
A SUPPORTING INSTRUMENT FOR REFLECTION BASED ACTIVITIES IN HIGHER EDUCATION

ACHIEVING MORE POTENTIAL THROUGH REFLECTION

Bachelor Thesis for Creative Technology by

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“If You Are Working On Something That You Really Care About, You Don’t Have To Be Pushed. The Vision Pulls You.” – Steve Jobs

ABSTRACT

This bachelor thesis starts with the interest from the researcher in motivating students for their study. Reflecting about the study progress is helping a student to motivate themselves for their study. Because it is useful for students to become aware about they are learning and what is useful. The problem is, students nowadays are not reflecting well enough as pointed out in literature, questionnaires and interview, conducted in this thesis. This is due to reflection tiredness, so reflection tiredness has to be reduced. This thesis will show that, reflection tiredness can be reduced by partly replace the role of a reflection partner and generating automatically a reflection report. Combining these facts, the following research question has been conducted: *How can an interactive reflection instrument contribute to improve insights in ones qualities and viewpoints, as part of their professional development during their study?*

A research is conducted about reflection in higher education, with as most interesting the effect of a reflection partner and the problem reflection tiredness. A partner is not always available and therefore the instrument can replace a reflection partner. Normally when a reflection partner is replaced students have to write a reflection report. However, despite writing a report could be effective, this is not done correctly, due to reflection tiredness. This is where the instrument will be used, to replace the partner and the reduce reflection tiredness. Also the instrument will be implemented in the Creative Technology curriculum, where reflection is important for professional development. According to the research, students were missing reflection about their orientation during their minor choice.

Next, an interactive system is developed which helps the students reflect, depending on their specific situation or experience. The system needs met important requirements which are set during the ideation, specification and realisation. The important requirements were: the instrument needs to generate a reflection report, student must feel more confident after using and must be interacting with the student. This has been done with the use of the software Berkeley Bridge, which is software to program decision trees¹. This is programmed so it could generate a reflection report and generate reflective questions depending on the input of the student.

The outcome will be an interactive reflective instrument, with which students can interact, in different words the system will act as a reflection partner. The system is based on line reflection which has been incorporated to focus on the orientation about the minor choice. This has been tested on n=8 students. What resulted in that students became more confident about their choice and they pointed out that the instrument was effective, in other words it could replace the reflection partner.

Finally, making the line reflection method, about orientation during the minor choice of students, interactive will contribute in development of the professional development. The recommendations are for further research, to research what the differences are about reflecting with an instrument and reflecting with a real partner? And in how far can the instrument replace the real reflection partner?

¹ A decision tree is a structure that sends a user to a specific node depending on the previous answer.

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'Thanks mum and dad, for everything, this is one also for you.'

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1. INTRODUCTION

In this chapter the relevance and the playing field will be shown about reflection (for guidance and introduction through this report). Firstly an introduction will be given, why this project is about reflection, substantiated from own motivation, interviews with students and teachers and from literature. Due to the fact that reflection in higher education can be approached from multiple viewpoints, a clear definition will be formulated which will be used throughout this report. Next the research questions will be stated and the relevance. In the end this chapter with an outline of this report will be presented.

1.1 INTRODUCTION

In the following section, will be explained why reflection is the main subject for this project. First the author will tell a personal experience, following this experience is placed in a broader context where the behaviour and attitude of other students will be taken into account and finally the connection will be made why reflection may be important in higher education.

“A project I participated in is called School at Sea. During School at Sea you are put in a whole new learning environment compared to the normal secondary school system. You sail for half a year from the Netherlands to the Caribbean and back and do all your courses on board by yourself. During this experience, I figured out how to motivate and challenge myself. There was no homework or a teacher in front of the class, we had to challenge ourselves from the start. This worked for me as well as for all the other students who participated in this project. After the students came back; they were more motivated, happier and more responsible. These were all side effects when the students knew how to challenge themselves, in this new environment.

While I did not notice it at the time, many different experiences occurred. These experiences were both good and bad it did not matter, as we got confronted with different viewpoints in every experience. Because we lived so close together, we were confronted so easily with these viewpoints from others that we learned and adjusted ourselves to our findings. Which led a positive study progress and knowing how to motivate oneself. In other words, reflecting helped me find out what the true nature was of a choice and what chances it offered. What also comes with this is, ideally, that the student will get to know more about him- or herself.

A couple of years later a new period started, studying at the University of Twente. I noticed students from Creative Technology also entered a completely new environment, the same as I did. But these students are not so easily confronted with other viewpoints about an experience as it was at sea due to that in Twente we did not live as closely together as I had at sea. And therefore I found out that the natural reflection process did not occur. Because most students just did the obligated study work to show they are/were making process. My approach was the same when I started in a new environment full of freedom I did not reflect as much as I had at sea. Is it possible to help other students to reflect on their behaviour during their study period?”

As will be explained in the definition of reflection (section 1.2), students reflect by looking from different viewpoints. A point of view is more applicable in the personal area than in the academic area, where students reside. Therefore Creative Technology students may not see the importance of reflection in higher education. However, as described in my experience, seeing different points of view helped my motivation for a better study progress. Therefore it may be important for students, who are entering a new environment, to reflect on their experience. In the next section these findings will be substantiated by interviews and literature and shown why the implementation of reflection is needed in higher education. First a definition of reflection in higher education will be stated and a description of the client (the study Creative Technology) will be given.

1.2 DEFINITION AND USAGE OF REFLECTION

A general definition of reflection is “*reflecting is thinking about a certain fact, with a view to learn something for improvement in the future*” [1]. This definition of reflection is not specific enough, to fully grasp the topic of this report. For this report the focus will be on reflection in higher education. Therefore the framing of reflection is important for guidance through the report. How this definition is shaped will be explained in section 2.2 the Literature Research.

The following definition is used throughout this report (stated in section 2.2):

“Reflection is a process (activity) which looks back at a study-related experience through different viewpoints, in which the student, with the use of a dialogue/exploration, will become aware of both the importance of the situation and the action perspective(s). Which may influence and adjust the self-specified standards.”

1.3 CLIENT

This project is developed for the client, the Creative Technology program at the University of Twente. To better understand the client and the proposed solution I will give a brief description of the program.

The Creative Technology program is challenging students to use technology for developing creative innovations which the market needs. The study is combining insights in new media, smart technology, creativity and design. Developing new technical skills and knowledge, how this is influencing humans and how to start a creative processes and innovative design is at the heart of this program. All courses are instructed in English. After graduation students, most of the time, end up at businesses that foster innovation. Due to the multiple disciplines, students are able to transform dreams of clients into new solutions. It could be said, students begin with a broad range of topics and finish in the same fashion.

There is a danger that the benefits of a broad education are not recognized by the labour market. Therefore students need to be critical and aware about what is useful for their professional development. Therefore an important final learning outcome is that students need to be able to critically reflect, this will be substantiated in the next section 4.4 Problem Description.

During this report there will be talked about two different forms of reflection. The first is as explained above about reflection specifically in Creative Technology. As this project is about developing a reflection instrument for the client, Creative Technology. The second is reflection in a broader context, namely reflection in higher education. This is because research will be conducted on information about reflection in broader context. This distinction is made to get information about reflection in higher education, before adapting it to the client, who also has used reflection in his own way. This will be explained in the next section.

1.4 PROBLEM DESCRIPTION

Experience and personal findings are not enough to substantiate a problem for a project. Therefore interviews and research has been done, to verify these findings.

This section will show evidence why reflection is still unused to its full potential in higher education and will give guidance why reflection is needed in higher education. During reflection moments in Creative Technology, students take subjects like professional development and an academic skills process, which will guide them towards Academic and Professional learning outcomes. One of these learning outcomes is explained as followed, *“Graduates are capable of critical reflection and can adapt their behaviour on the basis of that reflection”* [2]. In other words students need to be able to reflect on their study progress. Moreover, an interview with A. Schaafstal included in *Appendix E*, is echoing this, she stated that students need to be critical thinkers. On the whole reflection is an important and mandatory skill for academic students.

Reflection in the current curriculum is implemented in professional development; especially in the second year. This will be explained in section 2.2.5. Despite this, during the professional development the focus is primarily on new subjects, not much on reflecting. Due to the fact that this skill is required from students, raises the next question: *“is reflection implemented well enough to satisfy the critical reflection skills which are required?”* According to my experience during the study, in the previous section, students are not capable of reflecting well enough. Besides this experience, as mentioned in literature, reflection in higher education has also not reached its full potential. Mittendorf [3] is pointing this out, the goals students need to achieve are not met. And is Procee and Visscher-Voerman [4] are adding, some students see reflecting as self-evaluation. This may lead towards misinterpretation of reflection with the consequence that reflection does not lead towards its desired outcomes. So it can be concluded, the current reflection in higher education is not yet providing enough to contribute to a good reflection process. To summarise this section, reflection is needed in higher education for critical thinking.

It is offered in higher education but from experience, interviews and literature it is shown that reflection is still not used to its full potential. This is the overall problem: reflection is not used to its full potential. At the moment we live in a time where technology is used as enabler of transformation and the main topic of Creative technology it seems therefore highly logical that a smart instrument could be developed to help reflection to be used more to its full potential in higher education. There is no smart instrument suitable for the current higher education curriculum. This may be an opportunity for a new innovative implementation on the area of reflection in higher education. On the basis of this and the conclusion of the next section, the research questions will be formulated.

1.5 GOAL

The goal of this report is to see where and how a smart reflection instrument can be designed and implemented in higher education and help with different reflection methods. Due to the fact that the implementation of reflection in higher education has not reached its full potential. According to I. Visscher included in *Appendix C*, it could be very interesting if there would be an instrument which can help with a reflection process. This requires insights and knowing where the smart instrument can improve the current way of reflection in the Creative Technology curriculum. .

1.6 RESEARCH QUESTIONS

Building forth on the previous problem description, a concrete research question and three sub research questions were formulated.

The research question:

RQ: *How can an interactive reflection instrument **contribute** to improve insights in ones qualities and viewpoints, as part of their professional development during their study?*

The first question is to substantiate the research question. This question is not focussing on the instrument, but on where reflection in higher education can be improved:

sRQ1: *What kind of **improvements** can be done in (and where the instrument can be **integrated** in the current curriculum of) Creative Technology towards reflection processes?*

The second sub research question is also to substantiate the research question, however this is one focussing on where the instrument can add value:

sRQ2: *Where can a reflection instrument **add value** to the study progress, for reaching the final learning outcomes of Creative Technology related to critical reflection?*

The final sub research question is for a later stage in this report, which is for implementation of a smart instrument. If effects can be measured this will give opportunities for the instrument, it may help give feedback, input or output:

sRQ3: *How can the effects of a reflection process be **measured**?*

1.7 RELEVANCE AND POTENTIAL OF REFLECTION

The relevance of this project, is to find a place in the current higher education in general and in Creative Technology in particular, where a smart reflection instrument can be implemented. A smart instrument can help students achieve a higher level of reflection and benefit from its full potential as we have seen that there is room for improvement concerning the impact of reflection.

The potential of this smart instrument will help students during their education to be more motivated for the learning processes or for professional development, this will increase the self-studying behaviour.

In literature is shown why to learn to motivate oneself helps with professional development. According to Sikibar and Sima Pal [5] students who learn to motivate themselves have better achievements than others. Learning to motivate oneself, as a student, is an important factor, which influence the achievements of a student during his study positively. Mittendorf [3] states that learning to motivate oneself will lead to better self-managing behaviour. Thus by learning how to motivate themselves students understand more about their professional development during their study.

As motivation is important for the study progress of a student [3], reflection can support students to learn to motivate themselves. By the use of reflection according to Mittendorf students can be more motivated for their study. Also Procee and Visscher-Voerman [4] are supporting this, that reflection can be a perfect method for students to motivate themselves and improve the knowledge around their motivation. Reflection can contribute to motivate themselves, so it can be concluded that an effective reflection process is important for students.

1.8 REPORT OUTLINE

In this section the structure of this report will be described. The structure is based on the Creative Technology Design Process [6] which will be explained in chapter 3 Methods and Techniques. The outline describes all chapters and their purposes.

Chapter 2, the State of the Art, the background research which has been conducted for this project. Within this chapter interviews, literature research and reflection models are discussed. The aim of this section, is to gain background information, which can be used in the ideation phase and may contribute to answering some research questions.

Chapter 3, Methods and Techniques, this section will explain what the Creative Technology Design Process is and how it will be used to develop a prototype. Also, this section will describe the research techniques which are been used to conduct information or insight how from the users.

Chapter 4, Ideation, this section is about generation and conceptualization. This is the first phase, where the prototype requirements would be set according to conducted information from the stakeholders. The important stakeholders will be pointed out with a stakeholder analysis.

Chapter 5, Specification, is about functionalities of the system, to show how the system would interact with the user. The list of requirement will be adjusted with the use of the information how the system should interact with the system.

Chapter 6, Realisation, this phase is about realising the instrument. How it will be developed, with the use of the activity diagram and the system architecture of the Specification. This section will explain which software will be used and how the final instrument has been made.

Chapter 7, Evaluation, includes the evaluation methods, a functional, expert and user evaluation. To test if the instrument is working according to the set requirements. The aim of this section is to convey the user experience with the instrument and to understand where alterations and development is needed.

Chapter 8, Conclusion and Recommendations, the purpose of this chapter is to conclude the report by answering the research questions. Based on these conclusions, recommendations will be done for further research and development.

2 STATE OF THE ART RESEARCH ON REFLECTION IN HIGHER EDUCATION

In this section the background research which is conducted for this project will be described. Based on this research, insights in reflection in higher education came forward. With the use of this research, an overview of how reflection is implemented in higher education is made. This will show where opportunities are and where a smart reflection instrument can be implemented. This research will partly answer the sub research questions one and two (which will contribute to answering the research question).

The order of this chapter is as follows: first, the literature research is presented which provides insights in how different factors play a role in a reflection process. Secondly, the results of the interviews with experts are presented, to state their experience with reflection and to get a better image how reflection is implemented in higher education and Creative Technology. In addition, as finally different methods, conducted from interviews and literature, about reflection will be discussed.

2.1 LITERATURE RESEARCH

The literature research is conducted to show which factors are of influence for a good (effective) reflection process. Therefore, the purpose of this article is to investigate, how different kind of factors play a role in a reflection process, which contributes towards a positive study progress of students during their study. The research is meant to point out different important factors which are of influence when practicing reflection in higher education.

For a substantiated realisation subtopics have to be investigated. To start the establishing of the definition of reflection in higher education is delineated, for a clear guidance through this section. Next challenges are discussed why students are not reflecting, this is of importance to know where students might get stuck before reflecting starts. These problems may be overcome through the understanding of the epistemology² of reflection. If these challenges can be tackled, the focus will be on which kind of aims reflection has and to know where reflection can contribute to a positive study progress. Followed by an important of environmental factor during a reflection process is highlighted. Finally to conduct a conclusion based on the gathered information.

2.1.1 DEFINITION OF REFLECTION IN HIGHER EDUCATION

There is not one clear definition for reflection in higher education. Vos and Vlas [6] state that the definition of reflection can easily be vague (fuzzy). Therefore, it is important that there is clear definition of reflection. According to Procee and Visscher-Voerman [4], reflection is a certain personal process about an experience. Bruno and Dell'Aversana [7] are defining these processes into '*reflection on action*' and '*reflection in action*'. Both cases

² The theory of knowledge, especially with regard to its methods, validity, and scope, and the distinction between justified belief and opinion. [34]

are using different viewpoints during or after an experience, to develop the understanding about the experience. The similarities of these processes is that they are analysing the viewpoints (and developing these from the experience). On the whole, the process is about developing the viewpoints about the experience. To make this process move forward Vos and Vlas notice that students need to turn into a dialogue.

Now is it important to know what will happen if these viewpoints about the experience will be developed? Therefore, understanding is required on what these viewpoints are based on. Procee and Visscher-Voerman are trying to understand these viewpoints by the use of the theory of Kant. Who is distinguishing the human mind, so it can function properly, into understanding, judgement and reason. For a good reflection process, only understanding and judgement are necessary, these two are needed to understand viewpoints. If viewpoints about the experience are developed, knowledge and understanding are required. These factors are helpful for an effective reflection process. If an effective reflection process happens, according to Vos and Vlas, it will allow the student to become more aware of both the importance of the situation and the action perspective(s). According to Procee and Visscher-Voerman this can also influence the self-specified standards³.

To summarise, the process of reflection is related to: a past experience, where you analyse different viewpoints, the use of a dialogue will allow a student to make active and aware decisions about the experience. It may also influence the self-specified standards of a student. So with the use of these aspects the following definition will be shaped, with respect to students.

“Reflection is a process (activity) which occupies looking at a study experience through different viewpoints, in which the student, with the use of a dialogue, will become aware of both the importance of the situation and the action perspective(s). Which may influence and adjust the self-specified standards.”

2.1.2 OBSTRUCTION FOR REFLECTION

In the last part of the definition of reflection an aim of reflection is constructed, it states - that students “*will become aware of both the importance of the situation and the action perspective(s)*”. Unfortunately, this aim is not always achieved according to Mittendorf [3]. This section will show challenges why students currently do not get their full potential out of reflection. With other words, why they are not achieving these aims. These factors are important to be aware of before students are entering a reflection process. For preventing them from happening or otherwise reduce these factors.

A negative influence on reflection process is *reflection tiredness*. Next will be explained where this comes from. An important aspect why students do not want to reflect is because they dislike reflection. This is substantiated from different studies from Meijers, Kuijpers and Winters [8] and Mittendorf, Jochems, Meijers and den Brok [9]. Both are pointing out that students see reflection as an obligation and they dislike it. This obligation comes from that students need to reflect from the start of their study. According to Zijlstra and Meijers [10], because students have to adopt reflection from the first moment of their study, they have not fully grasped what reflection is. This can

³ Standards people (students) have specified based on knowledge and judgments, who are true according to themselves.

cause misconceptions about the essence of reflection. The misconception is that students do not make the relation between themselves and the study progress. Which will come back that students see reflection as an obligation. Kinkhorst [11] points out, if there is a misconception about the essence of reflection which lead towards a feeling of obligation, it is called 'reflection tiredness'.

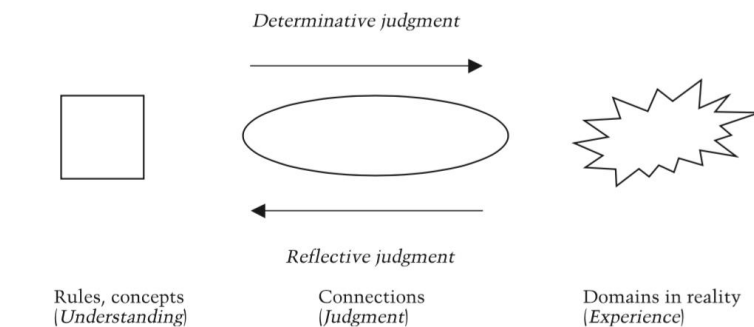
On the whole, the challenge which needs to be overcome is reflection tiredness, to get a full potential out of reflection. If students overcome reflection tiredness, a reflection process will have a better effect. Therefore, students need to realise they need to overcome reflection tiredness. How can students be helped to overcome reflection tiredness? Looking back how tiredness arises, it can be concluded: the nature of reflection tiredness comes from the feeling that reflection is an obligation. But this is a feeling students have because they do not know what reflection is. Therefore, students need to overcome reflection tiredness by understanding what reflection is.

2.1.3 UNDERSTANDING OF REFLECTION BY THE EPISTEMOLOGY

The next section will explain how reflection can be understood by knowing about the epistemology of reflection. As has been pointed out, reflection does not always succeed or does not reach the aims which they were looking for. Most of the researchers are trying to understand this by looking at the process or outcomes of reflection. However as Max van Manen [12] is pointing out looking at the process or aims does not help to understand reflection, this has to be inverted. By looking at the epistemology of reflection, someone would get a better understanding about processes, structure and especially the nature of reflection. For this reason, it is important to understand the epistemology of reflection.

First, the aspects which are of influence in a reflection process will be addressed. As has been discussed in the 'Definition of Reflection', for a good reflection process two aspects of the human mind are necessary: understanding and judgment, according to Procee and Visscher-Voerman [4]. The understanding creates regularities, theories and concepts and judgements help to overcome stagnate in someone his or her own theory. So, these two factors of the human mind make it possible to reflect, therefore it is essential if trying to understand the epistemology of reflection this needs to be done with the use of the factors understanding and judgement.

Next it is important to understand how these factors are put into a reflection process. By using these two factors Procee [13] observes that the epistemology of reflection can be understood by dividing judgement into two forms of judgements: reflective judgments and determinative judgements. Before explaining both judgements, it is important to be reminded that reflection is always about an experience where a student uses different viewpoints, to better understand the experience. So the understanding about the experience, goes back and forward, it keeps repeating throughout the reflection process. *Figure 1* is showing this iterative process, going back and forward (in the picture from left to right). The iterative process goes from an experience to understanding and from understanding adapting different viewpoints of the experience.



FIGUUR 2

Figure 2.1.1: A Kantian Epistemology of Reflection [14]

Finally, the process will be explained. This is where the different judgements of Kant, used by Procee, come in: determinative judgements and reflective judgements. Determinative judgement comes from general concepts or rules which are used to indicate and describe experience. Reflective judgment is in contrast with this, it is a judgment which comes from the experience which is used to understand the concepts. Understanding both kind of judgments will a student help to be aware what he or she is doing during the reflection process. To give an example, if there is awareness what kind of judgement the student is practising. The student can deliberately focus on the process, which creates more awareness and less reflection tiredness.

To summarise the importance of knowing about the epistemology of reflection, the focus was to overcome reflection tiredness. Therefore, it helps to understand the epistemology of reflection, what the nature is and how the process of reflection works. In a reflection process understanding has influence on the experience, and the experience on the understanding. This is done by practicing these two types of judgements. Helping students to be aware about these two kind of judgements will give guidance for understanding the reflection process. When finishing a reflection process a student will reach certain goals, where he or she was maybe aiming for. Therefore, it is important for a student what reflection can aim for.

2.1.4 THE AIMS OF REFLECTION

It is important to know where in higher education it can bring a positive contribution. Therefore, understanding what a reflection process in higher education can aim for is necessary. If the aims of reflection are clear; it will give guidance to students as to how it can be used. The aims of reflection will be pointed out by four groups of judgements. The origin of these four will be shown by, the use of where reflection is resulting in. The goal in this section is to show the aims of reflection in higher education, so students know where reflection can contribute.

