

Seminar paper

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Investigation of the possibilities for the creation of an online concept for the use of the serious game EDIPS2

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1 Introduction (Henning Meyer)

Today's world is without question constantly changing and especially for companies there are always certain dangers. Those who want to survive in the present time must always draw attention to themselves with new and innovative concepts. Product-Service Systems (PSS) combine the products with the service and therefore forms the basis for a new business model. In order to make the concept of a PSS provider clear, the Department of System Design at Tokyo Metropolitan University has developed an educational business game called EDIPS: Edutainment for Designing Integrated Product-Service System.

Board games are a welcome change in everyday life for many people, you can get together with family and friends and have a good time. Most people know the classic games like "Monopoly" or "Scrabble", but if you ask them about educational games or more specific business games, the list gets shorter and shorter. This is not surprising, since these types of games are primarily used for learning new knowledge, concepts, or skillsets. Games like chess are meant to train strategic thinking, business games are meant to teach an important concept or improve teamwork in a playful way. The game EDIPS introduces you to the concepts of the product-service systems.

The aim of this project work is to deliver a concept to transfer the analogue board game EDIPS into the digital world. Even if the aspect of social interaction suffers from a digital game, the demand for digital board games has risen sharply, especially in recent years. A combination of different programs can make the wish of a computer version of the desired board game possible, even with simple means and without deeper knowledge in programming languages or game design. EDIPS is no exception and can be converted into a digitally playable version using existing software. The use of free software is an important part of this and should be made accessible to everyone. The programs used for this work are therefore all freely accessible or are available to us as students of the University of Applied Sciences Würzburg Schweinfurt for free use.

2 Critical literature review (Henning Meyer)

Globalization is just one of the factors why a digital version of serious games makes sense, companies are becoming more and more global and in order to teach critical concepts even in such global communities, the use of a computer-based version of EDIPS makes perfect sense. The primary purpose of this literature review is to assess the process and the literature used for it and to pave our way to the final variant using this literature.

For this purpose, the review follows a clear thread, as we also used it within our project to get structure and a clearly defined procedure. In the first step, we gathered general information about the game EDIPS, what kind of studies have already been done about this business game and how do these studies influence our project. Afterward, general information about digital board games could be obtained. The limitation to free software was another major research challenge. A lot of time was invested in finding appropriate programs and tools. In the end, we went through several methods and models to solve our problems for methodology and data analysis.

2.1 General studies about EDIPS

The Department of System Design at Tokyo Metropolitan University has conducted some studies with the game EDIPS to investigate the effectiveness of EDIPS for learning the product-service system design. For the study, twenty-one students and two engineers were given a pre-test and a post-test to answer after playing games with EDIPS. According to the study, it was found that almost every participant was able to achieve a learning effect. “The score changes shown [...] indicate that EDIPS has specific leaning effects, as the post-test largely had higher scoring results than did the pre-test” (Yamamoto 2014). Even though this conclusion sounds very positive, in detail the results are actually more complex and diverse. The tests are made up of 16 intellectual skills, which the test takers were asked to rate with a value from 1 to 12.

Intellectual skills	
(1)	Utilizing one's own manufacturing and selling abilities fully to obtain high profits with limited time and resources
(2)	Entering different product fields to enhance the robustness of product offering
(3)	Advancing standards of products to enhance their value
(4)	Developing services to launch them to the market
(5)	Offering services to products to construct a PSS
(6)	Entering different product areas to enhance the robustness of service offerings
(7)	Offering services considering their compatibility with products to increase profits
(8)	Offering a PSS by combining products and services to enhance the value of products
(9)	Offering one's own services in combination with one's own products to increase competitiveness of the services
(10)	Offering one's own services in combination with an alliance partner's products to increase competitiveness of the services
(11)	Considering the circumstances of other companies to smoothly establish an alliance
(12)	Building a product reuse system to enhance efficiency of the product offering
(13)	Formulating strategies by considering market trends to increase the price of products
(14)	Formulating strategies while considering contingencies to gain steady profits
(15)	Understanding product life cycles to formulate appropriate sales strategies
(16)	Formulating strategies by considering reduction of environmental burdens to keep one's own societal value

Figure 2.1

Each skill reflects a specific aspect of EDIPS. In the study, it was found that after playing EDIPS the participants improved the intellectual skills 7 and 13 well, however, there were only small learning successes for skills 2,3,9 and 14. In order to guarantee a better learning success for skills 2 and 3, the authors give a direct suggestion: „To enhance the learning effects for intellectual skills (2) and (3), a more concrete explanation about the relationship between components, rules, and real business should be given to players before or after using this game. This would prompt players to associate real business with the game playing.” (Uei et al. 2014).

Just as important as the learning factor in a business game is the fun factor for participants. To validate the value, the Department of System Design at Tokyo Metropolitan University conducted a survey of a workshop that played a few rounds of EDIPS. In this survey, all participants gave positive feedback to the question "Did you enjoy playing EDIPS?" answered (Compare: EDIPS: Effective and Enjoyable Product-Service System Design Education Through Active Thinking (Uei et al. 2014)).

The papers about EDIPS published by the Department of System Design at Tokyo Metropolitan University and the studies discussed therein provide information on the general usefulness of the game. Even though the results shown were often positive, the authors always pointed out weaknesses and often included suggestions for solutions. Nevertheless, all studies have only been conducted by the Department of System Design at Tokyo Metropolitan University and therefore cannot be compared and validated with other independent studies.

However, the survey studies show a significant improvement in understanding of product-service system design therefore, the board game EDIPS definitely serving its purpose. EDIPS is, besides "Battleship", the only serious business game designed to teach the concept of PSS (Product-Service System) design. „Battleship is a game based on a gamestorming approach, which uses brainstorming in a playful

way.” (Nguyen et al. 2014). EDIPS on the other hand tries to teach the participants PSS design on an economical basis by showing the players that it is necessary to provide product-service systems to be successful in the market (compare Nguyen et al.). Although both games try to teach product service system design, "Battleships from Herzog" is specifically designed for industrial product service systems. Furthermore, EDIPS provides a fully thought-out game concept and is based on a board game, while "Battleships" is only based on a mind game. (Compare: Herzog et al.).

2.2 General information about digital board games

Digital board games have been widespread in the community for many years. The well-known board game "Carcassonne" was already published for the first time in 2002 in a digital version. In later years some standalone videogames were developed just for the purpose of giving the community a platform to digitize board games, card games, or simply dice games with the simplest means. Videogames like Tabletop Simulator offer such possibilities.

One of the papers we are discussing is about the digitization of three well-known "European board games ("Eurogames"), Puerto Rico, Agricola and Ascension" (Rogerson 2015). Here, the authors look at the various methods and ways to bring a modern board game into a digital form. All three board games are widely played in the community, so it's no wonder that players are demanding a digital version. Each of the three games has been brought into online form in some way. According to the authors, the digital version of a board game is always the second choice of players even though they can definitely see the advantages and possibilities of a digital version. For one, the ability to play more often and learn more as a result. (Compare: Rogerson 2015, p. 6). Further, the authors write „This desire to play – and to enable play – and the recognition that the game is the same (but maybe a little different) is fundamental to the digitization of board games (Rogerson 2015). A very important point, as our customer gave us the instruction not to change any of the basic rules of the analogue version of EDIPS. However, we also came to the conclusion that mechanics that are difficult to implement on the computer need an alternative, but do not break the underlying rules of the game. An interesting study conducted in another paper looks at the gaming habits and consequent preferences of players of board games. This study shows, as already mentioned above, that „the most important features are social interactions and flexibility in altering game rules and objects since addressing them in a satisfactory manner allows players to enjoy at least the same level of game-play experience as they do with traditional board gameplay” (Frapolli et al. 2010). This strengthens our opinion that mechanics may be changed to enhance the game experience in the digital version.

The authors Melissa J. Rogerson, Martin Gibbs, and Wally Smith write in their conclusion that “Digitization can support the player community by supporting sophisticated players and/or by making the

game accessible to new audiences” (Rogerson 2015). With the possibility of an online version of our game, game rounds can be quickly set up with interested parties and they only need to be on a device with internet access to participate in a game. Making EDIPS accessible to more new players is one of the main reasons why we want to bring the board game into a digital form. Nevertheless, the authors are referring with their statement to already established board games, which have a large community and therefore a wider field of players, who in turn can attract new players to their game. EDIPS is known at some universities but does not have the reach of Puerto Rico, Agricola or Ascension, so it is more difficult to attract new players to this game despite an online version. Nevertheless, an online version of EDIPS allows many interested people to participate in a game without long journeys. With their work, the authors of the referenced papers have given us a good insight into the potential of a digital version of EDIPS.

