Prakriti: A gamified approach to saving water

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Abstract— Prakriti is a Sanskrit word which signifies mother nature. Our game Prakriti is designed to educate people about how they can save water resources and contribute to freshwater resources. This is a multiplayer game designed to set a thrilling, challenging and dramatic effect on the players. The game consists of its formal and dramatic elements. We design the game in Unity 2D and every move is created to provide information about water-saving to the players. We playtest the game with many players and updated the game in three iterations. This feedback gives us a direction to improve the quality of the game. The game was assessed with many strong qualities such as a good aesthetic quality, good user interaction and supportive of providing information about saving water resources, and players also stated that this medium of learning about water resources through gaming was very satisfactory).

Index Terms— Interactive Learning, UN sustainability Goals, Water Resource Management, Playtesting

1 INTRODUCTION

Earth comprises 71% water in which only 3 % of freshwater. In that 3% of fresh water, only 1.5% of freshwater is accessible to the human being, rest is stored in the form of ice on the glaciers or mountain cap [1]. More than half a billion people face water crisis every year throughout the world [2]. Therefore, to bring a panacea to the globe, people should be aware of how to use and save water for their future. Today, hydrology and water management become a significant part of research as water depletion has taken a devastating form. The recent trend illustrates that we should incorporate interdisciplinary research to bring a panacea in today’s water scarcity problem. We can approach this problem by:

1. Making people aware of the interaction between man and nature
2. Through technical skills, design entertainments that will engage people and teach them about how to minimize water consumption.

With the progress in science and technology, we believe it is possible to make people aware of the water depletion and iceberg melt in the poles. Since 1967, the link between social science and water resource education has been a prime highlight. The main motivations of this paper mentioned as follows:

Motivation1: Build an interesting game that will attract and engage players.

Motivation2: Bring awareness among the players on water consumption through the game.

Motivation3: Introduce dramatic elements and formal elements of the game to increase the degree of competition and challenge.

As the consciousness started growing, interdisciplinary approach in understanding the relationship between water and society and in developing water policy led to the establishment of the concept of Integrated Water Resources Management (IWRM). The emergence of the concept of sustainable development in the same period reinforced the call for interdisciplinary approaches in teaching. In practice, interdisciplinary research slowed down due to the traditional form of teaching. Most of the countries put the concept of water management as a part of Geography or civil engineering. This results in the ignorance of people about water consumption [3].

The paper aims to create a game that will support sustainable development goals, teach people about water conservation and at the same time become fun and entertaining. The game supports the following UN sustainability goals [4]:

1. Good health and well-being: Avoid waterborne diseases
2. Clean water and sanitation: Distribution of accessible water
3. Affordable clean energy: water electricity
4. Sustainable cities and communities: Purifies water pollution
5. Climate action: Affordable and scalable solution
6. Life below water: Conscious management of water resource
7. Life in the land: Encourages afforestation

We discuss the literature review in the next section.

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Please note that all acknowledgments should be placed at the end of the paper, before the bibliography (note that corresponding authorship is not noted in affiliation box, but in acknowledgment section).
2 Literature Review

2.1 Electronic Games to reduce water consumption

Fraternali, Piero, et al represents a derived study that represents how people compare their actual water consumption with that of forecasted water usage through a board game. Unlike Water-wise, this game derives from a game "Push your luck". The game comprises of one protagonist and one antagonist. The whole game revolves around drawing cards continuously until they meet the risk condition. This game uses scanning the QR code in the monster card with a smart mobile device. If the player answers the questions correctly, the negative points on the monster card turn into positive ones. This whole scene takes place on the cloud. Whereas, Water-wise is a simple board game with a board with lots of concentric circles, four players, chores written on the tile and cards that boost the player’s score. This game teaches water consumption in every move of the players. It creates a challenge as well as competition among the players to go to the end and select the correct card to gain more water units [4].

