

An interactive game for enhanced learning

Group 11

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Preface

The purpose of this report is to analyze how the digitalization project in TPK5100 have been carried out and how the project management part of it was handled. This will be done by going through important aspects of project management, and reflect on how they were handled in this project. We would like to thank the people who helped us with testing our product and for providing us with valuable feedback.

1. Product description and digitalization projects

Our product is a simple game that lets the student learn curriculum in an active and fun way. The game starts with a given amount of resources and have ten turns. For each turn the player/student has to make a choice for a scenario in the project and the resources gets affected based on the choices the player makes. The goal is to do the best choices to deliver on time, within budget and with proper quality. We decided to make this game because all in the group thinks that a game is a fun and good way to learn, and that we had two good programmers who has the required skills to make a game.

The goal of a digitalization project is to use digital or computer technology to increase value in an organization, country, class and so on. Digitalization is not the same as digitization which is the process of turning something analog to digital, nor digital transformation which is the process of using digitalization to change a business model. There are many different types of values that can be increased through digitalization. Cost of production can be decreased, communication can be improved, quality of products can be increased, competence can be learned, and many other improvements. Today digitalization is a very important topic as technology is changing at a rapid rate, and to stay competitive it is important for businesses to implement new technology. It is also an important part in making processes more eco-friendly (Nerja, 2019).

A factor that is important in digitalization is the customer experience. It is always important that the digitalization gives a good experience for the targeted customer group, and some digitalization projects has "improved user experience" as their main goal (Nerja, 2019).

In this project the focus was on how to improve learning by using digital technology. We found the most challenging part of the project was to identify how exactly to make the digitalization valuable as a learning tool. We focused on making the project interactive for the user to make it more involving for the user. A lot of learning is passive, and digitalization can help making it active learning instead. In order to make it active in a way that interests the student, it was important for the group to make game mechanics fun and to make a case story that is both involving the user and at the same time gives a large learning benefit. In order to enhance the learning benefit we decided

on giving immediate feedback to the users after each question when it was fresh in mind, instead of a summary at the end of the game.

Another main challenge of a digitalization project is the digital competence of the group. In order to make a digital product you need to know the tools you are using well enough. Before we decided which product to make, all members of the team shared their experience and competence with various digital tools. It became clear that all members had programming experience, but only a few felt they had enough to make a product. The more experienced programmers expressed an interest in creating a game, and because this also was seen as a potential fun way to learn we decided on this product. The other team members that did not have enough competence to contribute to the programming was given the other tasks that was needed for the project.

2. Self-evaluation of the project management effort in the project

We managed to organize the project group very well. We divided the team into three groups where each group had one main responsibility on the project. We had one group that focused on programming the game mechanics, one that focused on making a case story for the game, and one that focused on the management part (planning, communication and so on). We choose the programmers based on experience to minimize the risk of not being able to develop the game mechanics. For the other two groups we choose based on preferences. This worked well as the programming group did a good job, with almost no bugs in the first implementation, and the other groups did a good job since they were motivated for the task.

The project team managed to identify most of the risk in the planning phase. One risk that were not considered in the planning phase where the risk of group dedication, considering we used a project matrix approach. Another that is tied up to the first is the risk of people leaving the project. One of the members dropped the subject and left the project team. This was a risk we had not thought of in the planning phase, but we handled it well. He was a part of the management group, so to compensate for him leaving we made the two other groups help out the management group. The rest of the risks where much as predicted and were handled well. We did not have much problems with development of the game mechanics, nor with making a suitable case for it. The fact that we identified them in the planning phase and choose how to approach the project to minimize them helped.

We managed to fulfill the success criterias as we delivered a learning game on time that students learned from. We do however see improvement potentials to many aspects of the game, but for a proof of concept solution the project delivered on the success criteria stated in the plan.