2.3 The limitation of freeware

One of the main requirements of our customers is that the programs used are available free of charge. However, we can also fall back on software that can only be used free of charge by us as students of the University of Applied Sciences Würzburg/Schweinfurt. All ultimately used programs are also accessible to outsiders and therefore allow any person to participate in the game. According to a paper published by the Department of the Informatics University of Fribourg Switzerland, there are two main approaches to bringing an analog board game into a digital form. „In the first, the user is provided with a virtual playing environment by simply creating a one-to-one mapping of the graphical game elements from the physical to the digital domain” ... “The second approach enables the implementation of both the game graphics and logic by means of high-level game development frameworks.” (Frapolli et al. 2010). The first approach therefore only provides the player with a model of the board game and the software does not ensure compliance with the rules of the game with any digital script; the players have to take care of that themselves. The second approach is more interesting for the game experience, as it can control the game through programmed sequences and therefore provide a rule-following experience. The problem with the second approach is that the developer has to invest a lot of time into programming the necessary scripts. Due to our limited time, only the first approach comes into question.

The authors mention "Vassal" as a possible game engine (a basic software to create videogames) for the first approach. Since this software seems promising, we have considered it for our project, but there are many other free game engines available. “The quality of free game creation software is surprisingly high. Many engines in this chapter actually represent a hybrid business model, offering a free, fully functional version of the system and also a paid version with additional functionality.” (Compare

Ciesla 2017, p. 97). The game engines listed by author Robert Ciesla are all free to use. Engines like Unity are capable of generating relatively simple things like board games but require a higher level of skill. Vassal, on the other hand, is specifically designed for use with board games in digital form. For this reason, we shortlisted Vassal rather than any of the more complex and common game engines. Our search spread to already existing software that can provide a basis to build a digital board game. A game engine only provides you with the building blocks to create a complex and well thought out version of a game if you are able to put in the necessary time needed. Instead of starting from scratch, existing software could provide us with the tools we need, so we do not need to design all the mechanics for ourselves and therefore can save some time. The selection of free programs available is large but the majority of these programs only provide limited access on a fee basis. Websites like "tabletopia.com" offer a free way to bring board games into a digital interface, but these programs are only free up to a certain point and a subscription is required to use all the features. As a result, we quickly considered the range of programs available to us free of charge as students. In this way, we included Miro Board in our shortlist. Even though Miro is a whiteboard platform and is mainly a tool used for online teaching or as a tool for businesses, it offers many features that make a digital board game possible.

2.4 Methods and models for problem solving

The first step before applying a project management method is to define the problem (compare Kuada 2013, p. 22). After you have clearly defined the reason for the project, you can start looking for a suitable management method that is best to use for your problem.

In order to build the project of digitization of the board game EDIPS on the basis of models, methods, and analysis, we considered some of the better-known project management methods. In the first step, we considered the SWOT analysis. For this purpose, we studied and discussed the relevant excerpt in the book "Praxisorientiertes Marketing" (Kreutzer 2017, p. 85). It was specifically considered for the evaluation and analysis of the player experience of the digital version. For this purpose, the strengths and weaknesses of the digital version should be defined in comparison to the analog version of EDIPS. However, SWOT analysis is a tool to "make an assessment of one's own performance in light of relevant competitors while evaluating future market realities" (Kreutzer 2017).

This is described by all literature, for comparison: "A strengths, weaknesses, opportunities, and threats (SWOT) analysis has become a fundamental tool for organizations to evaluate their position in the market and is widely used to analyze the internal and external environments of organizations during times of indecision" (Benzaghta et al. 2021). Since SWOT analysis is actually a tool for analyzing a com-

pany's own strengths and weaknesses and "...covers the opportunities and threats of the entire industries not of the specific company alone" (Kreutzer 2017), SWOT analysis is not a suitable tool for our project.

As a result, in order to test our different variants and validate them in conjunction with a suitable methodology, we have used the SCRUM method as a possible approach to solve our problem. One of the points why we considered the SCRUM method is that it is heavily used in software development. „The origin as well as the most frequent use of the methodology is in the development of software“ (compare Grote and Goyk 2017, p. 118).

Likewise, the proceeding in the SCRUM method promising, according to Grote S., is the division of the programming tasks into "sprints" or "interaction cycles", which are then organized by the individual groups separately (compare Grote and Goyk 2017, p. 121). This is in line with our general structuring in the project, as we always work on our progress in blocks, or compare changes made to previous variants. Likewise, the SCRUM method requires and promotes a strong engagement with the customer. (Compare Grote and Goyk 2017, p. 123). Since we were in close contact with our customers, the SCRUM method also presented itself. However, it became apparent that the application of the SCRUM method only makes sense with a larger working group.

From the knowledge of the SCRUM method, we have finally found the PDCA cycle. The PDCA cycle forms a cycle for the continuous optimization of working methods (compare Syska 2007). Andreas Syska describes the PDCA cycle in German with the steps "Planen, Ausführen, Prüfen und Handeln" which forms the acronym PDCA in English "Plan, Do Check, Act. The PDCA cycle forms a cycle of action that is very useful for our project, since we always make changes to our variants, then test them and have them evaluated or assessed. If the change has a desired positive effect, this is standardized and then the cycle starts again from the beginning. The continuous cycle makes this method ideal for projects that focus on incremental improvement. „To improve and solve the quality problem [...] all need to apply the scientific application of the PDCA cycle“ (Ren et al. 2015). This coincides with the procedure of our project and was therefore brewed into our method. Especially with regard to our data analysis, this model is very helpful. The experience gained through surveys, and how changes were perceived by the participants, could always be evaluated through the PDCA cycle, and assessed as positive or negative for the existing variant.

2.5 Summary

The literature used for the project was varied and was able to give us a lot of knowledge for the solution to our task. Often the literature was very clear, and many sources made the same statement or came to the same conclusion therefore no contradictions could be found in the existing literature. Even

though the studies conducted regarding EDIPS could not be compared with results from other institutes, they are nevertheless decisive due to their definiteness. The process of digitizing a board game has been covered in publications before, which were very helpful for our own project, but it soon became clear that our limited time was a decisive factor in using an implementation method in an already existing program. To give our project a methodical structure, different project management methods could be considered. After a thorough analysis of various methods, we chose the PDCA cycle, as it was the best tool to work effectively on our project.

3 Methodology (Jan Kunkler)

3.1 Introduction

3.1.1 Kick-off Meeting

The kick-off meeting was needed as a start to the project in order to define the framework conditions and the expected results together with the client/coach. A structured approach has been indispensable, which can be divided into the individual steps:

- Make it clear to project participants what the focus is on - the project goals.
- The basis for project structure (values, rules, how who works together).
- Project risks must be clearly identified.
- Offer the opportunity to get to know each other.
- Give the starting point for team building.
- Getting the commitment of all parties involved. (Brönimann and Bommer 2022, p. 56)

In the kick-off meeting, the best approach to the coach meetings, as well as the team meetings, was discussed in detail. It was decided that the team meetings would take place weekly on a defined day via Zoom meeting. A duration of one hour was considered optimal and efficient, as it allows the questions and results prepared by each project participant to be discussed quickly and purposefully. The coach meetings were held in consultation with the coach in presence, although this had the disadvantage that protective measures had to be taken in the event of any changes to the corona regulations, this ensured active participation as well as better integration of individual team members into the prepared presentation.

Methodology

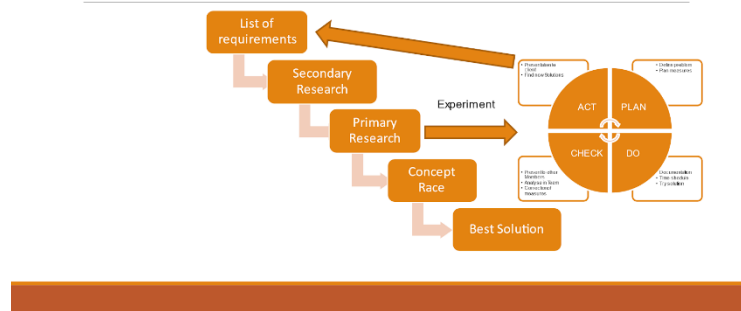


Figure 3.1 Methodology overview

3.2 List of Requirements

3.2.1 Create the list for all project participants

In order to ensure clarity during the project and to provide an overview of what the defined requirements are for all project participants, a list of requirements was drawn up by the project team in close consultation with the client.