Albertarelli, Spartaco, et al. discusses the game Drop which is created by SmartH2O research consortium. The motto of the game is to save water. This technique compares the data collected by smartH2O and compares that data with the daily usage of the people in the town. This game is based on machine learning techniques. The game predicts ideal water usage and teaches people how they can reduce water consumption to save water. But the difference between our game and this game lies in the technique. Our game involves several ways to reduce water consumption by not negatively affecting our personal and social life. Along with that water-wise is more user interactive. The players learn ways to save water while playing the game. The players don't need to get information about what is the predicted water usage for them. This game does not include cloud computing platforms and machine learning approaches. It is thrilling, educating and engaging for the players [5].

Hoekstra, Arjen Ysbert depicts the role of an interdisciplinary approach to bring panacea in environmental control. This paper is about two games; The River basin and The Globalization of Water role Play. Both these games represent different aspects of the water-saving approach. The first game experiences the user the risk of over-abstraction of water in the river basin and how that affects the person, society and the mutual interest among people. The second game makes the players familiar with the global dimension of water management. These two games let the players think critically about how they can develop good cooperative actions to save the water cycle and freshwater resource of the earth. Water-wise is designed so that players can learn about how they can contribute to less water consumption. This game does not consider the theoretical approach. It is the practical study of how they can gain maximum water units and save their initial water units to win the game [6].

Cheng, Ping-Han, et al. talks about Water Resource Adoption (WRA) and the importance of promoting it worldwide. It emphasizes cross-cultural education, responsibility for managing the water resource, maintaining the public benefit and empathy and negotiating thinking. The board game named Water Ark enhances the participant's knowledge about water resource management. The participants here are grouped into government, agriculture, industry, and public sector and playing the role of a water resource-related organization. This game teaches the players to be altruistic and work for public benefits. Whereas Prakriti does not approach in this way. It includes pawns to represent players and also it teaches what can cause water resource depletion and what can reduce water consumption [7].

2.2 Traditional Board Games to reduce water consumption

Treher, Elizabeth N Tells that board games have been used in corporate settings for about ten years but are not yet in broad use. In general, the true value and impact of board games designed for learning are unrecognized by most people. This paper presents some of the myths, specific solutions, and current research showing the power of certain types of board games to facilitate rapid learning and retention and the impact of "Pay for Performance." Board games are an important tool to provide hands-on and heads-on skill and knowledge development for people of all ages on all subjects. Not only do well-designed games create an engaging atmosphere, but they also provide a non-threatening, playful, yet competitive environment in which to focus on content and reinforce and apply to learn. Mistakes are useful and point out what we need to learn. The board itself provides a visual metaphor to help connect information. Game elements, discussions, and problem-solving with fellow team members about the content are vehicles for learning. Subtle redundancy to reinforce learning and ensure retention should be incorporated into the game design. Good questions, problems to solve, and situations to consider allowing players to think through and apply what they learn. Board games provide exceptional, cost-effective resources. They can incorporate heads- and hands-on learning, summarize and reinforce important information in an easy-to-grasp format, reduce the time needed to learn, remember, and apply new information and promote discussion, collaboration, and build communication. Our Prakriti committed to helping players save water and save nature. We follow the basic concepts of learning from board games. The game gives players a playful, happy environment, and use game elements to teach players good and bad activities for saving nature [8].

2.3 Tabletop and Shared Display Games

Whalen, Tara. Says tabletop displays allow people to sit around a shared display, facilitating group work. One advantage of tabletop displays is their support for face-to-face collaboration: with traditional computer monitors, people must sit shoulder-to-shoulder to view the display. There are many aspects of tabletop displays to which board game designs can be applied. These can be grouped as follows: recognizability of graphical objects
under various orientations; accessibility of display for interaction; demarcation of individual and shared space; and creation of public and private display areas. Board games designers achieve this by:
- Combining Orientations
- Minimizing Use of Strongly Oriented Objects
- Distinguishing Objects

This early pilot study suggests that rotating a display is not desirable for tasks performed concurrently and may not be optimal even for tasks performed serially. A major open question that remains is whether one solution re-designing layouts to be more orientation independent is truly an effective approach. Furthermore, the displays for these tasks must be chosen so that there can be a means of comparison between different design approaches used for tabletop interfaces.