I will start with an explanation why reflection has a different result on every student. From the definition of reflection in this essay can be concluded, that the student 'will become aware of the importance of the situation and the action perspective(s)'. This is defined as the *aim* of reflection process in higher education during this essay. This *aim* is not concrete, in other words reflection is hard to measure, for this reason the result on

each student is different. Vos and Vlas [6] are supporting this, they claim reflection will give a result which will show something new or even give something surprising. Reflection can lead for example towards; process improvement, plan of action, for design changing attitude, etc. So each student has different goals or aims when using reflection

Therefore consequently, it is important to point out where reflection is derived from, to understand why and how students are reflecting. Because there are possible derivatives from the goal, one clear aspect will be pointed out, which is *tact*. Van Manen [12] claims an important skill of the human mind is called tact. This suggests tact is necessary for a reflection process. Procee [13] links the skill tact with practicing judgments, the same has been pointed out in the previous section. In other words, by practicing judgments the skill “tact” is used. Now it is clear that aims, which come from practicing judgements are derived from tact, it is important to know what the skill tact can aim for.

Finally, by the use how to practice judgments, shown *Figure 1*, will result in what kind of aims the process has. A systematic approach helps to clear this up. Procee and Visscher-Voerman [4] are pointing out, by using Kant’s analysis in the *Critique of Judgements*, four main groups which they use to make reflection systematic. The four groups are, quantity, quality, relation and modality. These four groups can be used to show where practicing judgements can aim for in higher education. Therefore, for each group will briefly described where they are about and followed by the aims:

- Quantity, is about stretching the experience of the reflector in a new dimension, this will be done by a random point of view outside the experience. It aims, by stretching this experience, for new thinking activities could take place;
- Quality, helps evaluating the experiences and appreciating choices made during the experience. This reflection helps with seeing which viewpoint are more realistic, more meaningful and which has more value compared with to another. Its aim towards education is to evaluate the quality of the educational process, of the person who is doing it;
- Relation, has as starting point: people are informative creatures. This has two different aims, first is by comparing the different meaning frames to get to a point which shows how to handle with possible differences. The second is by change of perspective which will lead towards other viewpoints of the experience, to formulate a learning experience;
- Modality, has as overall aim towards the experience: to search for all kinds of relation, and seeing it with a more skilled viewpoint. This can come from gained experience (projects), about the reflection itself or professional identity.

By the use of these four groups, four concrete aims can be identified as follows: quantity aims for new thinking activities, quality aims at appreciating standards, relation aims for empathy and modality aims for a professional identity. These outcomes give a simplified and organised overview which aims a student can have with the use of reflection.

Because four different aims have been pointed out, a conclusion can be made where reflection can bring a contribution for students in higher education. By practicing judgement about an experience, a student uses tact to aim becoming more aware of the importance of the situation and the action perspective(s). By the using a systematic

approach four different groups of practicing judgements have been pointed out. All these four groups seem to have in common that they aim for making study-related experiences clearer. In other words, it can bring a contribution to someone's professional development. To summarise, reflection can contribute in many occasions, a student knows which aims he/she can have and reflection is mainly helping with developing the professional development.

2.1.5 THE PARTNER AS ENVIRONMENTAL FACTOR

During a reflection process a student is not the only one who is involved in this process. This section will briefly describe why a reflection partner is of need during reflection. The search supposed to be about which environmental factors were of influence on a reflection process. But then literature research pointed out multiple times, the importance of a reflection partner as an environmental factor during reflection. Therefore, this section is about why the roll of a reflection partner is of importance for a good reflection process. Before the different roles will be pointed out first the value of a reflection partner will be discussed.

The student is now not the only key factor of the whole reflection process. A second party is added to the reflection environment to make sure a reflection process is going well. Of course the student is remaining a key factor in the reflection process but now also the reflection partner will play a part. Schön [15] is supporting this, he points out the key factors in a reflection process: are the use of teachers/trainers (and groups). So now, these two important figures are the key factors in environment of a reflection process. To simplify the value of these two factors, they are the only resources needed for reflection, no other resources are needed according to Vos and Vlas [7]. Now the value is stated, some important roles of the reflection will be pointed out.

The first role is to support the learning process. The partner can be both supportive as critical to the content. Procee and Visscher-Voerman [4] state "*A reflection partner is someone without any personal interpretations and generates images, but lets the other describe images infinity.*" So the role is to guide the student to find new viewpoints. The second role is making the student emotional more secure also Procee and Visscher-Voerman are pointing that also out. Reflection can bring certain emotions with it, being emotional is not bad but the partner needs to make sure reflection does not lead towards an insecure student. The last role is time management, because a reflection process requires time according to Korthagen [16]. As been said, a student can be confronted with all kinds of viewpoints and to let the students overcome these viewpoints time is required.

In short, three important roles are pointed out to show the importance of a reflection partner during a reflection process. Which are: helping students to find new viewpoints, to support being emotional more secure and time management. If a partner was not a key factor in this reflection process a student needed to do this by himself, which will probably have a negative influence on his own reflection aims. Rogers [17] is echoing this, a good reflection process can lead to success if both environmental factors and student are managed. Thus managing the roles of the partner is important, but the partner does not have to fulfil all the roles. A device can maybe play a part in supporting the partner, or even the student, to help them with the fulfilling the roles.

2.1.6 CONCLUSION

The purpose of this essay was to investigate, how different kind of factors play a role in a reflection process, which contributes towards a positive study progress of students during their study. Hence, a table will be constructed, which will show the factors which play a role before and during the reflection process.

To start, with the factors before reflection. The first factor has been found by getting insight in what a common problem was for students, namely reflection tiredness. The solution was that students need to know how the process works. This process has been discussed and explained, by showing which type of judgements there are needed to reflect. With the use of this factor students become aware what is happening. The second factor is that if students know where reflection can aim for, so they know where it can bring a contribution.

To finish with the factors during reflection. The first factor is consistent with the common problem, reflection tiredness. Only now a student needs to be aware while reflecting the judgements are still practiced. Otherwise a student would not be reflecting anymore. The second factor, the partner who guides the student through the process by fulfilling the three important roles. Being supportive and critical, secure the emotions and manage the time. The factors before and during reflection are shown in *Table 2.1.1*.

Before reflection	During reflection
<ul style="list-style-type: none"> • A student needs to know how a reflection process works. By explaining which type of Judgements there are, a student can know during the process what is happening. • If a student knows which kind of aims the process may have, the focus will be on achieving these. It follows that reflection can be of effective use for the student. 	<ul style="list-style-type: none"> • Needs to overcome reflection tiredness, by keeping track during the process if the student is still aware of the different judgements. • The role of the partner. Who needs to fulfil the three important roles: being supportive and critical, secure the emotions and time management.

Table 2.1.1: Factors before and during reflecting

It can be concluded, based on these factors, which can help to contribute with a good reflection process. Because these factors can be manipulated to get a better reflection process. Therefore, the reflection instrument can maybe influence in one of these factors. For example, the role of the partner can be replaced being more critical or help with time management. Or help the students with practicing one specific judgment. These findings will be elaborated upon with the interviews and different methods in the conclusion.

2.2 EXPERTS RESEARCH

This section shows the results of the interviews which were being held with the different experts. The complete interviews can be found in the appendix. This section is showing the important findings from the interviews which have value for this research. First, briefly the description of each expert is given, followed by the summary of the important aspects and afterwards a short conclusion. These interviews with experts are held, for their experience in the field and to get a better image how reflection is adjusted in the current higher education and Creative Technology in particular. Therefore at the end a summary will be given of the important findings which will help shaping the image of reflection in the current higher education.

2.2.1 B.H. VAN DER GAAST

Works at the University of Twente at the Faculty of Behavioural, Management and Social Sciences and teaches ethics and philosophy within Creative Technology (in module eleven and twelve). The entire interview can be found in *Appendix A*, the important findings gained from this interview are listed below:

- The subject ‘reflection’ is difficult to work with because the definition could be interpreted in different ways. Van der Gaast is talking about ethical reflection, the essential in this case are ethical and social problems. The essential of reflection in higher education and in more specific in Creative Technology is about professional development.
- Reflection in higher education is more about the development of skills, the skills from learning through an experience. This process is personal, not exact science. A question which could arise for helping could be: ‘Where do students benefit from if they practiced reflection?’

2.2.2 T.H. DE KLUIJVER

Study Adviser for Creative Technology and is currently developing/reshaping the course track, professional development in Creative Technology (from module one until eight). The entire interview can be found in *Appendix B*, the important findings gained from this interview are listed below:

- Implementing a reflection instrument would fit perfectly into the course professional development. However, due to that it is currently being reshaped it is no option the instrument could be implemented into this course.
- Reflection will only be adjusted in the second year. Because by then students are better capable of reflecting due to their developed physical and mind state, compared to the first year.
- Reflection could be better implemented in internships, therefore bring a better contribution into HBO.
- With the Study Creative technology students need to reflect on their professional development. This is something different than an event, therefore it is more difficult to reflect on such an experience. Students need to become aware which tools of the study are necessary for their *own* professional development.
- There is no place for adjustment of a smart reflecting instrument in professional development, but there might be an opportunity in projects.

2.2.3 I. VISSCHER-VOERMAN

Is lecturer in Innovation and Effective Education. Involved in both small-scale and large-scale educational innovation projects within Saxion, with the role of researcher or adviser for teachers and management. In addition, Visscher is the Academic Director of the Master in / of Educational Leadership (MEL), in which she provides the Personal Leadership learning path. At the University of Twente, Visscher worked on the redesign and implementation of the bachelors' degree, now so called Twents Onderwijs Model (TOM). The entire interview can be found in *Appendix C*, the important findings gained from this interview are listed below:

- For a good reflection process, the following aspects are needed. First concrete experience is needed, with the use of a conversation a better concrete experience can be conducted. Secondly different viewpoints, are needed which helps looking for the right aim or method. Most of the time students are stuck into their own experience and by asking the right questions it should help them widen their view.
- The aims of reflection are getting more insights. Insights about what is motivating the student and where the student can grow. Most of the time it is about improving yourself. To get a better grip on the experience.
- Students are not reflecting well enough due to two causes. The first is because reflecting is pretty new for students, they have no clue what reflection can bring them. And second because reflection takes time, during a reflection process students need to position themselves as vulnerable. Which is not easy to do for students.
- This could be overcome by an explanation of the process and a simple exercise, also in these processes asking the right questions is important.
- Some students, according to Visscher, are always more able to reflect than others. Because of their metacognition skills, these skills cannot be trained and are necessary for a better reflection.

Visscher used during reflective practice four types of reflection, which are briefly described below and are also explained in section 2.3 Reflection Methods:

- Point reflection, is about making an experience more sensitive and how well can a student look towards him or herself. With this exercise students most of the time start practicing, because it helps widen their view.
- Line reflection, is about seeing the standards of others. Has similarities with evaluation but differs in that it also focuses on what is accomplished together with the different standards.
- Triangle reflection, is about empathy. By asking question about an earlier experience students can become more aware how others are, before entering another project. If this has not worked well enough then probably learning effects did not land.
- Circle reflection, is all about the metacognition. Students reflect on their reflection process.

2.2.4 K.M.J. SLOTMAN

Works for CELT (Centre of Expertise in Learning and Teaching), which are working on improving education. Also Slotman works on implementing ICT in higher education.

Both at the University of Twente. The entire interview can be found in *Appendix D*, the important findings gained from this interview are listed below:

- Teachers need to write a reflection report, but this takes time. Which has as a cause that teachers sometime do not reflect well enough. Currently Slotman is working on fastening this process, by doing these reflections by interviews, this has as a result reflection is more authentic (it is more personal) and it is faster. Teachers seem to like these conversations, it makes more impression on them and suggest more.

2.2.5 A.M. SCHAAFSTAL

Works as programme director for the study Creative Technology/Interaction Technology. The entire interview can be found in *Appendix E*, the important findings gained from this interview are listed below:

- For Creative Technology students is of importance to develop as a student, who knows what he or she wants. In other words, knowing about their professional development. A student is reached different knowledge to shape his or her own profession during the study. To help students to shape their own profession it is of importance students learn to reflect critically on their study experiences. Hence, critical reflection during a study is a final learning outcome, which is important for professional development of a student.

2.2.6 IMPORTANT FINDINGS

To conclude the important findings in this section of the interviews will be summarized:

- The goal of reflection in higher education and in more specific in Creative Technology is thinking into a much broader framework.
- Due to that the course professional development is currently being reshaped, it is no option the instrument could be implemented into this course. This course was probably the best option for implementation of the instrument.
- For a good reflection process, experience is needed and different viewpoints are needed.
- An aim of reflection is to get more insights about yourself.
- Students are not reflecting well enough, because they do not have a clue what reflection can bring them and it takes time to make yourself vulnerable. This could be overcome by an explanation of the process and a simple exercise.
- Reflection is depending on the metacognition skills of a student, therefore some can reflect better than others. This cannot be trained.
- Having a reflection conversation is more authentic than writing a reflection report, which is used to show the reflection effects.
- During the conversation it is important to ask the right questions, this can be done by the partner. This also will make the reflection more authentic and will help the student with a better reflection.
- Critical reflection during a study is a final learning outcome, which is important for the professional development of a student.
- During a reflection process it is important to ask the right questions, this can be done by the partner. This will make the reflection more authentic and will help the student with a better reflection.

2.3 REFLECTION METHODS

This section describes different methods of reflection used in higher education. The methods which have been chosen are based on the judgement skills defined by Procee and Visscher-Voerman [4]. They used Kant's analysis in the *Critique of Judgements* (see section 2.1.4 The Aims of Reflection), to define four groups to make a reflection systematic, which are: quantity, quality, relation and modality. Each judgement is related to a reflection method.

First, for each method a brief description and usage is given, followed short the explanation how they work. It is important to get insight which methods are currently used, what aims do they have, implementation of them and where they can improve in the current higher education. Therefore an overview will be given in the end of this section.

2.3.1 POINT REFLECTION

Comes from the judgement skill quantity [4]. This reflection starts from a random point of view, outside of the experience. Which will stretch the experience area of the reflector in a new dimension, in which new thinking activities could take place. In Figure 2.3.1 is shown how point reflection is represented schematically.

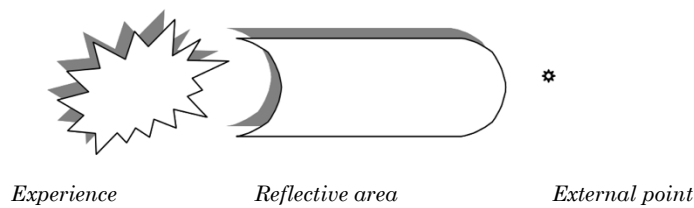


Figure 2.3.1: Point Reflection [4]

The external point must be guided with the decisive/pragmatic question: ‘*Do we suspect to learn something from this?*’

3 steps for this reflection:

- Step 1: Search for a ‘point’ from which you suspect to learn something about.
- Step 2: Reflect not on the point but from the chosen experience. Do not only ask why questions, but also ‘how’ and ‘why’.
- Step 3: Notice the learning points.

2.3.2 LINE REFLECTION

Comes from the judgement skill quality [4]. This type of reflection is about concepts which are helpful in evaluating the experiences and appreciating choices made during the experience. It can be conducted this method is focussing on appreciating different standards to develop a new point of view for the reflector and the self-specified standards.

This reflection helps with seeing which viewpoint are more realistic, more meaningful, has more value compared with the other. It also shows that standards are not a static characteristics, which are always fixed.

Important to keep in mind:

1. The student decides for *himself* which domains and standards will be taken into account;
2. The goal is to *learn* from it and not being judgemental;
3. The chosen standard is not treated as a given external criteria but is researched on *its own quality*. The three phases:

Phase 1:

- Step 1: Choose an experience.
- Step 2: Make a distinction between the actor, process and the product.
- Step 3: Think about the fitting standards of these parts. (empathize)
- Step 4: Select a standard where you can think you can learn about and optimize.

Phase 2:

- Step 5: Put your own experience beside the taken standard.

Phase 3:

- Step 6: Note the learning points, with perspective towards action alternatives or standardization.

2.3.3 TRIANGLE REFLECTION

Comes from the judgement skill relations [4]. This reflection form uses more dynamic viewpoints, by taking about viewpoints from the experience and perceptions of others, both in the professional and societal domain.

This method uses a structure which has three elements involved: a fact which serves as a sign, the person for whom that sign has a meaning (provider of the meaning), and the interpretation scheme that gives to the sign meaning.

It is important to keep in mind for the student, *'People are creatures who are generating information.'* [4]

First the provider of the meaning:

Social groupings can be a provider of meanings.

- Step 1: A fact or event which serves as sign.
- Step 2: Make a list of everyone involved.
- Step 3: Put away the ones who are the less obvious involved.
- Step 4: Formulate the experience hypothesis of the suggestion about the ones who are involved.
- Step 5: Compare and decide how you will deal with it next time.

Another way is to use different interpretation frameworks. By using a perspective change which will put another view on the experience.

- Step 1: Select a reflection subject.
- Step 2: Research how this reflection subject can be modelled into different visions.
- Step 3: How the lesson has to look like according to these viewpoints. Think about the pros and cons.
- Step 4: Formulate the learning experience.

2.3.4 CIRCLE REFLECTION

Comes from the judgement skill modality [4]. This is a relatively simple but important method of reflection, reflects about the reflection. What has the reflection offered, what does it mean for the student? This is of most useful for the personal development.

The reflection goes through a cycle: taking distance from your own direct received experience. To take this distance the students investigates three levels where circle reflection can be adjusted, which uses: the quality moments within the reflection,

searching for corresponding relations and looking through different perspectives. This reflection happens on 3 different levels:

Level 1: Regarding towards, a gained (finished) experience. (Finished project or lesson)

- Step 1: Which methods of reflection has been adjusted?
- Step 2: Which collisions (questions, problems) have been generated?
- Step 3: What did I learned from these collisions; on which points did I achieved progress, on which points can I ask clear questions which are in need of more research?

Level 2: Regarding towards, reflecting itself. (The cycle)

- Step 1: What happened during the reflection?
- Step 2: What were the negative and positive results?
- Step 3: Which reflection methods do I want to use more often?

Level 3: Regarding towards, own professional identity:

- Step 1: How is my professional identity fitting my personality?
- Step 2: What do I have in my professional toolkit? And what do I miss?
- Step 3: How does this given project suits my personality as a profession?

2.3.5 OVERVIEW

To conclude this section two tables have been made, *Table 2.3.1 and 2.3.2*. These give an overview of the four judgment skills named by Procee and Visscher-Voerman [4]. In the first *Table 2.3.1* an overview is given to show where the different methods are aiming for. This aim will show where these methods can be the best implemented in higher education. Where they can be implemented will also show space where they can improve this process in higher education. And as an important aspect how does it motivate students to use this method. This is still a guess because this needs to be researched and maybe verified by the stakeholders. In the second *Table 2.3.2* an overview is given when a reflection method can be adjusted to show the types of setting a student needs to be and where it can be about. Based on findings in the section 2.3 Reflection methods and in the book *Reflectie Tools* [18].

	Aim/Effects	Implemented	Improve	Motivate
Point	Expand the experience area	- Group work - Systematic completion	Being able to be more relaxed over a certain experience	Work with less stress
Line	Accepting different standards	- Developing the quality of working - Thinking creative about new ideas	- The start of a new project - Giving empty space meaning	Helping with think more creative
Triangle	Creating empathy	- Group process - Processing of feedback	Easier accept different types of people	Managing group process, taken leading role.
Circle	Personal development	After reflection	Developing as a person	Improving on personal and professional skills

Table 2.3.1: Judgement skills Overview

	One on One	Group
Inter vision, Supervision and Coaching	- Point - Circle - Line	- Point - Triangle
Projects and Group work	- Point - Circle - Triangle	- Point - Line - Triangle
Professional development	- Point - Circle - Line - Triangle	- Point - Circle - Line
Project Planning	- Point - Circle - Line - Triangle	- Point - Line

Table 2.3.2: Implementation overview of judgement skills

2.4 CONCLUSION

This section was meant to partly answer the three sub main research questions. With the use of literature, interviews and methods research a clear image is created. Firstly the first sub research question will partly be answered with the use of literature and interviews:

sRQ1: What kind of **improvements** can be done in (and where the instrument can be **integrated** in the current curriculum of) Creative Technology towards reflection processes?

Literature and interviews are showing that there is place for improvement for reflection in higher education. According to the literature in section 2.1.2. Obstruction for Reflection in higher education, reflection tiredness is among student. Equally important, the interview with I. Visscher-Voerman is echoing this, students have no clue what reflection can bring them and it takes time. Hence, students need to overcome these problems.

The solutions are pointed out in literature and interviews. Literature showed different kind of factors which are playing a role in a reflection process, which contributes towards a positive study progress of students during their study. And the findings from the interviews show students can overcome this by giving before an explanation of a simple exercise and asking the right questions. This is matching the findings from the literature which factors are playing an important role before and after a reflection process. With these findings the *Table 2.4.1* which is showing these findings will be adjusted. So it will show an overview which factors are need to be taken into account to improve the reflection process in higher education, this is shown in *Table 2.4.1*.

Before reflection	During reflection
<ul style="list-style-type: none"> The simple methods are explained, together with the types of judgements. The aims should be shown, so student knows what the results can be. So reflection can be effective for the student, which results in that the student gets more insights about him or herself. 	<ul style="list-style-type: none"> Students need to be aware of the reflection process, by asking the right questions students can become more attracted to the process. The role of the partner plays an important part in this. And also, being supportive and critical, secure the emotions and time management.

Table 2.4.1: adjusted Factors before and during reflecting

These factors should be taken into account if the concept(s) will be developed. Due to these factors will help to overcome the problems stated above form reflection in higher education. Which may improve the reflection process in particular in Creative Technology. For this reason in the next phase, knowing where the instrument can be implemented in Creative Technology should help testing these factors.

Secondly, the second sub research question will partly be answered with the use of interviews and the methods research:

sRQ2: Where can a reflection instrument **add value** to the study progress, for reaching the final learning outcomes of Creative Technology related to critical reflection?

Interviews showed that critical reflection during Creative Technology is a final learning outcome, which is important for the professional development of a student. Which methods can be implemented where is shown in section 2.3.5. Overview. This is important to know, because these methods are used for critical reflection in higher

education. As a result, the instrument can be implemented in one or more of these methods which may be used in reflection in Creative Technology. Evidently, more research is needed where the instrument can help when students are using these methods and helping the students to motivate themselves to reflect.

Finally, the third sub research question will partly be answered with the use of literature, interviews and the methods research:

sRQ3: How can the effects of a reflection process be **measured**?

According to the interviews a report is a normal way to show or measure the reflection process. However, this takes time and consequently what follows is reflection tiredness. This can maybe overcome by knowing what students is motivating to reflect see section 2.3.5. Overview. Or finding another ways than writing a report. Accordingly to this conclusion, further research it needed to find other options than writing a report, or making the report easier and to find out how to motivate students.

