

Project 2

Electroflow Card game

Educational Game design based on the concept
of electric circuits for school children

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Guide

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Approval Sheet

A project title "Electricity Board Game" by Tejaswini Pundge, 216330012 is approved for partial fulfilment of the requirement for the Degree of 'Masters In Design' in Interaction design.



Guide

External Examiner:
Punam Medh



Declaration

I declare that this written document represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and provided references to the original sources. I also declare that I have adhered to all the principles of academic honesty and integrity and have not misrepresented or fabricated, or falsified any idea or data or fact, or source in my submission. I understand that any violation of the above will call for disciplinary action by the institute and can also evoke penal action from the sources which have not been properly cited or from whom proper permission has not been taken when needed.

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Abstract

This is essentially a multiplayer card game that aims to explain Understanding the role of components, Their ways of application in electric circuits, and how they interact with each other. The game focuses on the fundamentals of electric circuits such as component roles and electron flow where students enjoy the game by performing the roleplay of circuit components. The main objective of the game is to collect the desired combination of electrons which will be achieved by passing the electrons among the players.

Objectives

The project's main objective is to make a product that would 1) Engage participants with pre-defined instructional content of electric circuits and

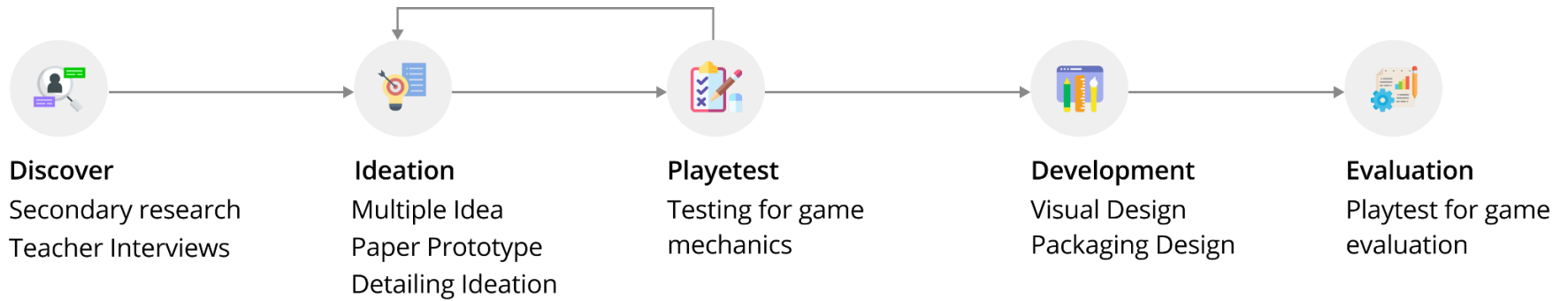
2) Make the learning experience fun with the help of gameplay.

Context

I aim to create a board game/ Card game that will explain NCERT textbook content on electric circuits for students of classes 6th to class 8th. The product would be aimed at all children who have prior knowledge of building electric circuits, Product would specifically serve as a user base in the process of finishing or having a secondary school education (Class 7th - 9th). The game will be introduced as reinforcement with regular teaching hours.

The Method

I plan to follow is an iterative design process, allotting maximum time to ideating, prototyping, and playtesting ideas. After an initial research phase solidifying my basics and understanding the vocabulary of game design, I have kept dwelling on secondary research throughout the process of design. Secondary research essentially includes playing games and discussing that with researchers, Looking for different narratives to build games on and recent research happening for board game design. Individual methodologies of each phase are given below:



Primary Research

1. Research with the teachers to get to know how the class environment while teaching the electric circuit concept, the Kind of activities they conduct to make the learning experience interesting, and the difficulties they face while teaching this concept.

Secondary Research

Topic specific- Researching through books, papers, articles, and other resources pertaining to concepts of electric circuits to brush up my own understanding of electricity and look for the social, Human context around the topic.

Other resources - Research and analyze other games based on electricity, hands-on activities conducted in school to make students understand electricity concepts, and Video tutorials.

Game specific - Research to get familiar with the overall context, and vocabulary of game design. Also, researched to understand the specific frameworks for game design and game evaluation

Ideation

At the start I brainstormed about the various ideas and detailed them as much as possible. Among them, 2 Ideas were carried forward and playtested. In the end, Multiple iterations of one finalized idea were playtested.

Playtesting

has been done multiple times to check whether the game mechanism working smoothly or not. Feedback helps here build the next iteration.

Development

In this phase, the visual design, and packaging of the product have been designed.

Evaluation

Final game has been playtested and evaluated with two goals 1) Learning and 2) Player Experience

Introduction

We as children always face difficulties in understanding abstract science concepts. For eg. the structure of the atom, the particle nature of cells and chemical reactions, magnetism, electricity, gravity, etc.

The term abstract is often used to denote a concept lacking a tangible referent in the real world. Children face this difficulty as it is difficult to visualize or has little relevance to students' lives. To help them understand abstract ideas at the conceptual level teachers use various techniques such as experiments, bringing real-life examples, use of digital media, etc. Concept-based learning emphasizes helping children understand the core concept rather than just sharing a layer of important information.

The main difficulty with concepts like electricity is misconceptions and remembering different functional use of key components. Games have the potential to motivate children and create an engaging experience. These games offer real-time feedback to participants while learning which helps them retain knowledge.

In this project, I have designed an Educational game for school children of class 7th to 9th class. As an interaction designer, my major focus is on designing the player experience.

Why the electric circuit is difficult to understand:

Primary and secondary school topics involving abstract concepts are challenging to teach. Electric circuits can be simply constructed but complex to explain. An electric circuit is one of the difficult topics for Students because 1) a lot of abstract concepts 2) have a lot of symbolic representations, 3) don't have concrete examples, and 4) it needs a lot of mathematical manipulation. Studies show that student's conception of the simple circuits is influenced by their perception and supposed by (1) their experience, (2) their understanding of mathematics language and physics language, (3) their intuition to get conclusions, and (4) their understanding of the finite concept. In the research study conducted by science education post-graduates, it is observed that students have misconceptions about the fundamental concepts of electricity.

Why Games

To solve the problem of basic fundamentals and abstract concepts teachers are expected to eliminate the traditional teaching practices and instead create a learning environment that would protect students from memorizing and making them participate in the lesson willingly.

Nowadays, using games as a learning aid is becoming a common method for students.

Games are said to have great potential to improve science learning in elementary, secondary, and undergraduate science classrooms. They can individualize learning to match the pace, interests, and capabilities of each particular student and contextualize learning in engaging virtual environments.

As pedagogical devices, games are beneficial because they can enliven teaching topics and are especially effective for dealing with problem-solving and key concepts. Research shows that “games have a special role in building students’ self-confidence” and “they can reduce the gap between quicker and slower learners”

Secondary Research

As a part of secondary Research, various games available in the market are studied and analyzed. Also, I went through the other learning materials such as activities and the video material students usually refer to for learning the concept of electricity.

1. Games

a) Railroad Ink: The electricity expansion



In the multiplayer puzzle game Railroad, the player's goal is to connect as many exits on your board as possible. In each

round, a set of dice is rolled in the middle of the table, determining which kind of road and railway routes are available to all players.