Applied Project Management EDIPS					Date: 28.05.2022
No.	Type	Designation of the requirement	Value (quantitatively)	Source	Remark
Operating System					
1	D	Windows		Client	
2	D	macOS		Client	
3	V	Android		Team	
4	V	IOS		Team	
System requirements					
5	V	Webcam	1		
6	D	Microphone	1		
7	D	Internet access	16Mbit/s		
8	V	Installed ZOOM			
9	D	MiroBoard access			
10	V	Skype			

11	V	Installed Vassal			
12	V	Full Office Package	1		Student Version
		Design			
13	D	The same colors as the board game have			It's not allowed to change the colors of the board
14	D	Designed for 6 Players			
15	D	No changes in the geometry of the original board			
		System modifications			
16	D	see and speak at the same time			
17	D	24/7 Available			
18	V	Interactive Bank Included in Miro	1		
19	D	stable run of the systems			
20	V	Dice included in Miro	1		One for all Players visible
21	V	External Dice function	1		For each Player's visible
22	D	External Calculator	1	Client	for the Bank
		Costs			
23	D	Every single system for free		Client	
		Additional materials			
24	D	Manual	1		Visible for all Player
25	D	Manual in English	1		Visible for all Player
26	V	Manual in German	1		

Table 3.1 List of Requirements

The project team discussed the advantages and disadvantages of the list. It was advantageous that each project participant constantly has the framework conditions for the project goals in mind at a glance. The Excel table can be accessed by each project participant via a cloud, so that any changes to the framework conditions in the Zoom Meeting can be edited together and, if necessary, changed. The list also ensured that individual team members do not deviate too much from the actual project goals and thus the goal-oriented efficiency in the project is counterproductively influenced. A disadvantage of the list was that it was very much designed for development projects in 3-dimensional space. This means that lengths and units of measurement, as well as materials and auxiliary materials, had no relation to the project to be digitized. Likewise, it was not yet clear at the beginning of the project which changes would be necessary for implementation. As a solution, the team decided to update the

list during the secondary review in order to integrate the previously unknown possibilities for digitization. The wishes and requirements of the client were not changed so the advantages were to integrate further wishes and requirements after each agreement with the coach and the associated milestones of the project and to present them clearly.

3.3 Secondary search

In the project, secondary research was carried out on the subject of EDIPS2. This is perfectly integrated into the order of the methodology in order to obtain an overview of existing data material.

In secondary research, data material is obtained and analyzed for the solution of a problem, which already exists and was collected for other purposes (Nieschlag et al. op. 2002, p. 1310).

By systematically reviewing the data material, the project team had the advantage that time and costs could be saved, as a primary search was already carried out by third parties. The disadvantage of secondary research is that the information does not always fit exactly the respective problem and some data is outdated even in times of rapid digital progress. Secondary research was important in order to determine the further need for information regarding primary surveys. Through the secondary research, the information base in the project team could be expanded, which determined the decisions for the further procedure, especially with regard to the survey priorities and the survey methodology in the primary research.

3.3.1 External

The external sources were data material, which mainly comes from studies and surveys of primary research. These are publicly accessible data materials, such as databases of the government or the economy (Michel, Schulz 2022, Lecture 7, p. 2). The project group specifically evaluated data material that was related to the topic and explicitly addressed the digitization of board games. These data were advantageous in that they gave an insight into the current state of the art. It was specifically researched whether there were other companies that also dealt with this topic. It was also important for the scientific work that preferably Google Scholar, Statista, or lib web were used. Through this approach, causality could be determined, which gave the project team the selection of potentially relevant contact persons.

3.3.2 Internal

Here, the project team was handed over various documents by the client, which dealt with the topic of the board game EDIPS2. There were explanations of the game itself, as well as various research

results which were summarized here. In order to carry out the further procedure in the project correctly and purposefully, it was necessary to understand the game as well as the individual game phases and interactions of the individual characters.

3.4 Primary research

In the primary research, the individual techniques for data collection were dealt with in detail. The data was collected by the project team itself. Various techniques were discussed, tried out, and partly discarded due to a lack of guidance.

3.4.1 SWOT analysis

To illustrate the strengths and weaknesses of the project topic, a SWOT analysis was initially considered. An internal and external perspective of the game EDIPS2 should be made visible. "Only from the synthesis of internal and external perspectives can strategic derivations for the further development of the company be obtained" (Kreutzer 2017, p. 85). The project team pursued the idea of creating a relationship between the client and the players in order to show possible strengths and weaknesses between the board game and a digitized version. From this, it should then be possible to derive the further procedure for the project, as well as possible adjustments in the List of Requirements in order to create an identical game atmosphere in the digital rough without distorting the basic idea of edutainment¹.

However, the project team determined that this methodology is not suitable for the project because the actual project goal is not achieved. For this reason, it was decided to make successive changes to the digital version taking into account the list of requirements, and then to test them experimentally with test persons as players.

3.4.2 Experiments

The project team decided to carry out experiments and used different tools such as Table Top Simulator, Vassal, Miroboard, Skype, and Zoom in their research. The individual tools for creating a game interface were Table Top Simulator, Vassal, and Miroboard. These are programs that give the creator of the game the opportunity to digitize the game board and thus visually represent the figures, aids, and the playing surface itself. In varying combinations with Zoom or Skype, an experiment was carried out under real conditions to determine the strengths and weaknesses of the respective variant. Should there be considerable complications with a variant from the outset, or if monetary problems arise, this

¹ Edutainment is a portmanteau word derived from the terms education and entertainment and programmes that want to combine play and learning for children and partly also adults in multimedia environments, i.e. want to be something like playful knowledge transfer through new media. (Stangl, 2022).

variant was immediately discarded. The remaining variants were then improved by the project team, using first the SCRUM method, then the PDCA cycle in the further course of the project.

SCRUM Method

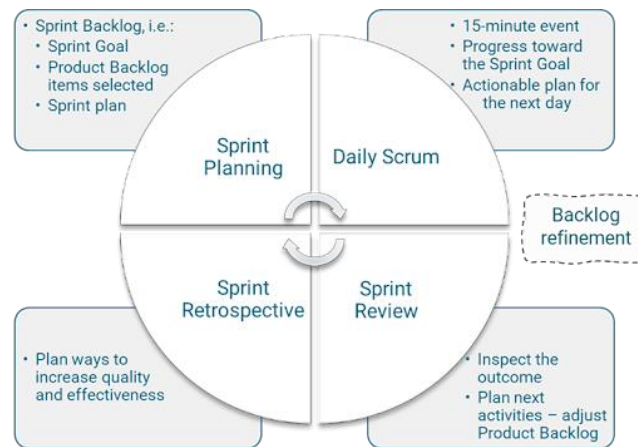


Figure 3.2 SCRUM Method

The SCRUM method was intended for planning and carrying out the experiment. The experiments consisted of partly already improved connections between software tools (Vassal, Miroboard) and communication platforms (Zoom, Skype). The impressions and conclusions of the past run have already been incorporated. As a result, the project team was able to work out the strengths and weaknesses of the individual combinations/variants in more detail for each experiment. Through the preliminary planning in Sprint Planning: What/How something is done/changed, the improvements could be constantly incorporated. The Daily Scrum was replaced by the multiple Weekly Meetings, in which the next run was briefly discussed. The disadvantage was that there was no SCRUM Master. He should have been the coach of the project, but this was not possible for reasons of time and effort. In the Sprint Review, the project team discussed the improvement/deterioration of the throughput of the individual variants. It was also a disadvantage that in this case, the customer would have had to be presented with the change to the variants in each case. However, since the customer and coach are one and the same person in this project, the meaningfulness was already doubted by the project team in the 1st run of the experiment. The Sprint Retrospective reflects on the way individual team members work and the efficiency of improvements. Through the systematic flow of this variant, the project team was able to determine that such an approach is extremely useful to the project goal. Due to the lack of a SCRUM Master and the conflict of interest between customer and coach, respectively, the lack of an objective customer and a SCRUM Master independent of the project, it was decided that SCRUM is unsuitable as a tool, but the rotating approach would be useful. The project team then researched alternatives.

PDCA style

Based on the knowledge gained from the SCRUM process, the project team opted for the PDCA cycle. This binds the advantages of the rotation of SCRUM in itself, but without having the disadvantages.

"A further development of the Deming circle is the PDCA cycle. This quality and the improvement control loop enables continuous improvement of every management activity. The PDCA cycle is one of several problem solvers (this includes, for example, the seven statistical tools). It consists of the steps Plan, Thu, Check and Act" (Syska 2006, p. 99).

In the 1st step of the cycle, the current situation was analyzed. Data was collected which is needed to develop the improvement plan. The problem was described in detail and the methodology on which the problem is based was also defined. In the following, the causes of the problem were researched by the project team, and measures were developed to solve the problem purposefully.

In step 2, the improvement measures listed in step 1 were carried out in compliance with a previously agreed schedule. Detailed documentation of the results was then presented to the other team members in the weekly meeting.

In the 3rd step, the results were presented and discussed during the weekly meeting. It was checked whether an improvement or deterioration of the variant can be determined.