Statement: We evaluate our project management effort as successful

Scale	Strongly	Disagree	Neither	Agree	Strongly
	Disagree		agree		Agree
			nor		
			disagree		
Your				We managed to plan and	
response				execute the project. But	
				since we had to treat it as	
				a project matrix because	
				of other subjects there is	
				room for improvement.	

3. Self-evaluation of the value to the learners

There are multiple scientific studies on videogames that shows that they create a value to the learners (Griffiths, 2002) (Saghir, 2016). The studies imply that videogames gives a more direct involvement of the ones playing them, instead of a more traditional passive learning environment. For us it was important to test if the game we made had any of these learning benefits. But before we tested the learning benefits of the project it was very important for us to test the technical aspect of the game.

To test a digital project is very important. A lot of digital developments, and especially games, might have many unforeseen bugs on release. A classic example of this is the release of Assassin's Creed Unity (Kelion, 2014), which got a huge amount of backlash. It was important to us to first test the game for bugs. This testphase we only did ourselves. We wanted to have a product that was bugfree before we tested it with other students. For this testing we tried every way of answering and saw if the results were logical. We also tried if there were any unexpected things you could do that would break the game. We found no game breaking bugs, and decided to move on to test the game for learning potential.

We discussed in the group how we should approach this. We saw that other groups had reached out to the class to make them test it out. After some discussion we decided that we would rather try it on other students we know so we could actually test if they learned something, since that they have not studied the subject before. We had each group member find 3-4 students that were willing to try the game and give feedback on it. For feedback we asked questions from the subject that the game covered (5 questions), if they found the game interesting to play as a learning tool, and if they had any comments to the game we could use in the report. In total we had 17 students try out the game and giving feedback.

On the answering subject questions the results was varying. All the testers were able to answer at least one question about the subject matter correctly. The worst result was two students only getting one question correct, while nine of the students got all questions correct. On average the students answered correctly on 3.8 of the questions. This is a good indicator that the students learned something from the game. In hindsight we should have taken the questions with the students before

they played the game as well to map their previous knowledge. Other factors that can explain differences in performance from the test group is dedication of test subjects and how fast learners they are.

On feedback on how interesting they found the game we got mixed feedback. In general the students liked the concept, but saw room for improvement to get them more involved in the game. Asking further questions from the feedback we found out that many of the students would like more graphics and features in the game. As commented by one of the students, "It is a little lifeless. Would be more fun with some animations. At least on the responses to the choices.". This is something we discussed in the planning face and something we would like to implement. The reason we did not do this in this proof of concept is that we wanted to minimize the risk of not being able to develop a product for the hand-in date.

One of the comments we got that we reflected the general feedback quite good was:

"I think it is better than reading it in a book or going to class, but it didn't feel like it was something I really wanted to play for fun. I guess it is good as an additional way to learn and test your knowledge, but I think it could need some more interesting stuff happening to be really fun as a game" - Iqran Iftikhar (Answered 5/5 questions correctly after playing)

All in all we are satisfied by the feedback from testing and think it shows that there is learning value in the game, but that there still is features in it that could improve it and increase the learning value.

	Our product is of high quality and we recommend it to be used as learning aid in				
	project management				
Scale	Strongly	Disagree	Neither agree nor	Agree	Strongly
	Disagree		disagree		Agree
Your				We saw that most of	
response				our test students	
				learned subject	
				curriculum from	
				playing the game. We	
				still see that there is	

	improvement potential	
	that can both improve	
	the learning potential	
	of the game.	

4. Success factors

Time requirements

It was important to follow a timeframe that gave us enough time for each of the tasks and time to test the product. One of the key time requirements was that the case, and the main game code would be done at approximately the same time so they could be integrated. In all we were able to keep to our timeframe and complete the project.