The Electricity Expansion Pack contains 2 unique expansions:

- Street Lamp (2 dice)
- Power Grid (2 dice)

Idea is to Build Street Lamps and power them with Generators to light your board and score a lot of points with the Street Lamp Expansion, or connect your Exits to the central Accumulator and charge it with electricity with the Power Grid Expansion.

b) Current electricity Boardgame

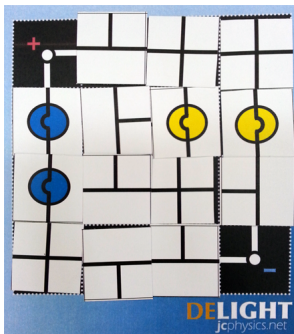


This is a challenging, engaging, and enjoyable board game,

for up to six pupils per set, with 54 question cards on the basics of current electricity including various topics such as understanding the terms current, voltage, and resistance, conductors and insulators, circuit symbols, circuit diagrams, units and measurement of current and voltage, etc.

The highest score of dice starts, participants take turns and work their way around the board following the instructions in the squares. The participants take a question card from the face-down pile. If correct they move on 2 spaces. If a player thinks an answer given by an opponent is incorrect they can challenge. If the challenge is correct the challenger moves forward 2 spaces. If the challenge is wrong the challenger moves back two spaces. In the event of a challenge, participants are encouraged to consult their books but the teacher has a quick-check answer sheet.

c) Delight: An educational board game



This game is meant for 2 players or 2 teams of players. Each player/team has the following tiles:

- 2 x light bulbs
- 3 x T-shaped wires
- 2 x crossed wires

The players will take turns placing the tiles on the board. Each new tile must have at least one wire connected to an existing wire on the board. The game will end when the last tile has been placed on the board. The person with the brightest bulb will win. In the event that there is an equal number of opposing bulbs of the same brightness, it will be considered a tie. If there are three bulbs of the same brightness, the one with two of these bulbs wins.

d) Power Failure Card Game



Power failure is an electrifying card game in which the most productive grid. Participants are supposed to compete to

meet rising demand by acquiring resources, building power plants, and activating them to generate energy. However, power production is inherently volatile, as rash individuals risk environmental catastrophes that set everyone back. The player who provides the bustling city with the most megawatts will win the game.

e) Do not short circuit



It is a logical game that teaches the basics of electrical engineering. Participants have to repair the device by restoring the maximum number of electrical circuits and lighting the bulbs and LEDs. Participants will use resistors,

transistors, and diodes to get the maximum benefit, Skill up their electrician's experience to the maximum and win. The main thing is not to short circuit.

f) Power grid: Board game



The objective of a Power Grid is to supply the most cities with power when someone's network gains a predetermined size. Players mark pre-existing routes between cities for connection and then bid against each other to purchase the power plants that they use to power

their cities.

However, as plants are purchased, newer, more efficient plants become available, so by merely purchasing, players potentially allow other players access to superior equipment.

Additionally, players must acquire the raw materials (coal, oil, garbage, and uranium) needed to power said plants

(except for the 'renewable' wind farm/ solar plants, which require no fuel), making it a constant struggle to upgrade your plants for maximum efficiency while still retaining enough wealth to quickly expand your network to get the cheapest routes.

The table below shows the rough analysis of all these games on the basis of cost, playtime, and game mechani

Product name	Origin	Cost	Playtime	Game mechanics
Railroad Ink: Electricity expansion	Spanish	3,800 Rs	15-30 min	Dice rolling
Power grid	German	9914 Rs	120 mins	Turn order, network Building
Delight and educational board game	Singapore	Free	15-20 min	Tile placement
Current electricity board game	-	3 \$	30 min	Dice rolling
Do not short circuit	German	Not listed	15-30 min	Network Building, Tile placement
Power failure	India	9999 rs	45 min	Open drafting, Stacking and balancing

- From the secondary research it is observed that there is not much work happening in the Indian context.
- The board games available are not economical solutions.
- The board games considered for the secondary research are not based on any specific academic curriculum.

2. Activities

Following are some of the activities given in the textbook for students. These activities are more focused to give some hands-on experience to students for building the circuits and learning by doing

Activity 1

Take a torch and look inside its bulb. You can also take out the bulb with the help of your teacher. What do you notice? Do you find a thin wire fixed in the middle of the glass bulb [Fig. 12.2 (b)]? Now switch the torch on and observe which part of the bulb is glowing.

Activity 14.3

Make a circuit as shown in Fig.14.10. Take about 10 cm long piece of nichrome wire and tie it between the nails. (You can get nichrome wire from an electric repair shop or you can use a piece of discarded coil of an electric heater.) Touch the wire. Now switch on the current in the circuit by moving the switch to the 'ON' position. After a few

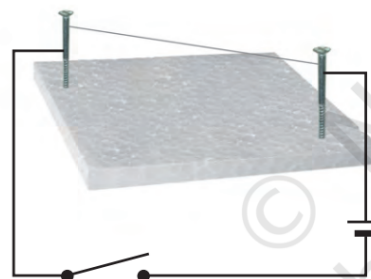


Fig. 14.10

Activity 5

Disconnect the switch from the electric circuit you used for Activity 4. This would leave you with two free ends of wires as shown in Fig. 12.12 (a). Bring the free ends of the two wires close, to let them touch each other. Does the bulb light up? You can now use this arrangement to test whether any given material allows current to pass through it or not.

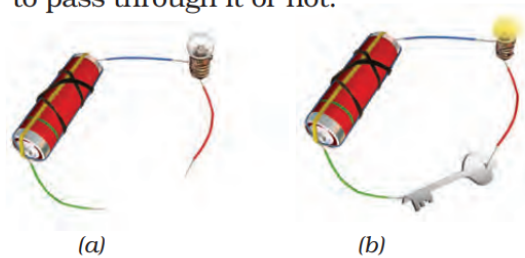


Fig. 12.12 (a) A conduction tester (b) Testing whether the bulb glows when the tester is in contact with a key

Activity 2

Take four lengths of electric wire with differently coloured plastic coverings. Remove a little of the plastic covering from each length of wire at the ends. This would expose the metal wires at the ends of each length. Fix the exposed parts of two wires to the cell and the other two of the bulb as shown in Fig. 12.3 and Fig. 12.4.



Fig.12.3 Electric cell with two wires attached to it

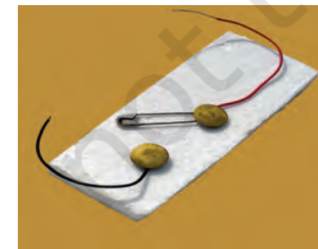


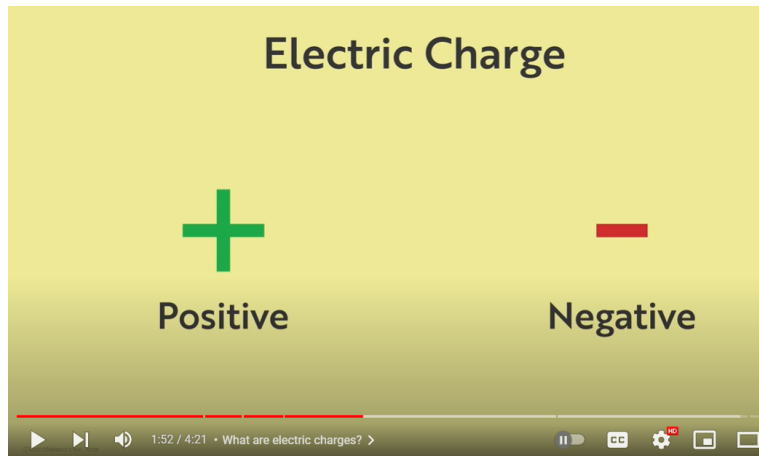
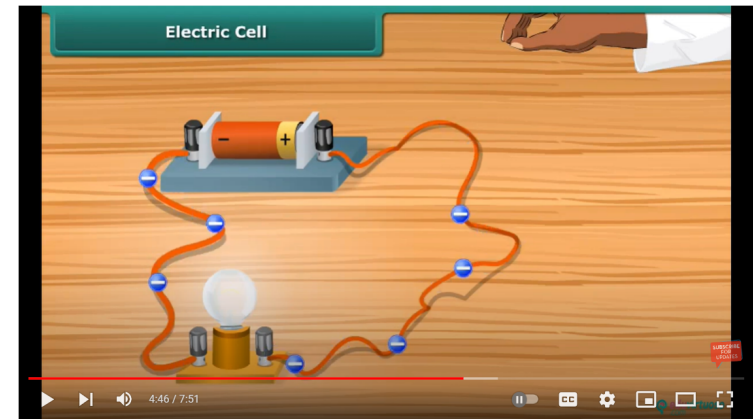
Fig. 12.8 A simple switch

Activity 4

You can make a switch using two drawing pins, a safety pin (or a paper clip), two wires and a small sheet of thermo Col or a wooden board. Insert

2. Video content

Nowadays video contents are the most accessible learning materials for school children. These video tutorials are more focused on easing out visualization of abstract concepts.