In the 4th step, a standardized procedure for improvement in the next run was discussed at the end of the meeting. In doing so, they actively involved the team members of the existing problem solution in the discussion in order to then agree together on a procedure for the next run. The results were recorded in a weekly protocol. The new tasks for improvement have also been set out in this protocol. Depending on the expertise, it was possible to work on an approach/improvement, alone or with several team members. The end of this step was also the beginning of a new cycle each time until the desired result, the project task was fulfilled.

3.4.3 Interviews

During each run of the experiment, a short interview was held afterward with feedback from the people involved. The subjects were carefully selected and had no relation to the game. New subjects were also used throughout to achieve objective results in the interview and no evaluators from the difference to the last run. The interviews were always conducted with the same ready-made questions in order to be able to compare them statistically and qualitatively. In the interviews, care was taken to ensure that the questions also focus on the playability and the experience of edutainment. It was objectively asked about the learning effect and the possible problems during the game of the digital version. In order to have a comparison of the edutainment, the same interviews were also conducted during the "Game Board Night" in the FHWS on the real board game. The advantage of these interviews is that they can be carried out quickly and cost-effectively and give the first insight from the point of

view of the test persons. The disadvantage is the shallow depth of the data collection, as the interviews are not as extensive as a questionnaire. To counteract this, the project group has opted for a 2-stage method. Here, two methods are combined in the primary research. In this project, it was the interviews together with a questionnaire.

3.4.4 Questionnaire

With the questionnaire, a qualitative and representative result for the continuous improvement of the project progress could be achieved. The questions were kept objective and also related to the playability of the digital version. Five choices were offered and explained. The questions were kept as simple and unambiguous as possible in order to give the international subjects the same conditions for understanding. All questions have been written in English to ensure uniform comprehensibility. The questions were chosen in such a way that they answer the research question qualitatively. The questions were also explained to all test persons in advance in order to prevent any comprehension problems and to ensure a uniform starting point. A disadvantage of the questionnaire was the time required and the evaluation. That is why the project team decided to design it digitally. The participants of the "Game Board Night" were also able to fill out the questionnaire via their smartphones, which is why it was regarded as a suitable means of solving the research question by the entire project team.

3.5 Matrix

Through a detailed matrix representation of the requirements, the importance of the individual points can be decided by the team members in a direct comparison. Here, a horizontally standing requirement is compared with all vertically standing requirements according to their importance. It is important that the importance of the individual points is expressed as a percentage. Unlike other matrix representations, this percentage approach is more advantageous here, as only a few points are compared with each other. A division into factors such as 0-3 according to the sum of the points is not advantageous here. The percentage distribution is further required for the calculation in the concept race.

Evaluation criteria		Easy to access	Technical complexity	Easy to play	Element of uncertainty	Reusability	Dice function	Similarity to the physical game	Sum	Weighting factor:
1	Easy to access		1	1	1	1	1	1	6	0.29
2	Technical complexity	0		1	1	1	1	1	5	0.24
3	Easy to play	0	0		1	1	1	1	4	0.19
4	Element of uncertainty	0	0	0		1	1	1	3	0.14
5	Reusability	0	0	0	0		1	0	1	0.05
6	Dice function	0	0	0	0	0		0	0	0.00
7	Similarity to the physical game	0	0	0	0	1	1		2	0.10

Figure 3.3 Evaluation Matrix

3.6 Concept Race

For the final decision of a variant, the project team decided on a concept race. In a direct comparison, each of the remaining variants could be finally compared. Various economic, social and technical aspects were used. Important in the calculation of the individual points are the percentage distributions from the matrix. To find a final solution, a questionnaire was created for the remaining variants. Both the players and the team members could submit their ratings. This offered the advantage that the team members could incorporate their internal knowledge and experience from the continuous improvements, but also objective views of the players, some of whom only played once, were taken into account.

4 Data Collection (Deniz Aras)

4.1 Objectives

The most important thing is the use of the data appropriately in conjunction with the objective of the goal so that answering the research question for an online game for EDIPS is on the right path. It is important for the team that the objectives of the project are well defined by the supervisor. “A project, in this regard, usually starts with a problem formulation... It could relate to solving a problem (or set of problems) for a company, an organization, or an institution. It can also be a general social problem that attracts the curiosity and intellectual interest of the students” (Kuada 2013, p. 22).

In this research, the definition of the project phase started from the first kick-off meeting with our supervisor Prof. Panshef. We defined some of the questions regarding this unknown topic. What are the objectives of the project, what are the project criteria, and what are the project goals? This phase had a significant effect on the course of the research order to make sure the project objectives are well defined and grasp the project boundaries.

Firstly, team members were asked to conclude 20 results regarding the articles distributed by Prof. Panshef in the kick-off meeting about strategic learning and game EDIPS. After the presentation of the results, team members gained extended knowledge about the EDIPS board game and how to play it strategically and create tactics to win over other players. Next, team members were asked to find relative literature about this game and look for three possible solutions where the EDIPS board game can be played and accessed by online users Worldwide. In summary, our project target was to figure out three possible solutions to play the EDIPS board game in a web version that can be Worldwide accessed.

4.2 Data Acquisition Methods

Typically, data collection has two methods. Quantitative and qualitative. “Textbooks on research methodology group data collection methods into two broad categories: one is qualitative methods, and the other is quantitative methods. Each group of methods is designed to help researchers achieve specific research goals. Some textbook authors will suggest to you that you should choose either one of the two sets of methods, based on your preferred way of understanding the social phenomenon that you want to investigate (i.e., your choice of a paradigm)” (Kuada 2013, p. 91). According to Kuada, both sets of methodologies can be merged to gain a deeper understanding of the difficulties you're looking at. To make an informed decision, you must first comprehend the similarities and contrast between the different sets of techniques. Also, according to research from Bryman and Bell (2011, cited Kuada 2012, p.93), the phrase "qualitative method" is used to describe a wide range of data collection techniques. Ethnography, participant observation, in-depth interviews, and conversational interviewing are examples of these methods.

So, if the goal of your research is to gather fresh insights for the subject, you're working on rather than to test existing hypotheses, qualitative data collection should be considered. Quantitative data gathering methods should be considered if one wants to test concrete hypotheses or get precise solutions to specific parts of research questions. Quantitative data collection targets systematic measurement and analysis are often used with numerical values. On the other hand, qualitative serves often if the research object is new or to explore new research and develop a hypothesis. Qualitative data usually are not standardized and allow open questions and open answers subjected to the viewpoint.

Interpretation as Method	
Quantitative Research	Qualitative Research
<ul style="list-style-type: none"> Operationally binds the inquiry to be defined into variables (small number). 	<ul style="list-style-type: none"> Seeks unanticipated as well as expected relationships.
<ul style="list-style-type: none"> Minimises importance of interpretation until data are analysed. Period of data collection and statistical analysis thought of as 'value free'. 	<ul style="list-style-type: none"> Dependent variables are experientially rather than operationally defined.
	<ul style="list-style-type: none"> Even independent variables expected to develop in unexpected ways.
	<ul style="list-style-type: none"> Situational conditions are not known in advance.
	<ul style="list-style-type: none"> Findings are not so much 'findings' as 'assertions'.

Figure 4.1 Interpretation as Method (Kuada 2013, p. 93)

4.2.1 Reason for Data Investigation

The identified issue is examined by researchers, who reveal new perspectives or knowledge. As a result, the advantage of a well-defined research question and target is unavoidable. As a result, data

collection is usually motivated by a variety of factors. The reason for this research includes all of the following factors. “It is important for you to state the aim of your project very clearly. This specifies what your readers should expect from reading the project. You can choose between descriptive and normative types of research. As the name implies, the aim of descriptive research is to provide a description of a particular problem under investigation” (Kuada 2013, p. 42). Adams, Khan, and Raeside highlight that most of the research is done to achieve one or more of the following goals.

- To gain a competitive advantage
- To test new products and services
- To solve a management/organizational problem
- To provide information, which may help to avoid future business problems (Adams et al. 2014, p. 3).

Also, Adams, Khan, and Raeside state that as a researcher, you'll need to know the answers to the following questions about the research issue you're looking into:

- Has the work already been done?
- Who are the experts in the field?
- What are the main theoretical perspectives?
- What are the common research methods on the topic?
- What are the main problems in researching the topic?
- Are there any major controversies in this topic area? (Adams et al. 2014, p. 34).

“One of the most common problems is data—for example, does it exist? If it does, can you get access to it? Is it in a format that is easily manipulated? Is it trustworthy? How old is it? Have the variables in the data been measured correctly and consistently?” (Adams et al. 2014, p. 37). „This is arguably the most important part of any research project and the most important function of the literature review. As you know from earlier chapters, data comes and goes, the relationship between variables changes, society changes, and therefore the primary function of academic research is to continually move theory forward” (Adams et al. 2014, p. 40).