To conclude, further research is needed to answer the following questions:

- Knowing exactly where the instrument can be implemented in Creative Technology.
- Where the instrument can help when students are using the different methods and helping the students to motivate themselves to reflect.
- Finding other options than writing a report, or making the report easier and to find out how to motivate students.

3 METHODS AND TECHNIQUES

In this chapter different methods and techniques which are used during this research are described. Included, with a motivation why these methods and techniques are used for this type research. Hence, this chapter is constructed as follows:

1. Creative Technology Design Process
2. Stakeholder Analysis
3. Brainstorm Sessions
4. Questionnaires
5. Interviews
6. iPACT
7. FICS
8. Functional System Architecture
9. Requirements
10. Evaluation

3.1 CREATIVE TECHNOLOGY DESIGN PROCESS

As first the process “Creative Technology Design Process”, is used throughout this project for creating new developments [6] . This design process is shown in *Figure 3.1.1*. This process has been designed for Creative Technology bachelor students who are developing, for example, new product. For this a user-centred based approach is used. This model consists of four phases, the ideation phase (3.1.1), specification phase (3.1.2), realisation phase (3.1.3) and the evaluation (3.1.4).

The ideation and specification are for exploring different solutions. These solutions will merged into one final solution. Keeping in mind the user’ preferences and opinion. Next is the realisation phase, where the final product will be realized. The realised product will be evaluated in the evaluation phase. Hence, this process has a divergent-convergent structure. To create new iterations of the solutions this process can be repeated. A more detailed explanation will follow.

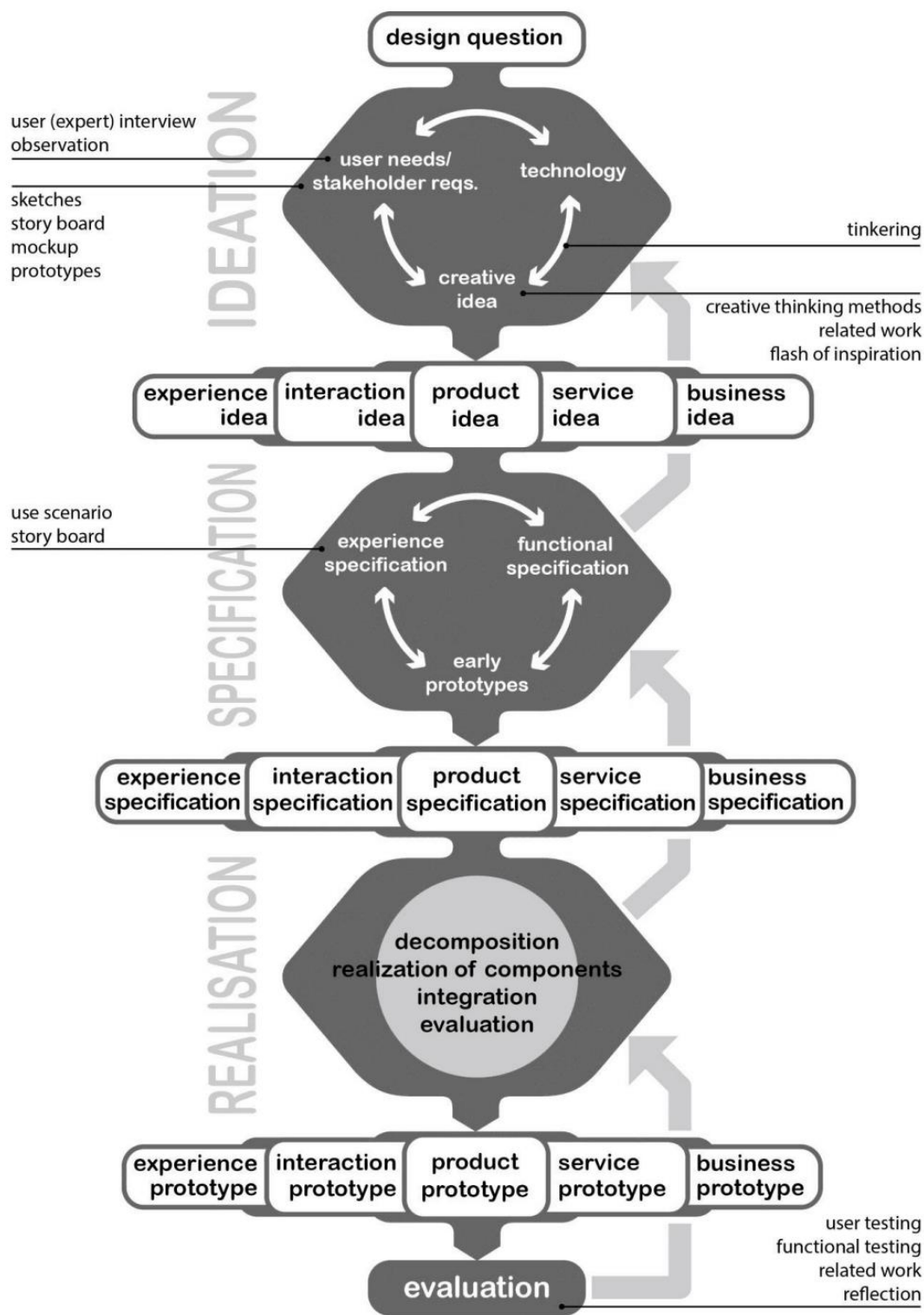


Figure 3.1.1: Creative Technology Design Process [6]

3.1.1 IDEATION PHASE

This phase is intended to go from a creative idea to the final product idea. There can be three different starting phases, as can be seen in *Figure 3.1.1* in the ideation phase, user needs, technology and a creative idea. The focus will be on the three sub research questions. With the use of the State of the Art in Chapter 2, an image is created how reflection is currently implemented in higher education and Creative Technology in particularly. Therefore it is important this phase is focussing on three aspects.

Due to this, the ideation will start with where it can be implemented. Using this as a basis, it is important to include stakeholders (see section 3.2). For understanding what their needs are, what their use is and what their ideas are, to find new ideas. This will be achieved with the use of brainstorm sessions, interviews and questionnaires. These concepts will be presented to some stakeholders to identify which will have a higher impact on the reflection process. To finally come up with an envisioned instrument which will be created. At the end, iPACT method is used to create an image how the system is interacting with the user. To show how the instrument is seen through the eyes of the user.

3.1.2 SPECIFICATION PHASE

This phase build forth on the information conducted from the ideation, to create an image what the perspective of the system is. Five important topics will be discussed through this phase. The first is to show the user interaction, how the user will use the instrument, with the use of the FICS method. The second, is an activity diagram to understand how the system will interact with the user. The third is a LoFi user test, to test if the concept needs some changes. The fourth, is to indicate how the envisioned instrument should be realised, with the use of a three levelled functional system. At the end, a list of requirements will be composed for a clear overview what is needed in the realisation phase.

3.1.3 REALISATION PHASE

In this phase a working prototype of the envisioned instrument will be realised. The working prototype will show the functionalities of the envisioned instrument. The prototype is based on the list of the requirement. This chapter gives guidance for a realisation of the prototype. Hence, how the prototype has been developed. The prototype will finally be used for the last phase, the evaluation.

3.1.4 EVALUATION PHASE

After the realisation three test will be held during this phase: a user, an expert and a functional test. These tests are conducted to evaluate if the current instrument works. To identify if the set requirements are met by the instrument, how these requirements will be developed is explained in section 3.9 Requirements. The results are used during the conclusion for both discussion and recommendations, this can be used in further research, developing or design of the instrument.

3.2 STAKEHOLDER ANALYSIS

This analysis is conducted to find out which stakeholders are most relevant to take into account when developing the instrument. The definition of stakeholders during this project is “any group or individual who can affect or is affected by the achievement of the organisation’s objectives” [19]. For the stakeholders, the influence and interest will be identified to point out which stakeholder is most important. The stakeholder analysis is divided into three phases, mapping the stakeholders, interest-influence matrix and a conclusion who is most important.

The first phase, mapping the stakeholders for requirement engineering. This is conducted according to Sharp [20], by distinguishing four different categories of stakeholders. These can be identified as users, developers, legislators and decision makers. Each category will be briefly explained:

- **Users** interact, control or use the information from the instrument or even purchase it.
- **Developers** are responsible for developing and creating the instrument.
- **Legislators** (institutions) provide rules and guidelines about the instrument which might affect the operation and the developing of the system.
- **Decision-makers** (managers or controllers) making structures which relate to the developing of the instrument.

During the second phase, for each category the stakeholders will be rated on terms of interest and influence. This rating will be done by low (1), medium (2) or high (3) interest. The level of interest is to identify the involvement of the stakeholder within the development. And the level of influence indicates how much influence the stakeholder has on the developing of the instrument. This rating helps with producing a stakeholder analysis matrix, where an overview is given of all the involved stakeholders and their interest and influence.

The last phase, to put it more simply the important stakeholders will be pointed out. This will be done by the use of the ratings, to show the relevancy of each stakeholders. These stakeholders will be used for interviews, questionnaires or brainstorm. This is important for the requirements which should be made.

3.3 BRAINSTORM SESSIONS

For generating new viewpoints on the research questions, brainstorm sessions are conducted. These brainstorm sessions need to provide sustainable answers on where to implement the instrument, how to students and what kind of reflection method is required. First individual brainstorm sessions are held to generate multiple ideas, for mapping what the instrument could do. As evident of this outcome new individual and joint brainstorm sessions were conducted. These brainstorm sessions were same for all three brainstorms the individual, with fellow students and with an expert.

Mind mapping [21] is a brainstorm technique, which is useful to organise the thoughts more productively. They show shape of the thoughts, relevant of each point and how the facts are related towards each other. This will to help organise each brainstorm session, also this is one of the few brainstorm sessions which can be conducted when working individual. Another point is that it is easy to communicate with other parties.

3.4 QUESTIONNAIRES

To easily collect lots of data from a large group of stake holders in the ideation phase, questionnaires were being held. The large group during this project are the students. According to Moore [22] gathering information for requirement engineering, is done by interviews and participatory design as traditionally forms. This however requires face-to-face communication with the stakeholders. Due to the amount of information and time, these forms of gathering information this is not possible. Therefore questionnaires are used to create a rough image what the attitude and viewpoints are from Creative Technology students towards reflection. The outcomes are used to conduct a part of the preliminary requirements.

3.5 INTERVIEWS

Interviews are also being held in the ideation phase with reflection experts and a project supervisor. For requirement engineering [22] doing interviews with stakeholders is an effective way of gathering information. Therefore these interviews are conducted, to get more insights were reflection can bring a contribution and what indented learning outcomes. Also to validate if the project is on the right track. According to DiCicco-Bloom [23] three different interview techniques can be applied:

- Structured interviews, is where the interviewer prepared a set of questions, the questions are asked in a specific order. Thus, is multiple interviews were being held every stakeholder would be asked the same question.
- Semi-structured interviews, in this case the interviewer prepared a set of questions but these are guidelines for the dialogue. The questions are open and need to help with the construction of new questions during the dialogue.
- Unstructured interviews, in this last form the interviewer did not prepared any questions. These questions are based on observations of the interviewee made by the interviewer. This should help to guide the dialogue.

For both, the state of the art (see Chapter 2) and the ideations phase semi-structured interviews are used. This form has been chosen over the two other forms because the researcher wants to search new insights. While beginning with a structured form, during the dialogue new insights could arise. Where the researcher could switch from the structured form to an unstructured one, this can lead to new discussion. However this takes a lot of time, this approach will give lots of insights, as has been pointed out before. The outcomes will be used, similar to the questionnaires, for the preliminary requirements.

3.6 iPACT

To explain the concept through the eyes of the user and put in a normal day scenario, the iPACT method will be used. The goal of iPACT [24] is to clarify the envisioned goal of the instrument towards the user. The iPACT method stands for **I**ntention, **P**eople, **A**ctivities, **C**ontext, and **T**echnologies. As first in the intention is stated what the goal of the system is towards the user. Next are the people, who are the users, described with the use of personas, who will interact with the system. Next are the activities, which describes the activities of the personas related to the instrument. The context section will describe in which context the instrument will be used. As last, the technology which show what the instrument needs to do. All the above announced components are used to describe a user scenario, from the user's perspective towards the concept.

3.7 FICS

To explain the concept through the eyes of the designer, the FICS method will be used. The FICS method stands for **F**unctions, **I**nteraction, **C**ontent and **S**ervices. The functions (and events) will be described, these are the reactions and actions of the system. The next part, the interaction (and usability), will be used how the user interacts with the system. Furthermore, the content (and structure) will show, in chronological way, the information transmission of the system. Lastly, during the services the used services for the concept will be described. All the above announced components are used to describe a user scenario, from the system's perspective.

3.8 FUNCTIONAL SYSTEM ARCHITECTURE

The scenarios created during the iPACT and FICS described in section 3.6 and 3.7, will contribute as a starting point for developing the functional system architecture. Resulting from the ideation phase, an architecture will be created which gives overview of where all functionalities of the instrument. This architecture of the final application will be done in three decomposition levels.

- The first level, in general the inputs and outputs of the prototype will be described.
- The second level, with the use of a block diagram the main different functionalities of the system will be described. In other words the transfer of different data will be shown.
- The third level, the sub-functionalities of the prototype will be described. Because in the second level a decomposition of the main functionalities are described. A more detailed information of the functionalities is required to provide a basis for the realisation.

This architecture will provide a solid foundation for the realisation phase of the project. Eventually, the instrument will be developed according to this architecture.

3.9 REQUIREMENTS

The gathered information during the all three phases a list of preliminary requirements is made, from gathered information throughout each phase. In other words, at the end of each phase the list will updated with the information gathered in that specific phase. In the last phase, the evaluation, the requirements list is updated for the last time, due to the gained information from the functional and user evaluation. The requirements will used in the conclusion to make recommendations for further research and development. These requirements will be listed into two groups, functional and non-functional. As last with the use of the MoSCoW method the requirements will be prioritised.

3.9.1 FUNCTIONAL AND NON-FUNCTIONAL

The requirements will be divided into two different groups, functional and non-functional [25]. Functional group will show what the instrument should do, it focusses more on the functionality of the instrument. While non-functional, shows how the instrument should work, this is more about the performance and usability.

3.9.2 MOSCOW

As been pointed the MoSCoW method will be used to prioritise the requirements, to show what is essential and what is not. MoSCoW stands for Must have, Should have, Could have and Won't have functions for the system [26].

- Must have: these are the functionalities which should be included in the prototype.
- Should have: these are not critical the functionalities, however are important to include in the prototype. Hence, if these functionalists are added it will add a great value.
- Could have: could be included, therefore are not essential, they could be included if they do not effect anything else.
- Won't have: are functionalities which are deliberately left out and from this version at this time. However, it would be of value in the future iterations, so the instrument can be developed in the future.

When MoSCoW is stated it would help prioritising the requirements. This is done for developing the prototype during the realisation phase, to show which requirements should be implemented first. In other words which requirement has the highest priority to be included in the system.

3.10 EVALUATION

The instrument will be evaluated in three ways, functional, expert and user evaluation. The goal is to find out if the prototype works properly, to see if the requirements of the envisioned instrument are met and if further research is possible. According to Bults [27] first a functional evaluation has to been done to find out if all the 'must have' requirements are met. So the expert and user evaluation could be performed properly. The expert and user are the major stakeholders for this project, these evaluation are conducted to find out if the non-functional requirements are met.

3.10.1 FUNCTIONAL EVALUATION

The functional test needs to be done to be sure at least the ‘must have’ requirements are met, to be sure the system works and could be tested properly. Therefore, this test is done before the expert and user evaluation, otherwise these evaluation did not have any contribution.

The functional evaluation has been done by the developer. This done as follows: by running the system, with the different requirements and find out which requirements can be checked off. If at least the ‘must have’ requirements can be checked of the system works properly to be tested. Only if one of these requirements cannot be checked off the prototype would not work properly and needs to be fixed.

3.10.2 EXPERT EVALUATION

Next is the expert evaluation, this is conducted to find the first important flaws which can be taken into account before the most important stakeholder (the users) evaluation. According to Lazar, Feng and Hochheiser [28] experts evaluation needed to be conducted before the user evaluation, to inspect the system to assess the level of usability. For this report two different methods of expert evaluation are conducted, which are reflection interface heuristics and a cognitive walkthrough.

First the reflection interface heuristics [29], this is done by walking through the system with the expert and find out if it is working according to the expert. This evaluation is done mainly to; strive for consistency; offer informative feedback and prevent errors.

Secondly the cognitive walkthrough [29], where the expert needs to do a series of tasks, a “walking through” the system. The expert needs to understand how the users are and which tasks they might expect. Therefore, this is a tasked based evaluation. This evaluation is done mainly to find out rarely occurring but important tasks and high-frequency tasks.

3.10.3 USER EVALUATION

As last the most important stake holder evaluation, the user evaluation, to find out if the non-functional requirements are met. Based on the non-functional requirements the user evaluation is conducted. With as key aspect, ‘how would the user interact with the instrument?’ The test will collect both qualitative and quantitative data by holding a small interview (qualitative) and questionnaire (quantitative) before and after the use. During the use, the researcher conduct naturalistic observations [28]. With the use of this technique the researcher observes and notes what the users does. This technique is used to find out all constraints the user has during the use of the instrument. The amount of users for the evaluation will be at least five. According to Virzi [30] five users will find approximately 80% of the usability flaws. Therefore, the minimum of users for the evaluation should be five.

4 IDEATION

The focus in this chapter, is on generation and conceptualization from the user perspective. The information gathered from chapter 2 is used as a basis during this chapter. To research where the instrument can be implemented, can bring a contribution, how to motivate students and what kind of technology can be used. Hence, this chapter is constructed as follows:

1. Stakeholder Analysis
2. Individual Brainstorm Session
3. Interviews/Joint brainstorm Session
4. Questionnaire
5. Concepts Choices and Idea Selection
6. Preliminary Requirements: 1st Iteration
7. iPACT analysis

4.1 STAKEHOLDER ANALYSIS

For this project different stakeholders are involved which can be identified. With the use of the method described in chapter 3, the stakeholders will be identified in different categories:

Users: The reflection device will have three main users, namely the students, the mentors and the project supervisors. Both three are of interest in using this device, for each three short an explanation will be given. First the students are of high interest because the device is helping them to reflect on their study experience. Also they are of high influence of the device because they need to use it. Because the device has to meet their criteria. Next are the mentors, they have an interest in helping the student with their professional development. And are of influence because the mentors know where it needs to help. Finally, project supervisors they are interested in this device because the device helps the students to learn more about their study experience. And has the same influence as the mentors.

Developers: The developer of this device is mainly the researcher. The influence is of great importance, the research of the researcher will finally help finalising the device. Of course the decisions will be influenced by the users and decision makers. But the researcher is making the final decisions. In the progress of making the device probably the help is called from program expert. Due to the lack of program skills from the developer. Hence, the program expert has an influence on the realisation of the device.

Legislators: Potential legislators are, in general, lawyers, the ministry of education, and innovation companies. Since lawyers develop guidelines that have effect on the development and operation for on lots of project, they are potential legislators. The ministry of education is more related to this project because this project is within the educational sector. Thus, their interest is low but they have a higher influence. There is also another legislator who can have more interest in the device, which are innovation companies. They have to be taken into account because they may have

already got some patent on certain innovations. For this reason, they also have a slight influence on the development.

Decision-Makers: The decision-makers consist of the researcher, the supervisors from Creative Technology (Erik Faber and Richard Bults) and the Create program. To start with the most important decision maker of this project, the researcher himself. Because this project does not have a client the most important decisions have to come from the researcher. Therefore, his interest and influence is high during this project. Although the decisions of the researcher are influenced by the by other stakeholders, because there is no client the important decisions have to come from him. However, the important decisions come from the researcher the supervisors can help with time management and keeping him on track. Hence the influence of the supervisors is important. As it is from the study program, because in this program the device should be implemented.

Each stakeholder from above are analysed by rating the interest and their influence. This are summarized in *Table 4.1.1*:

Stakeholders	Category	Interest	Influence
Students	Users	High (3)	High (3)
Mentors	Users	High (3)	High (3)
Project Supervisors	Users	High (3)	Medium (2)
Programmers	Developer	Low (1)	High (3)
Vasco van Pinxteren (Researcher/Developer)	Developers/Decision-makers	High (3)	High (3)
Ministry of Education	Legislators	Low (1)	High (3)
Lawyers	Legislators	Low (1)	Medium (2)
Innovation Companies	Legislators	Medium (2)	Medium (2)
Richard Bults	Decision-makers	Medium (2)	Medium (2)
Erik Faber	Decision-makers	Medium (2)	High (3)
Create Program	Decision-makers	Low (1)	Medium (2)

Table 4.1.1: Stakeholders categorized rated on their interest and influence

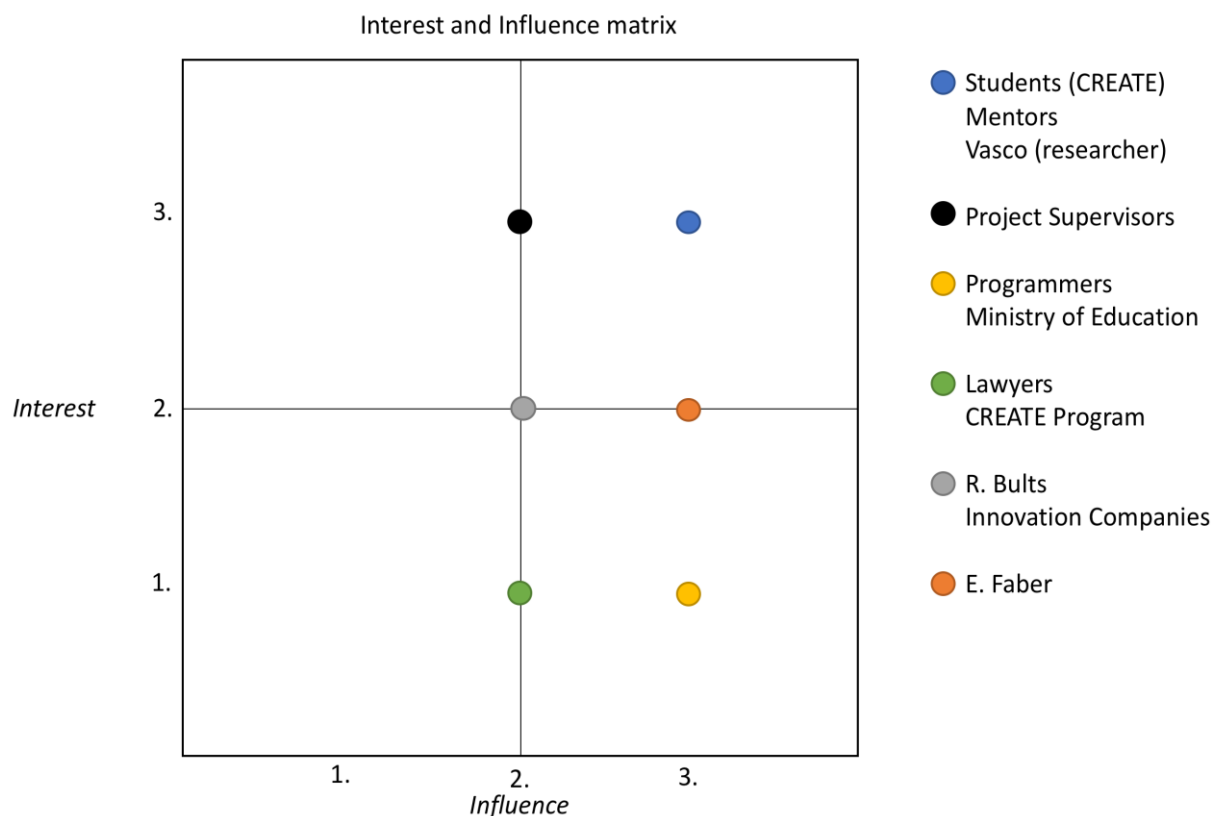


Figure 4.1.2: Interest and influence matrix, showing the stakeholders are most important during the research.