The video shows a blackboard with handwritten equations for power, voltage, and current. The equations are: $P = VI$, $V = IR$, $I = \frac{V}{R}$, $P = (IR)I$, and $P = \frac{V^2}{R}$. The video player interface at the bottom indicates the video is at 3:44 out of 18:09 minutes.

Primary Research

Primary research has been conducted to understand the class environment, Activities conducted in class, students' involvement in activities, and methods of evaluation of learning.

Following is the questionnaire prepared for primary research:

- What teaching material they used?
- What activities do they conduct?
- How do they plan activities? Are they group activities or individual?
- How do students respond to activities?
- Is there any training/ reference for conducting the activities?
- How do you manage resources needed for the activities?
- Are games part of the activities?
- How do you evaluate children's learning through activities?
- Are there any specific play hours?

Insights from primary research

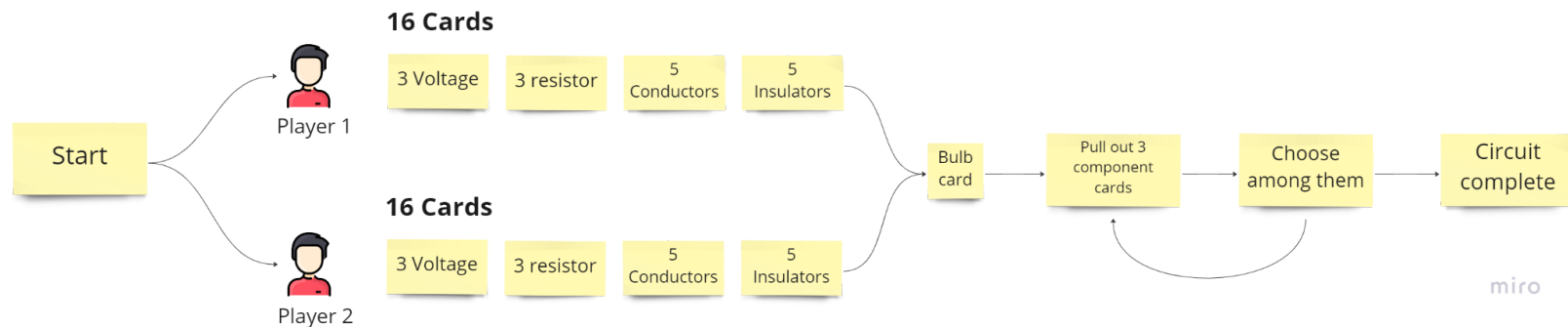
- General practice is to explain the topic through real-life examples and simple activities
- There is no specific training given to the teachers to design the class activities
- The class activities are usually conducted among a group or pair of students.
- Teachers don't evaluate the learnings from activities but they do explain what activity means and what students should learn from it to students.
- Class activities aim to ease the visualization of abstract concepts and help students to remember the concepts for a longer time.

Product Requirements

- Economical solution - It should be the economical solution
- Indian Context - Not much work has been done in the Indian context so there should be some Indian context in the design.
- Multiplayer game - It is observed that majorly activities are conducted in a group so multiplayer games are recommended.
- Teaching Aid - The product can be used as a teaching aid.
- It should help to visualization of concepts
- Provide some hands-on experience for students.

Ideation

Idea 1



Game Objective

To build the circuit around the bulb

Game components

A board - A map-like structure consists of guidelines to put the components.

A stack of cards - Mix the resistor, conductor, and insulator cards.

Bulb card: A bulb

How to play:

Each player will get a set of cards which consist of 3 cards of voltage, 3 cards of the resistor, 5 cards of conductor, and 5 cards of insulator.

Players will pull out three cards at the start from which they will choose the component.

In each turn, the player will choose one card to place on the board. After three turns new cards will be open. The cycle will be repeated till the circuit gets built.

Victory condition

The player who is able to complete the circuit first will win the game.

Mechanics:

Card pulling

Game type: Competitive game

Players will be strategizing on

- 1) Selecting the component card
- 2) Place to put the component card

Player actions

- 1) Place component on a component on board

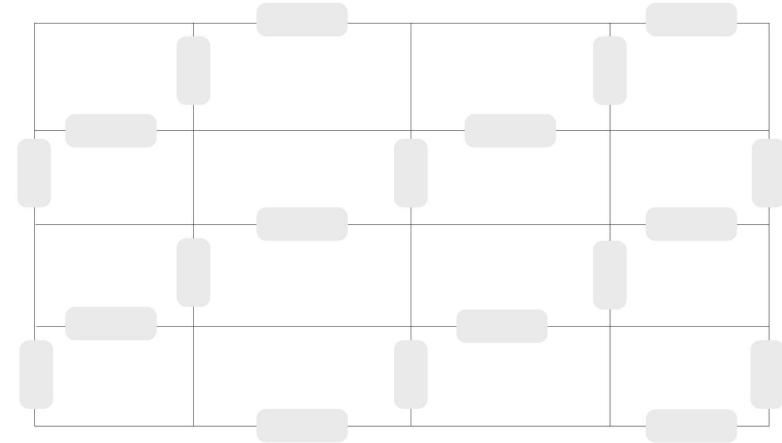
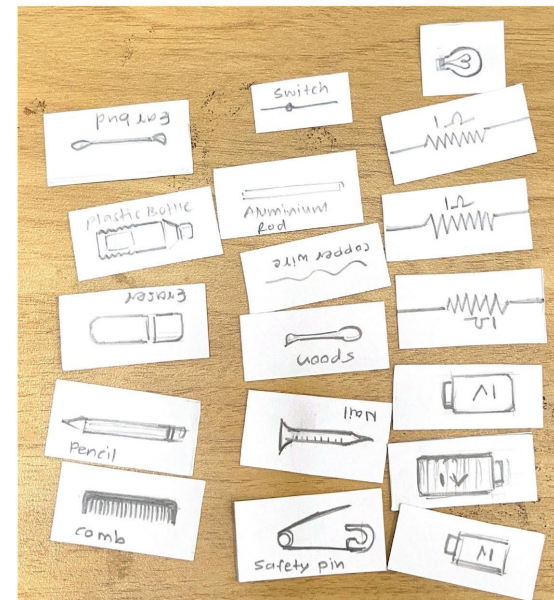


Fig. Board



Limitations:

This game has only one type of player interaction i.e blocking each other using components. The more the player interacts, the more fun will be.

The guidelines are acting more like conducting wires which contract the conceptual model.

There are very few options choices that players have to decide on.