4.3 Primary sources

The methods of data gathering differ depending on the research field, such as engineering, social sciences, anthropology, chemistry, or medicine. We distinguish data as primary so-called firsthand data, secondary or tertiary. Primary sources allow for the formation of one's own viewpoint. For example, interviews, surveys, letters, records, art, film, or music. Original material for scientific investigations can be found in primary sources. They haven't been interpreted, filtered, or assessed yet. Although

they are hard to retrieve and as time is an important factor in projects, we have managed to conduct a few of them. One of the primary research methods that we benefited from was a survey with companies and students contacted through telephone or email.

As mentioned, primary data sources are from the people that whom a direct connection was conducted. The following methods of collecting primary data were used to carry out this research paper.

4.3.1 Semi-Structured Interview

Attending the lecture is the greatest method to get to the primary source. It is to interrogate the individual who will work with you on the one-on-one assignment. The day and time of the kick-off meeting were determined in advance and the group members had to direct the specific questions to the supervisor within the specified time. Prof. Panshef, the academic supervisor, began by introducing the target study as a first-person description of the event, also, company owner of “Navigator”. The primary person in charge of addressing the situation leads the group through the process of designing, exploring, and writing the project. A project kick-off meeting's main goal is to get everyone on the same page and off to a good start. It was an opportunity to meet the team and have a better grasp of the project so that work can get started right away. “The group discussions offer you some insight and training in how to listen and interpret viewpoints of work colleagues, enabling you to not only understand other people’s viewpoints but to draw their attention to the hidden assumptions underlying their viewpoints”. Where the first group discussion has taken place team members has involved by asking specific questions. Some of the questions asked and collected were:

Who will be the primary point of contact for the team?	Supervisor, Company owner, Prof.Panshef
How much effort do we produce?	Internal meetings, reports, minutes, agenda, etc
What does the project entail?	Project boundaries, project goal, project duration.
What is the most effective means of communication?	Internal communication canals, external communication canals.
What materials are we going to use?	Distributed materials, and literature reviews.

Table 4.1

KOSMOS has become one of the most successful game makers in recent years thanks to its high-quality equipment, design, and playful needs. CATAN (won Game of the Year in 1995) has established itself as a staple of the gaming industry. Their games have contributed to the success of the German Games in many nations throughout the world. The company is located in Stuttgart. Kosmos provides services such as guidelines, products, templates, and game solutions. The responsible person was Mr. Weber that the team conducted the interview. The interview was made based on a semi-structured methodology. Some of the structured questions and answers were as follows:

What experience they made with creating a digital version of a board game?	<ul style="list-style-type: none"> • In the very beginning, they had problems with the stability of their online games, if too many people joined the game. The solution was to change the whole programming code which was a big cost factor. • They had problems finding the best working programming language for different operating systems
What difficulties did they face during development?	<ul style="list-style-type: none"> • Some features you can do in a board game, you can't even do that easily in a digital version: Like choosing some cards from your opponent player in a card-board-based game. • They had problems finding the best working programming language for different operating systems
How was the market developed in 10 years?	<ul style="list-style-type: none"> • Nearly 10 years ago, many smartphones and tablet-user were skeptical if digital versions of board games make the same "family" fun as real board games. Because of this, Kosmos made a big marketing campaign for their digital products.

Table 4.2 Questions and answers

4.3.2 Unstructured Interview

Performing primary and secondary research using the internet in today's world is inevitable. Using email is one of the primary research methods. Accessing one's view in a company directly with developers or responsible provide huge advantages for research.

The managing director of ESPOTO GmbH, Matthias Tielbier, was the contact person for this interview. The information flow was established with email. The company is a Berlin-based software development company that specializes in "mobile serious gaming". They provide customizable and innovative software solutions, as well as ideas and concepts for demand. The company makes the most of its event benefits by combining educational elements with team spirit and good times. The company is also funded by the Ministry of Economics and European Affairs of Brandenburg and the EU.

As FHWS students we reached the company firstly by using the contact form on their website. After a few weeks, the answer from Mr. Tielbier has dropped to the mailbox offering access to game software to transfer the EDIPS board game into an online web version including information for testing the software online. The game can be tested via android, iOS, or web version on the computer. Software is tested via web version. It can be set as global or private which was one of the features our team looked for. Secondly and most importantly the software has a QR code option which you can address to other players to join. There is a dashboard where the first steps for the event begin. The dashboard includes a few widgets, for example, a countdown widget for event start, and a tab spots widget which is a map

where players interact with the game over and hunt for secret objects. Photos widgets serve game creators to add images but the software itself does not allow to play over images. Images serve the function of hunting and looking for objects.

As a result, the company is reliable, helpful to users, and takes care of customers to develop future games. But now does not serve the needs of the online EDIPS version. However, how much time companies invest in such games is revealed.

4.3.3 Survey

Throughout our project, we gathered data in a variety of areas. The interviews we conducted over a period enlightened us on this subject. As mentioned in previous sections, the trial version we created on Miro board and Zoom provided us with many features. But not only the team, but also the players we recruited from outside had to put the game to the test. After testing the game on the board, students were invited to play the online version. These students were selected according to the criteria that they played the game at least once on the board. In this way, students would be able to analyze the differences between the online version and the table version. We asked some questions to the students who were called to the online version, both during the game and afterward with a survey. FHWS as team members wanted to associate a qualitative measure with different aspects of a product by using a rating scale. Any question in which participants are given options is referred to as a closed-ended question.

The questions we asked in the survey were as follows:

Which variant did you play?	1. Miro +Zoom 2. Just on Zoom 3. Concept board + Zoom	Closed-ended question.
Did you have free access to the game?	Yes or no	Closed-ended question.
Did you have technical issues during the game? How would you rate it?	Rate between 1 to 5 (1= a lot of issues, 5= there was no issue)	Closed-ended question.
Was it easy for you to play it online?	Rate between 1 to 5 (1= I couldn't play it. Too complicated, 5= very easy)	Closed-ended question.
Did you feel a lot of difference in the gaming process between offline and online?	Rate between 1 to 5 (1 = Yes, feels like two different games, 5= No difference.)	Closed-ended question.

Table 4.3 Questionnaire questions and evaluation

4.4 Secondary Sources

Secondary sources interpret primary sources. For instance, scientific articles, journal articles, and newspapers. Because we are unable to cite some sources, material selection is critical. Therefore, we examined the academic acceptability of the sources. There are three factors for determining whether a piece of study is scientifically acceptable to use during our studies. Citability, quotability, and relevance are all terms that can be used to describe a piece of writing. „First ask do I really need to collect data myself or is the data I need to answer the research questions available elsewhere (this is termed secondary data). If it is then use secondary sources if you can get access to it. Often secondary data is easier to use and tends to be more comprehensive, reliable, and valid than data that you will be collecting yourself. Using secondary data is the subject of the next chapter, but often it does not answer the questions you are pursuing. This will mean you need to collect data yourself, which is the primary data. Collecting primary data is expensive, time-consuming, and difficult. “(p.92). To give example, secondary data is usually preferred by college students because they have the possibility to easily access University’s library catalogs. This is for students are a cheaper and more convenient way of research. In our research, we collected secondary data through FHWS library catalogs. By this, we are allowed access to most of the online books in the Bayern region. Our university library catalog is a big advantage for us, students, to collect the data from prospective areas around the country. Most of them are accessible as an online resource. The regional library catalog allows students to access the regional books in their specialization. Gateway Bayern provides access to national and international catalogs by off-campus access.

For specific, there are many databases available. And our university offer usage for these databases. However, the most important ones in the engineering field are the “Compendex” database. This is a reference database for engineering. List over fourteen million journal articles. Another significant database called “EconBiz” is a search portal in the economics area. As a result, it is critical to establish the most appropriate data collection procedures before beginning the research activity.

4.4.1 Literature review

Conflicts in manufacturing companies have become a major issue in the aftermath of the Corona pandemic. To address their problem, system designers look for new ways to combine products and services. As a result, many businesses have switched from a product-oriented to a product-and-service-oriented system. Finally, educational methods such as EDIPS are required to implement these processes. EDIPS (Edutainment for Designing Integrated Product-Service Systems) was created at Tokyo Metropolitan University's system design department. As a result, the goal of this research is to compile the related studies of EDIPS and investigate a possible concept for online use. To be more specific, we

focused our research on serious games, using keywords such as metacognition and online concept creation games. Using keywords, we narrowed our search even further. It provided us with extraordinary resources in our secondary data research, allowing us to determine whether there had previously been research in this area and which methods were used in these studies. “How can the characteristics of durable learning that are evident in players of many popular video games, such as high interest and motivation, critical thinking, effective engagement, social feedback, metacognitive monitoring and control, and strategic planning, be fostered in serious games to make them valuable instructional tools? The belief that the high engagement engendered by the entertainment value of video games can be used to motivate academic learning needs to be substantiated” (Hacker 2017, pp. 19–44).