We implemented Water-Wise in a shared display. The game can be easily played on one screen, every player shares the display and learns from the game together. It is a good way to express the thinking of saving nature to players. Xu, Yan, et al describes the features of the game:
- Chores - interactions arising from activities needed to maintain or update the game state
- Reflection on gameplay - reacting to or reflecting on gameplay after a move
- Strategies - discussion play before a move
- Out-of-game - talking about topics outside of the game

The game itself - commenting on the game as an artifact
- Social interactions involved in "chores" emerge as an interesting type with a variety of related behaviors.
- "Chores" refer to the work necessary to make the play happen in these non-digital games. Players need to update and maintain the game status manually, taking care of rule enforcement and other forms of bookkeeping.

In our Prakriti, we focus on helping players understanding saving nature. We set many kinds of virtual events for players to explain good and bad activities for saving the environment. Also, we set the countdown to let players save time.

2.4 Mobile Games

Horn, Michael S., et al says the purpose of this study is to implement a popular board game Turn Up the Heat incorporates a tablet computer app. The game playfully confronts power dynamics associated with the use of residential thermostats to control heating and cooling systems. The tablet computer app simulates a household heating and cooling system and gives all players (parents and children alike) the opportunity to adjust a thermostat on their turn.

Banerjee, Amartya, Michael S. Horn, and Pryce Davis tried to design a board game to encourage families to face largely energy usage problems playfully in their daily family practice and create opportunities for informal inter-generational learning around sustainability issues in [12]. Energy monsters go through a repetitive process in which many prototypes are developed and tested. They have listed two versions of the game for families to test at home. Both versions of the game contain traditional tangible elements, such as cards, tokens, and tiles that make up the game board. In the second design, however, they used the iPad app as an integral feature of play. The problem showed in this paper tends to solve is not how to best provide ecological feedback for individual consumers. The research group has completely solved this problem. Instead, they have more interested in using playful games as a way to begin to reshape, reconfigure or generate energy consumption practices across families, children, and adolescents.

Grammenos, Dimitris, Anthony Savidis, and Constantine Stephanidis. First introduces the concept, background information and related methods of computer and game accessibility. Then the software implementation is introduced. Finally, this paper discusses how UA chess supports the accessibility of different user categories through the game interface, adaptability and available input and output modes. This paper discusses the development of a general multi-players board game with some key features. The best future vision is that through these games, people will be able to enjoy fun and basically have equal competition, meanwhile interacting with each other easily and effectively, regardless of personal abilities, skills and preferences. Besides, this effort can make some primitive forms of "physics" games inaccessible to several groups of disabled people (for example, "real" chess games).

Harteveld, Casper, and Rafael Bidarra. describes an inspiring field of research and game development, which has received great attention from the media all over the world. Most serious games focus on learning and training in education. In contrast, few studies have focused on how games promote learning in professional settings. To mind the gap in this direction, the authors studied the usage of games for learning in a professional environment. This is done by looking at the design and learning experience of a dike patrol game called dike patrol. Based on this case study, they found six valuable learning lessons which are the game needs to be a whole, as a discussion support tool, simplify and emphasize all aspects of the reality, and require a complementary learning style, which is the motivation enhancer for those who are interested and needs to change the course.

Rajabu, Kossa RM discusses about Rufiji River in Tanzania has faced difficulties in water usage and protection at the local level. RBG (River basin game) has been created to help water users to know water knowledge and situation in their practice. This essay showed how RBG worked in the Mkoji sub-catchment (MSC). MSC in this test worked three days and have an analysis of water usage and management. This article gave a conclusion of RBG as a powerful tool to increase people’s awareness and behavior. At the same time, people should understand water saving is a social manner.