Idea 2

Game Objective

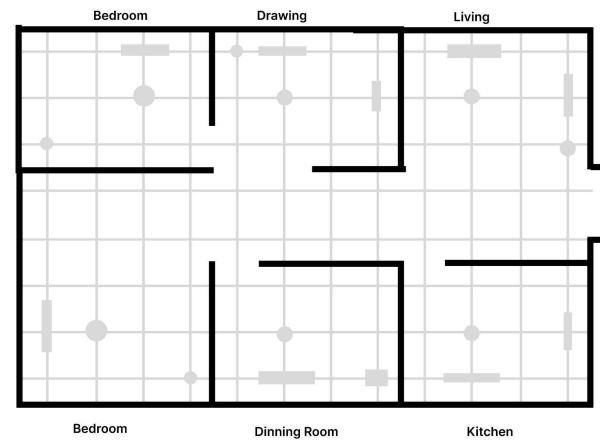
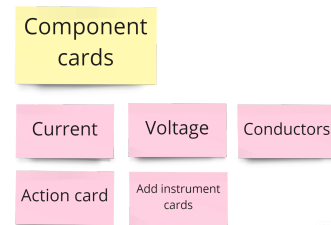
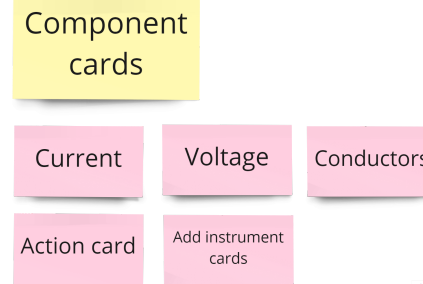
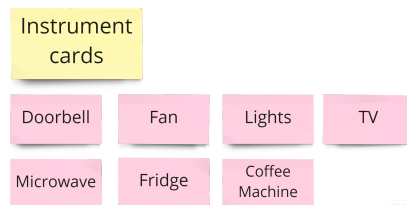
Fixed all the instruments in their respective rooms by completing the circuit using components such as voltmeter and current.

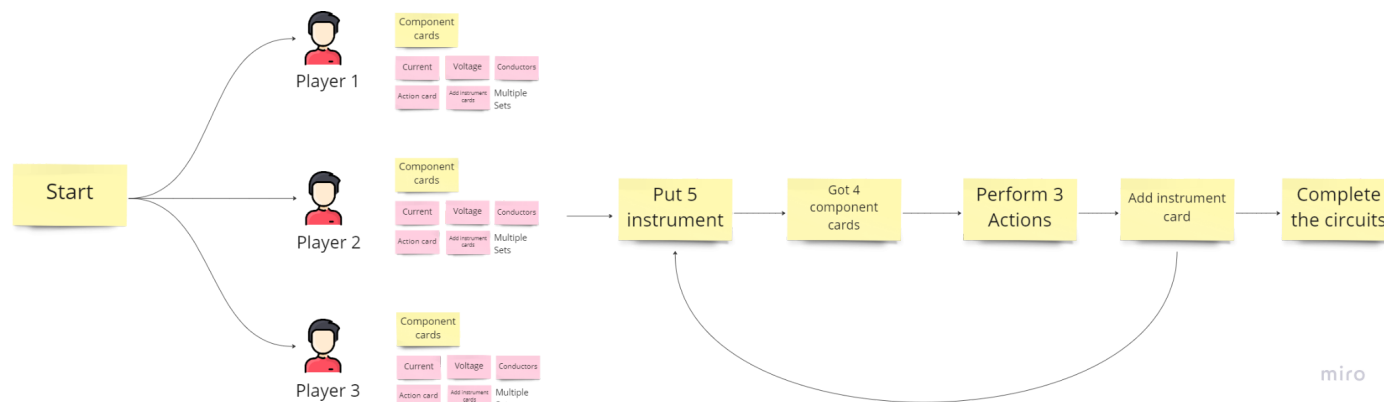
Game components

A House map - An architectural plan on which components will get placed.

A stack of cards - A mix of voltage and current cards.

Instrument cards: Cards with an instrument and power required for it.





How to play:

- Every player will pull out one instrument card and put it according to the room mentioned on it.
- The next step is to complete the circuit around it
- Every player will get 4 cards of the component at the start. Players have to pull out one card in each turn. But they can keep a maximum of 4 cards only.
- Instruments have some mentioned power requirements on it. Players have to complete that requirement.
- Players can fix the instruments in which room they are.
- Each player can perform 3 actions in each turn. Following are the set of actions

- Move point to point: Players can move point to point on grid lines on a map.
- Fix component: Fixing the component at the location will count as one action
- Exchange cards: Players can exchange the cards if they are in the same room
- Switch battery: Switch the battery direction to complete the circuit.
- Shift the component: Shift the component to some other place
- Component card stack contains one power card which will lead to adding more instruments to the house.

Game type: Co-operative game

Victory condition: All rooms get fixed.

Lose condition: Component card gets over.

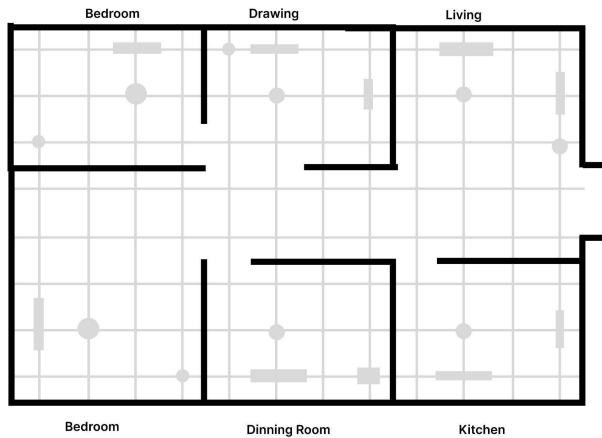


Fig: Sample map of house

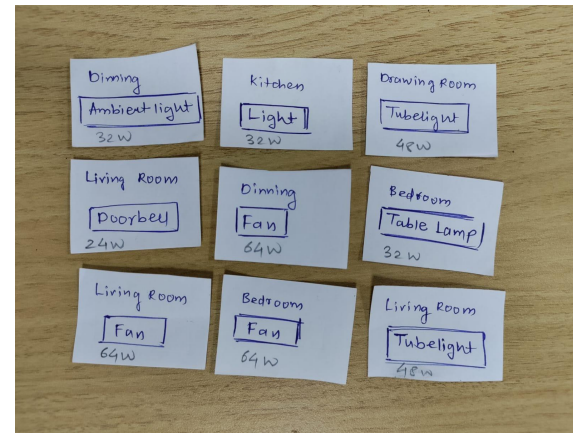


Fig: Instrument cards

Limitations

- To play the game player should be aware of the power formula and how to apply it.
- Players have to do some calculations to balance the voltage and current in a circuit.

Idea 3

Game Objective

Collecting the given amount of electron cards

Electron Cards	Action Cards	Role Play Cards	Requirement Cards
2E	Switch direction	Voltmeter	24
3E	+1 Capacity	Resistor	32
4E		Battery	36
5E		Conductor	48
6E		Capacitor	64
8E			
9E			
12E			

Game components

Roleplay cards: Battery, Resistor, Capacitor, Voltmeter, Bulb

Stack of cards - Mix of electron cards and action cards

Action cards: Switch the direction, 1+ (Now everyone can carry 5 cards)

Minimum Players required:

5 players

How to play:

Role cards will be shuffled and distributed amongst the players.