In serious games, the human brain is trained with a focus on learning. In the light of the information learned, the person regulates his own brain and thinks strategically. A serious game promotes metacognition while learning. The findings demonstrate the value of metacognitive instigation during gameplay. Metacognition is “knowledge of one’s knowledge, processes, and cognitive and affective states; and the ability to consciously and deliberately monitor and regulate one’s knowledge, processes, and cognitive and affective states” (Hacker 2017, p. 3).

4.4.2 Videos

Videos that have already been captured and described by other groups or investigators could be used to carry out research if they hold data pertaining to the study in question. This information is mostly obtained from secondary sources. It is critical to understand the sources of this information to determine whether they can be used for scientific research. The information collected from these videos was later used in an investigation between the team. Videos served as a valid source for the team and were deemed for gathering work information.

EDIPS Tutorial 1	https://www.youtube.com/watch?v=r-tK4Ozxux0&t=29s
EDIPS Tutorial 2	https://www.youtube.com/watch?v=OsN012PXn44&t=42s
EDIPS Tutorial 3	https://www.youtube.com/watch?v=UFp_IE0uMAk&t=39s
EDIPS Last Phase: Event Phase	https://www.youtube.com/watch?v=mZW93kZs7tc

Table 4.4 Links to EDIPS tutorials

5 Data Analysis and Findings (Deniz Aras)

After explaining the procedure and associated benefits of the data analysis method chosen in the first section of this chapter, the second section discusses the results obtained. This section contains information on data analysis and results. Our findings come from student communities that played the

game. The majority of these students played the board game before being invited to the online version. We have provided three options for the online version, as previously stated. And we looked at how students responded to these three options. The first option that the team devised was Miro+Zoom. Zoom was the second possible option. Because zoom includes a miro board. The Concept Board was the final option. The game was previously tested on these whiteboards by the team. Before inviting students, the team established the game rules and visual effects based on the online concept, with only minor changes to the original game. However, the students' experiences would make our research more accurate for the survey and analysis.

5.1 Evaluation Criteria According to List of Requirements

Our team assessed the data using the following criteria. The team allowed students to test both the board game and the online version of EDIPS. The following are some criteria proposed by the team. As stated in the methodology section, the team created an evaluation matrix based on these questions. The team also sent a survey to the students who tested the game online again and who had an early version of the board game. The criteria were established in accordance with the criteria in the requirements list:

- Easy to access, meaning accessibility to the needed software.
- Technical complexity. Does it require a lot of data? Technical issues? Internet problems?
- Easy to play. What does it look like? Can a person easily understand what they have to do? How can they move around a board?
- Element of uncertainty. Is it the same as in the board game?
- Reusability. How easy is it to use the software again?
- Dice function.
- Similarity to the physical game. Does a person have the same feeling playing online?

The Evaluation matrix was created by our team. This matrix has been developed according to the list of requirements we created at the beginning of the research to define the boundaries. The results from the evaluation matrix from the methodology part were as follows: According to this data and methodology part, the easy accessibility of the game received the most votes from our team. This data was evaluated only by the group and the students who did the research. Later a survey was distributed to the student group.

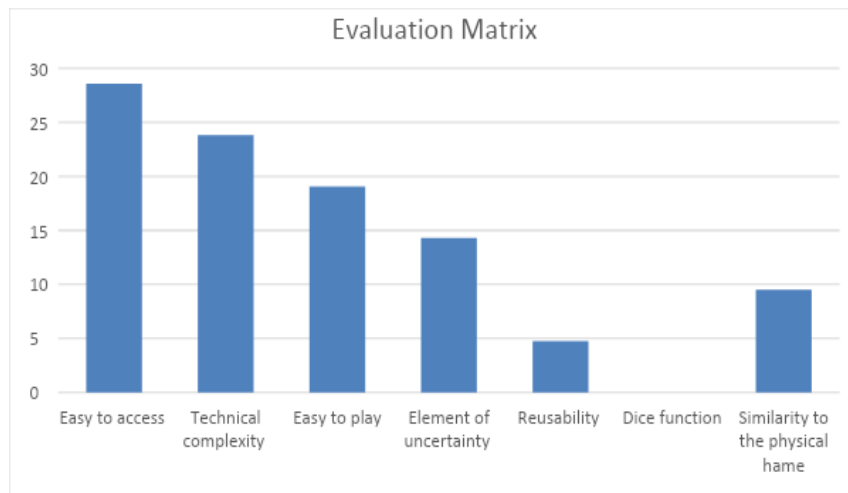


Figure 5.1 Importance of each evaluation criteria

5.2 Data Analysis from The Surveys

As stated in the methodology and survey section, we evaluated the criteria developed within the research group and developed some survey questions. This survey would be evaluated by students who played the table version of the game as well as tested the online version on three different platforms, and the results would be significant for our research. Survey questions were close-ended while we aimed for specific answers to the questions. The survey questions and their evaluations looked like this:

Questionnaire						
1. Did you have free access to the game?	Yes/ No	Yes = 5 / No = 1				
2. Did you have technical issues during the game?	Grading from 1 to 5	1. There were a lot of issues, not playable	2. There were a lot of issues, but it was somehow playable	3. There were some issues, but the game was fine	4. There were just a few issues, but they didn't affect the game	5. There were no issues
3. Was it easy for you to play it online?	Grading from 1 to 5	1. I couldn't play it	2. There were a lot of problems, had to spend a	3. There were some problems, that needed more explanations	4. Easy, but had few misunderstandings	5. Very easy

			lot of time understanding how to play			
4. Did you feel a lot of difference in the gaming process between offline and online?	Grading from 1 to 5	1. It is like two different games	2. Gaming process was not the same except for some elements	3. It was similar, but some important elements were missing	4. Almost the same gaming process, but I didn't like a few things	5. No difference

Table 5.1 Questionnaire structure

5.3 Data Analysis and Results

5.3.1 First round

Surveys were sent to 20 people who tried the game in person and also all three online variants, resulting in 20 responses for each of them.

From these responses, average ratings were found, which can be found in the table below.

Evaluation							
Variant	Technical Issues	Easy to play	Differences	Easy to access	Uncertainty	Reusability	Dice function
Miro +Zoom	4.2	4.05	3.85	5	3	4	5
Zoom	3.8	4.15	3.95	5	3	4	5
Concept board	2.1	2.95	2.65	5	3	3	1

Table 5.2 Variants evaluation Round one

Then these rates were multiplied by a weighting factor and added to create a single grade.

Evaluation	
Miro +Zoom	4.185714 286
Zoom	4.119047 619

Concept	3.314285
board	714

Table 5.3 Variants evaluations

As you can see from the rating, variant “Concept board” got the lowest grade, due to a lot of technical issues and other factors that can be found in Table 5.3. Therefore, this variant was eliminated and according to a response from users, some changes in other variants have been made. For example:

- The currency system changed from bars and a bank to calculations of game master alone and post-its on service cards.
- An Excel sheet was integrated into the board.
- Initial rules were added in order to make a board more understandable and provide hints throughout a game to decrease the number of misunderstandings.
- Playing phase time was increased to 20 minutes and amount of phases was decreased to 4, instead of 6.

After integration of these points, were provided more game sessions with the same group, and evaluations were obtained.

5.3.2 Second round

With the same procedure from 5.3.1 and the same number of responses for each variant these ratings were obtained:

Evaluation						
Variant	Technical Issues	Easy to play	Differences	Easy to access	Uncertainty	Reusability
Miro +Zoom	4.65	4.55	3.05	5	3	5
Zoom	3	3.5	2.9	5	3	5

Table 5.4 Rating Round two

Evaluation	
Miro +Zoom	4.359523 81
Zoom	3.752380 952

Table 5.5 Variant evaluation

As you can see in the table above, the “Dice function” factor was eliminated from evaluation as unimportant. Also, the “Miro +Zoom” variant got better grades in terms of technical complexity and how easy is it to play it. Therefore, this variant was chosen as the best one and is recommended for further use.

6 Summary (Diana Pidruchna)

This chapter will be divided into two parts: Guidelines for users and a Discussion.

User guidelines were created as part of the research task and are based on the original game rules from Shimomura Laboratory. Because of the online version adaptation, some rules were changed or eliminated.

Discussion consists of the following parts: Summary of the research paper, Further recommendations, and Suggestions.

6.1 User Guidelines

EDIPS2 is a serious game, which means it is not simple and requires some guidance, either from a game master or a manual. It also takes a bit of time to understand how to use it online in the Miro board software, even though interviews and surveys prove it is not that problematic. For example, as you can see from Table 5.3 and Table 5.5, this variant was rated the highest, therefore had the least problems. However, sometimes game master's explanations can take too much time, especially when some people already know the rules, and some do not. Therefore, it was decided to add user guidelines that can help to understand a game and its online version.