Communication

In all projects communication is key. The primary communication for us was between the project team members. We also had to have communication with Bassam Hussein (project owner) and the students (end users). For communication within the project team we used a common line of communication through message group. Because the members of the project team are from different lines and studies it was sometimes complicated to find meeting time. We solved this by having some few meetings where we went through the concepts of each part of the project and dividing into smaller task that could be solved individually or with little direct communication with the team. This worked most of the time, but communication and division of labor became a little harder when one of the project team members dropped the subject and left the project. We solved this by having a meeting and dividing the remaining of his task over the rest of the project team. For communication with Bassam Hussein we had an early meeting where we went through our idea and got feedback from him on what we should focus on. This gave us a red-thread to how we should work forward to make a good product. We didn't involve many end users before the testing phase, as we as students of the subject also worked as a representation of the end users. Although a biased one. In the test phase we communicated with end users by letting students try the game and hear their feedback, as well as testing if they learned anything.

Documentation

In a digitalization project, especially one that has a lot of new code, it is important to document and comment on what is done. This is important to make debugging and further development possible. It is also important to keep everyone on the project team up to speed on how everything is developing and what progress is made. This was one of the success factors we were not so good in making sure was followed. Luckily this project and project team was small enough that we didn't

encounter many problems as a result. But we still see that this is an area that we have to improve on. If we were to upscale this project and keep developing on the lack of proper documentation would create problems.

Sub-system integration possibilities

For this project it was very important that the case was made in a way that made it easy and logical to implement as a game. It was also important that the game mechanics was made in a way that made it easy to integrate the case into it. We managed this without many problems

Choosing project structure

When choosing a project structure we had to consider all the other subjects the members of the project team are taking. This consideration forced us to choose a project matrix approach. This had some drawbacks that we did notice through the project. When all members worked on it like a project matrix with different matrices it resulted in different working times and making it quite difficult to find meeting times that worked for everyone. We also noticed that many of the members had subjects that was very demanding, making them not prioritizing this project. Even with these challenges we found ways to get the work done, and manage to create a game within the timeframe. The quality of the final game did not get as good as it could have been if we had the possibility to choose a different project structure. We could have added more options and gameplay factors.

Managing risks

An important part of every project is to identify potential risks and finding a way to minimize or otherwise handle them. Early on we discussed and identified different risks in this project and how to handle them.

One of the major risk factors in developing a game is if the competence of the team is adequate for managing the coding challenges of game development. We decided to leave the task to do the programing to the two most experienced programmers on the team, where one had previously used Unity (a game engine). As the project developed we found this to be a wise choice as the programmers handled the task of making the game very well and did not end up with a lot of bugs. Another risk factor was if the case was relevant for the subject and to make sure all the answers matched with the theory. This was quite a challenge as it is hard for us to evaluate our own

understanding of the subject. The case team solved this by focusing on making questions that could find reference directly from the book. This made sure the answers were correct and relevant to the subject.

We also discussed how we should evaluate the learning potential of the game. We found out that a good way to test this was to try the game on students that doesn't take the subject and ask them some questions from curriculum to see if they learned anything from the game. We found that most of the test users learned some key points from the curriculum.

One major risk we had to discuss was the risk if we didn't manage to follow the timeframe and get a product ready for the presentation. We found that the best way to make sure this didn't happen was to start small and build on from there. This made it possible for us to keep the timeframe and get a product ready.

The last risk we discussed was the dedication of the group. We decided to divide task to make people directly responsible for their job. Then everybody has direct ownership of one part of the project and could be held responsible if it didn't get done. This worked pretty well, but we got some problems as one of the team members left the subject and project. Since he had a clear task it was still easy to divide these and find a way to make it work even with him leaving.

We think the most important factor was communication. This is because almost all the other success factors are dependent on how well we manage to have good communication. It is very hard to fix problems and make good progress if we don't have communication within the group. It is also hard to make a product that is beneficial and can be a learning tool if we do not communicate with the end users and project owner.