Power of role cards:

Battery - Can pull out new cards from deck

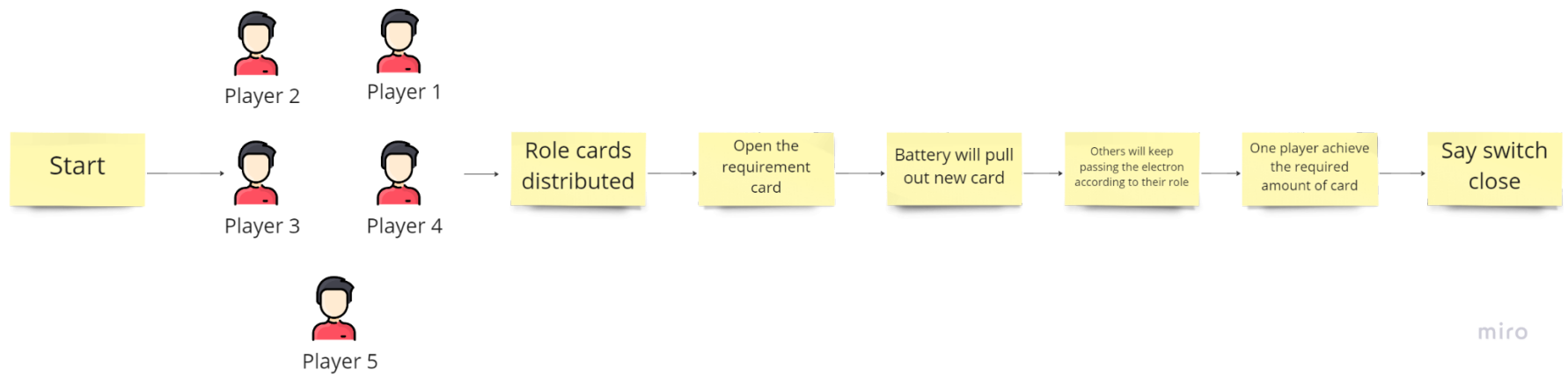
Resistor - Can pass only half of the cards. Eg. If he got 2 electron cards, he will pass only 1 electron.

Capacitor - Save the cards. But if the battery skips the turn then the capacitor has to pass the card.

Conductor: No special power just passing cards

Voltmeter: He has some power to open cards just once.

The one who is able to collect the required number of electrons will win the game.



Game type: Competitive game

Victory condition: One who is able to collect the required number of electrons

Lose condition: Electron cards over

Limitation:

- Some players will not enjoy the game due to the inequality of the roles.

Idea 4

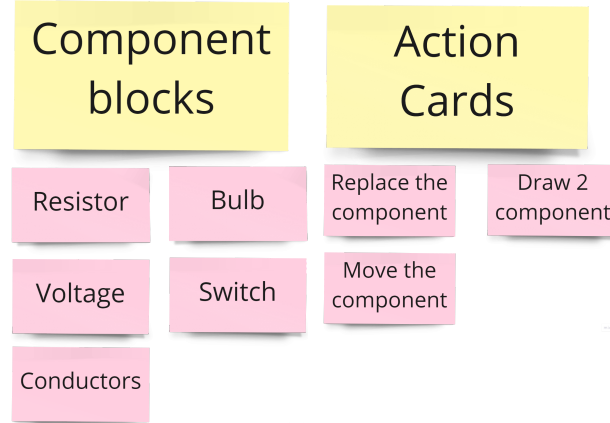
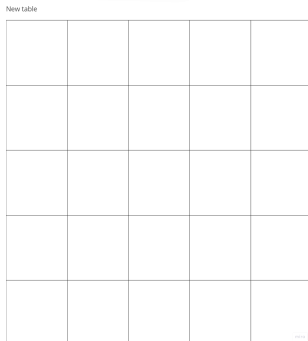
Game Objective

Recreating the similar pattern of network

Game components

- Mainboard
- Small cards of network circuits
- Component blocks
- Action cards

Main Board

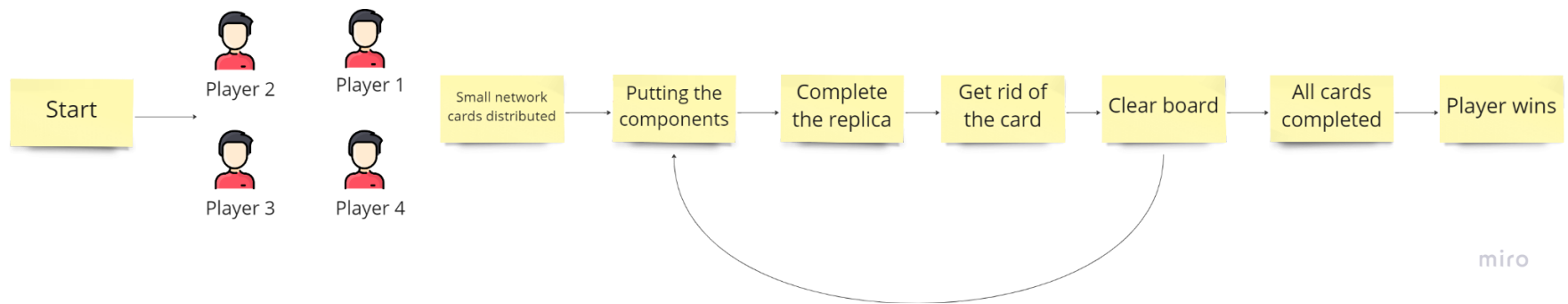


Minimum Players required:

4 Player

How to play:

- Each player will get 3 mini cards of network
- Players to have to recreate the network on main board as like network on their cards
- Every player will get three action cards. Players can use that throughout one play.



miro

Game type: Competitive game

Victory condition: The one who replicates all three patterns first.

Lose condition: Component block ends

Limitations:

- In spite of smooth and easy gameplay no learning experience has been created from this idea.

The table below is a rough analysis considering the learning factor and payer interactions. After this analysis **Idea 3** has been carried forward.

Idea	Learning	Player interactions	Gameplay Easy to understand?
Idea 1 Putting component around the bulb and completing the circuit	Basic fundamentals of conductors and insulators	Only one - Blocking	Yes
Idea 2 Completing the circuits and fixing all the instruments in the home	Power Rule	Multiple - Co-operation Card exchange Interdependent choices	Not much
Idea 3 Collecting target number of electron cards	Fundamental of component role	One type of interaction with two touch points,	Yes
Idea 4 Putting component around the bulb and complete the circuit	Not a much learning	Only one - Blocking	Yes

Iteration 1

To remove the inequality of roles the rule of shifting roles after every turn has been introduced.

Game Objective

Collecting the given amount of electron cards

Electron Cards	Action Cards	Role Play Cards	Requirement Cards
2E	Switch direction	Voltmeter	24
3E	+1 Capacity	Resistor	32
4E		Battery	36
5E		Conductor	48
6E		Capacitor	64
8E			
9E			
12E			

Game components

Roleplay cards: Battery, Resistor, Capacitor, Voltmeter, Bulb

Stack of cards - Mix of electron cards and action cards

Action cards: Switch the direction, 1+ (Now everyone can carry 5 cards)

Minimum Players required:

5 players

How to play:

- At the start target card will be open by one of the players.
- Role cards will be shuffled and distributed amongst the players.
- At the start every player will get 4 electrons
- Battery will start the round every time.
- Players have to pass the role according to their role.

Power of role cards:

Battery - Can pull out new cards from deck

Resistor - Can pass only half of the cards. Eg. If he got 2 electron cards, he will pass only 1 electron.

Capacitor - Save the cards. But if the battery skips the turn then the capacitor has to pass the card.

Conductor: No special power just passing cards

Voltmeter: He has some power to open cards just once. the one who is able to collect the required number of electrons will win the game.

Game type: Competitive game

Victory condition: One who is able to collect the required number of electrons

Lose condition: Electron cards over

Playtesting



Limitations:

- Players have to keep calculating the number of electrons they have.
- There was no game element to strategies on. Players were passing the electron with the lowest number by default.
- The target was the same for everyone so for some players it was unachievable. Whereas Some players were able to complete the target at the start of the game itself.