To keep the clarity of instructions and the authors' originality most of the instructions below will be taken from the original EDIPS Manual that was provided by Shimomura Laboratory.

6.1.1 Accessing EDIPS2

To start a game Miro Board and Zoom accounts are needed. Access links for both will be sent from a game master directly before the game session.

6.1.2 Game Roles

The main purpose of the game is to understand a market and how Product and Service providers are engaging in it. Here, the person with the most points wins, and they can do it by becoming a Product-Service provider (one player) or creating a Product-Service alliance (two players).

The game is done in 4 rounds, 20 minutes each. Between rounds, there is an event phase when an event card is drawn, and the game master has to announce how much money (points) they have. The player can make only one action at one time. Actions are described below.

Product Providers

Actions of Product provider:

- Buy products from a factory and move them to their manufacturing area (only 4 products at a time).

- Sell products to the market (at the initial price, only 2 products at a time)).
- Buy an additional color (costs 12 points).
- Raise the price of their product (costs 8 points).
- Become a PSS provider (costs 20 points).

Main earnings for Product providers are coming from selling their products. Once products are sold, they are moving through the lanes of their own color every time it is the player's turn. Moving products should not be skipped and is not considered an action.

Service Providers

All Service providers have to choose what they are specializing in. In this case cards of this service will cost less for them than other cards. Players should place their cards only on the lane with the corresponding color they choose before the start of the game.

Actions of Service providers:

- Buy up to 4 cards (1 point for specialty, 4 points for others).
- Place their service card on the board and invest at least 1 point (up to 2 cards).
- Buy additional color to be able to place on the other lanes (8 points).
- Shift to PSS provider (50 points).

Service providers earn points when a corresponding to their color product lands on the phase where they put their card.

PSS provider

When switched to a PSS provider, a person can do 2 actions at the same time: from Product and Service.

PSS providers get 4 Service cards after changing roles, and they can place their cards regardless of competition. This means, that their service card doesn't have to have a higher competitiveness number to overrule other's cards.

Alliances

Alliances are formed between Product and Service providers. At the end of the game, they have to combine their funds. Similar to PSS providers, a Service provider in the alliance can replace other players' cards regardless of competitiveness value.

6.1.3 Board Overview

In the picture below you can see the whole Miro board with all game elements, that will be discussed further. On the right side of the screenshot, you can also find some ground rules that may be used as a hint for players for the game start.

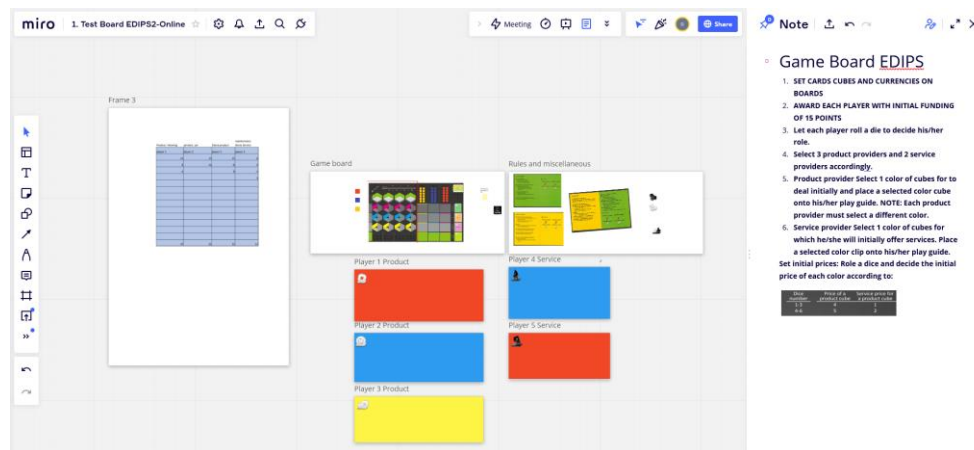


Figure 6.1 EDIPS2 on Miro board (All elements)

Game board

As in the original game, the Game board consists of a playing field with different card categories placed on it.

The playing field consists of Factory areas, Product Provider's lanes, and Card decks, which include Event cards deck and Service cards decks.

Same as in the board game, Product providers are moving on the Product lanes and Service providers are placing their cards in the specific area below Factory areas. To invest money in the service a player should place a post-it with a number on top, as you can see an example in Figure 6.3 EDIPS2 on the Miro board (Playing board during a game).

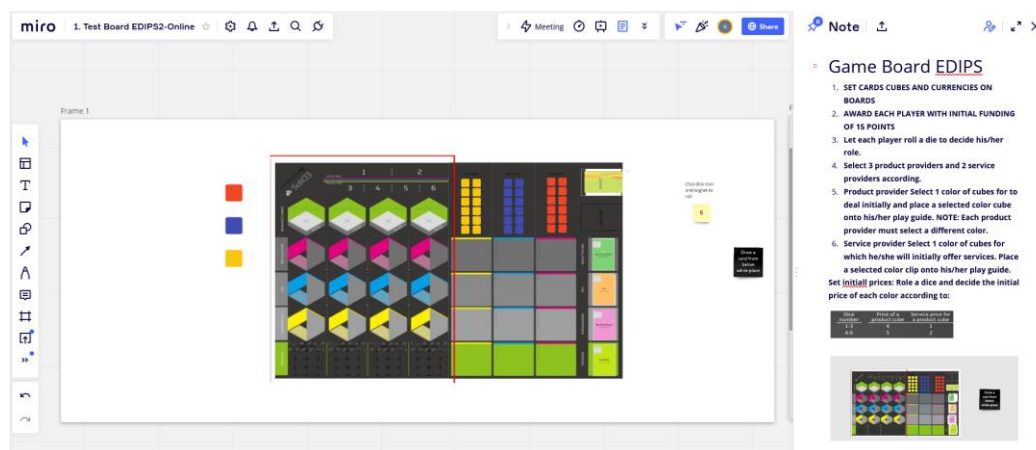


Figure 6.2 EDIPS2 on Miro board (Playing board before a game)

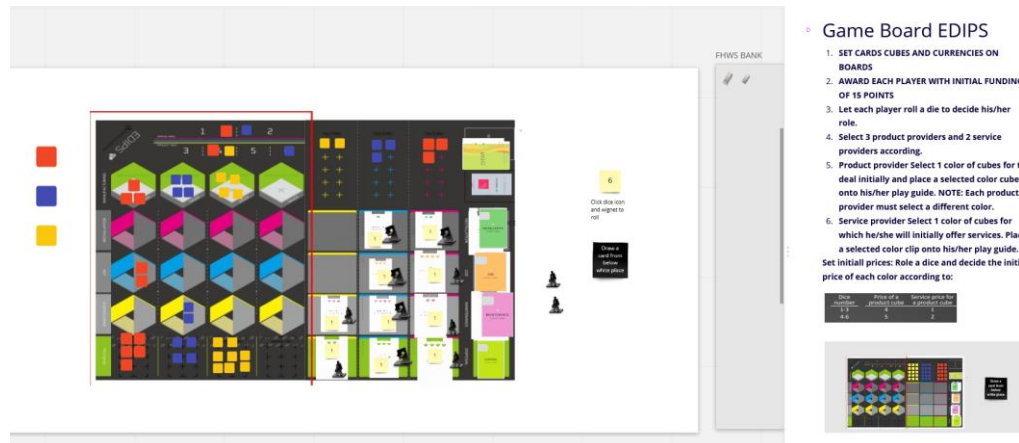


Figure 6.3 EDIPS2 on Miro board (Playing board during a game)

Rules frame

The rules frame is located on the right side of the Game board. In this frame rules for Product, Service and PSS providers can be found, so players can check it anytime in case they forget something. They correspond to the rule books players get when playing face-to-face.

Also, on this frame are placed figures for alliances or PSS providers, which will be needed later in the game.

Player's frames

It is located below the Game board. All player frames are indicated with a product a player wants to produce and the color he chose. Additional colors are added by adding a color cube.

Points table

This table is located on Frame 3 (on the left side of the Game board) with all points that players collect during one round, and it is visible for players only during the event phase.

6.1.4 Figures and Cards

Cubes

Both service providers and product providers select one color of product cubes to deal with.

A player can buy up to 4 cubes from the factory to their manufacturing area, each of them costs 2 points. No more than 4 cubes can be placed in the manufacturing area. Cubes can be also sold to the market (therefore move through the line and lifecycle) for the price determined before the start of the game.

Figures

There are 3 different Product provider figures (which correspond to different products they manufacture), 2 different Service provider figures, and 1 PSS provider figure. Service provider figures should be placed on top of the service card they offer (refer to Figure 6.3).



Figure 6.4 Game figures

Event cards

Event cards are for the event phase and are in general for creating an element of uncertainty, that exists in the real market.