Meinzen-Dick, Ruth, et al says it is important for people to pay attention on environmental protection problem. However, the lack of knowledge of farmers make it difficult to collect more surface water in some areas. The writers realized this problem and try to design a game to increase social learning. The statement of this article is to design a behavioral game as a guidance to help local peo-
ple have a social learning on increasing understanding and significance of groundwater in India and Andhra Pradesh. In the literature review, it will include three main concepts: the research results, methodology and the effects of the game which is alike from our game [16].

De Luca, Vanessa, and Roberta Castri spreads information about energy consumption can be integrated into our daily life patterns. It is a promising challenge for interaction designers in today’s world. To help users visualize their home energy performance and to help control the consumption of energy, Home Energy Management displays real-time usage, cost, and data analysis. Various studies have been performed to explore which factors influence and motivate users to save energy. The method that has proven to be the most effective in reducing energy consumption at home is Feedback Mechanism. Previous research has proved that energy consumption can be controlled if these habits are more visible to the user and they are presented in a friendly manner. One of the first ways of providing a visual insight is an in-home display. Energy providing companies have recently discovered that social competition and feedback rewards can be two major driving forces in encouraging people to participate in energy consumption. Therefore, local energy service companies such as "OPower" and "MyEnergy" in the USA, have started promoting energy saving through social comparison. It has come to their knowledge that social feedback can lead up energy savings ranging from 11% to 36.5%. Interaction design and communication design can be applied to enhance feedback and commence a process through which new technologies and portable media can contribute to and become an integral part of the way people live. An analytical tool and self-monitoring feature is being merged with social media through mobile applications. This not only sparks users' interest but also suits utilities, local operators and telecommunication strategies. Mobile games and interactive social media combined are creating opportunities for an action-oriented and participative approach to involve the end-user. Considering that the users make decisions according to their concern and environmental awareness in conjunction with the belief that their actions shall be beneficial and effective making this aspect of utmost importance. The design strategy focuses on giving the users a tangible experience to make the players make changes for real. The game is a continuous parallel system that tracks the energy consumption of households. The players must choose between two groups, namely, Yellow or Blue. Competition is sparked in the game between the two factions through constant comparison.

Contributions can be made by the players to their factions and society in the three following ways:
1. Saving energy: the closer players get to 48kWh a day, the more experience points they add to their faction.
2. Play collaboratively: creating/discovering energy 'hives' and mapping them on the shared map as a point of interest (POI).
3. Cooperating with the community and friends by completing missions.

Our game does not implement energy-saving behaviors for sharing and does not track the water-consumption of the users. [17].

Recent History of Computer Game
Bang, Magnus, Anton Gustafsson, and Cecilia Katzeff. Discusses that for the past two decades, computer games have been used as educational tools. However, researchers have had their doubts about whether students can use that knowledge and apply it in their day-to-day life. They believe that traditional games such as interactive games have resulted in shallow learning. Furthermore, they believe that interactive games have failed to convey the deeper meaning and the underlying learning models. Due to these problems, researchers have particularly emphasized the importance of authentic and relevant real-world tasks in learning, social aspects of education, mediation skill through peer interactions. Researchers have stated that when their learning technique was based on real-world tasks and previous experiences, students were able to actively participate and retain knowledge.

The major difference between pervasive games and traditional simulations is the extension of the gaming experience brought to the physical world. Hence, the developers don't need to build a game world. Instead, we can adapt to the real-world environment and objects into the game (augmented reality). Usually, the games make use of technologies such as ad-hoc computing networks and satellite positioning to link the devices together and track them along with the users in a physical environment. Pervasive games are trying to incorporate the virtual game world into our everyday physical spaces. Pervasive learning games extend the game world into the real world. However, ours is a board game so it doesn't implement a game world but equally tries to implement changes into the day-to-day life of the players [18].

De Luca, Vanessa, and Roberta Castri expresses that in recent years, to raise awareness especially in the younger population regarding environmental issues and to stimulate pro-environmental behavior, designers have come up with various games that incorporate our daily life choices and crisis. We sincerely hope that our game not only targets the younger crowd but a larger demographic since ours is a board game along with a software version. Examples of these include energy management simulations, multiplayer pervasive games, etc. Some games require visualizations of data relating to energy consumption such as charts and gauges. Design choices for the game get dominated by game-specific requirements. [19].