As shown in *Figure 4.1.1* and *4.1.2* the influence and interest of the stakeholder are combined to show who has the most value for this project. The stakeholders with the most value are students, mentors and the researcher. Owing to this fact during the ideation and specification phase these groups of stakeholders are of most importance to take into account.

4.2 INDIVIDUAL BRAINSTORM SESSION

In the beginning of the ideation phase the researcher made a scheme to image where a certain reflecting instrument could be implemented. This is done to show how a reflection process is working and to see where an implementation in the reflection process is needed. The scheme is shown in *Figure 4.2.1*. In the scheme is shown how the reflection process works. A brief explanation of the scheme, there is a student who is reflecting over a study related experience. By asking the questions about the experience, determinative judgements, the student is widen his experience, reflective judgements (see section 2.1.3. Understanding of Reflection). A reflection instrument can be best implemented in helping with the determinative judgements. Because during these judgements there are multiple options to support the students in developing these judgements. (In *Appendix F* is shown the first draft, where the reflection instrument should be implemented.)

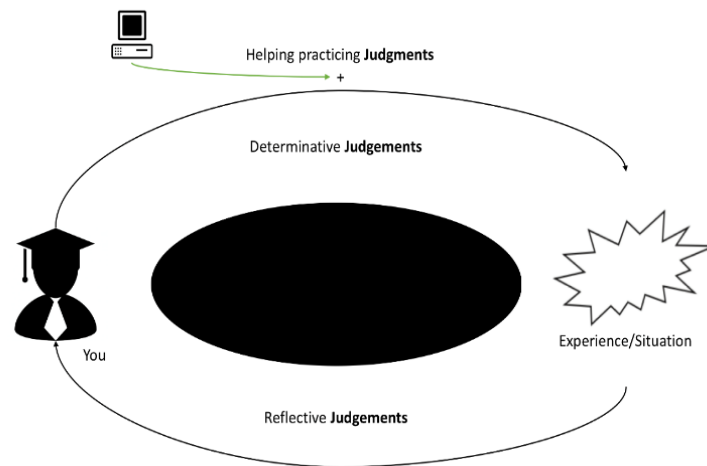


Figure 4.2.1: Reflection process, how students are reflecting over a situation and where the instrument should be implemented

Next, an individual brainstorm is held to think about what the system could do, which can be found in *Appendix G.1*. This resulted into four functions, the functions will be briefly explained and why it should be of value. These are the following four functions:

- Generate a reflection report, when a student uses a certain method to reflect it should be documented what is learned. But as been pointed out for a student is reflection is better when is done with a reflection partner. If during the reflection a report will be generated it will save the student lots of time, which the student could help with a better time management during the reflection process. Maybe the instrument could take notes during the process. Different options what kind of reports can be generated are pointed out in the appendix X.
- Measure physical signals, when a students is reflecting certain physical activities take place. If certain signals can be measured this can give input to the system. Certain signals can be interesting to know to find out if a students is reflecting well enough or to see if it has any effect on the student. Different physical signals which can be measured are shown in the mind map.
- Generate questions, asking questions is of great importance during reflection. This helps students to explore their study experience and may give new viewpoints where the students never thought of. Generating questions can be done with basic questions or with more difficult questions which can be added throughout a process. Nevertheless it is especially important good questions are asked of a student which helps explore the experience. Therefore, when the instrument can generate question it would help think the students about the reflection. This can also be of value for the reflection partner, for helping asking the right questions.
- Measure the quality of reflection, when a student finished a reflection process it helped the student with thinking about new improvements. If these improvements maybe can be measured or put into a logbook. Or keep track of different kind of improvement proposals.

Based on this information, a research during the supplementary sensors analysis will be done, to find applications for a device. After this, a stakeholder analysis is conducted to find out which stakeholders are important to take into account when information is gathered. Next the two other important aspects should be discussed. The first is to find out where in the curriculum the instrument could be implemented, this is done with interviews, questionnaires and joint brainstorm session. The second is to find out what makes it interesting for students to start reflecting, this information is also conducted with interviews, questionnaires and joint brainstorm session.

4.3 INTERVIEWS / JOINT BRAINSTORM SESSIONS

During this section different interviews and brainstorm are conducted. To find information about where in the curriculum the instrument could be implemented, and to find out what makes it interesting for students to start reflecting. The important

4.3.1 JOINT BRAINSTORM SESSIONS:

Fellow Creative Technology students are asked to conduct a mind map brainstorm session, as is explained in section 3.3. This brainstorm session was important to find out how students can motivate themselves to do certain actions as well where the instrument can be implemented, the whole interview is included in *Appendix G.2*.

Also three other topics are discussed, first the students is asked what they noticed during their study career related to reflection. Secondly, where they think a reflection instrument could be implemented to help reflection being more used to its full potential. And how the current tutors are during the important reflection moments. The important findings are pointed out below and the interesting findings are underlined.

When are students doing something from themselves:

- When they are about to fail.
- If they get new insights from it. This is an important goal of reflection, if the process went good.
- When they enjoy doing.
- If they see result, maybe conducted from data and if the data can be analysed. Data can be collected through a report, to show the process.
- They know what they are going to do. This refers to the important factors which are important before reflecting, which can be found in section 2.1.6. Conclusion. Briefly this was about showing which kind of judgement a student is using during reflecting.
- When it is fitting the student.
- If there is a reward system, if students are able to collect their rewards. This can be combined with showing the results.

Where can the instrument be implemented:

- Subjects
- Projects
- Professional development

The last two can be put together, for professional development the important experience from the project can be used. Certain experiences during the project time can be help full and informative for students to reflect on.

Reflection implemented during the study period:

- One time reflecting helped out with a project, by giving an anonymous questionnaire about project members. This helped thinking about you own doings. This may be an important finding, as questions can be formulated from the feedback which can be used as input for the instrument.
- Also it can bring a contribution in the transition between the different modules. Every module has a brief evaluation but not something what can be used as an outro for the module. A reflecting instrument could be implemented in this part.

Reflection is also included during tutoring, however some problems are occurring:

- Most tutors have no idea what they are doing.
- Tutors do not have any interest in reflecting.
- Tutors do not see that reflecting can help solve a problem.

4.3.2 BRAINSTORM E. FABER

As second information source a brainstorm session is conducted with Erik Faber, who is the supervisor as well a programme coordinator of Creative Technology. The brainstorm can be found in *Appendix G.3*. This brainstorm was about where in the curriculum there are opportunities for the instrument to be implemented. The interesting opportunities are pointed out below:

- Projects, a good example for this was hybrid worlds. A project where anonymous feedback was given.
- Professional development, would be the perfect place to implement an instrument. However, the only problem is that this is still under construction/development by Thea de Kluijver. Hence, in the interview, which can be found in 5.2.2. Also pointed out there is now no room for adjusting a reflection instrument.
- Minor space, students are going on an exchange where they supposed to get 30 EC for half a year. Sometimes students are certain ECs, up to 5 EC, the instrument could be implemented to compensate this. For this the reflection process need to become a supplementary subject, therefore reflection should meet certain final outcomes, this is followed by the next opportunity.
- Reflection subject, this could be a supplementary subject, if it would be supported by measureable final learning outcomes. Consequently ECs could be linked to the supplementary subject.
- A learning process throughout the study, from module one until eight. It could be going analogue with the academic skills.

4.3.3 INTERVIEW I. VISSCHER-VOERMAN:

Educational expert Irene Visscher has been interviewed for the second time, the whole interview is included in *Appendix H*. This interview was important to conduct information about which effects of reflection can be measured and what is motivating students to reflect. The important findings will be pointed out and what the use is of these findings are.

- To make sure the instrument would get shape and could be implemented a new tool is suggested called NARRA⁴. NARRA gives a level how the student see the experience, what they do with other viewpoints, what the students do with the viewpoints and what the transformation is. To put it more simply, NARRA is grading the whole reflection process, which can show how well the student has reflect. Hence, NARRA could help to make sure the effects can be measured with the use of scheme.
- Another effect what could be measured are improvement proposals. This could show the teacher the student learned from the process.
- There is a quartering which could help show a clear overview through the time what kind of development the student made. The quartering questions are always about an experience: *'Who am I in ... ?; What do I want in ... ?; What can I do in ... ?; and What am I doing in ... ?'*. This effects can be adjusted in the improvement proposals.
- If reflection becomes a supplementary subject it is important the show the first basic technique, before starting to reflect. After the first reflection, this should be repeated over time. Consequently there would occur a learning process throughout the study.
- A reflection report is a good way to measure the learning outcomes of a student, a report has a value for the reflection.
- The goal of reflection is to get knowledge about yourself. By asking the right questions and where a student is forced to formulate an answer.

4.3.4 INTRVIEW H. PROCEE:

Prof. Dr. Henk Procee is a passionate teacher, who taught diverse groups. From HBO (chemistry) to masterclasses in philosophy, reflection and research supervision. Procee did research in reflection education and also adjusted it in higher education. About his research he wrote articles which are useful for this project. The important findings will be pointed out and what the use is of these findings are, the whole interview is included in *Appendix I*.

- During reflection, Procee pointed out that there are two domains, which are open and closed domains. The closed domain are reflections were students reflect on their mistakes and open is depending different of viewpoints from the experience. It could be said students reflection needs to be in the open domain, to let students think and come to new insights.
- An alternative for writing a reflection report for children is drawing their experience. For students this may relate to mind mapping, this is creating a quick overview of different relations from viewpoints about the experience. A capacity of reflection is to find new relations which does not occur before.
- During reflection it is essential students find out, how do they develop as a professional. Therefore, the goal of reflection is to develop as a professional and your qualities. This relates to an outcome, which is an increasing in self-confidence.

⁴ NARRA is a rubric for reflection reports in higher education, to improve and evaluate reflective narratives [35].

- Asking good questions can help with the development of professional development. Which the can be output of the instrument. Good questions is making students confused.
- An interesting feature of the instrument is that, it has no interest in what the student is saying. To put it more simply, if a student is saying stupid answers during the reflection, the student does not need to shame for a respond. Which could be given by the teacher or supervisor. A student can than filter what will be shown.
- A partner can be internal or external. In other words, reflection can be with someone else or with yourself.
- An option for the instrument is, it can produce (confusing) repeating questions and it can produce some kind of a report. This can be linked to line and triangle reflection because both give new insights and are helping with future plans. The other two are harder to adjust an instrument.
- Confusing questions is meant, to make explicit choices and become naturally.
- Reflection in projects can add a value. Hence, in terms of professional there is happening a lot and students work with different types of students. However, about implementing, in this phase it is hard to say where it should be implemented. Therefore, it should first be developed and afterwards be tested in the different options.

4.3.5 IMPORTANT FINDINGS

During the interviews and joint brainstorm sessions, important findings are made which are important to take into account when working on the requirements. The following findings are important for developing the instrument:

- NARRA can show the effects of a reflection report.
- An the quartering overview can give a student insights in the current professional development. The quartering questions are always about an experience: *'Who am I in ... ?; What do I want in ... ?; What can I do in ... ?; and What am I doing in ... ?'*.
- Mind mapping can be an alternative for writing a report.
- The goal is to develop as a professional and develop your qualities.
- The instrument:
 - can help the student to filter the reflection report and make a report;
 - could help the partner, both internal as external;
 - can produce (confusing) repeating questions;
 - and bring a contribution with line and triangle reflection methods.
- The questions:
 - can be formulated and generated from anonymous feedback, or questionnaires (when working in projects),
 - should make students confused;
 - let them think about alternative viewpoints;
 - and make choices explicit and naturally.

However, the implementation of reflection is most recommended in projects. In this phase it is hard to say where the instrument should be implemented. Therefore questionnaires are made to find out where students should find the implementation the most interesting.

4.4 QUESTIONNAIRES

In this section, information is gathered from students of Creative Technology about reflection in Creative Technology. The following findings are based on the questionnaires, the complete findings can be found in *Appendix J*. The relevant findings will be highlighted, which may be important for the developing of the instrument. The number of responses is $n=22$ and 45.5% were both second and third year students, the other responses came from a first year students and graduated students. In short this questionnaire was find out the associations, attitude, elements and implementation of reflection.

The association students have with reflection in Creative Technology, is that it is helping to create better understanding, adjusting the self-specified standards and development about a study experience. This is relates to the findings of the aims of the reflection defined sections 2.1.1. The Definition and 2.1.4. The Aims. In a nutshell, this is indicating that most students are knowing what reflection is and what it can bring them.

Moreover students are seeing reflection as beneficial and helpful, which is showing students are acknowledging reflection can bring a contribution during their study. However, besides these positive finding a third large population is also pointing which is, that students see it as an obligation. But this was partly predicted in section 2.1.2. Obstruction of reflection. Therefore, it can be concluded most students have a positive point of view towards reflection.

According to the findings the elements which should be in reflection could be described as, developing as a professional. Because the outcomes are that reflection is about learning more about

In most cases there is no need for changes of implementation of reflection, it is going well. However, two cases are standing out because they show reflection in not working and is even missing. These two are orientation (minor, master and inside study choices) and the course professional development. According to the questionnaires, the reflection in professional development should be re-implemented and the reflection about orientation should implemented. With other word reflection about professional development is not working and about orientation is missing. In the interview with T.H. de Kuijver in section 2.2.2 is stated that reflection in professional development is currently being reshaped. Therefore according to the findings of the questionnaires reflection can be best implemented during the orientation.

To conclude, a brief summary what questionnaire showed about the relation between Creative Technology students and reflection in Creative Technology:

- Student have a clue what reflection is and what it can bring them.
- Students see reflection mostly as beneficial, an obligation and helpful.
- Developing as a professional is a collective name which elements should be in reflection.
- Reflection should be implemented in orientation phase.

4.5 CONCEPT CHOICES AND IDEA SELECTION

First concept choices have been made based on the findings in the previous chapters. These choices will be elaborated in the first requirements iteration section, to show the functions of what the concept can have. The choices will be substantiated with the findings, the choices are:

- The instrument will be implemented in the orientation space, in particular to help student choosing a minor. According to the answers from the questionnaires in section 4.4, students are pointing out reflecting in the orientation is missing and should be implemented. The orientation includes, minor, master and inside study choices. During the orientation in minor choices students do not get an opportunity to reflect on their profession. To find out what extra study opportunities will bring a contribution to their profession. Therefore, the minor space has been chosen where the instrument will be implemented.
- Making choices about the minor more explicit. Reflection is about to develop as a professional and the qualities. During the choices around the minor, it is important for students to know what will help to develop themselves as their profession.
- The method which will be used is line reflection. The two methods which were advised where the instrument could be implemented were line and triangle reflection, see section 4.3.5. Important Findings. To make the implementation of the instrument easier, the implementation for only one method is chosen, namely line reflection. This is because line reflection is helping with finding out which qualities standards are of use and important to reach a certain goal. The tool will now be adapted to this reflection method. However the instrument could also be implemented to triangle reflection.
- The instrument will help students to think about their professional development by asking questions. These questions will help students to formulate a line reflection or help during the line reflection.
- The instrument will help the students to produce a short reflection report. If the students made a line reflection, the students can make a short reflection report with what they can show their line reflection.
- The instrument is helping the student with individual (internal) and one on one (external) see section 4.3.5 Important Findings.

So now the instrument, is helping the students with line reflection by letting the student think before reflecting, to make their incentive and preferences about the minor more explicit. These explicit choices will be formulated in a line reflection report, to show and give an overview of the explicit choices.

4.6 PRELIMINARY REQUIREMENTS: 1ST ITERATION

For the final design concept, important decisions are be made based on the findings from this chapter. These decisions are helping with the development of the requirements. The requirements would be adjusted every chapter, this will be the first iteration. The first iteration is given with the use of MoSCoW, in sections 3.9.2 is explained how MoSCoW is used. Also the requirements are divided into functional (F) and non-functional requirements (N-F), are based on the previous findings and mainly on the concept choices.

The student must use the instrument with enthusiasm is and feel it does not cost too much time. The first preliminary requirements are listed below in *Table 4.6*:

Must	1. Instructions: <ul style="list-style-type: none"> • Give an explanation how the reflection process works, with the use of practicing judgements during reflection. • Show the intention/goal of the reflection. During reflection:	1. F
	2. Student must make a choice to reflect on study experience or their minor situation.	2. F
	3. The instrument must cover all the different suggested situations or experience of a student to reflect on.	3. F
	4. The instrument must be implemented to help the student to orientate about their minor.	4. N-F
	5. The instrument must make choices about the minor more explicit.	5. N-F
	6. The instrument must be based on the line reflection method.	6. F
	7. The student must use the instrument with enthusiasm is and feel it does not cost too much time.	7. N-F
	8. The student must not feel that the use of the instrument is boring and is costing too much time.	8. N-F
	9. A student must be more confident after the use of the instrument about their minor choice/situation.	9. N-F
	10. The student must have considered to get new insight and viewpoints about their minor choice/situation.	10. F
	11. The instrument must generate reflective questions depending on the answers/situation of the student.	11. N-F
	12. The student must feel free to give all the answers he or she wants.	12. F
	After reflection:	
	13. The instrument must produce a representative reflection report of the reflection process.	13. F
Should	14. The student must be able to rephrase the report after the use of the reflection instrument.	
	15. The instrument should be used by a student individual or be used as an interaction system between student and reflection partner.	14. N-F
	16. The student should feel that the report is a well basis to start from to orientate about their plans.	15. N-F
Could	17. Questions should make the students more confused and let them think about alternative viewpoints.	16. N-F
	17. If a report can be generated, it could be checked with NARRA so it could show if critical reflection has taken place and to show the effects.	18. N-F
	18. Questions could be formulated and generated from anonymous feedback, questionnaires or teachers. To help the students to see their experience from different viewpoints.	19. F
Would not	20. Be implemented in different orientation phases, inside study choices master or even the study itself.	19. N-F
	21. Measure physical reactions, so it can be able to show when the student is reflecting and which questions are of more	20. F

impact to the students.	21. N-F
22. Made into a subject, where EC's can be linked with the use of the report and can be checked with NARRA.	

Table 4.6: Preliminary Requirements

4.7 IPACT ANALYSIS

The following section will give an explanation of the system, via the iPACT analysis. The system will be described through the eyes of the user, with the iPACT method described in section 3.6 iPACT.

INTENSION

The intension of the instrument towards the user is to help them to ensure their qualities about the minor choice. Help students think about different qualities, essential qualities and different actions from the categories. To produce an overview on the reflection.

PEOPLE

Next are the people, these are the users who will interact with the system. They will be described with the use of personas. The personas framed on the following criteria, the students are;

- creative Technology students;
- second year or higher;
- are about or in the process of making a minor (orientation) choice;
- are doubting what to do.

For the people four personas are made, which can be found in *Appendix*. The four personas are four types of student who will use the instrument differently. This is done to get an insight why it will be profitable for these students to use the instrument. All the students who are described have certain conflicts in their choices. The four students which are described, is a students who:

1. is still orientating what to do, wants to work hard however studying is not het strongest skill;
2. wants to do a technical pre master, because of the well job perspectives;
3. has a gap module, but wants to get to get as efficient trough his study;
4. wants to go on an exchange, but has no clue where to go.

ACTIVITIES

The instrument will be used by student to reflect about the future plans of their minor situation. The instrument will;

- ask reflective questions;
- generate a reflection report;
- provide the student with a line reflection method.

CONTEXT

Because the instrument would be designed for second year Creative Technology students. The instrument will be applicable (probably) during the second year of Creative Technology. Therefore, the context will be in an educational setting.

TECHNOLOGY

The technology will show an interface, where a student can answer certain reflective questions and which will produce at the end a reflection report. A decision tree software is used to make an interface which the student can use, the software is called Berkeley Bridge, which will be explained in section 6.2 Software.

USER SCENARIOS

All the above announced components are used to describe a user scenarios, from the user's perspective towards the concept⁵:

1. Sophie is still orientating what to do.

When Sophie is looking back at some projects and other subjects, she finds out she was working pretty hard to achieve everything. Getting frustrated to see how little effort other students are putting into their work compared to her, she is getting demotivated. But she is managing to pass, by working hard and being eager to learn. She is questioning herself what kind of skills she has which can help her to study more efficient. Her best friend is going to study business and is saying that Sophie also has to do it.

With the use of the instrument, she needed to use from her tutor, Sophie will look back at certain projects. To find out what her skills were, which are useful to learn easier but can help her to learn more. She has chosen to look back at a recent project and with the help of different viewpoints she got new insights about her qualities. Because she found out she helped more fellow students than she remembered. So, her qualities were not in knowledge but also in explaining and guiding others. These qualities she never thought of she has. Therefore, she is considering to explore and learn more about this skill. This consideration is a perfect addition for further future plans.

2. Pascal wants to do a technical pre master, because of the well job perspectives.

Having a fine job perspective is important for Pascal. Based on this he thinks he has already made his future plans. However, a tutor advised he can use the new instrument to check if his choice was right. Despite being completely convinced about himself, Pascal is using the instrument to find out if he made the right choice. During the reflection about his situation he finds out he is not completely happy with his choice. Hence, in this choice also some aspects come back what is not fitting the personality of Pascal. Being successful early, means he will not have such a fun time anymore. Instead he has to work hard to achieve his goals, which are in contrast with other aspects which are also

⁵ Advised is to read the persona first in *Appendix K* because this will help to read the user scenarios easier. Of the four personas two are about reflecting about the experience and the other two about the situation.

motivating him. For example, exploring more and spending time with friends. Therefore he starts to reconsider his choice, if his choice was based on everything what he wants to do.