5. Most important lessons from your project

- You should use a lot of effort on the planning phase. If you got a good plan that covers risk and gives a good starting point.
- 2) You should define the responsibility of the group members early on. This makes it easier for group members to do work individually and can discussions in the group later on.
- You should find out who has what competence early on so it is easy to discuss possibilities and easy to divide tasks.
- 4) Our advice is to actively communicate with the group. Make sure everybody is up to date and on board on the project.
- 5) We learned that it is possible to handle a project member leaving if the rest of the team is dedicated and communicate on how to handle it.
- 6) We learned that doing a project like this with students from many different lines of study can be a challenge because of finding meeting time that works for everyone, but is still doable with good communication.
- 7) We suggest to keep good documentation from the start. This makes communication easier, and makes it easier when to write a good report.

References

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Peer-review evaluation report

Name of the group we are assigned to evaluate: Group 1

Strengths

The idea of the product is very good, and it is a nice variation from reading text in a book which can become a little boring at length. It can also be a nice way to break up the lectures in the course. The visualization tool used is of very high quality, and has a funny vibe to it. The duration of the video is also very good, as you want to receive as much information as possible over as little time as possible.

Weaknesses

The product had some weaknesses that reduced the quality. The most prominent weaknesses was that the voice in the video was too monotone, robotic and fast. This made it difficult to catch the essence in the case. We had to see the movie several times to catch all the important information. The voice that is too fast and monotone is the main reason for the decreased quality. We recommend that a real person is the voice in the video. Another weakness was that the case-text in the book was more informative than the video.

	The product we reviewed is of high quality and we recommend it to be used as learning aid in project management				
Scale	Strongly	Disagree	Neither agree	Agree	Strongly
	Disagree		nor disagree		Agree
Your				Idea is	
response				very good,	
				but the	
				product	
				needs	
				higher	
				quality	

A) On a scale from 0 to 10. What grade would you recommend for this product? 6

Project Plan

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Description of the product

We will be making a text based game where the player is a project manager. The goal of this game is to give students a more fun and interactive way to practice project management. The goal for the player is to make the project succeed by making the right choices. The player starts with a budget and timeframe. Choices of the player will affect the budget, timeline, and the player has to balance these to reach the best possible score. At the end of the game there will be an outcome based on the choices the player makes. This is meant to make the student think about how different choices affect simple factors in the project.

There has to be some kind of feedback during/at the end of the game so that the player knows how to improve his/her knowledge of project management. The consequence of each decision could be presented so that the user knows what went right and wrong, maybe along with some relevant theory and real-world experience.

Structure of the game:

The game begins with the player getting a project case and measure for resources used, time used of the project. There are limits on each of these parameters which the player has to try to keep within. There is a predetermined number of turns. For each turn the player will be presented with a situation where the player will need to make a decision. Each decision will have an impact on the parameters as well as give the player a feedback on the choice. This feedback will help the player reflect on the choice. If the parameters goes far over their limit the game can be ended early as the simulated project gets cancelled by one or more of the major stakeholders. This will give an endgame text explaining why the project got cancelled. If the player makes it all the way through the game the endgame will give them a score based on which choices the player makes. The goal for the player is to get as high a score as possible. The score is determined by the combined parameters. This means it can be ok to for example go a little over budget if the project is finished before estimated time.

Overview of the project case in the game:

The project case is inspired by the case "Construction project B4" from the course textbook (Bassam, 2018). This case is chosen because a construction project is something the end user probably can relate to. It is also motivating to have a tangible end product. Another reason for the choice of case is that a construction project can easily be written as a

storyline. The case is modified and adjusted to make it more interesting and appealing for the user.

In the project case the user is a project manager that is going to construct a luxury hotel in Trondheim. Construction of the hotel has a timeframe of 2 years and a budget of 750 million NOK. In addition the construction process has to be environmentally friendly and the end-result is to be of high quality since it is a luxury hotel. Timeframe, budget, quality and environmental friendliness are the success criteria of the project. The user also has to manage the stakeholders of the project. The stakeholders in this case are the owner, Trondheim municipality, contractors (builders, electricians, plumbers, etc.), neighbours, hotel management and external suppliers needed for the daily hotel operation. The construction team has previously completed a similar project that failed on some of the success criteria. This resulted in bad morale among the construction team. The project manager will therefore need to increase the morality among the workers and contribute to a better work environment.