Iteration 2

To make the targets relative instead of single number target instrument cards with colour codes are introduced in a game.

The gameplay of collecting the target number of electrons is shifted to collecting the desired combination of instrument and electron to remove the calculation load

Instead of an electron with variable numbers, a different colour electron with the same value is introduced. Now players have to strategies on which electron to pass.

Game Objective

Collect as much as combinations of electrons and instruments.

Game components

Roleplay cards: Battery, Resistor, Capacitor, Conductor

Deck of cards - Mix of electron cards and action cards

Action cards: Exchange the instrument card, Exchange steal the electron, Exchange the role

Minimum Players required:

4 players

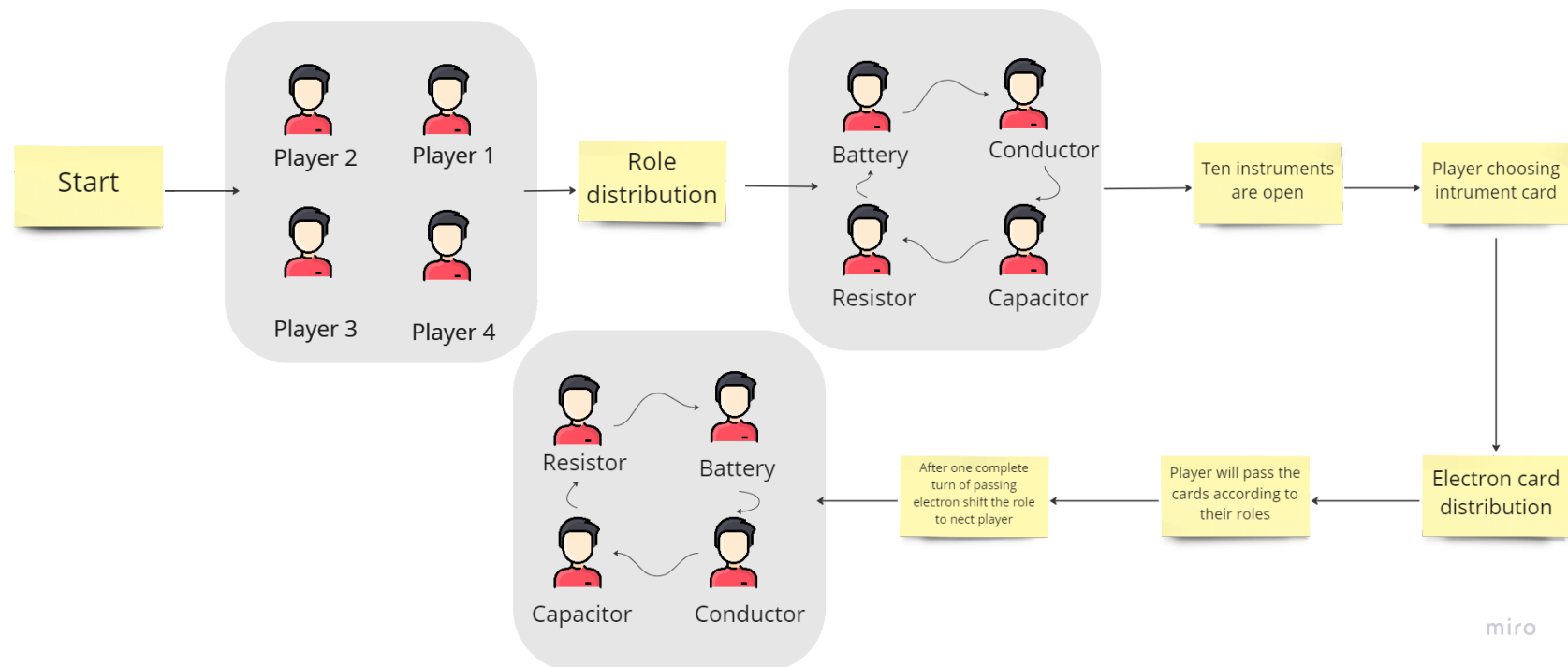
How to play:

- At start role cards will be shuffled and distributed among the players.
- Ten instrument cards will be open, and a player can choose the instrument cards they want
- Every player will get 4 electrons at the start.
- The round will start with the battery. Players suppose to pass the electron as per the role they possess.
- After one turn player has to shift the person to the next in the circuit.
- Whoever is able to complete the match will be battery first. (So that he will get a chance to pull out a new electron first)

Power of role cards:

Battery - Can pull out new cards from deck

Resistor - Cannot pass the card to the next person, Player has to put the one card back in the deck

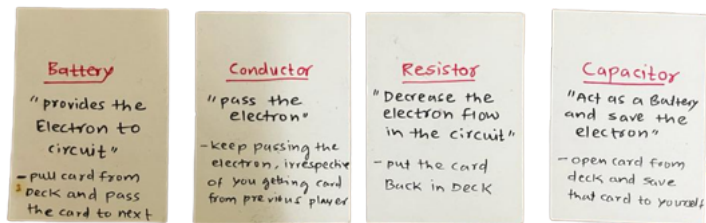


Player can change the game by

Using action cards such as Exchange the electron, steal the

Paper Prototype:

Role Play Cards



Instrument Cards



Electron Cards

electron and Exchange the target instrument card.



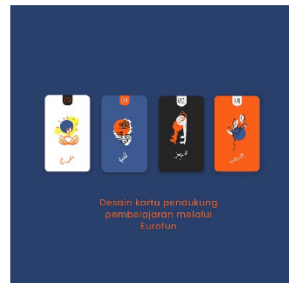
Playtesting



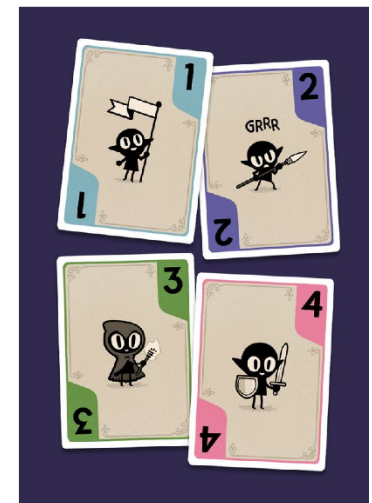
Development

Moodboard

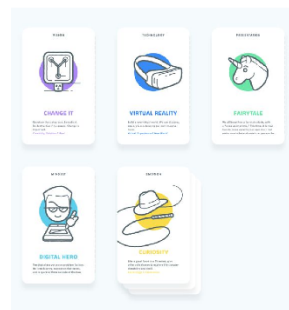
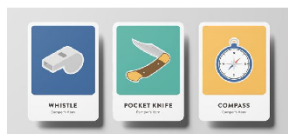
Role Play Cards