CONCLUSIONS OF THE USER SCENARIOS

These user scenarios helped with finding out what students will probably start doing after using the instrument. They start to reconsider their choice or take other aspects into consideration when making a choice. These two findings may be important, hence it can be a consequence of the reflection, when it is working.

5 SPECIFICATION

The focus in this chapter is on functionalities of the system, to show how the system will interact with the user. In this phase design choices have been made, with perspective towards the development of the envisioned system. Resulting information from the previous chapter will be used as fundamental of this phase. Hence, this chapter is composed as follows:

1. FICS
2. 1st Activity Diagram
3. Interview
4. LoFi test
5. 2nd Activity Diagram
6. System Architecture
7. Preliminary Requirements – 2nd iteration

5.1 FICS

The following section will give another explanation of the system. As seen through the eyes of the designer, using the FICS method described in section 3.7.

FUNCTIONS

The system has five main functions, the first is it needs give instructions how the reflection is working. The second, to generate the first initial questions. The third, to analyse the answers for generating the reflective questions. And the next function it needs to save the answer to generate the report, which can be adjusted later by the user. The last function is that the report could be download so the student could reconsider the answers.

INTERACTION

The system will start to ask initial and reflective questions which a student needs to answers. By giving answers these questions, the user will proceed in the reflection process and new reflective questions will be generated. This all depending on the described situations by the student. To finally generate a reflection report.

CONTENT

The analysing of the answers of the student of the initial questions, which the system will use to generate new reflective questions, during the reflection. Different answers from different questions need to be saved, therefore the saving function needs to give input for the reflection report.

SERVICES

The only two services which are needed are, a working internet connection, because the instrument will be online. And word software, due to the instrument will produce a reflection report in a word document.

USE SCENARIOS

All the above announced components are used to describe a use scenarios, from the designer's perspective towards the concept⁶:

3. Erik wants to finish his study as soon as possible, however he failed a module which may because he has to study a half year longer (due to the new school system).

Erik is at the moment really frustrated because he does not have a clue what he wants to do. Is he going to do a premaster and has to study a half year longer. Or is he going to do one module a minor so he has only a quartile longer to study. Erik is answering the reflective questions of the instrument. Because he wants to do something else the first questions are boring. However if the questions arise which are relating to the situation of Erik he is thinking different about the situation. Due to this related questions Erik is thinking about his future perspectives. He is writing everything down and because everything is generated in a report he is able to see his answers which helped him with making future plans. With this report he has a good way to talk about it with his coordinator.

4. Marlot has no clue to which country she really wants to go, is it her environment which is guiding her or is it her own opinion.

Marlot is doubting, is her choice based on opinions of others or is it her own decision? She is going to use the reflection instrument. While she is using it lots of new viewpoints come to her mind and she is writing everything down. Still having no clue what she is really doing new questions arise which will help her to think about the situation. After the reflection she gets a report, the report is full of grammar mistakes and information she would not like share with other people. Hence, she is rephrasing the information in the final report. The result is a brief but substantive reflection report which helps her finds new way of thinking to her situation. This rephrased report is helping her to talk with the coordinator about her situation.

In both cases the system is helping the students to ask reflective questions depending on the situation or experience from the student. First the system is giving information to the user, what he is going to do. Next the student will give his situation or experience and the system will generate, depending on this input reflective questions. During this reflective questions the system will translate more than only the situation of the student for generating reflective questions. If the student thinks this is positive or

⁶ Advised is to read the persona first in *Appendix K* because this will help to read the user scenarios easier. Of the four personas two are about reflecting about the experience and the other two about the situation

negative or a random other input. And during the answering of these questions the system will save the answers in a final reflection report which the user can download.

5.2 1ST ACTIVITY DIAGRAM

Based on the four user scenarios in the sections 4.7 iPACT and 5.1 FICS and on the requirements in section 4.6 the activity diagram is made, which can be found in *Figure 5.2.1*. This is done to show step by step the interaction activity between the user and the instrument. The interaction phases are giving an overview how the system must work. This overview is showing different options, these options will be taken into account during the user tests, to make design choices. First a short explanation about the diagram is given and next the questions are stated for the user tests.

As first the diagram is made in three sections, the first one ‘*User*’ is showing the actions which the user has to make. The next section, ‘*Interface*’ is what the screen is showing. In other words, it shows what the students has to do and to fill in, but also it is showing reflective questions to help the students. These reflective questions are generated depending on the actions of the user. The last section ‘*Software*’ will process the actions of the user to give information to the interface. Where ‘*TREE*’ is formulated in this part multiple options are possible.

Secondly, the instrument is made to let the student make a line reflection report without knowing he or she is making it. By letting the student fill in an interactive question generator, depending on the chosen situation or experience. The line reflection process is based on the method described in the book ‘*Reflectietools*’ [18] and by Procee and Visscher-Voerman [4]. Both described different steps in the reflection process, these steps are translated into the activity diagram. The six steps can be found in an easy overview (which is shown in section 5.4 LoFi test, *Figure 5.2.2*), which will be used as the final report. The six steps which will be used are (they are slightly adjusted from the used sources):

1. description of the situation/experience;
2. the clarification of the situation/experience;
3. defining the different categories;
4. defining the qualities of each categorie;
5. defining the essentials of each categorie;
6. and defining the optimisation of each categorie.

The student will go through these steps, by answering the questions which are shown on the screen.

As last according to this diagram, some options are shown which will need to be answered with the use of user tests. The options are shown by numbers in the diagram in *Figure 5.2.1*, the options are:

1. According to the book ‘*Reflectietools*’ [18] an experience can also be a situation where the student is in. Some students will prefer to reflect on a study related experience some prefer to reflect on a situation, when working on the minor orientation. The option is what do students prefer to reflect when orientating about the minor, study related experience or the minor situation.

2. The most common and general situations and study experience need to be pointed out, to generate the right reflective questions. The option is which situations and experiences are covering the biggest part.
3. The book *Reflectietools* [18] and Procee and Visscher-Voerman [4] have a different point of view about this part. It is about, asking clarification questions. Therefore the option is are these clarification questions necessary?

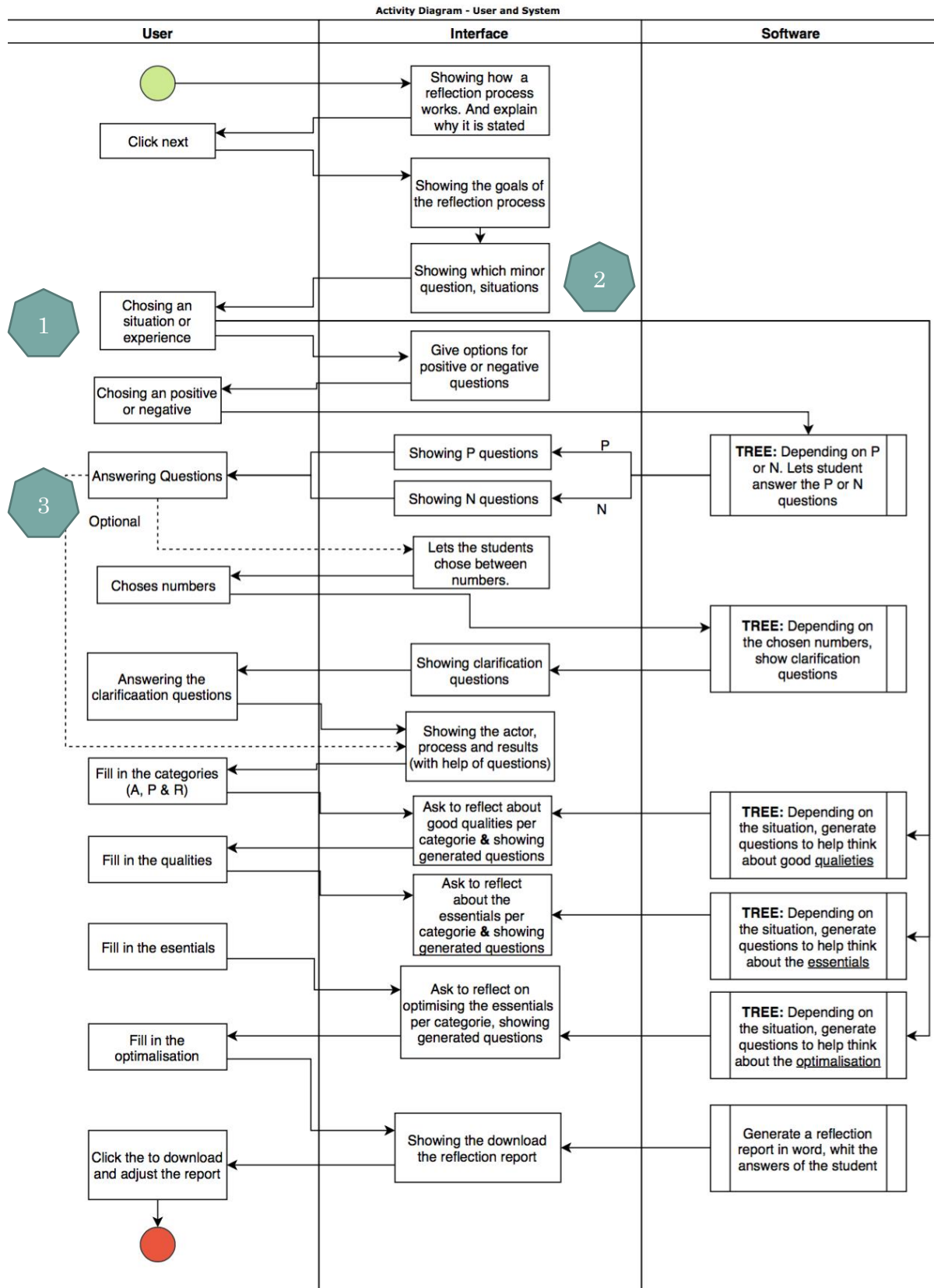


Figure 5.2.1: 1st Activity Diagram. Block meaning, the green circle is the start the red is the end. The dashed line will be tested and the P and N are decisions of the students. And the numbers are representing the options

Situation: <i>(minor question)</i>		
Clarification: <i>(deepening into the situation)</i>		
Categories		
Actor	Process	Results
<i>(Student)</i>	<i>(What will the process be?)</i>	<i>(What is the goal, what will be achieved?)</i>
Qualities		
<i>(What will a good actor do?)</i>	<i>(Where does a well process consists of?)</i>	<i>(Where is this goal consisting of?)</i>
Essentials		
<i>(What is essential for the actor in this situation?)</i>	<i>(What is essential for the process in this situation?)</i>	<i>(What is essential for the results in this situation?)</i>
Optimizing		
<i>(What is necessary to achieve this for the actor, in terms of actions and attitude?)</i>	<i>(What is necessary to achieve this for to optimise the process, in terms of actions and attitude?)</i>	<i>(What is necessary to achieve and optimise the results, in terms of actions and attitude?)</i>

Figure 5.2.2: Line Reflection Report, the report which will be automatically generated after using the instrument

5.3 INTERVIEW

Before the LoFi-tests an interview is conducted to get two kinds of information. It is from a mentor who is helping students with making their minor choice. To gather inspiration for reflective questions which could help students to reflect.

5.3.1 EDDY DE WEERD

De Weerd his task is to perform and accompany research in the field of Micro and Nano-Fluidic systems and Lab-on-a-Chip technology. And is an active tutor for Creative Technology students, and in this field on expertise an interview is conducted. The information from this interview is used to conduct reflective questions depending on related minor situations. First the six minor situations are described, which are used to sketch in which situations the students can be during their minor orientation;

1. Going on exchange;
2. choosing a pre-master;
3. going on an internship;
4. filling up one semester, of 15 EC's;
5. no idea what kind of minor;
6. And already knowing what kind of minor.

Next the de Weerd pointed out some aspects which are helpful for students to help them think about the minor situation. The used information is elaborated, this information is also implemented in the reflective questions;

- defining the milestones;
- what is the weakness of a student;
- what is the drive of a student;
- being aware of the different outcomes;
- knowing what is necessary;
- having a plan B;
- think what is important for parents and friends;
- what will be achieved;
- how to overcome stress;
- what is making the student happy;
- what is needed to make this manageable.

Based on these finding, reflective questions are made in combination with the information given in the literature [4] [18]. The questions are shown during the LoFi test in section 5.4.

5.4 LOFI TEST

This section is to investigate and make different design choices based on the qualitative and quantitative information from the user group, which are second year Creative Technology students. Before explaining what will be tested, an explanation will be given why this user test is not in the ideation phase. The ideation phase is about the user perspective to the design and the specification is about the system development. Because the LoFi test is about the users it should be in the Ideation chapter. However, for these tests information was required from the ideation and specification chapter. Namely the requirements of the system and the activity diagram. With information from both chapters a solid LoFi prototype could be developed. Which will give information to develop a well-constructed instrument. Thus, the LoFi test is being held in this phase of the project.

As explained in section 5.2 three options need to be tested, for a well-structured prototype:

1. What do students prefer to reflect on when orientating about the minor, study related experience or the minor situation.
2. Are clarification questions necessary?
3. Are all the situations and experiences covering enough study related situation and experience to reflect on. And is there anything missing?

Equally important, the questions which will be generated should be tested and the effects should be observed. Therefore two extra questions will be taken into account.

4. Are the questions (generated by the software see *Figure 5.2.1*) good or is there something missing? Is it showing enough different perspectives?
5. What are the effects?

Paper LoFi-prototypes are made which can be found in *Appendix M*. Two different prototypes have been made to find the different effects to reflect on the experience and situation. Also the report which will be automatically be generated is used during the test, this is shown in *Figure 5.2.2*. The layout of the report is based on the information from the book '*Reflectietools*' [18].

5.4.1 LOFI RESULTS

The LoFi test results will be formulated in order of the questions mentioned in the previous section. The quantitative data can be found in the *Appendix N*. For the LoFi test were n=8 students used:

1. Students do not really prefer one specific scenario to reflect on. However, the quantitative data showed students are slightly more confident to reflect on when reflecting on their minor situation. What was standing out during the observations of the students for them it was easier to relate it to their future choice. However, it was slightly harder to reflect compared with experienced situations. Despite this disadvantage, the minor situation was preferred to reflect on.
2. The clarification questions were fine and helped to explore the situation more. Nevertheless, they were putting much time in answering the questions, what followed that the attention span was fading away. On the whole, it is an addition but all the questions make it too much.
3. All the situations and experience were covering all the study related situation and experience to reflect on, therefore nothing needs to be added.
4. The questions made the students think much. Some find them a bit vague and not easy to answer. So, they are an addition and let students view the experience new viewpoints. None of the students had any alternatives, therefore the questions are fine for this part.
5. The effects so far were positive, despite the weird reactions on the reflective questions. The positive effects were, students said they thought of new viewpoints about the experience, without asking them in this direction. A smaller part of the users said it was 'okay' and nothing special.

5.5 2ND ACTIVITY DIAGRAM

A second activity diagram has been made, which can be found in *Figure 5.5.1*, before functional system architecture. This is done to answer the questions, which were raised during the first activity diagram. The answers on these questions are helping to make a well-constructed architecture. Therefore the following decisions are made:

1. Because for the realisation a simple system will be constructed to conduct the user tests. Therefore, the choice is made to use the minor situation instead of study related experience. This will also be explained during section 5.7.
2. The minor situations are covering all the situations students could be in.
3. Clarification questions are an addition, however due to the time this choice has been made students could pick random numbers to just answer one or two clarification questions.

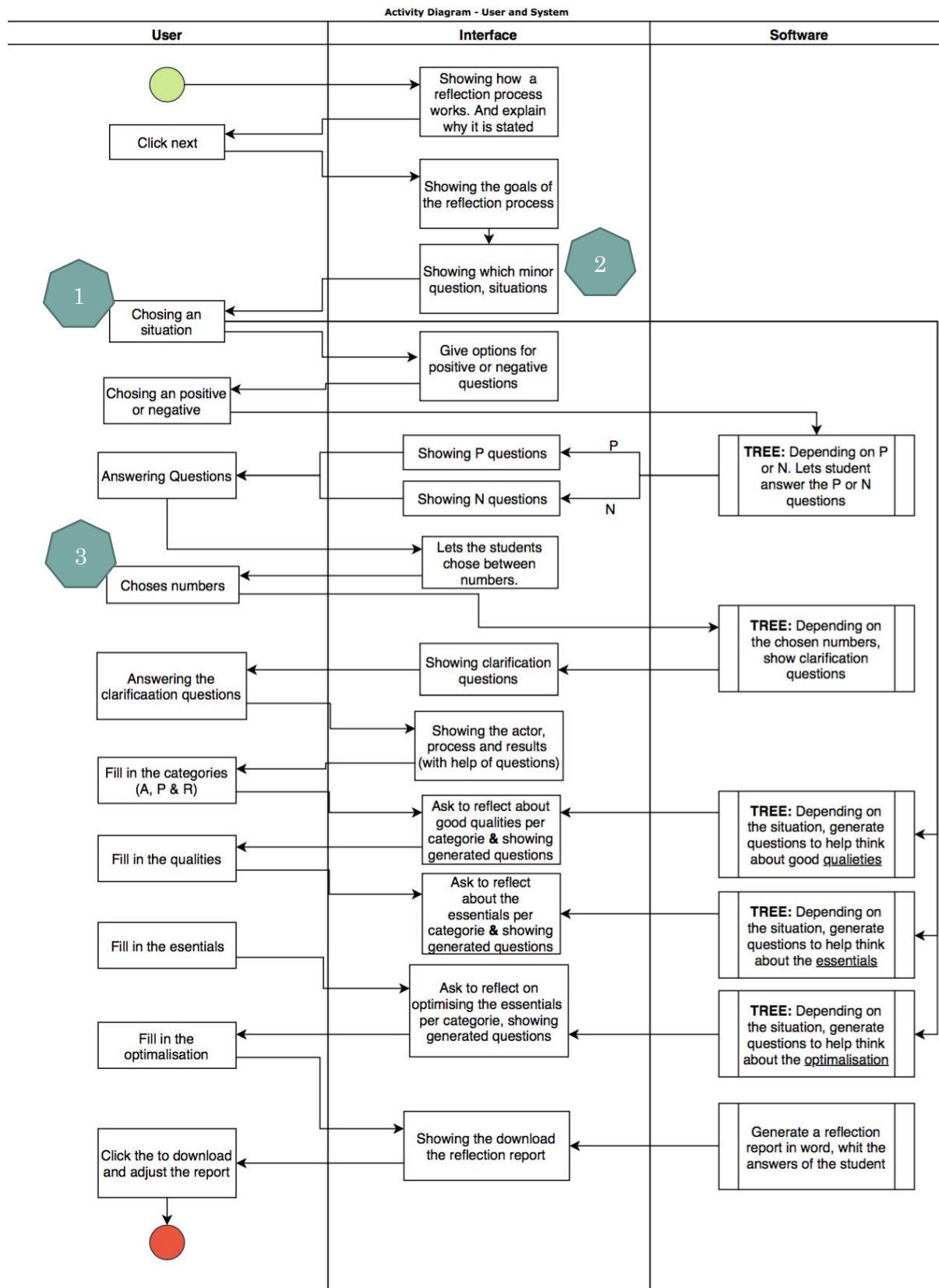


Figure 5.5.1: 2nd Activity Diagram. Block meaning, the green circle is the start the red is the end. The dashed line will be tested and the P and N are decisions of the students. The numbers are relating to made decisions in section 5.5

5.6 FUNCTIONAL SYSTEM ARCHITECTURE

During this section the functional system architecture will be elaborated, to show which input and outputs have which kind of functions. This will be done with the use of three different levels, which are explained in section 3.8 Functional System. These structures are based on the scenarios described in iPACT and FICS. Moreover, which is most importantly, based on the second activity diagram, shown in section 5.5. With the information of these sources the architecture is created, these can be found in the following paragraphs.

5.6.1 LEVEL 0: SYSTEM ARCHITECTURE / INPUTS AND OUTPUTS

To start with the basics, shown are the inputs and output of the system, which can be found in *Figure 5.6.1*. The two input sources of the system are the student, who is using the instrument. And the developer who is giving the input to the system, these are the questions which will be generated. The blue square is the instrument where the information will be used. Which will give as an output a reflection report, generated by the system, with the input from the developer and the student.

Briefly a short explanation how the system will work, this will help understand how the system works. The system will generate questions related to the answers from the students. The answers on those questions will be saved, to generate the reflection report.

