

LEVEL 1 | Empowered Learning in Games (7384)

Mentor Game Details

- Name: Ludwig
- Organization who developed the game: Ovos realtime3D GmbH
- Target audience for the game: children aged 10 to 14.
- Learning topic the game focuses on Renewable energy and researching physical phenomena (energy through combustion, hydropower, solar energy, and wind power).
- Gameplay work as delineated by Kapp (2012, chapter 2):
 - Abstraction of Reality: The gameplay immerses players into an operating model featuring the robot Ludwig, a broken spaceship, a planet, and its resources. Players can strategize and identify the effect of their actions as they accompany Ludwig on his mission to protect the Robotronics on Unitron. Complex physic processes are explained as Ludwig carries experiences in the lab and all over the planet.
 - **Goals:** Ludwig game claims to focus on learning goals from the Physics curriculum about renewable energy. There are various enabling objectives, including tasks and subtasks the player is prompted with visual clues (blue and yellow marks).
 - **Rules:** the game offers a variety of operating rules. The player can guide Ludwig to walk in any direction (even under water) and jump to collect items. The player can answer quizzes to develop a knowledge base, can build tools in the workshop, and experiment in the lab. Instructional rules include knowledge and skills the player should internalize. For example, the combustion can only happen with oxygen being present as this is experimented in the lab.

- Conflict, competition, or cooperation: Ludwig seems on his own in his query and shares small talk with the space shuttle main computer. Their cooperation is based on an army-style leadership.
- Time: Ludwig seems to be unhurried as the game has no constraints on time, which is not aligned with the imminent collapse and emergency of the home world. However, this freedom creates a safe learning environment.
- Reward structures: Although the author of the game mentioned a leaderboard during his Ted Talk (TedxVienna and Joerg Hofstaetter, 2011), I am not sure if this social feature has been implemented. Kapp (2012, chapter 2) asserted that a leaderboard “is a powerful motivator to play the game again and again” (p. 34). Other motivators include the development of a knowledge base and successful completion with experiments and tools.
- Feedback: Player can see the items they collected, the tasks to do and completed on screen and in the journal, and there are some indicators with numbers on the left top of the screen. There are success animations that mark the main milestones.
- Levels, Game levels, Playing levels, Player levels: the game is organized by chapters mimicking the structure of a book. Some gadgets like the Navi one can be upgraded to level 2 which offers more support to figure out where the objects. There are 4 levels that can be activated.
 - Storytelling and Curve of Interest: there are sufficient dialogs that tell a story along the way and keep the quest going in an interesting way.
 - Aesthetics: the 3D environment is pleasing to the eye. It is fun to move the robot on the planet. Sound is making a great addition to the overall visual atmosphere.
- Replay or do over: Ludwig can be replayed as many times as desired. A player can save a game session and reload it later. It is also possible to get directly to a chapter and skip

parts of the game for specific instructional sessions and offer flexibility for using the game in a classroom setting.

Gameplay Experience

I played 4 sessions of the game for a total of 4 hours because after 2 hours I had no luck to experience any physical phenomena of interest. Finally, I was able to experiment combustion in the lab and found some parts were a great experience like seeing the small residue molecules and grabbing their names along the way.

I struggled with the way Ludwig must walk all over the place to find stuff. I would prefer to find a coal mine and collect many blocks there, find a garbage

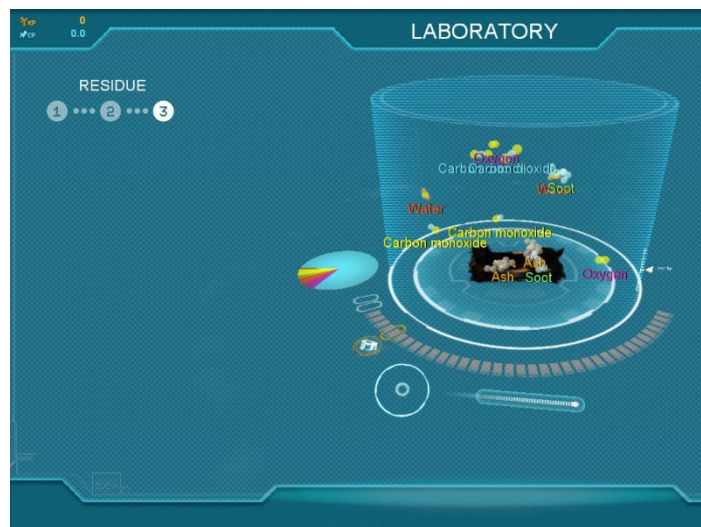


Figure 1: lab residue analysis step 3 - molecules all named

area with many old newspapers, arrive at a place where there is a wood storage. It would be more realistic and less pain and give more time to spend with the actual research on physical phenomena. The BBQ with the shops and decoder made little sense in the game as not related to the goals.

Principles of Learning

Gee's principles of learning are presented in a class video (Gee, 2013) and summarized by (Tozk, 2014). I selected and discussed below 5 principles as per the instructions provided.