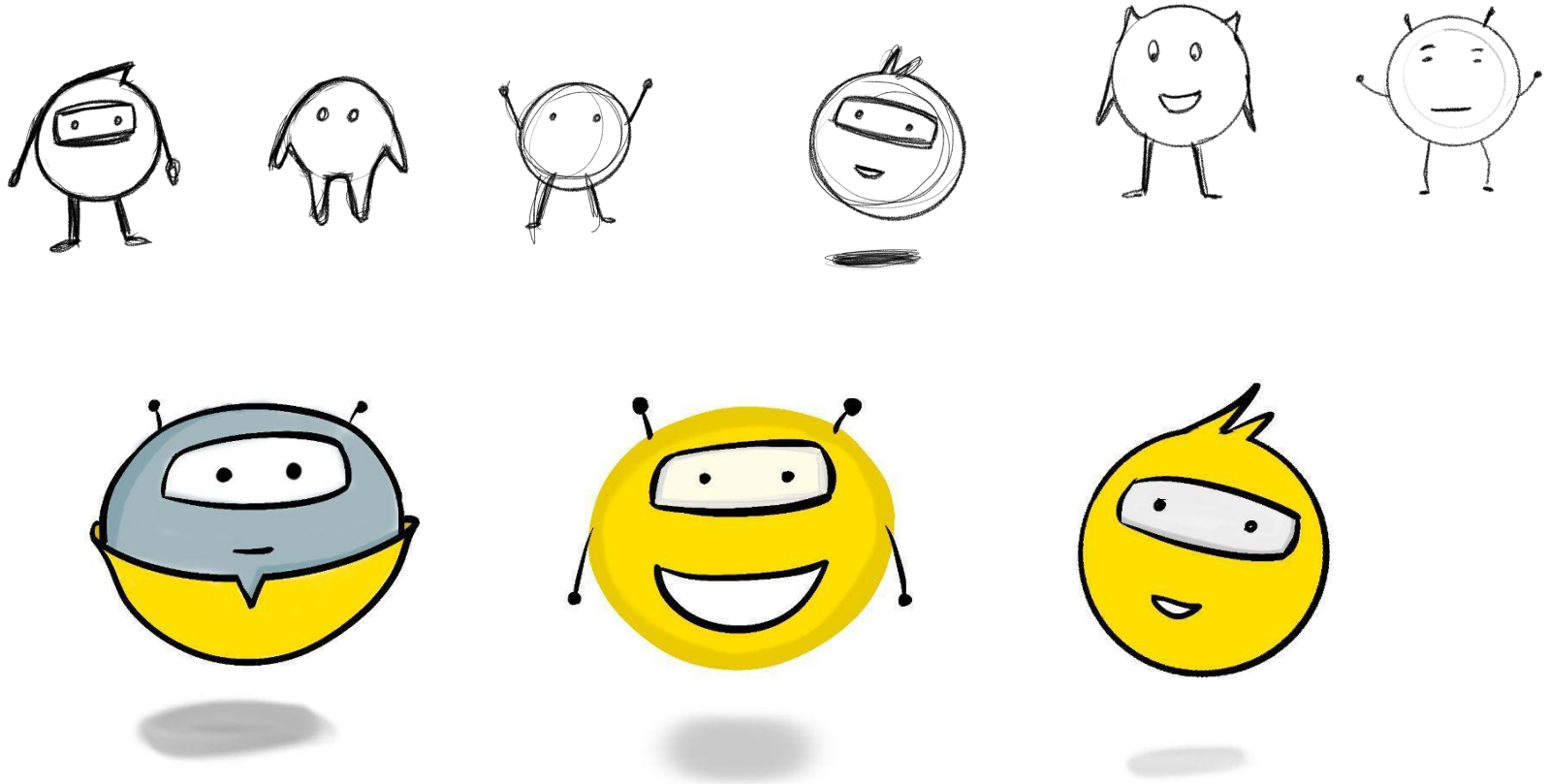
Electron Cards



Instrument cards



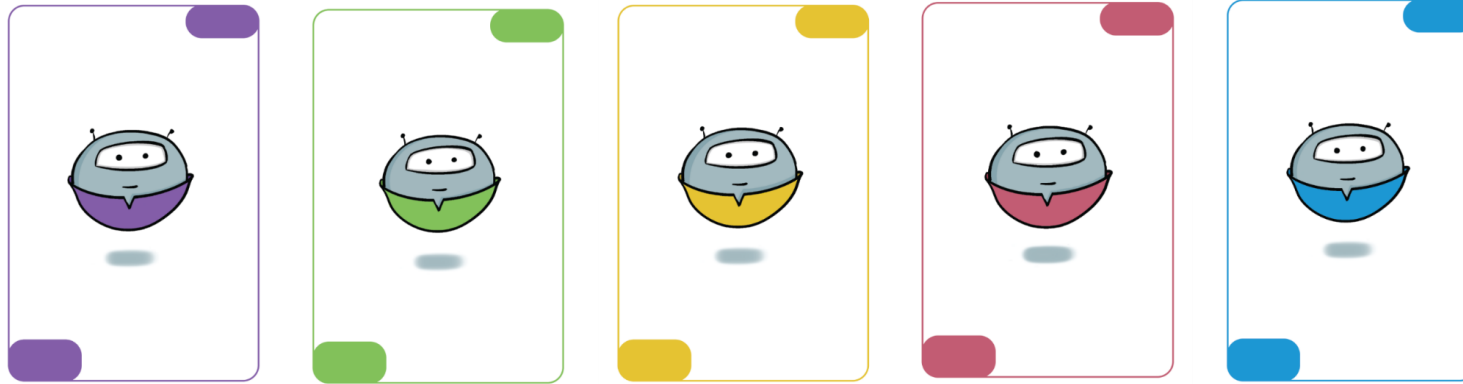
Character exploration for electron



Final Prototype

Electron Cards

Character has been done to Humanize the experience and improve the students engagement with game



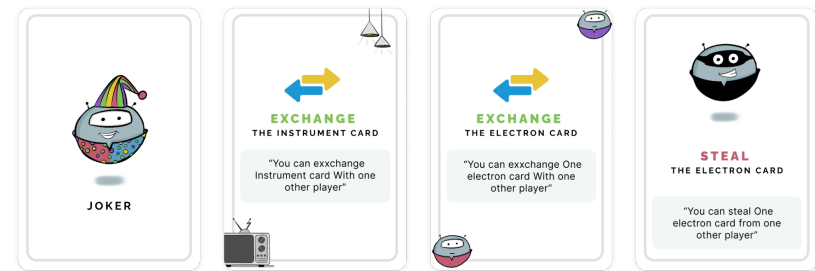
Action cards

Action cards are special cards of a game. There are four types of action cards.

- 1) **Joker:** It can be used as a replacement for any colour card.
- 2) **Exchange Instrument card:** By using this card player can exchange the target instrument cards.

- 3) **Exchange the electrons:** At the time of using this card every player has to open one electron card and the player who is using this action card can exchange the electron card from anyone of them.
- 4) **Steal electron card:** At the time of using this card every player has to open one electron card

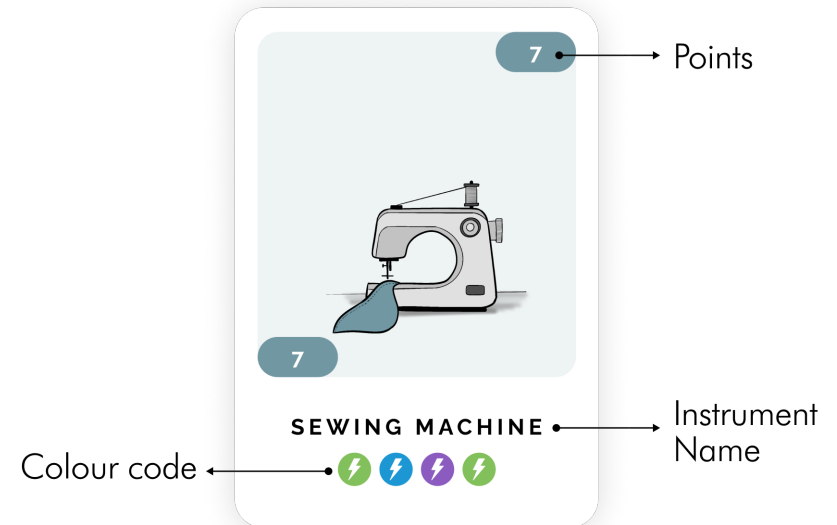
and a player who is using this action card can steal that card from any one of them.