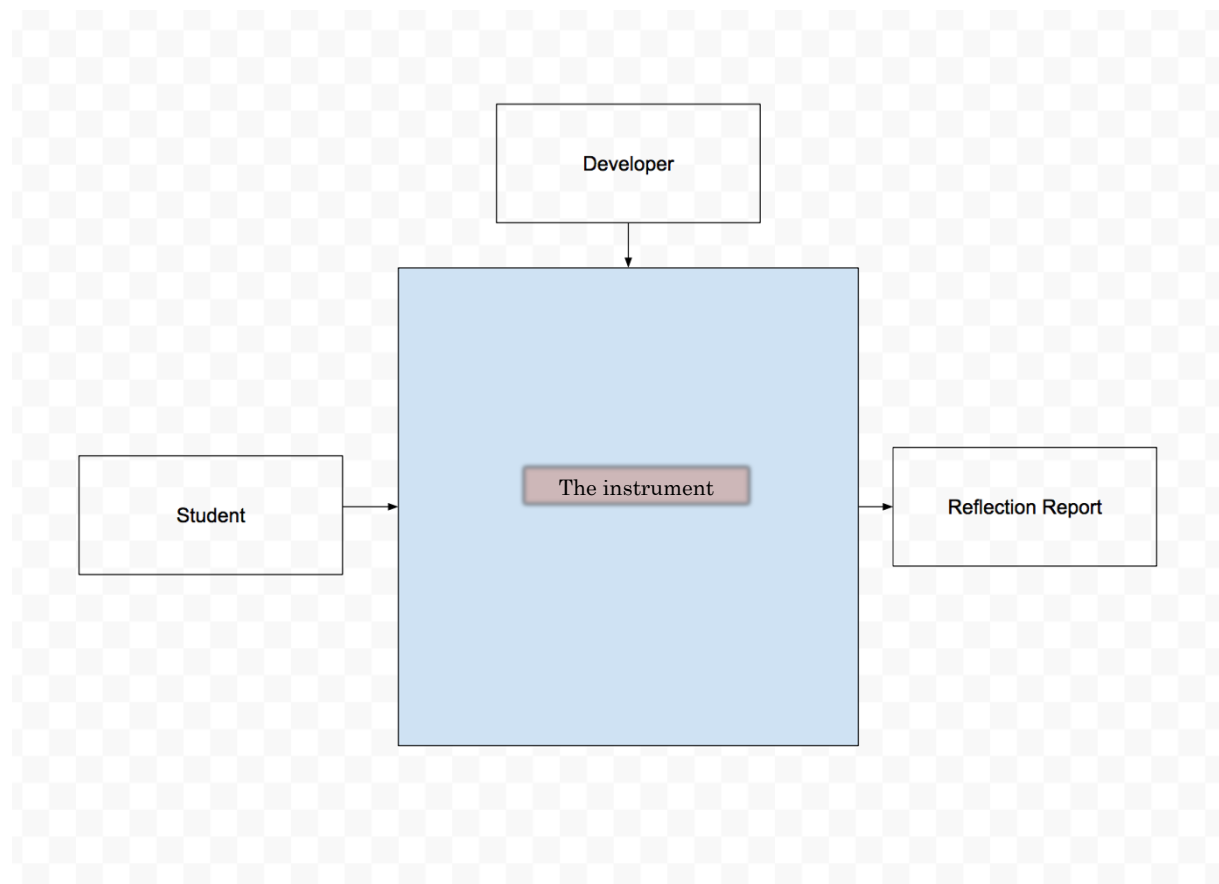


Figure 5.6.1: System architecture level 0

5.6.2 LEVEL 1: MAIN FUNCTIONS

Secondly, a slight more advanced architecture is shown in *Figure 5.6.2*. Here is shown the different functions the system has and which variables the student can give as an input. The instrument is consisting of three subsystems, which will be decomposed in level 2. Briefly the three systems are: the interaction system, which is using all the input data (from student and developer), generating questions related to the answers. Secondly, the reflection instrument which is showing the front-end. This system has two inputs and gives one output. The inputs are, from the student (the answers) and the storage (generated questions). The outputs are the saved answers on the generated questions, which will finally generate the report. Therefore as last, the report regenerator which will save the output from the reflection instrument to produce a reflection report.

Input student:

In two ways the student is giving input, the first is storing and influencing the developed storage, done via the TREE information. The striped line is showing where the first input from the student is stored, and will guide to the influencing of the developed storage. The second, is giving input to the questions which are generated (in the saved data) which will generate a report.

Input of the developer:

The developer has developed different questions, relating to the different options of input from the student. The input from the user is combined with the input of the developer, which will generate output (questions) used in the reflection instrument.

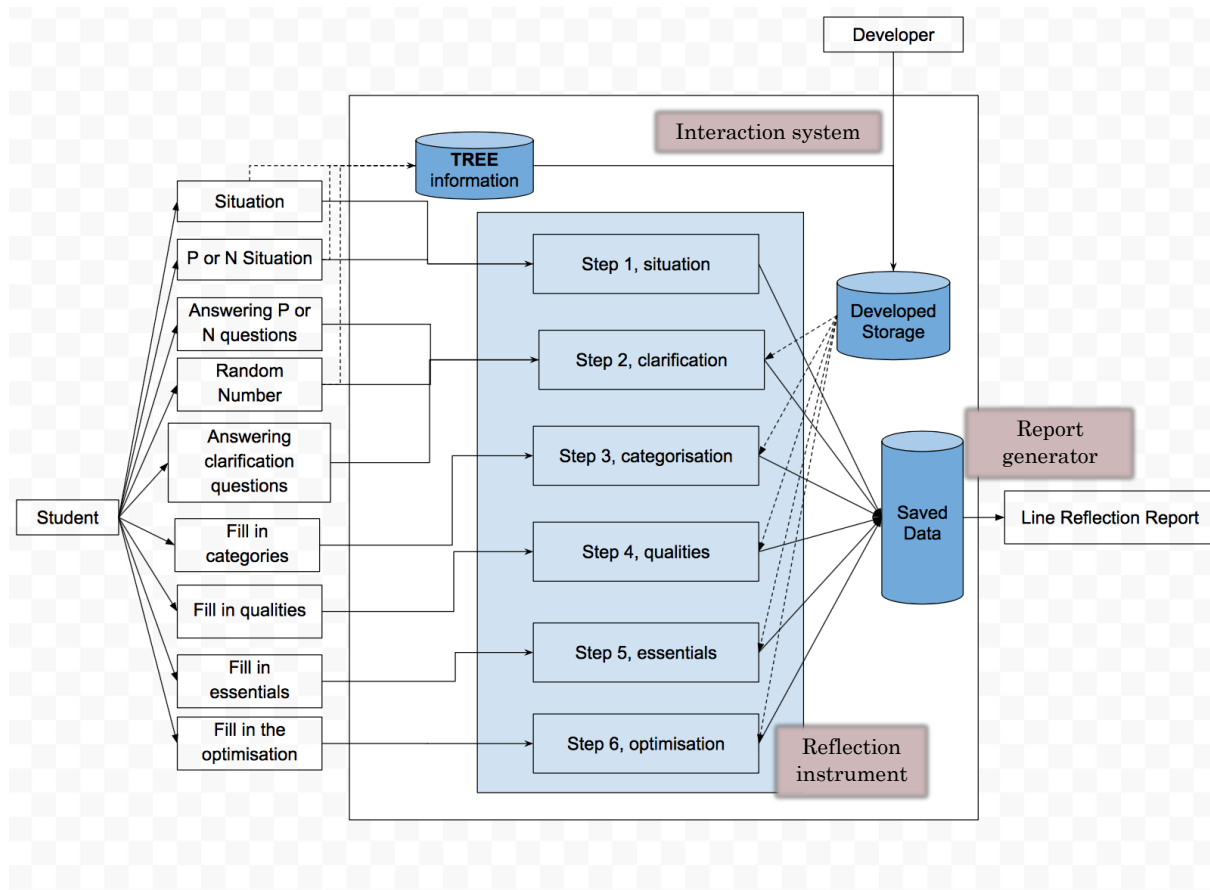


Figure 5.6.2: System architecture level 1

5.6.3 LEVEL 2: SUB-FUNCTIONS

The input from the student, portrayed in level 1, is elaborated in the following architecture see *Figure 5.6.3*. With a decomposition of the previous level, the upper part is showing the variable input (the interaction system), what has a influence on the structure. The left lowest part is showing the the standard situation, which are the steps a student needs to make (the reflection instrument). The right lowest part is showing when all the information is given, the report will be generated (report generator). All subsystems will be explained briefly. Important to know for understanding of the architecture the developed storage in the upper right corner is the same as the storage in the bottom left corner (see the stars). Hence, the output of both are the same.

Interaction system:

First the upper part, the variable input. This specific input is shown in the upper three input boxes, these are describing the different variables. These variables are saved and influencing the input which is given by the developer. Also the input data from the developer is shown. The related information from the developer and the student is combined in the developed storage. This combined information (the questions), is the output of this subsystem, the specific output is shown in the top right at the end of the striped line.

Reflection instrument:

The reflection instrument has two kind of input. The first is, as explained above, the information from the storage. The variables from the storage are given with the striped line, in the botton left corner. These variables are used for generating the questions. The second input, given with the dotted line, is from the students and are simply the answers on the generated questions. The output are the answers on the generated questions.

Report generator:

The subsystem has only one kind input and output. The input is all the output from reflection instrument, which are the answers on the generated questions from the student. The output is the reflection report, this will be generated if every generated question is answered.

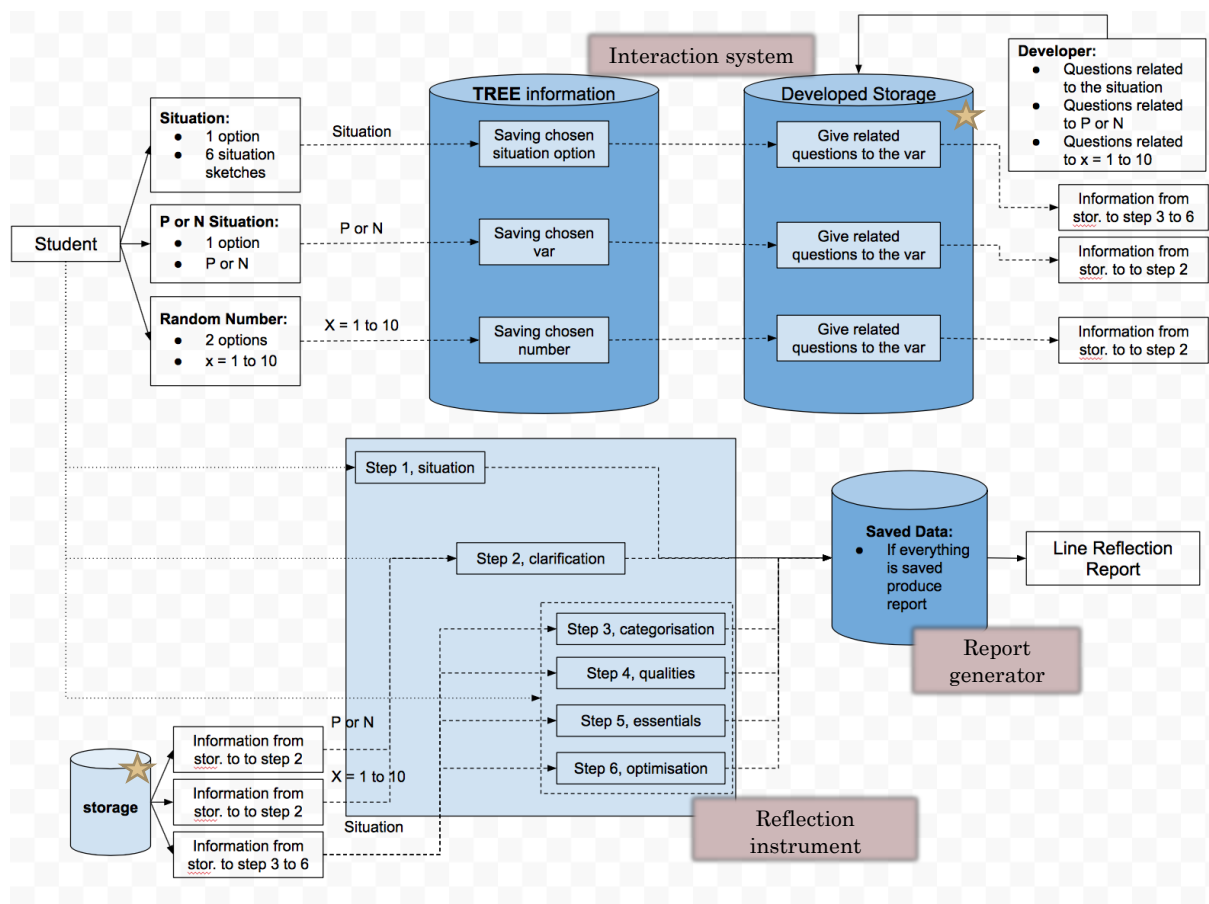


Figure 5.6.3: System architecture level 2

5.7 PRELIMINARY REQUIREMENTS: 2ND ITERATION

Based on LoFi-test, the activity diagram and the system architecture the preliminary requirements are updated. Therefore, a second list of requirements are listed, these requirements are updated and more specified. The newly requirements are listed below in *Table 5.7*:

Must	1. Instructions:	1. F
	2. Give an explanation how the reflection process works, with the use of practicing judgements during reflection.	
	3. Show the intention/goal of the reflection.	
	During reflection:	
	4. Students need to interact with the system.	2. F
	5. Student must make a choice to reflect on study experience or their minor situation, to make it positive or negative and choice a random clarification question,	3. F
	6. The instrument must cover all the six situations or experience examples of a student to reflect on.	4. F
	7. The instrument must be implemented to help the student to orientate about their minor.	5. N-F
	8. The instrument must make choices about the minor more explicit.	6. N-F
	9. The instrument must be based on the six steps of the line reflection method.	7. F
	10. The student must use the instrument with enthusiasm is and feel it does not cost too much time.	8. N-F
	11. A student must be more confident after the use of the instrument about their minor choice/situation.	9. N-F
	12. The student must have considered to get new insight and viewpoints about their minor choice/situation.	10. N-F
	13. The instrument must generate reflective questions for each step (except for step 1) in the process. Which are depending on the input from the student and the developer.	11. F
	14. The student must feel free to give all the answers he or she wants.	12. N-F
	After reflection:	13. F
	15. The instrument must produce a representative reflection report of the reflection process, based on the answers of the student. The reflection report is based on the standard line reflection report.	14. F
	16. The student must be able to rephrase the report after the use of the reflection instrument.	
Should	17. The instrument should be used by a student individual or be used as an interaction system between student and reflection partner.	15. N-F
	18. The student should feel that the report is a well basis to start from to orientate about their plans.	16. N-F
	19. Questions should make the students more confused and let them think about alternative viewpoints.	17. N-F
Could	18. If a report can be generated, it could be checked with NARRA so it could show if critical reflection has taken place and to show the effects.	20. N-F
	19. Questions could be formulated and generated from anonymous feedback, questionnaires or teachers. To help the students to see their experience from different viewpoints.	21. F
Would not	22. Be implemented in different orientation phases, inside study choices master or even the study itself.	20. N-F
	23. Measure physical reactions, so it can be able to show when	21. F

	the student is reflecting and which questions are of more impact to the students. 24. Made into a subject, where EC's can be linked with the use of the report and can be checked with NARRA.	22. N-F
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Table 5.7: Updated Preliminary Requirements

6 REALIZATION

This chapter will describe the realization of the instrument, how the instrument is developed, with the use of the information from the activity diagram and the system architecture of the Specification chapter 5. During this chapter these two will serve as a guideline, to develop the system. Hence, this chapter is composed as follows:

1. Software
2. Process
3. Implementation Considerations

6.1 SOFTWARE

Briefly a short explanation is given why the software Berkeley Bridge has been chosen for developing the instrument. All the information can of the software can be found online [31].

It was important the instrument needed to be a decision tree. According to the activity diagram which can be found in section 5.5, the student needs to make decisions and depending on these decisions questions needed to be generated. This has strong similarities with a decision tree. This is an explanation of a decision tree: *‘a decision tree is a map of the possible outcomes of a series of related choices... A decision tree typically starts with a single node, which branches into possible outcomes. Each of those outcomes leads to additional nodes, which branch off into other possibilities. This gives it a treelike shape.’* [32]. This relates perfectly with the envisioned system, where questions are nodes linked and depending on the answers given linked to another specific node. Therefore software is needed to develop an interactive decision tree and Berkeley Bridge is suited for this.

Berkeley Bridge software can be used to make an interactive decision tree application. This enables the student to interact with the instrument, which is an important requirement. According to the developers of Berkeley Bridge [31], *‘Berkeley Bridge can be used in any industry to improve decision-making processes’*. This software enables the developer to translate the developed questions (from the LoFi) into an interactive (online) application. Hence, it will be perfect to use for developing this instrument.

6.2 PROCESS

The next step, after the software has been chosen, is to develop the instrument in Berkeley Bridge. The development of the instrument is conducted in six steps, which are listed below. The steps are in chronological order how they were executed. The development is done by trial-and-error, because there was no previous experience in using this software. The final interface will be shown in *Figure 6.2*.

Qualities Actor

What will a good actor do?

(example: - being decisive)

Below are reflective questions, try to answer every question.

What qualities do you need to have, according to your exchange coordinator?

Experience or situation

About what do you want to reflect, when you want to reflect on making a minor choice?

To make a suitable choice, it helps to ask yourself the question "what is more important for me? Being busy with future plans or with my current skills."

Examples of future orientated: sketching your situation and make a plan how to operationalise this.

Examples of experienced orientated: relating back to a study related experience and use this to make a plan how to operationalise this.

☐ Future Orientated

☐ Experience Orientated

Figure 6.2: Final interface, left the generated reflective questions and right where the student can choose to reflect on a certain experience or situation

6.2.1 DEVELOPMENT

These are the steps which are conducted to realise the instrument. Every step will briefly be explained. The following steps have been done:

1. Decision tree
2. Subgraphs
3. Text & Questions
4. Variables
5. Report
6. Publishing

In this prototype the option to reflect on experience, could not be implemented due to time constraints. During the testing this is done with a paper prototype, further explanation is given in the Chapter 7 Evaluation.

DECISION TREE

The first step was to make the basic tree. Following the same steps as in the line reflection according to the line reflection method. These steps are also used during the LoFi-test and are copied into the system. In the LoFi nine different steps have been made and in the system one is been added, which is the option to download the reflection report. The steps are shown below and can also found in *Figure 6.2.1*, from the top to the bottom:

1. Introduction
2. The Method
3. Experience or Situation
4. Step 1
5. Step 2 – Situation
6. Step 3 – Categorising
7. Step 4 – Qualities
8. Step 5 – Essentials
9. Step 6 – Operationalisation
10. Report

In the node experience or situation is where the first interaction with the student takes place. Because depending on the answers of the student, the student is guided to the next steps in reflection method. The interaction takes place in all the grey nodes in *Figure 6.2.1*. It starts where the student needs to choice between reflecting on an experience or on a situation and ends with downloading the reflection report. The interaction flow can be found in the activity diagram in section 5.5, this shows how in which direction the students are guided depending on the input. Important to know, in step 1 is chosen for the specific situation. Depending on this choice the student is guided through different reflective questions. This choice will also be used in for the reflection report.

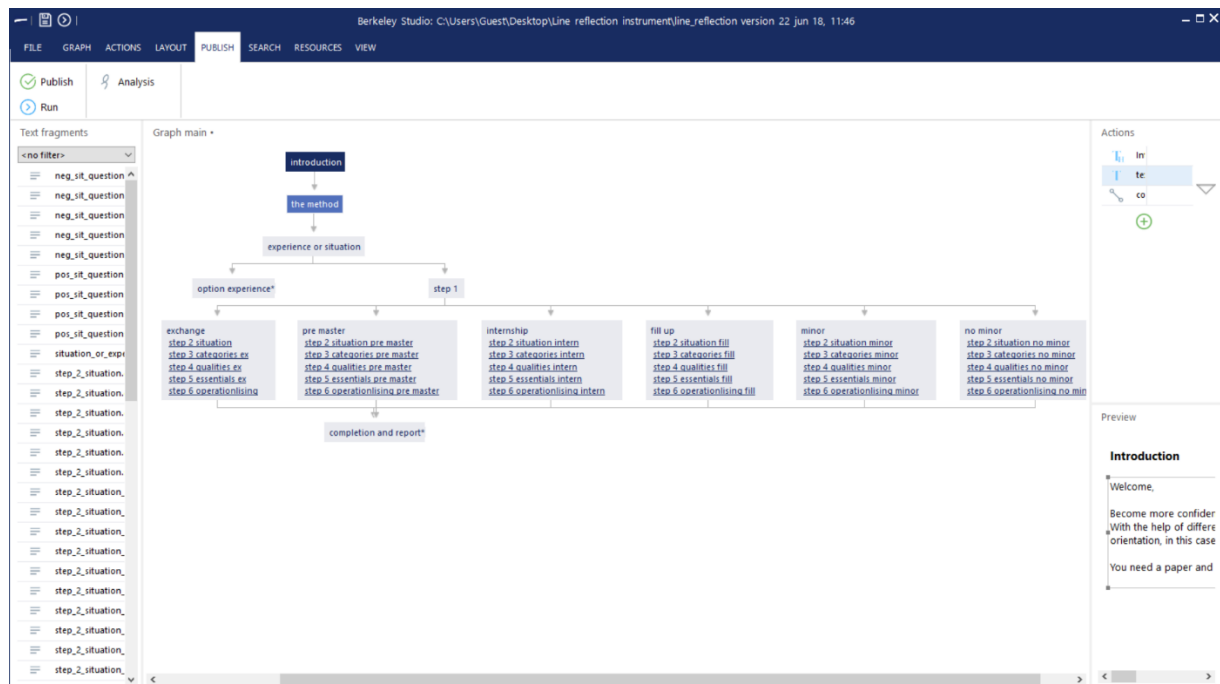


Figure 6.2.1: Screenshot of the basis of the system tree, with the steps described in the Line Reflection Method

SUBGRAPHS, UNDERLYING UNDER THE MAIN GRAPH

The second step was to edit the all subgraphs, subgraphs are made to keep it organised and have an overview. The editing was needed to make sure the implementation of the different reflection questions was possible. The subgraphs are all the underlined steps in *Figure 6.2.1*, which are:

1. Step 2 – Situation (*Figure 6.2.2 and 6.2.3*)
2. Step 3 – Categorising (*Figure 6.2.4*)
3. Step 4 – Qualities (*Figure 6.2.5*)
4. Step 5 – Essentials (*Figure 6.2.6*)
5. Step 6 – Operationalisation (*Figure 6.2.7*)

For every subgraph will briefly be described;

- what the students need to do;
- if there are any subgraphs;
- is saved for the reflection report.

1. Step 2 – Situation (*Figure 6.2.2 and 6.2.3*)

- After the student has chosen about which situation the student wants to reflect (step one), as explained before in this chapter. The student will explore this situation during step two, which is shown in *Figure 6.2.2*. By choosing if the situation is positive or negative in the student's point of view and answer the different questions. The questions of the situation can be found in the subgraph in *Figure 6.2.3*, where the questions are generated and needed to be filled in by the student. After this option one (random) of the five clarification question is asked to be filled in.
- There are two subgraphs underlying this subgraph the positive and the negative, depending how the student thinks about the situation. One subgraph can be found in *Figure 6.2.3*.
- For the reflection report is saved: the answer if the students described the situation as something positive or negative. The answers about the positive or negative perspectives. And as last the answer on one of the clarification questions.



Figure 6.2.2: screenshot of step 2



Figure 6.2.3: Screenshot of the negative subgraph with related questions (the positive subgraph looks the same)

2. Step 3 – Categorising (*Figure 6.2.4*)

- The student needs to answer the three category question about the situation.
- There are no underlying subgraphs in this graph.
- The three saved answers are the answers given by the student on the category questions.