Learning goals of the game:

The learning goal of the game is to let the students try themselves as a project manager and get an understanding on how choices affect parameters in the project. By playing this game students should reflect around choices in a project and what consequences they have. The game will help the students reflect by giving feedback on their choices.

Benefits of the product

We have experienced that a lot of theoretical subjects can be a little one sided where one just read about project and reflects on choices made. While this definitely has learning potential it doesn't necessarily make the students reflect on how they would make choices as they come up. This game will try to make the students use what they learn by analyzing an other project to use when they themselves have to do them. This will help them reflect more on choices and consequences. It is often easy to think post-project when the consequences are displayed that "of course that was a bad decision", but it might not be that easy when one is presented with the choice mid project. Often choices have consequences the project team doesn't consider which might greatly affect the project.

Many studies show that practical experience is a really effective way to learn. By making an interactive game we create a close to practise experience that will help students learn from doing, not just reading.

Another benefit is that an interactive story where your choices matter are often more intriguing and fun than plain reading about it. This can help the students get more motivated to learn and be active in the subject.

Stakeholders

Bassam Hussein: As the teacher of this subject he is a major stakeholder. A good product can help him in making the subject better. We will try to actively include him by talking to him throughout the project to get feedback to make a successful project.

Students: Students are the end users and if they find the product useful and learn from it is what decide if the project is a success. We will try to involve and ask other students than ourselves what they think and how they would like the product.

Project team: It is the project team's task to make the product. We have divided the group into three "departments"; management, IT and creative. We need good communication through the project.

Potential other user: It might be possible to make the product adaptable for other subjects. We will not put too much effort on this before we know if it will be easy or not.

Risks

A video game is ambitious and the main risk is therefore that there will simply not be enough time to reach the specified goals. Generally in programing the task might often more difficult than the estimates. To lower the risk we will keep it simple in the start and build on it from that. This will make sure that we have a working product at the very least.

The storyline has a risk of being too complex or abstract for the end-users, resulting in loss of interest and reduced learning outcome. In addition, there is a risk the storyline doesn't appeal to the end-users. The storyline will take root in one of the cases from the course literature. To make the case more appealing the storyline will be modified, and the language will be simplified where possible. Also, we will test the interest and complexity to the storyline by having other students, both in the course and outsiders, review it before the final product.

There is also always a risk when working with a completely new team that the couperation doesn't work as planned. People might have other goals and values than one thinks. To avoid problems here we will focus on good communication.

Needed skills

- Game development, Unity
- Content for the game, thorough understanding of a project case and the background theory
- End user testing, someone should learn how to do this properly in order to test our system

The IT-crew need to learn how to make a game in Unity. One of the project team has already used it. He will need to share his experience with the other person in the IT-crew. Other than that they will need to use the internet to read on how Unity is and how to make games. They will also need to use the internet to search up problems as they come.

The storyline-crew need to have a thorough understanding of the theory of the course in order to create a game that covers a large part of the course curriculum. To acquire these skills the storyline-crew will use a lot of their time studying the theory of the course and implementing this in the storyline. Since the game is for learning-purposes, there needs to be a lot of theory in the game, both as part of the questions and comments. In addition they need to be creative. This is a skill that is difficult to attain over such a short time-frame, but with their background combined with research and inspiration from others it should be enough for an interesting story.

We also need to do research on how an end user test in a product like this should be performed properly and how to qualify the feedback to make improvements.

Project breakdown structure indicating the major deliverables, sub-

deliverables and work packages

The projects major deliverable is a ready to use game that offers its users (e.g. students) the opportunity to significantly improve their understanding of project management in a fun and interactive way. It should offer the opportunity to improve lectures and/or use it in a private learning environment.