3 DESIGN DOCUMENT:
The design document comprises of 3 subsections. We describe the subsections below:

3.1 Wireframe
We design the wireframe as follows:
Figure 1 describes the board. On the board, the players, dice and the chores are the formal elements. Whereas the cards contribute to the dramatic elements. The game is a 2 to 4 player's game. The game assigns 25 units of water to each of the players in the beginning. We design the procedure of the game below:

I. The game starts with the players rolling the dice; if the die rolls to an even number, the player starts the game by placing the pawn on the nearest START tile.

II. Then the die's role determines the patient's movement.

III. Next, the tile they land on due to the die movement decides their score. If they land on the chore, their initial water unit reduces as specified in the tile and if they land on cards, they may lose water, gain water or jump into the inner circle.

IV. Each player should reach the end ultimately.

We define the pseudo code of the game below:

```
Initialize position, score, winner, timer

setting position()
while winner==0 and timer>0
  switch player()
  rollthedice()
  moveplayer()
  if jump=true
    jumpto()
  else if score=true
    getscore()
  else if card=true
    pickcard()
  if player .position==end .position
    winner=1
end while
if winner ==0
  highestscore.=winner
```

3.2 Conceptual Model

The conceptual model provides a detailed diagrammatic view of each move of a player in the game. Figure 2 to Figure 8 illustrates the player movement in the game from beginning to the end. Two players will enter their field of play that is represented as a circular path (concentric circles). They begin on the outer circle, each player at a different location and travel in a clockwise direction, and once they have completed a circle, they enter the next outer most circle and so on until the reach the innermost circle. The player who has the maximum number of water units saved when they reach the center is the winner.

Figure 2: First move
3.3 Software Requirements:
To execute this project, we incorporate the following software:
The software development process uses the Rapid Application Development (RAD) method [20]. We rapidly develop each phase of the game and deliver the final product iteratively. Figure 9 depicts the software development flow of the game.

Next, we discuss the algorithm of the game.

3.4 Algorithm of the game:

The game is implemented by Unity 2D, it includes multiple game objects and four C# scripts, which are Dice.cs, GameControl.cs, pick_card.cs and FollowThePath.cs and the details of these methods are as follows:

Game Objects: There are 1 dice, 4 players, 12 cards, a game board and 49 way_points which allows the player to move through them. Besides, there are multiple text objects to display the corresponding information for players.

Dice.cs: embedded in the game object "dice", it includes 3 functions, Start(), OnMouseDown() and RollTheDice(), respectively.

Start(): Call once when the game starts, it initializes the status of the dice. Includes 4 players and the initial dice image.

OnMouseDown(): call once on each mouse clicking. Call RollTheDice() when the game is not over and roll_dice is allowed.

RollTheDice(): 1, randomly shows the image of the dice side 20 times from 1 to 6 and has a yield time 0.5 seconds, then get the last number we get from the loop as the dice number. 2, the function is also responsible to switch player turn from 1 to 4 after each dice roll.

GameControl.cs: control the whole game operation, it includes Start(), Update() and MovePlayer().

Start(): Call once only when the game starts, Initialize the status of 4 players objects and their start positions, scores.

Update(): Call once per frame, it checks if the player is allowed to move and call move() when it is true and call events when it is false.

Move(): Once it gets the dice roll number from dice.cs, the function lets the player move to the next way_point, then minus the roll number by 1 until the roll number is 0.

Events(): Once the dice roll number is 0, the function checks which event will occur in this position for the player. In this game, there are three kinds of events, pick a card, jump to some position or get a score. The function will call pick_card(), jump_to() or get_score() respectively by the position record.

Pick_card(): move the layers of cards and background on the top of the screen, then randomly generate a number to indicate which card the player picked and call pick_card.cs, then calculate the score and display changes.