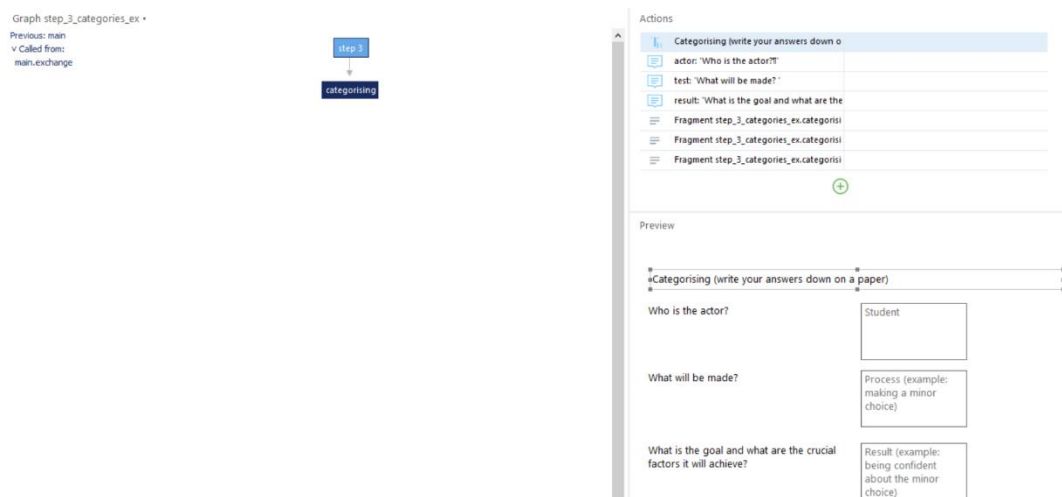


Figure 6.2.4: screenshot of step 3

3. Step 4 – Qualities (Figure 6.2.5)

- The student is going to reflect on every category, with the use of a dropdown-bar different situation related reflective questions can be chosen. For every category different questions are asked about the qualities.
- There are no underlying subgraphs in this graph.
- The three saved answers are the answers given by the student on the category questions.

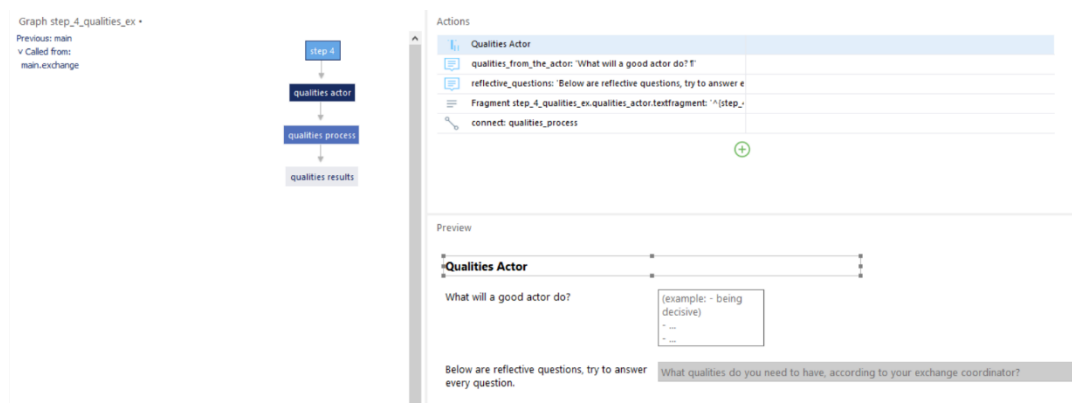


Figure 6.2.5: screenshot of step 4

4. Step 5 – Essentials (Figure 6.2.6)

- The student is going to reflect on every category, with the use of a dropdown-bar different situation related reflective questions can be chosen. For every category different questions are asked about the essentials.
- There are no underlying subgraphs in this graph.
- The three saved answers are the answers given by the student on the category questions.

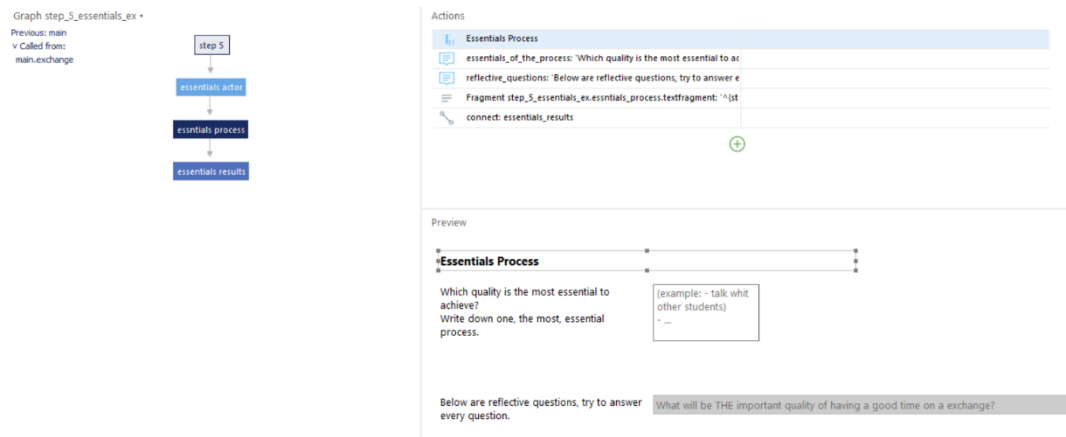


Figure 6.2.6: screenshot of step 5

5. Step 6 – Operationalisation (Figure 6.2.7)

- The student is going to reflect on every category, with the use of a dropdown-bar different situation related reflective questions can be chosen. For every category different questions are asked about the operationalisation.
- There are no underlying subgraphs in this graph.
- The three saved answers are the answers given by the student on the category questions.

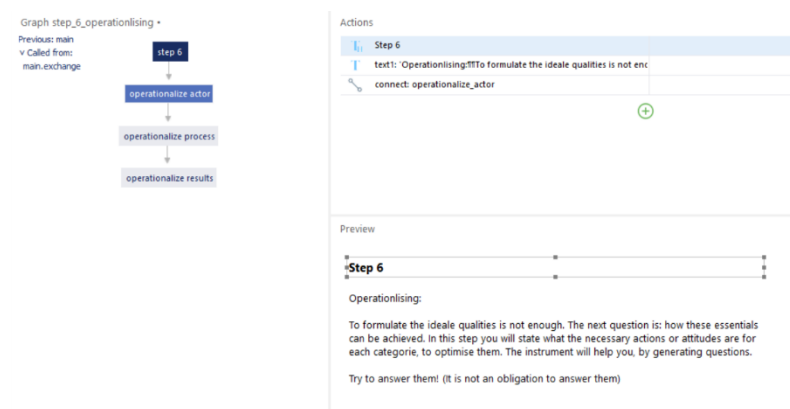


Figure 6.2.7: screenshot of step 6

TEXT & QUESTIONS

The third step was editing all the text and the questions from the LoFi which can be found in *Appendix M*. In the LoFi different questions are used for reflective questions and text to describe how to use the instrument. Based on the results these questions and text have been edited and implemented in the prototype. All questions are for specific situations, therefore for every situation different questions needed to be implemented. For every type of questions different classes have been made to make editing easier. Because the classes make it able to get an overview and change certain questions.

VARIABLES

The fourth step was to link the answers from the students to different variable, so it could be automatically be filled in into a word report. Thus, the answers of students are related to the variables, the list of every variable linked to every answers can be found in *Appendix O*. Resulting, that the system knows which answer relates to which variable.

REPORT

The fifth step was to make a word document where the different variables could be implemented. This blank document is based and edited on the basic line reflection report, which can be found in the LoFi-test section 5.4. The report which is used as a basic form is shown in *Figure 6.2.8*. This report is going to be automatically filled in as the student goes through the questions.

Situation:		
Clarification:		
Assumptions Categories		
Actor	Process	Results
Qualities		
A good actor will:	A good process consists of:	The goals or what will be achieved is:
Essentials		
The most essential quality to have for the actor is:	The most essential quality to achieve this is:	The most essential quality of the result is:
Operationalize		
What is necessary to achieve this for the actor is:	To operationalize the process is necessary:	The result would be:

Figure 6.2.8: basic empty line reflection report

Next was to make it possible the answers from the student could be automatically filled in into the word document. With the use of the preparations from steps four and five, the variables from the different answers needed to be put into the right place. The edited report with all the variables can be found in *Figure 6.2.9*.

Situation: <text name="situation_or_experience"/>
Clarification: <text name="step_2_situation.step_2.textfragment"/> <text name="step_2_situation_pre_master.step_2.textfragment"/> <text name="step_2_situation_intern.step_2.textfragment"/> <text name="step_2_situation_minor.step_2.textfragment"/> <text name="step_2_situation_fill.step_2.textfragment"/> <text name="step_2_situation_no_minor.step_2.textfragment"/>
<text name="pos_sit_questions.question_1.textfragment"/> <text name="neg_sit_questions.question_1.textfragment"/> <text name="pos_sit_questions.question_2.textfragment"/> <text name="neg_sit_questions.question_2.textfragment"/> <text name="pos_sit_questions.question_3.textfragment"/> <text name="neg_sit_questions.question_3.textfragment"/> <text name="pos_sit_questions.question_4.textfragment"/> <text name="neg_sit_questions.question_4.textfragment"/> <text name="neg_sit_questions.question_5.textfragment"/>
<text name="step_2_situation.clar_1.textfragment"/> <text name="step_2_situation.clar_2.textfragment"/> <text name="step_2_situation.clar_3.textfragment"/> <text name="step_2_situation.clar_4.textfragment"/> <text name="step_2_situation.clar_5.textfragment"/> <text name="step_2_situation_pre_master.clar_1.textfragment"/> <text name="step_2_situation_pre_master.clar_2.textfragment"/> <text name="step_2_situation_pre_master.clar_3.textfragment"/> <text name="step_2_situation_pre_master.clar_4.textfragment"/> <text name="step_2_situation_pre_master.clar_5.textfragment"/> <text name="step_2_situation_intern.clar_1.textfragment"/> <text name="step_2_situation_intern.clar_2.textfragment"/> <text name="step_2_situation_intern.clar_3.textfragment"/> <text name="step_2_situation_intern.clar_4.textfragment"/> <text name="step_2_situation_intern.clar_5.textfragment"/> <text name="step_2_situation_fill.clar_1.textfragment"/> <text name="step_2_situation_fill.clar_2.textfragment"/> <text name="step_2_situation_fill.clar_3.textfragment"/> <text name="step_2_situation_fill.clar_4.textfragment"/> <text name="step_2_situation_fill.clar_5.textfragment"/> <text name="step_2_situation_minor.clar_1.textfragment"/> <text name="step_2_situation_minor.clar_2.textfragment"/> <text name="step_2_situation_minor.clar_3.textfragment"/> <text name="step_2_situation_minor.clar_4.textfragment"/> <text name="step_2_situation_minor.clar_5.textfragment"/> <text name="step_2_situation_no_minor.clar_1.textfragment"/> <text name="step_2_situation_no_minor.clar_2.textfragment"/> <text name="step_2_situation_no_minor.clar_3.textfragment"/> <text name="step_2_situation_no_minor.clar_4.textfragment"/> <text name="step_2_situation_no_minor.clar_5.textfragment"/>

Assumptions Categories		
Actor	Process	Results
<text name="step_3_categories_ex.categorising.textfragment"/>	<text name="step_3_categories_ex.categorising.textfragment1"/>	<text name="step_3_categories_ex.categorising.textfragment2"/>
Qualities		
A good actor will:	A good process consists of:	The goals or what will be achieved is:
<text name="step_4_qualities_ex.qualities_actor.textfragment"/>	<text name="step_4_qualities_ex.qualities_process.textfragment"/>	<text name="step_4_qualities_ex.qualities_results.textfragment"/>
Essentials		
The most essential quality to have for the actor is:	The most essential quality to achieve this is:	The most essential quality of the result is:
<text name="step_5_essentials_ex.essentials_actor.textfragment"/>	<text name="step_5_essentials_ex.essentials_process.textfragment"/>	<text name="step_5_essentials_ex.essentials_results.textfragment"/>
Operationalize		
What is necessary to achieve this for the actor is:	To operationalize the process is necessary:	The result would be:
<text name="step_6_operationlising.operationalize_actor.textfragment"/>	<text name="step_6_operationlising.operationalize_process.textfragment"/>	<text name="step_6_operationlising.operationalize_results.textfragment"/>

Figure 6.2.9: edited and prepared word document with all the variables from the system

Now the report can be accessed via a link enabling the student to download the generated report. This can be found in Figure 6.2.10, to make it able to download the prepared report with the specific answers the report needs to be in the same folder as the application. This way the answers given would be on the place where they needed to be, to result into a proper automatically generated reflection report

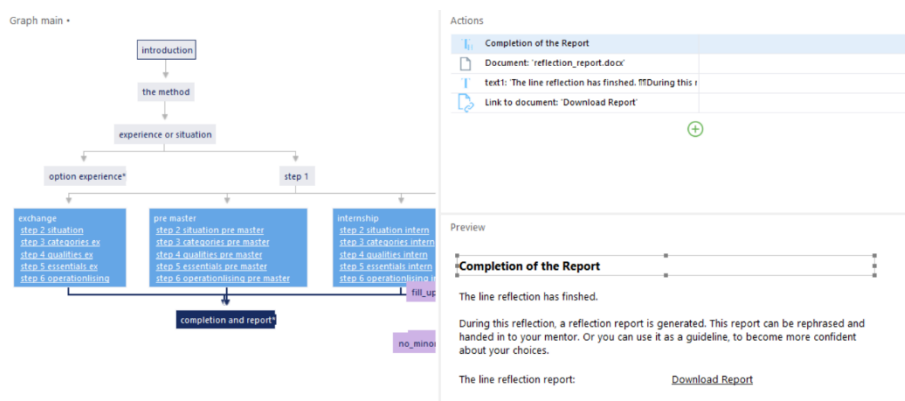


Figure 6.2.10: last node where the student is able to download the reflection report to see all the given answers

PUBLISHING

The last step was to publish the instrument online, to find out if the instrument could work via an URL. This is done via a Berkeley Bridge server. Which can be found with the following link:

<https://berkeleypublisher.com/bb.html?modelid=345&username=VascoUtwente&password=Bachelor123>

Link 6.2.1: link to the online instrument

To login into the page the following username and password are necessary:

- Username: VascoUtwente
- Password: Bachelor123

6.3 IMPLEMENTATION CONSIDERATIONS

Because the software enables the developer to publish the instrument online via an URL. Maybe it is possible to implement the instrument into a new LMS⁷, called Canvas [33]. Canvas will be the new online LMS at the University of Twente, therefore replacing the currently used Blackboard. Canvas enables developers to develop plug-ins, which can be used in Canvas. To find out if there are possibilities to implement the instrument into a plug-in, an interview is conducted with a system developer. The advantage of this will be that students the instrument also can really use online.

6.3.1 EXPERT INTERVIEW A. KOSTET

Ard Kosteres who is a system developer, had information the implantation of the instrument in a learning environment for students, called canvas [33]. So students can access the reflection instrument online. This may influence the system architecture, because it should be implemented in an online software.

Kosters is a system developer who contributed with the implementation of Canvas at the University of Twente. This interview is been held to see if there are options for the reflection instrument to be implemented into this learning area. If the reflection instrument could be implemented into the learning area, it would help to integrate and use it after the development. The important findings of the interview are pointed out below;

- Canvas is using lots of different plug-ins and is stimulating to produce new plug-ins. Hence, a new plug-in could be developed to integrate this instrument.
- An URL is an easy way to make a plug-in, because it is an external web application. And with the use of LTI it could be implemented into Canvas to use it as a plug-in. On the contrary, to do this some coding skills are required and will take about two weeks, with my current skills.

⁷ Learning Management System

To conclude, the instrument could be implemented into Canvas, which makes it possible to implement it during the study. This will make the realisation possible to put the instrument in use, so it can really help students in the future. On the contrary, this will take more time and due to time this would not be possible.

6.4 PRELIMINARY REQUIREMENTS: 3TH ITERATION

Because new findings have been done to during the development/implementation process during the realisation. A minor addition has been done in the requirements, namely the implementation of the instrument in Canvas. Therefore, the new updated preliminary requirements in *Table 6.4*:

Must	1. Instructions: <ul style="list-style-type: none"> • Give an explanation how the reflection process works, with the use of practicing judgements during reflection. • Show the intention/goal of the reflection. During reflection:	1. F
	2. Student must make a choice to reflect on study experience or their minor situation, to make it positive or negative and choice a random clarification question,	2. F
	3. The instrument must cover all the six situations or experience examples of a student to reflect on.	3. F
	4. The instrument must be implemented to help the student to orientate about their minor.	4. N-F
	5. The instrument must make choices about the minor more explicit.	5. N-F
	6. The instrument must be based on the six steps of the line reflection method.	6. F
	7. The student must use the instrument with enthusiasm is and feel it does not cost too much time	7. N-F
	8. A student must be more confident after the use of the instrument about their minor choice/situation.	8. N-F
	9. The student must have considered to get new insight and viewpoints about their minor choice/situation.	9. N-F
	10. The instrument must generate reflective questions for each step (except for step 1) in the process. Which are depending on the input from the student and the developer.	10. F
	11. The student must feel free to give all the answers he or she wants.	11. N-F
	After reflection:	12. F
	12. The instrument must produce a representative reflection report of the reflection process, based on the answers of the student. The reflection report is based on the standard line reflection report.	13. F
Should	13. The student must be able to rephrase the report after the use of the reflection instrument.	
	14. The instrument should be implemented into Canvas, to make it available for students to use it.	14. F
	15. The instrument should be used by a student individual or be used as an interaction system between student and reflection partner.	15. N-F
	16. The student should feel the report helps to start orientating	16. N-F

	about their future plans. 17. Questions should make the students think about alternative viewpoints.	17. N-F
Could	18. If a report can be generated, it could be checked with NARRA so it could show if critical reflection has taken place and to show the effects. 19. Questions could be formulated and generated from anonymous feedback, questionnaires or teachers. To help the students to see their experience from different viewpoints.	18. N-F 19. F
Would not	20. Be implemented in different orientation phases, inside study choices master or even the study itself. 21. Measure physical reactions, so it can be able to show when the student is reflecting and which questions are of more impact to the students. 22. Made into a subject, where EC's can be linked with the use of the report and can be checked with NARRA.	20. N-F 21. F 22. N-F

Table 6.4: Updated Preliminary Requirements

7 EVALUATION

This chapter will describe the evaluation of the reflection instrument. The evaluation is consisting of a functional test and evaluation with experts and users. This is done according to the described methods in section 3.10 Evaluation. The evaluation has been done to find out if the instrument is working and if further research is possible. Hence, this chapter is composed as follows:

1. Functional test
2. Expert Evaluation
3. User Evaluation
4. Discussion
5. Conclusion
6. Final Requirements

7.1 FUNCTIONAL TEST

As explained in section 3.10 Evaluation the functional test has been done by the researcher self, to find out if all the functional requirements are met. Below the functional requirements are listed, with their corresponding numbers in *Table 7.1*. In the table is pointed out which requirements are met and which are not. After the table, briefly an explanation about the checking will be given.

1. Instructions: <ul style="list-style-type: none"> The system gives an explanation how the reflection process works, with the use of practicing judgements during reflection. The system show the intention/goal of the reflection. During reflection:	1. Is met
2. Student can make a choice to reflect on study experience or their minor situation, to make it positive or negative and choice a random clarification question,	2. Is met
3. The instrument covers all the six situations or experience examples of a student to reflect on, defined in <i>Appendix M</i> .	3. Is met
6. The instrument is based on the six steps of the line reflection method.	6. Is met
10. The instrument generates reflective questions for each step (except for step 1) in the process. Which are depending on the input from the student and the developer.	10. Is met
After reflection:	12. Is met
12. The instrument is producing a representative reflection report of the reflection process, based on the answers of the student. The reflection report is based on the standard line reflection report.	
13. The student is be able to rephrase the report after the use of the reflection instrument.	13. Is met
14. The instrument is not implemented into Canvas, to make it available for students to use it.	14. Not met
19. Questions could not be formulated and generated from anonymous feedback, questionnaires or teachers by the instrument.	19. Not met
21. The instrument would not measure physical reactions, so it can be able to show when the student is reflecting and which questions are of more impact to the students.	21. Not met

Table 7.1: Preliminary Functional Requirements

All the ‘must have’ requirements have been checked of this makes it available to conduct a proper expert and user evaluation. This has been tested by the researcher to find out if the system is fully functional. This is done by using the instrument and test each requirement. Because this was needed for a solid prototype which could have potential for further research.

The ‘should, could and would have’ are all not met by the system. The ‘should have’ was almost possible, this requirement was important for implementation in Canvas. Therefore, during the recommendations further research is recommended to make sure the instrument could be used by students.

7.2 EXPERT EVALUATION

To evaluate the prototype two experts have been interviewed, with different expert evaluation methods. The two experts are Henk Procee and Karen Slotman, both experts were already interviewed during the ideation interviews in section 7.3. From both evaluation qualitative data is collected. In *Appendix P* (H. Procee) and *Appendix Q* (K. Slotman) the evaluation structure is described.

Firstly, Procee, especially his information is important, since lots of the literature of him is used in this report and the whole system is based on his method line reflection. Hence, the method used for this expert evaluation is the reflection interface heuristics. This method is used because it strives to optimise the instrument, according to the feedback of Procee. Due to the fact that he developed this reflection method and used it in practice. No one could give better feedback to the automated system of his line reflection method.

Secondly, Slotman, she works with different students and helped a lot with reflection and education. Therefore also this expert evaluation would be of importance for conducting a conclusion. A different expert evaluation method is used this time, namely the cognitive walkthrough. Due to the fact that Slotman has worked a lot with different students and know how students react and think. By walking through the system with the expert a notice rarely occurring but important tasks, which would also be noticed by the students.

7.2.1 EVALUATION RESULTS HENK PROCEE

The important findings during the expert evaluation with Procee are described below:

- Important to know there is a slight difference in the line reflection method. This type of line reflection is pro-active, which means it is going to tackle the same problems as in the situation. His type of reflection is a bit different, because he is looking back at which role the actor had and reflect on those qualities. Instead of looking at the qualities of a situation. But nevertheless the method is still the same, this was already predicted before see section 4.5 Concept Choices.
- About the questions generated by the instrument:
 - In the first choice, the instrument is guiding the student to much between the choice about experience or the situation.
 - The questions about the quality of the process need to be better, there are no alternative viewpoints or what the plan is for better decision moments.

- The questions about the quality of the results are difficult, more focus on the product and can be more surprising.
- Overall the questions need to be more substantive and more specific related to the situation. This will make the process more effective, nevertheless the process is more important compared to the product.
- If second questions could be generated on the given answers, the answers could be more specific and students need to explain more.
- It is interesting that questions are used from the method triangle reflection during the line reflection.
- If the system can manage it could be more effective for students to reflect with a system.
- Step seven is missing the real operationalising, how are you going to research this? There are possibilities needed to say what you are going to do with it.
- The instrument is partly instrumental but moreover pragmatic.
- It would definitely help students with their choice if they search for the different qualities.