Service cards

There are 4 Services (Installation, Use, Maintenance, and Disposal) and each has 15 service cards. Service cards all have competitiveness value (which corresponds with hearts on every card). Each service has 5 cards with 1 heart, 5 with 2 hearts, 3 with 3 hearts, and 2 with 4, and all of them are mixed. Competitiveness value is important for later stages in the game when players can have more than one color. In this case, they can overrule other players' cards if they have a card with higher value and more investments.

6.1.5 Initial Setting

Before the start of the game few actions should be done:

- Each player had to choose the color of their product.
- Each player should roll a dice twice to choose a role (Product or Service provider) and price for their product.

Dice number	Role (# of players)	Symbol
1-3	Product provider (3)	
4-6	Service provider (2)	

Figure 6.5 Corresponding role to the dice number

Dice number	Price of a product cube	Service price for a product cube
1-3	4	1
4-6	5	2

Figure 6.6 Corresponding product price to the dice number

6.2 Discussion

In this research paper were researched the possibilities of transferring a serious board game into online. The main task was to choose one best and the most suitable variant, which will satisfy all the requirements given by the supervisor (customer).

One of the biggest limitations for this was the requirement of no investments and free and open software use. Because of that a lot of possible variants were eliminated, including programming and using board game simulators, such a Table Top simulator.

One important point for this research is a literature review, which helped with understanding a problem deeper. For that, at firsts research papers written by the creators of the game were thoroughly studied, which was helpful in better understating of the game itself, and the important elements in it. Also, different papers about business and serious game were explored, as well as existing implementations of different games for online environment.

Based on the literature, suitable methodology methods were developed. It included experiment method, in which were included semi-structured interviews and questionnaires. Another method that was adopted is called PDCA cycle,

During the research four possible variants were chosen, but one of them in the end was not taken into consideration because of the lack of time, which is needed to create a playable version in this software. Then, three variants that were left, were evaluated with the help of experiments and questionnaire. Rating values that were obtained, were then used to create a single evaluation value with the help of weighting analysis and choose the most suitable one.

For weighting analysis were used evaluation criteria, which was derived from the list of requirements. Then they were compared for the importance between each other, and therefore the weighting value, that corresponded to the percentage of importance, was found.

Also, important to mention that there were two rounds of evaluation. After the first one, one variant was eliminated as not sufficient, and the other two were adjusted accordingly to complaints gathered for the players directly after the game sessions. After the implementation of the changes, new game sessions were conducted, and evaluations gathered.

As a result, was chosen the best fitting variant, which is Miroboard and Zoom combination. Both these applications are free of charge and easily available for students, who are the main users of the resulting product.

However, there is a possibility for the further development of this variant and also consideration of using or developing another software, which was not available in the scope of this project. There are few reasons for that. Firstly, because of the complex setup some computers may not be able to process the information flow, therefore technical issues may arise. Secondly, Miroboard is not perfectly secure application, which may result in license problems in the foreseeable future. Thirdly, because of the load of work to conduct one game, it cannot be played more than 2 times a day. Therefore, it is not really mass exposed. And important here is that game master is absolutely needed to conduct a game, unlike the board game itself.

Considering the points above, recommendation for the further development is:

- Create a software or application with a help of programming or use available software for board game simulators. This should eliminate the problems of dependance on the game master. Therefore, game can be spread between more people, and as a result use for further searches and studies.
- Further investigation on the possibilities of upgrading or changing the rules, in order to make the game more efficient.
- Further investigation about the game development to make it more spread and known, which can also help with following research and studies.
- This game and its online implementation can be used for the lecturing, studies, trainings, brand development and brand trainings inside the companies.

Appendix

Diana Pidruchna		
Team 2, Chapter 6 Summary, pages 33-39	Grade	Comments:
C1: Contribution to scientific problem solving	1.7	All the requirements from criterias are met.
C2: Method	1.7	All the requirements from criterias are met.
C3: Clarity of content	1.3	Summary shows a clear representation of the whole document.
C4: Comprehensiveness/Completeness	2.0	All the requirements from criterias are met.
C5: The "golden thread"	1.7	All the requirements from criterias are met.
C6: Connection to relevant theoretical literature	2.7	
C7: Terminological unambiguousness	1.7	Terminological unambiguousness was avoided.
C8: Substance and degree of sophistication	1.3	Terminological unambiguousness
C9: Language, form (cover page, length of paragraphs, index, etc.), intelligibility,	1.3	The whole document was edited in accordance with the standarts.
Calculated grade	1.71	
Expected Grade	1.70	

Figure 0.1 Diana Pidruchna's Self-assessment

DENIZ ARAS		
<Team 02, Data Collection&Data Analysis and Results, PP 21-32>	Grade	Comments:
C1: Contribution to scientific problem solving	1.3	Totally contributed, the requirements are met.
C2: Method	2.0	Various methods to reveal information are used.Requirements are met.
C3: Clarity of content	1.7	Perfomed clear and understandable language in documentation.
C4: Comprehensiveness/Completeness	1.3	Quatations of unknown knowledge,descriptions, evaluations, experiments and results are documented.
C5: The "golden thread"	1.3	Overall argument is consistent.
C6: Connection to relevant theoretical literature	1.3	Relevant literature are used to reveal the unknown knowledge and connected to own research.
C7: Terminological unambiguousness	2.0	Use proper words and terms. Confusion is avoided.
C8: Substance and degree of sophistication	1.7	Mostly satisfied.
C9: Language, form (cover page, length of paragraphs, index, etc.), intelligibility,	2.0	Mostly satisfied.
Calculated grade	1.62	
Expected Grade	1.70	

Figure 0.2 Deniz Aras's Self-assessment

Henning Meyer		
Team 2, Chapter 1 and 2 Introduction and critical literature review, page 6-13	Grade	Comments:
C1: Contribution to scientific problem solving	1.7	the requirements from the criterias are met
C2: Method	1.3	the requirements are greatly met
C3: Clarity of content	2.0	the requirements are met in many cases but not all
C4: Comprehensiveness/Completeness	2.3	The necessary literature was studied
C5: The "golden thread"	1.7	the requirements from the criterias are met
C6: Connection to relevant theoretical literature	1.7	Relevant literature was always used
C7: Terminological unambiguousness	2.0	the requirements from the criterias are met
C8: Substance and degree of sophistication	1.3	Attention was always paid to ambiguous
C9: Language, form (cover page, length of paragraphs, index, etc.), intelligibility, citations, visualisation (charts, tables, etc.), spelling, punctuation	1.3	the requirements are greatly met
Calculated grade	1.70	
Expected Grade	1.70	

Figure 0.3 Henning Meyer's Self-assessment

Jan Kunkler		
Team 2, Chapter 3 Methodology, pages 13-21	Grade	Comments:
C1: Contribution to scientific problem solving	1.3	Scientific problem could be solved very satisfactorily by the methodology
C2: Method	1.3	All the requirements from criterias are met
C3: Clarity of content	1.3	All content is clarity shown and discussed
C4: Comprehensiveness/Completeness	1.0	Every single step of the Project is complete shown in the Methodology
C5: The "golden thread"	1.0	Whole Methodology is connected to previous and following Chapter and includes experiences from the other chapters.
C6: Connection to relevant theoretical literature	1.3	Relevant literature is shown in the chapter and were explained
C7: Terminological unambiguousness	2.0	Terminological unambiguousness was mostly given
C8: Substance and degree of sophistication	1.3	Many methods were tried, used and some rejected with reason
C9: Language, form (cover page, length of paragraphs, index, etc.), intelligibility,	1.3	The whole document was edited and accordance with the standarts
Calculated grade	1.31	
Expected Grade	1.30	

Figure 0.4 Jan Kunkler's Self-assessment

Affidavit

I hereby declare in my word of honour

- that I prepared this final thesis independently and without any outside help.
- that I used no sources or resources other than those indicated.
- that I marked any verbatim quotes and paraphrased text by other authors within the work where they appear.
- that I did not submit it elsewhere for examination purposes.

I am fully aware that a false declaration will have legal consequences.

Ich erkläre hiermit ehrenwörtlich,

- diese Master-/Bachelor-/Seminararbeit selbstständig und ohne fremde Hilfe angefertigt,
- keine anderen als die angegebenen Quellen und Hilfsmittel benutzt,
- die Übernahme wörtlicher und sinngemäßer Zitate aus der Literatur an den entsprechenden Stellen innerhalb der Arbeit gekennzeichnet,
- die Arbeit mit gleichem Inhalt bzw. in wesentlichen Teilen noch nicht anderweitig für Prüfungszwecke vorgelegt zu haben.

Ich bin mir bewusst, dass eine falsche Erklärung rechtliche Folgen haben wird.

.....

Ort, Datum

.....

Unterschrift

The English text in this document only serves the purpose of providing information on the contents of the corresponding German text.
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