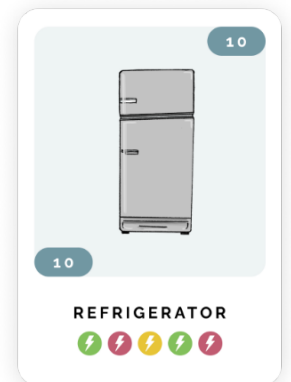
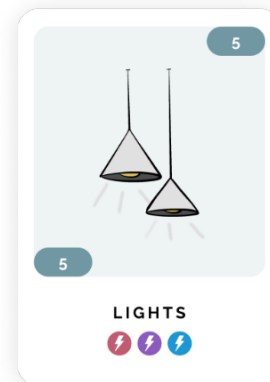
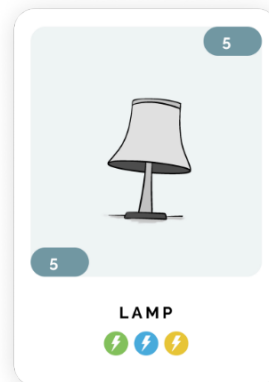
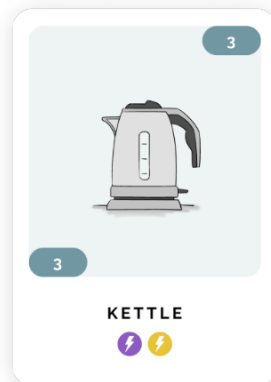
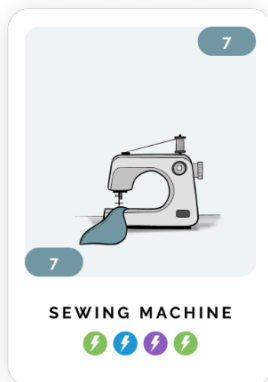
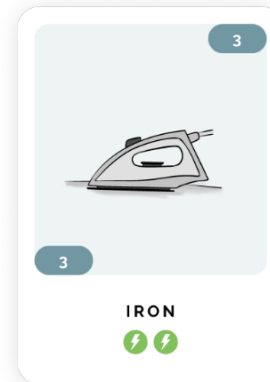
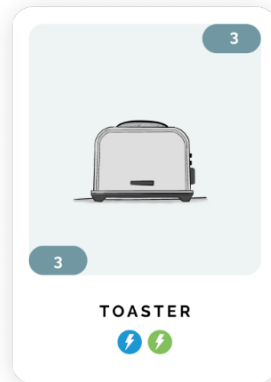


Instrument Card

Total of 10 cards of the instrument has been designed.

A **scoring system** has been introduced for balancing. As the player chose a card with 5 dots on it, it will take more time to complete the match compared to a player who chose a card with 3 dots. But same time playing with 5 dots on it will get more points. In the end, we will calculate how many points the player has earned and the one with the maximum points will win the game.





Rules

Compulsory action

- Pass the card as per the role play card you possess
- After each turn (Every turn starts with the battery and ends with the battery) shift the role to the next person in a clockwise direction.
- action cards will give you one more chance to play. Dont forget to pass the card as per the role you possess after you use action cards.
- Pick up the new instrument card and new four electron cards

Selective action

- You can use the action card at any point of the game. Discard the card after you use the action card.

Game components

Roleplay cards : Battery, Resistor, Capacitor, Conductor

Deck of cards : Mix of electron cards and action cards

Action cards : Exchange the instrument card, Exchange steal the electron, Exchange the role

Power of role cards

Battery - Can pull out new cards from deck

Resistor - Cannot pass the card to the next person, Player has to put the one card back in the deck

Capacitor - The player can keep the card to himself/herself.

Conductor - If a player gets the card from the previous player then pass it otherwise pass the card from yourself.

A player will be strategizing on

- Selection of an instrument card
- Selection of an electron card to pass
- Blocking the cards that other player needs
- Using action cards

How to play

Visit the [link](#) and click to start the video.

Evaluation Plan

I plan to evaluate my game with two different goals i.e Learning goals and player experience goals

Learning Goals:

Students should be able to understand the roles of the components in the circuits

Experience Goals:

Students should be able to experience the role of the components i.e how it feels being the components itself.

Students should engage with the game and have fun while playing the game

Plan

Icebreaking and understanding their conceptual understanding of the components

For the icebreaking I am planning to chitchat with the students and talk about what they learned in science subjects and ask them a few questions about electric circuits.

Explaining the Game

After the ice-breaking session I will explain the game concept and rules to the game to students.

Trial Round

In the trial round students will play a trial game so that they will get clarity about the game mechanics and also I can solve their doubts about the game.

Playtesting

In the playtesting students will play the actual game. Observations will be made on if game mechanics are not easy for children, and if children are really enjoying the game.

Discussion and Feedback

After playtesting a discussion round will be held where we will ask students about their experience playing the game, what they feel is challenging, what they like, most, and whether they enjoy the game. Also, questions about conceptual learning of the role of the components will be asked to check if students really learn something from the game.

Playtesting



Insights from playtesting

The playtesting has been done with 2 different standards. One is with 7th-9th and the other is 5th-6th.

From this, it is observed that

- Students of class 7th-9th were already exposed to instructional content of electric circuits hence they were aware of the function of electric circuit components. Whereas students of class 5th-6th were completely unaware of the electric circuits and for them, it was a learning experience.
- students of class 7th-9th find it a little easy whereas students of class 5th-6th enjoyed it more.

Overall observations from the playtesting

- Shifting of role after every turn is quite confusing for students. Hence there is a need for a facilitator who will be supervising the game.
- When students were playing the game first time had a lot of confusion about the game rules. But when they were playing the second time the confusion was resolved.

Future work

As now the game is strictly four player game with electron rotation clockwise and getting roleplay cards by chance of luck

Future work involves the game with

- Flexibility in a number of players playing the game
- Flexibility in direction of electron card rotation
- Autonomy to choose the roleplay cards

Learnings

- Through this project I just got introduced to game design. Although it creates a theoretical background for me to design the game.
- For this project, As I worked with the Campus school in IIT Bombay, I got a larger perceptive on reality.
- Also, I got an opportunity to collaborate with PhD students.
- This was my first solo project where I was working with real users. Hence it was a good learning experience.

References

Curriculum for students of class 7th - 9th

<https://ncert.nic.in/>

Boardgame Guide <https://boardgamegeek.com/>

Railroad Ink : Electricity expansion pack

<https://boardgamegeek.com/boardgameexpansion/320737/railroad-ink-electricity-expansion-pack>

https://horribleguild.com/product/railroad-ink-eelectricity-expansion-pack/**

Powergrid board game

<https://boardgamegeek.com/boardgame/2651/power-grid>

Do not short circuit : Board game

<https://boardgamegeek.com/boardgame/255290/do-not-short-circuit>

Power Failure Card Game

<https://www.geniusgames.org/products/power-failure-card-game-build-an-energy-empire-stack-blocks-on-the-carbon-tower-hope-they-don't-collapse>

Delight: Educational Board game on current electricity

<https://www.physicslens.com/introducing-delight-an-educational-board-game-on-current-electricity/>

ampedup learning board game

<https://ampeduplearning.com/current-electricity-board-game/>

Physics: Frightful, but fun. Pupils' and teachers' views of physics and physics teaching [Angell C, Guttersrud O,](#)

[Henriksen E, and Isnes A 2004 Physics: Frightful but Fun, Pupils' and Teachers' Views of Physics and Physics Teaching Science Education pp 6](#)