1. Customization of the experience for the learner (empowered learners)

This principle states the importance of providing a learning experience that could fit diverse learning styles and environment. For example, players could decide how the main character looks or which path to take first. In that regard, I did not experience the kind of freedom of choice I appreciate with my mentor game Ludwig, although there are chapters to enter the story at various points, the Physics part, which is the actual heart of the game, has little customization and is quite linear.

For example, I went into the solar power chapter directly but once there I had to align mirrors to reflect beams of light and there was no alternative path. I got stuck again.

Not all players are skilled with moves such as pushing handles on rails.

Ludwig misses on opportunities, as players could obtain the same result with an electronic control panel

(such as the one used to light the BBQ in the first chapter) or using a

geometric model using lines and angles that could be modified interactively.



Figure 2: Missing just one sub task makes the player stuck

In addition, having only one way to perform a task is not well aligned with learning about Physics phenomena.

2. Manipulation (empowered learners):

Games make it possible for players to feel their body and mind interconnected when manipulating powerful tools, such as piloting at distance a race car, or taking a ski jump from a Wii fit board. There was some of this feeling playing Ludwig as I could make a little robot jump and I could experience brisk walking. That was fun.

However, opportunities for simulation and manipulation as the player discovers physics phenomena appeared quite limited. What Ludwig offers is mostly animations, they play like a movie. For example, the combustion experience allows players to increase the heat in a basic way, by pressing multiple times on a pictogram (or space bar). It would be more realistic and empowering for learners to offer a more sophisticated control button like a gas knob allowing to increase and decrease the flow of oxygen and impact the combustion phenomenon. This would empower players to control with their hands and therefore better understand with their brain that there are different combustion temperatures for different materials.

3. Pleasantly frustrating (problem-based learning)

Problem-based learning is challenging because designers must find a middle ground where learners are faced with difficult exciting problems but within their abilities to solve. As such, players frustration is expected, although they should experience progress and even feel if the problem is hard, that it is

doable. Unfortunately, Ludwig is not well balanced in this area.

For example, looking for objects was often a waste of time and too lengthy for me.

Even if there are features like the journal (see screenshot with highlighted instructions there is no step by step clear instruction whenever stuck. Failure is not managed in a rewarding way. There are some levels for navigation to enable further help, it is like so there is not sufficient scaffolding throughout the game for an autonomous navigation.

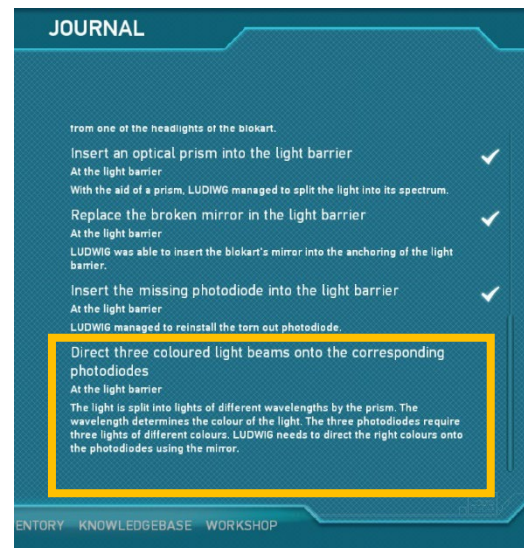


Figure 3: Journal provides some guidance but not sufficient.

May be because the game is meant to be played in classroom with the guidance of a teacher? I could not understand how the connection works with Ludwig lessons plans (Ludwig, n.d.b) as the only ones I found were in German with no illustration and hard to make sense of. In the Ted talk (TedxVienna and Joerg Hofstaetter, 2011), there is a mention about the role of the teacher to bring the knowledge and skills acquired during the game outside and into the curriculum.

One of the frustrating situations I experienced was somewhere with the first couple of hours of play. Ludwig had a task to light on a BBQ but this could not happen until a “decoder” was found. Once I got it (after a long painful and senseless search), I visited the workshop to assemble a command system but there was no interactive feature at this point. The readings offered were quite lengthy and not appealing. It was not giving learning rewards if you had read or understood, which in my opinion is a design flaw for a serious game. It was not pleasantly frustrating but awfully frustrating: making so much effort to find a crucial piece and not understand why or how it mattered. There was no progress in learning made, at least for me.

4. The fish tank principle (problem-based learning)

The eco-system of the game is less complex than real life and ought to be simplified, supposedly allowing learners to focus on specific learning objectives. Ludwig is doing a good job to bring Ludwig (and thus the player) attention to some specific Physics phenomena.

For example, the environment created around combustion and solar power makes sense and highlights the required key features. At the same time, it is providing a safe environment to experiment and is realistic enough so the players will be able to transfer knowledge and skills acquired to other more complex settings. Chapters are designed

around specific topics and I think this is where we see the most impact of the teachers who were consulted to design the game.

5. Systems thinking (deep understanding)

Learning is more effective when the game provides opportunities for students to connect the new knowledge and skills they are meant to acquire with other topics of reference.

When students can make sense of their progress toward mastery and competency of a larger subject matter.