To achieve this the project has to deliver two sub-deliverables. On the one hand, its underlying structure (the program) has to work without issues that prevent the user to play the game as it is designed. The IT-crew will focus on that sub-deliverable.

On the other hand, the storyline has to stick to the case while offering a stack of choices that feel natural to the user and make sense in a project management way. The storyline has to be consistent. Furthermore, the offered explanations on why a made choice was good or bad and why it affected the course of action in the way it did must be presented in a user-friendly and understandably way. The Creative-crew will focus on achieving this.

Finally, it is the managements task to ensure good communication between these two teams two come up with a working product in the end. To achieve this, it will be necessary to enable the IT-crew and the Creative-crew to come up with solutions for:

- 1) Main concept of the game the flow, goals e.t.c.
- 2) Case scenario, storyline, questions and answers.
- 3) System architectures
- 4) Integration of cases into game
- 5) Fault testing

Project schedule

To provide a working product after the relatively short time frame it is necessary for all teams to work at the same time. Therefore the IT-crew works on the programming while the Creative-crew focuses on the storyline from the very beginning. This makes additional time for combining game and storyline necessary and adds some potential risks. However, it is essential to succeeding.

The project schedule for the Creative-crew:

- Case definition 24.09.2019 08.10.2019
- Drafting 05.10.2019 15.10.2019
- Completing Storyline 10.10.2019 20.10.2019
- Fitting storyline for game 20.10.2019 27.10.2019

The project schedule for the IT-crew:

- Main concept of game 24.09.2019 01.10.2019
- Game system architecture 01.10.2019 15.10.2019
- Case scenario, storyline, Q&A 01.10.2019 15.10.2019
- Integration of case/storyline 15.10.2019 27.10.2019

Finally, there will be the necessity for testing which involves all team members and end-users:

- Fault testing 22.10.2019 01.11.2019
- End-user testing 30.10.2019 08.11.2019

The following Gantt chart gives an overview on the schedule. The red lines mark the different deadlines for the project.



At all times it is most important for the Management-crew to ensure the flow of necessary information between the IT-crew and the Creative-crew.

Most important success factors

- Commitment by all team members to come up with a working game within the given time frame every team member has to be committed to the project and its goals.
- Continuous communication at all levels communication between the subgroups is very important because of the parallely executed tasks. It is crucial that the subgroups run important changes and such by each other before implementing them.
- Sticking to the schedule as there are predefined deadlines, needing more time is not an option. Therefore, it is most important to stick to the schedule as much as possible. Otherwise proper testing before delivering the product would not be possible anymore which would result in a potentially not working final product.

Characteristics of digitalization projects

I a world that got overrun by the internet, computers, mobile phones and electrical devices in general in the last few decades, digitalization is happening around us all the time. We might even be so used to it happening that we do not notice it anymore.

There seem to be four major characteristics of (successful) digitalization projects:

- A focus on customer experience

It is crucial for companies to completely understand who their customers are, how they think and how they act. This is the key for being able to offer a satisfactory customer experience.

- Well defined operational processes

To allow for a successful digital transformation, the company needs clearly defined operational processes. That is very important for generating data needed for decision making. This data is also enabling the company to better recognise their customers needs and allows for good knowledge flow within the company.

- Clear data and process integration

Because of the data the company gets from well defined operational processes decisions can be made based on facts, not feelings. This leads to better decision making and offers the opportunity to improve not only operational decisions but strategic decisions as well.

Value instead of activities

Digital transformation enables a company to rethink how it delivers value to the customer. It challenges the status quo and provides opportunities to deliver value in new innovative ways. This often even leads to new business models.

The institute for digital transformation offers a good article for first steps into that topic.

https://www.institutefordigitaltransformation.org/four-characteristics-digital-transformation/

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