Jump_to(): transform the active player to a specific position.

Get_score(): calculate the score changes which is shown on the game board and display.

Text display: after each dice roll (import the parameter from dice.cs), the turn will go to the next player, then the next turn prompter will be displayed and remind the players

When there is any player in the 49th way_points object, the winner check will find that player as the winner. Besides, if the countdown goes 0 before anyone wins, it will find the player who has the highest score (calculated in FollowThePath.cs) as the winner.

When the rest dice number is 0 (calculated in FollowThePath.cs), the code is responsible to record the position of the active player and switch to the next player's turn.

MovePlayer(): this function is responsible to check if the player is allowed to move.

FollowThePath.cs: embedded in every player object, it manages the players move and events trigger, it includes Start(), Update(), Move(), events(), pick_card(), jump_to() and get_score();

Start(): Call once only when the game starts, Initialize the status of 4 players objects and their start positions, scores.

Update(): Call once per frame, it checks if the player is allowed to move and call move() when it is true and call events when it is false.

Move(): Once it gets the dice roll number from dice.cs, the function lets the player move to the next way_point, then minus the roll number by 1 until the roll number is 0.

Events(): Once the dice roll number is 0, the function checks which event will occur in this position for the player. In this game, there are three kinds of events, pick a card, jump to some position or get a score. The function will call pick_card(), jump_to() or get_score() respectively by the position record.

Pick_card(): move the layers of cards and background on the top of the screen, then randomly generate a number to indicate which card the player picked and call pick_card.cs, then calculate the score and display changes.

Jump_to(): transform the active player to a specific position.

Get_score(): calculate the score changes which is shown on the game board and display.
player is on the "pick a card" position (check by Events() from FollowThePath.cs).

Start(): Call once only when the game starts, it initializes the card images, 4 players and the card’s content text.

OnMouseDown(): call once on each mouse clicking. It will call flip card() when the game is not over and flip_card is unfinished.

Flipcard(): it switches the clicked card image to the front side, then gets the number from pick_card() in FollowThePath.cs. After that, the function shows the card content on the card image and give a two seconds yield time.

4 Evaluations/Results:

The aim of developing the game water-wise is to spread social awareness as well as make the game enigmatic, fun and engaging. Therefore, to playtest our game, we arrange a few playtesting sessions. After each of these playtesting sessions, we collected the playtesting data from each player. We prepared a series of questions in order to understand the demographic as well as the experiences of each player.

4.1 Evaluation methods:

To evaluate the game, we used both co-discovery and remote testing methods. In a co-discovery method, 2 to 3 players playtest the game simultaneously. Each of them figures out the rules, procedures of the game together and share their experiences. Whereas in a remote testing method a player remotely playtests the game and submit their feedback. We adopt both methods to find out the following impressions.

1. The level of difficulty for the game
2. The level of difficulty to understand the rules and procedures of the game.
3. The magnetic power of the game.

Next, we proceed further by providing the pre and post questionnaire.

4.2 Pre Questionnaire:

We incorporate pre-questionnaires to find the basic background of the players. These questions include age, sex, gender marital status, awareness, education level, etc. To broadcast the detailed view, we represent the data in Table 1.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>15-21</td>
<td>Most of the play testers are students</td>
</tr>
<tr>
<td>Sex</td>
<td>Male-24</td>
<td>Most of the play testers</td>
</tr>
</tbody>
</table>

Table 1: Results of pre-Questionnaire

Once we collect the data for the background of the play testers, we move forward and prepare another set of post questionnaire for the play testers.

4.3 Post Questionnaire:

Post questionnaires are designed to evaluate the player’s experience once they finish their playtesting session. As we take the Rapid Application Development model approach to develop the software, we incorporate the post questionnaires after each iteration of the development procedure. These questions include interrogations about the complexity of the game, the game rules, the difficulty level of the game, the material of the game, the techniques of the player’s move, the player interaction, etc. It becomes easier to modify the game based on the feedback after each iteration. We mention some of the feedbacks for 3 iterations in Tables 2.

