (2004). *Cognitive interviewing: A tool for improving questionnaire design:* Sage Publications.
- Wu, W. H., Yan, W. C., Kao, H. Y., Wang, W. Y., & Wu, Y. C. J. (2016). Integration of RPG use and ELC foundation to examine students' learning for practice. *Computers in Human Behavior*, 55, 1179-1184. doi:10.1016/j.chb.2014.10.023
- Zürn, B. (2015). Planspiele erlebnisorientiertes Lernen im Team. Retrieved from http://www.eigenland.de/magazin/zukunfttrends/planspiele/ch/5c07a9afc8e2b11aed3c98f5c56dc078/?S=76

Image sources

Page 17

Plantation worker: https://www.mmbiztoday.com/articles/sustainable-palm-oil-myanmar-could-access-premiummarkets, last checked: October 1, 2017

Plantation:

https://www.worldwildlife.org/pages/palm-oil-the-hidden-truth-lurking-in-your-home © James Morgan, WWF International Last checked: October 1, 2017

Oil Palm: Picture taken by Dr. Jonas Jörin, ETH Zurich, in Malaysia

Page 18

Plantation worker:

http://www.reuters.com/article/us-malaysia-palmoil-labour/malaysia-palm-planters-facelabor-shortage-as-indonesia-workers-stay-away-idUSKBN1790VO, last checked: October 1, 2017

Page 20

Plantation worker:

https://www.mmbiztoday.com/articles/sustainable-palm-oil-myanmar-could-access-premiummarkets, last checked: October 1, 2017

Transport:

http://www.opal-project.org/news/category/opal-indonesia, last checked: October 1, 2017

Transformation: <u>http://www.alibaba.com/product-detail/10-120TPH-oil-palm- processing-machinery 700612877.html</u>, last checked: October 1, 2017

Products:

http://www.ibtimes.com.au/mars-snickers-milky-way-chocolates- recalled-55-countries-1505870, last checked: May 1, 2017

Appendix available upon request.

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