Ludwig is a game that aims at educating students with renewable energy and related Physics phenomena. The content is well structured and matches with Physics curriculum. Many aspects of interest are explored and overall, the subject matter is well covered, and the training provide appears efficient. However, in detail, there are missed opportunities mentioned above that makes me worry about the quality and effectiveness of the training regarding the depth of it. It would be interesting to look into about the research conducted, if they evaluated the actual progress of the students? I could not find the research articles. Not sure if they were published at the end?

Player Type

- Caillois's Patterns of Play.

As summarized by Kapp (2012, chapter 6), in the 1950s, Caillois's has analyzed human play and suggested four categories to classify physical games. My mentor games display some aspects of the four categories. When Ludwig has to search for objects, they could find them easily by pure luck or a player could struggle much longer to get to them. That is the “Alea”

component of play randomness. I am not sure if this makes any sense in a serious game but may be it could be pleasant for some players.

A second category that appears in the game background's story is "Âgon". The scenario includes a battle of energy as the hero must defeat a historical loss. In a depleted world devastated by old ways of doing, Ludwig quest is to use his ingenuity to win renewable energy, not only to supply his crashed shuttle, but also possibly save humankind. This background provides an exciting and competitive goal for the players.

Ludwig includes an imaginary world with a simulation of hypothetical time and space where Earth has consumed all its fossil energy. This creates an opportunity for players to take a role of leader into the discovery of new renewable sources of energy. Caillois named this category "Mimicary".

Finally, Ludwig touches on perception of vertigo or dizziness as the camera can be rotated in any direction. There are times where a player can move fast enough to make Ludwig lose balance. Although it is not a physical situation but a virtual one, I find the way the player has control of the camera enters in the category of "Illinx".

In addition, Ludwig appears to provide a good balance between structured and rules-based game on one side and free movement. However, using the terms defined by Caillois, I observed that "Paidia" occurs mostly in object search while "Ludus" seems to be the preferred mode activated with Physics learning. That is why I felt constrained and not having enough freedom and options while experimenting with Physics phenomena. I also have preferred that the search of objects be more structured, like having all newspapers found in a storage for example, instead of picking them up all over the place.

- Bartle's Player Types

Ludwig and Autotronic are two characters of the game (see Figure 4) that I have experienced in the chapters I was able to explore so far. These characters, the environment they evolve within and the challenges they face could be attractive and enjoyable players having a type of achiever or explorer. Types of players are described by Kapp (2012, chapter 6).

However, socializers could feel quite alone and have no way to connect socially although the play aims to save all humans. Killers do not seem to have anyone to kill but could tackle bad habits of the past?



Figure 4: Autotronic discusses with Ludwig to introduce a new mission.

Although the game Ludwig includes the four patterns of play defined by Caillois, the emphasis of the play is on “mimicry” where players are immersed in a world where they must explore their environment for renewal energy, with challenges around water, wind, solar power. Because the end goal is to master related Physics, an achiever could find satisfying to overcome obstacles every step of the way and finally master the whole topic.

To conclude, Ludwig was an ambitious project that appeared to have reached some recognition among peers but may have failed to create a game that can attract a sufficient number of players. May be this is due to the weaknesses identified along this analysis.

Ludwig had a good potential, but it appears the production did not deliver a product on par with the expectations. During the Ted Talk (TedxVienna and Joerg Hofstaetter, 2011), the creator mentioned improving the game, removing some text that was perceived as too long,

but maybe they had so much work they could not find funding to reach a better version in a reasonable time length.

REFERENCES

Gee, J. (2013, November 13). Jim Gee: Principles on gaming. Retrieved from <https://www.youtube.com/watch?v=4aQAgAj>

Kapp, K.M. (2012). Chapter 2: It's in the Game: Understanding Game Elements. In *The gamification of learning and instruction: Game-based methods and strategies for training and education*. San Francisco, CA: Pfeiffer.

Kapp, K.M. (2012). Chapter 6: It's in the Game: Understanding Game Elements. In *The gamification of learning and instruction: Game-based methods and strategies for training and education*. San Francisco, CA: Pfeiffer.

King, N. (2021). *The Ultimate Guide to Serious Games 2021*. Chaos Theory. <https://www.chaostheorygames.com/what-are-serious-games-2021>

Ludwig. (n.d.a). *The adventure begins*. Retrieved from <https://ludwigplay.com>

Ludwig. (n.d.b). *Accompanying material*. Retrieved from <http://www.playludwig.com/en/info/info-for-teachers/>

Ludwig. (2013, September 25). *Ludwig wins world summit award 2013*. Retrieved from <http://www.playludwig.com/en/blog/126,ludwig-wins-world-summit-award-2013.html>

TedxVienna, Joerg Hofstaetter (2011, November 10). *Video games a powerful learning tool*. Retrieved from <https://www.youtube.com/watch?v=x5YtkTw4wn4>

Tozk Arena, C. (2014, June 6). *13 learning principles that games can teach us*. Retrieved from <http://www.carlaarena.com/13-learning-principles-that-games-can-teach-us/>