<table>
<thead>
<tr>
<th>Question</th>
<th>Feedback Iteration 1</th>
<th>Feedback Iteration 2</th>
<th>Feedback Iteration 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexity</td>
<td>3</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Game Design</td>
<td>7</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Game Rules</td>
<td>4</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Uniqueness</td>
<td>9</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>X factor</td>
<td>6</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>
Table 2: Results of post-Questionnaire (Iteration1); Score (scale:1-10)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>7</th>
<th>7</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Board Design and rules</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 2 evaluates each aspect of the game in different iterations. It can be seen that with each iteration the game design, board design, the x-factor and the other elements of the board game is taking a better shape. Sometimes, a few aspects were reviewed as poor than before, but in the next iteration we try to resolve the issue and make it better.

4.4 Feedbacks:

We prudently review and work on each of the reviews we get from the playtesters after each iteration of the playtesting session. We try different testing methods like the think-aloud method, co-discovery method, coach method to evaluate the game from every possible dynamic. Table 3, 4 and 5 depict the feedback after each iteration.

<table>
<thead>
<tr>
<th>Positive</th>
<th>Negative</th>
<th>Interrogation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Concept was good</td>
<td>1. Incomplete storyboard</td>
<td>1. Challenges</td>
</tr>
<tr>
<td>2. Unique concept</td>
<td>2. Card description absent</td>
<td>2. The functions of cards</td>
</tr>
<tr>
<td>3. Local level of social awareness</td>
<td>3. End of the game not specified</td>
<td>3. How tiles can be named</td>
</tr>
<tr>
<td>4. The design has uniqueness</td>
<td>4. Tiles need to be designed properly</td>
<td>4. What stands for chores</td>
</tr>
</tbody>
</table>

Table 3: Feedback from iteration 1

The positive and negative feedbacks help us to consider software prototype repeatedly and the questions help us to build stronger directions, rules, and procedures for the game.

We collected two-gallery walks as feedback. At least 30 people played and tested the game. We describe the feedback below:

<table>
<thead>
<tr>
<th>Positive</th>
<th>Negative</th>
<th>Interrogation (User Questions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The game is unique</td>
<td>Can we increase the number of players?</td>
<td></td>
</tr>
</tbody>
</table>

Table 4: Feedback from iteration 2

<table>
<thead>
<tr>
<th>Positive</th>
<th>Negative</th>
<th>Interrogation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The game taught us &quot;water consumption&quot; today is extremely essential</td>
<td>1. More interaction between the player and the computer should be included</td>
<td>1. What are the challenges you faced while designing this game?</td>
</tr>
<tr>
<td>2. Unique concept</td>
<td>2. Please reduce the difficulty level</td>
<td>2. Are you going to implement different levels of the game?</td>
</tr>
<tr>
<td>3. The cards are fun; they can act as magic to let you win the game</td>
<td>3. Sometimes, it is difficult to reach to the end</td>
<td>3. Why some tiles are kept empty?</td>
</tr>
<tr>
<td>4. The chores are scary; they can be a big challenge for winning the game</td>
<td>4. The design has uniqueness</td>
<td>4. What stands for chores</td>
</tr>
</tbody>
</table>

Table 5: Feedback from iteration 3

Figure 9, 10, 11 and 12 provide the screenshots of the final game.
3 CONCLUSION:

Water-wise is designed for educational purposes. This game teaches how human beings can be socially aware and save water. The board design, formal and dramatic elements of the game brings the X-factor, aesthetic and kinesthetic in the overall game. The challenge to enter into the next circle and reach to the end brings tension as well as challenges among the players. In the end, the players figure out, how they can manage their chores and contribute to saving the freshwater. Through an iterative redesign process, we incrementally improved the quality, complexity, game design, uniqueness, and aesthetics of the game. We feel that this indicates a game with strong support of user interaction and a dynamics game that gives players a feel of the realm of the game and that they are in control of their outcomes in the game.

5 REFERENCES