7.2.2 EVALUATION RESULTS KAREN SLOTMAN

The important findings during the expert evaluation with Slotman are described below:

- It could be not clear for students what is asked of them, in the introduction. Therefore, it could be explained more compact.
- Students could be overwhelmed with the reflecting situation sketch. They may need an explanation about what and how they want to reflect on the situation.
- The used terminology could be distracting for some students.
- For students it could be hard to choose between reflecting on situation or experience.
- The lay-out: the reflective questions could be in a more eye catching place, the drop down bar is not a good idea for this and is monotonous.
- The questions about the categories are not clear and needed to be specific and easier to understand.
- The reflective questions are: clear but could be hard to answer, are also monotonous and need to be more content related.
- Step seven is missing, in this step could be: what are you going to do with it? How is this helping or what now?
- Students maybe need a little bit more motivation for filling in the report. This could be interesting to test if showing what will be generated, students know what they are working towards and are more motivated to use the instrument.
- The generation of the report is very interesting, the report could be useful for the start of the first conversation about the orientation.

7.3 USER EVALUATION

Next are the user evaluations with second and third year Creative Technology students from the University of Twente. The user evaluation method used is described in section 3.10.3 User evaluation. The evaluation structure can be found in *Appendix R.1*. The structure is based on the non-functional requirements from section 6.4. Consequently, the non-functional requirements would be shown at the end of this section. For the user evaluation the amount of students is $n=8$, the same as the LoFi-test. During this

evaluation qualitative and quantitative data is collected and can be found in *Appendix R.2* (qualitative) and in *Appendix R.3* (quantitative).

The users were asked to use the instrument and the researcher was observing them. Before and after the students were using the instrument quantitative and qualitative questions (shown in *Appendix R.2 and R.3*) were asked to get information. This information has been used to formulate the results. For the evaluation to prototype of the instrument is used. However, due to time management, it was not manageable to program the part so students were able to reflect on a study related experience only on a situation. Hence, for reflecting on a study experience a Wizard of Oz methods has been used which can be found in *Appendix M*. The instrument was able to use if students want to reflect on situations.

For all the evaluations the *run* function has been used instead of the online published version. Since, when the user test were conducted there were problems with publishing the instrument online. On the positive side, the published version online already has a prepared lay out. In other words, students had a blanc prototype and they could give feedback how they want to have the lay out. This could be interesting for further research.

7.3.1 TEST RESULTS

The finding, as been pointed out in section 7.3 this information has been gathered by interviews and questionnaires before and after the student were using the instrument.

The results can be found in the following non-functional requirements *Table 7.3*. In the table is shown is the non-functional requirements are met. The non-functional requirements 3, 15 and 18 are elaborated because they needed some explanation to avoid confusion.

5. According to the quantitative data, the choices about the minor choice of some students did not became more explicit and from some were. The result were fluctuating, therefore this non-functional requirement could be partly checked off but not with enough evidence. This is resulting in that this requirement is still in black instead of red and white.

15. During the evaluation only students were using the instrument. However this is tested the instrument individually, the instrument could also be used as an interaction guide for the partner. This is briefly tested with two students.

18. The report could be checked with NARRA. But why this requirement is not checked off. Due to that the NARRA should be changed so it would fit this specific line reflection report. This would help both teacher and student to see if the reflection was critical and effective.

During reflection:	
4. The instrument can be implemented to help the student to orientate about their minor.	4. Is met
5. The instrument partly makes choices about the minor more explicit.	5. Partly met
7. Students use the instrument with enthusiasm and do not feel it is costing too much time.	7. Is met
8. Students are more confident after the use of the instrument about their minor choice/situation.	8. Is met
9. Students have considered to get new insight and viewpoints about their minor choice/situation.	9. Is met
11. Students are feeling free to give all the answers he or she wants.	11. Is met
15. The instrument can be used by a student individual or be used as an interaction system between student and reflection partner.	15. Is met
16. Students are feeling that the report helps to start orientating about their future plans.	16. Is met
17. Questions are helping students to think about alternative viewpoints.	17. Is met
18. The report, it could not be checked with NARRA.	18. Not met
20. The instrument is not implemented in different orientation phases, inside study choices master or even the study itself.	20. Not met
22. The use of the instrument is not made into a subject, where EC's can be linked with the use of the report and can be checked with NARRA.	22. Not met

Table 7.3: Preliminary Non-Functional Requirements

The important findings during the user evaluation are described below, the evaluation had two stages of collecting data before the use and after the use:

Before the use:

- Most students would use an instrument, offered by the study, which helps them to orientate about their minor.
- Because the instrument was also tested on some third year students who were already confident about their minor choice, because they already made a choice.

After the use:

- 62.5% of the users would like to reflect on an experience, where 37.5% would like to think about a situation.
- Using:
 - Students are positive about use of the instrument but not too enthusiast. The most positive reactions came from the downloading the reflection report, especially because they did not expect this would be the result.
 - The average time of using the instrument was about 25 minutes, which was fine according to both students and the book Reflection Tools [18].
 - Most students do not understand or misinterpreted the terminology, which makes it hard to understand for most students.
 - The use of the instrument could be very useful in an early state of the orientation phase.
 - An extra step is missing, for example, give recommendations what is relating to situation of the student or relating readings. This would help students to undertake the next steps easier.
 - Showing what students will generate at the end of the use of the instrument, would help motivate them using the instrument.

- Effects:
 - Students became slightly more (self)confident about their minor choice. Due to their already made minor choice, they were confident about the choice. Hence, it was a less effective than it supposed to be, this will be discussed in the discussion later on.
 - Students noticed they were busy with different viewpoints, but with three of the students it did not had the optimal effects. Which was getting new insights. However they are pointing out there are some viewpoints in the reflective question, about which they never considered.
 - The effects on making choices explicit was separated, every student gave a different answer.
 - The instrument helped to develop and think about the quality of the situations.
 - The report is representative for the reflection and students were positively surprised about the report.
 - The students felt free to give all the answers they wanted to give.
- The lay-out:
 - Textboxes need to be bigger and the pre filled text boxes should be more helping.
 - Less white space.
 - Easier guidance through the system.
 - A bar of the progress could be implemented, so the student can keep track how much still has to be done.
 - The red, yellow and green collars in the generated report, could relate to good, neutral or wrong. Different use of collars could prevent some confusion in this relation.
- The reflective questions:
 - The reflective questions are good but stay the same, could be more variance in it.
 - The reflective questions should have a different order, the reflective questions should help to answer the main question. Therefore, the order is not effective in which the questions are asked.
 - Some of the reflective questions could be better related to the situation. So the students are able to reflect better on the situation.

7.4 DISCUSSION

This section will briefly discuss some factors which played a role during the evaluation, which influence the reliability of the evaluation. The interesting points of discussion are:

- The terminology, the students were pointing out some of the used words were not clear. Hence, some students did not understand all the questions or what is asked of them. This may resulted that some students lost their attention during the use, find it had to use or interpreted the questions not correctly. This could influence the amount of effect the instrument had on the students and the pleasure during the use. Next time it should be tested with user-friendlier terminology.
- Already made choices, the instrument is made for students to start orientating, most students already did an orientation. Thus, the effects of being more confident and helping getting new insights, about making your choice is not completely reliable. The test would be more truthful if it was tested on students

who needed to start their orientation. And was not including also third year students who already made their choice.

- The students were busy with projects during the evaluation. During the testing some students have been picked out of their project work. These projects had a workload on the students and some were driven to continue on working. Therefore, did not work use the instrument to its full competence. This could influence also effect the amount of effect the instrument had on the students. Due to that some students did take all the time they needed for an effective reflection. Next evaluation it would be an addition if students were strived to work on their project.

7.5 CONCLUSION

During functional, expert and user evaluations, some important findings have been made which are interesting to point out. Some findings are used during the last chapter 11 Conclusion and Recommendations. The following important conclusions are made from the evaluations:

- All the functional requirements are checked off, therefore the instrument is functioning as required and envisioned. This will make it possible to conduct proper recommendations.
- Step seven is missing, both expert and user were missing a step seven. During this step a little more guidance is needed in what to do next. In other words help with operationalising. Students must get more situation related advice, different options what to do next. This was not pointed out in the steps in book the *Reflectie Tools* [18]. Hence this evaluation is of value for further recommendations, if the instrument should be developed.
- Different lay out aspects of the instrument, were not optimal:
 - Terminology, because the use of terminology which is not easily to understand. User-friendlier words should be used next time. So students can understand the instrument better and make the use easier.
 - The order of the reflective questions and the main questions should be different. Asking first the reflective questions would help answer the main answer.
The text inside the boxes, was sometimes confusing or led to misunderstanding of the question. Therefore, this has to be left out or simplified.
- Reflective questions had positive aspects as well as negative aspects. The questions were helping with different viewpoints. However these questions were over time repetitive, which could make it boring to use and the same during the process.
- The reflective questions must be better related to the questions. This should help the students to describe the process better and more content related. Therefore, second order of reflection questions should be needed. Second order questions are questions who are generated on the answers given on the first reflective questions.
- For students being busy with the qualities around a situation is helping to be more confident about their choice.
- The effect of the reflection report was really positive. Most students have reflection tiredness (section 2.1.2 Obstruction for reflection) due to making a

reflection report. All the data is showing, making it easier for students to generate a reflection report, is helping them to get less reflection tiredness.

- Having a progression bar below the instrument would help the students to have more focus during the use.
- When students know what they are working towards (generating the report and getting new potential insights), this is helping to keep the focus and would therefore motivate the use of the instrument.

8 CONCLUSION AND RECOMMENDATIONS

During this chapter the overall conclusions of this bachelor thesis are provided. This will be conducted by answering the research question and the sub research questions stated in section 4.6. Moreover, recommendations will be done for further research and development of the envisioned system. Hence, this chapter is composed as follows:

1. Conclusions
2. Recommendations

8.1 CONCLUSIONS

During this sections the research questions, provided in sections 4.6, will be answered. These answers are based on the conclusion of state of the art, system analysis, stakeholder interviews, questionnaires and brainstorm and most importantly on the evaluations. First the sub research questions will be answered, these answers will help to formulate the answer on the main research question.

The **first** sub question is not focussing on the instrument, but on where reflection in higher education can be improved:

***sRQ1:** What kind of **improvements** can be done in (and where the instrument can be **integrated** in the current curriculum of) Creative Technology towards reflection processes?*

The improvements which can be done in Creative Technology towards a reflection process are in professional development and about orientation, and in particular to the minor space. This answer is based on the findings in section 4.4, where students were pointing out they are missing reflecting about orientation. For this research the implementation of reflecting about the orientation about the minor space has been chosen. Because professional development is currently be restructured according to an expert interview in section 2.2.2. Therefore, the instrument should be integrated in the orientation space, to improve the reflection in Creative Technology.

The important improvement which has been done is to reduce the amount of reflection tiredness. This is accomplished by letting the students make a reflection report during the reflection itself and not making a reflection report by themselves after an experience or situation. Students were pointing out in section 7.3 that they enjoyed using the instrument and that the instrument was representative for their reflection. Also they became more confident about their choice, because students were considering new viewpoints about their situation also this result can be found in section 7.3. To conclude, this is showing that students are less tired of reflection and that the instrument is helping them to orientate, which results in becoming more confident.

Hence, a reflection instrument during the orientation about a minor choice is an improvement in Creative Technology, towards a better reflection process. To reduce the amount of reflection tiredness and becoming more confident about your choice. Therefore it should be integrated in the orientation phase about a minor choice.

The **second** is focussing on how the instrument can add value:

sRQ2: *Where can a reflection instrument **add value** to the study progress, for reaching the final learning outcomes of Creative Technology related to critical reflection?*

A reflection instrument can add value to help students start reflecting about their orientation about their minor choice. An important final learning outcome of Creative Technology is critical reflection, because reflection tiredness students are not reflecting well enough, therefore should it be reimplemented. The implementation is done with the use of the line reflection in the minor orientation. A line reflection can help students to make future plans (section 4.5). This way students will become more aware, more confident and are considering different viewpoints about their choice, these are the findings from section 7.5. Also by generating a reflection report will help with making the first step to start orientation, this first step could help student to overcome the first step of reflection, which is to start reflecting (section 7.3.1). Hence, to reach a final learning outcome so students can conduct a better critical reflection, is let them make a line reflection with the use of the instrument, to generate a reflection report which will help with to start reflecting.

The **final** sub research question is for implementation of a smart instrument. If effects can be measured this will give opportunities for the instrument, it may help give feedback, input or output:

sRQ3: *How can the effects of a reflection process be **measured**?*

If a student has done a well reflection is always shown with the use of a reflection report, this is the most effective way to measure a reflection process of a student. This has been pointed out in several interviews. The reflection instrument is helping to generate a reflection report during the reflection, so the report (which includes the effects of the reflection) is shown after the reflection process. Generating a reflection report at the end of the process, will show directly the effects of the reflection what the student has done. And therefore is measuring a reflection report possible, this could be done with the use of the rubric NARRA. NARRA is checking if the report has all the elements of a critical reflection. Thus, with the use of a reflection report which is showing the effects after reflection, is helping to make it possible to measure if the reflection was effective.

To finish with the **main research question**:

RQ: *How can an interactive reflection instrument **contribute** to improve insights in ones qualities and viewpoints, as part of their professional development during their study?*

Making the line reflection method, about orientation during the minor choice of students, interactive will contribute in development of the professional development. Reflection in higher education is always about the professional development of a student.

What skills does a student have, which has been learned through the study, which are useful for a future career. First will be explained how the instrument is contributing so students are getting insights in their qualities and other viewpoints. And next how this will contribute to improve the professional development of the students during their study. To finish with an interesting finding how maybe the instrument could partly replace the reflection.

So first, the instrument helps students to become more aware about different qualities they have or need to have if they want to be in a certain situation. The line reflection of the instrument is about defining the qualities of your future situation or the qualities you currently have. To become more confident and make a decisions what you want to do. The instrument is making this possible by asking reflective questions about a certain situation. Students were pointing out that during the use of the instrument they have considered different viewpoints, which they have never thought of (section 7.3.1). These effects is helping with defining the qualities about a situation or experience and helping to give new insights, which is useful if student want to orientate about their minor choice. Because during this choice they have to consider different options what they want to learn and become.

Therefore next, this will help with the professional development of a student. This development is that students become more aware about what they want to do in their future career. Student need to become more aware of their qualities and different viewpoints. The instrument does this by asking reflective questions depending on the certain situation of the student. Which will help the student to reflect about these qualities and viewpoints, this results in that students are becoming more confident about their choice after the use of the instrument. Therefore, it could be concluded that the instrument can help reflecting about the professional development, to help with reflecting what the students want to reflect about.

To finish, the instrument is showing to be used effectively when students need to reflect on their own, or with other words to be their own reflection partner. Because the instrument is constantly asking reflective questions about their situation the situation or experience the student is constantly thinking about the qualities and viewpoints. The research is pointing out that student felt free to give all the answers they want to the system. Therefore, the instrument could help with the first step to reflect with is partly replacing the role of the reflection partner. So, the instrument brings a contribution to professional development, improve in new insights in qualities and viewpoints by generating reflective questions, about their minor orientation. This could help to partly replace the role of the reflection partner, which is helping to let students start reflecting.

8.2 RECOMMENDATIONS

Recommendations for further research are based on the conclusions from section 7.4 and 7.5. The recommendations are made for further research and for development of the instrument.

8.2.1 DEVELOPMENT FOR THE INSTRUMENT

During the evaluation some aspects were pointing out which are interesting for further development:

- The implementation of an extra step, during this step is needed more guidance in what to do next, in other words help with operationalising. Students must get more situation related advice, different options what to do next.
- Change in lay out, this could be done with the use of java script:
 - The terminology should be changed to be user-friendlier, so student can easily to understand what to do and make the use easier.
 - The order of the reflective questions and the main questions must be changed. Also an alternative of a dropdown bar should be toughed of because this was not effective.
 - The text inside the boxes need to be left out or simplified.
- Making more variations in the questions.
- The reflective questions must be better related to the questions. This should help the students to describe the process better and more content related. Therefore, second order of reflection questions should be needed. Second order questions are questions who are generated on the answers given on the first reflective questions.
- For students being busy with the qualities around a situation is helping to be more confident about their choice.
- The effect of the reflection report was really positive. Most students have reflection tiredness (section 5.1.2 Obstruction for reflection) due to making a reflection report. All the data is showing, making it easier for students to generate a reflection report, is helping them to get less reflection tiredness.
- Having a progression bar below the instrument would help the students to have more focus during the use.
- When students know what they are working towards (generating the report), this is helping to keep the focus and would therefore motivate the use of the instrument.
- How the instrument could be implemented to different orientation phases.

8.2.2 FURTHER RESEARCH

These are the aspect which the instrument showed which may be interesting for further research:

- Research for better reflective questions, the reflective questions which are currently used could be more effective as been pointed out in section 7.5. The questions are now based on the information from section 5.3. This is not much information to ask students reflective questions. Therefore further research is recommended to investigate what kind of different questions have a certain effect on the students. To help them conduct a better reflection process.
- Something really interesting has been pointed out, students were feeling free to give all the answers they want to the system, as been shown in section 7.3.1. Normally students are reflecting with a reflection partner, the importance is pointed out in section 2.1.5. The downside of reflecting with a reflection partner could be that students feel the partner is judging (section 4.3.4) where the

student could be ashamed of. Which may result in that students are not saying everything during the reflection. In contrast with a partner a system is not judging and therefore a student may say more to a system compared to a partner. Hence, it is interesting to research what the differences could be of reflecting with a partner or a system. If this will result in that a system could be used for better reflection, than a system could contribute to a more effective reflection on higher education.

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APPENDIX

APPENDIX A: INTERVIEW B. VAN DER GAAST

This is a summary of the relevant aspects during this interview:

These were the questions, which gave guidance through the interview:

- What reflection does reflection in higher education mean?
- How does reflection in higher education work?
- Why do students reflect?
- How are students reflecting?
- What are the goals students want to achieve?
- What are the results of reflection?
- Which methods are currently available?
- Where does the current reflection process in higher education fall short?
- Which elements (such as viewpoints) are involved in a reflection process?
- What can be added to the current reflection in higher education?
- What role does the environment play in reflection?
- How do you initiate a reflection process?
- Are there ways / systems in which the reflection process can be measured?
- How can reflection change your interpretation of events during your study?
- Tips for the reflection box, in particular which subject for the ethical report best fits my subject?
- Which literature can be recommended for my research?
- To what extent can reflection influence a student to motivate himself?

CONVERSATION WITH BRAND VAN DE GAAST

First it is important what the meaning is of reflection, and the different possibilities of meanings. He teaches a more philosophical reflection, this is something different compared to the reflection during this report. In this reflection the ethical problematic is playing an important role. The goal of this kind of reflection is bringing thinking into a much broader framework.

The reflection which is meant in this topic is about a self-diagnosis, where students are looking back at their learning experience. This fits more in a pedagogical or educational science framework, this has nothing to do with philosophy or ethics. Reflection in higher education is more about the development of skills, the skills from learning through an experience. This is of course something personal, not exact science. A question which could arise for helping could be: 'Where do students benefit from if they are reached reflecting methods?'

To conclude, the subject 'reflection' is difficult because many different things could be understood by it. Seeing these two, ethical and social, aside from each other will help a lot in understanding reflection. A statement is noticed that reflection in higher education has nothing to do with philosophy. In the research from the literature is shown that some theory is based on philosophical statements. This shows a remarkable contrast which again shows the diversity of the definition about reflection.

APPENDIX B: INTERVIEW T.H. DE KUIJVER

The first approach of this interview was to find out where in the subject of professional development, a reflection tool could be implemented. However this approach did not go on because, the subject of professional development is still under construction. Furthermore reflection will only be adjusted in the second year, in the first year it is more evaluating. This is because students are more capable of reflecting due to their physical and mind progress, compared to the first year.

Next the problem which is pointed out, is that Kluijver says reflection events, for example an internship. This is why reflection can easily be of contribution on a HBO. With the Study Creative technology students need to reflect on their professional development. This is something different than an event, therefore it is more difficult to reflect on such an experience.

Why Creative Technology is about professional development, is because the study opens broad and ends broad. Therefore students need to become aware which tools of the study are necessary for their own professional development.

To conclude, according to this interview there is no space for adjustment at this moment for a reflection tool. Due to shaping of this subject and because reflecting is adopted in the second year. Also is reflecting with Creative Technology about professional development, not so much on an event.

However, this may bring some opportunities, despite reflection cannot be adopted in professional development, it may improve an other events during the study, namely the projects. For this, students are reflecting about a certain 'event'. Also it can be implemented in the first year, because it is less about the professional development, where students need, according to Kluijver, to be capable of reflecting due to their physical and mind progress. So there is no place for adjustment of a smart reflecting tool in professional development, but there might be an opportunity in projects.

APPENDIX C: INTERVIEW I. VISSCHER

Is lecturer in Innovative and Effective Education. Involved in both small-scale and large-scale educational innovation projects within Saxion, with the role of researcher or adviser for teachers and management. In addition, Visscher is the Academic Director of the Master Educational Leadership (MEL), in which she provides the Personal Leadership learning path. At the University of Twente, Visscher worked on redesign and implementation of the bachelor's degree, now so called Twents Onderwijs Model (TOM), where projected is key.

Visscher stated for a well reflection process, a student need to important aspects. First concrete experience is needed, with the use of a conversation a better concrete experience can be conducted. Secondly different viewpoints, which helps looking for the right aim or method. Most of the time students are stuck into their own experience and by asking the right questions it should help them widen their view.

The aims of reflection are getting more insights. Insights about what is motivating the student and where the student can grow. Most of the time it is about improving yourself. To get a better grip on the experience.

These aims are wonderful but on the other hand sometimes students are not reflecting well enough. This is due to multiple aspects. The first is due to that reflection is

pretty new for students, they do not have a clue what reflection can bring them. Students are not aware of added value of reflection. Next is because reflection takes time, during a reflection process students need to position themselves as vulnerable. If they have to reflect, it is a must, therefore it would take students even more time, because than it makes it harder to make themselves vulnerable.

Visscher tackles this problem by keeping students warm to reflect. If students learn to reflect the first thing to do is give an explanation and simple exercise. These exercise are done one on one and with a group, important in this traject is to ask the right questions.

However this can be tackled some students, according to Visscher, are always more able to reflect than others. Because of their metacognition skills, these skill cannot be trained and are necessary for a better reflection. With less of these skills students can still reflect but on a different level. These skills are important during the reflection process to regulate the work.

Visscher used during reflective practice four types of reflection:

- Point reflection, is about making an experience more sensitive and how good can a student look towards him or herself. With this exercise students most of the time start practicing, because it helps widen their view.
- Line reflection, is about seeing the standards of others. Has similarities with evaluation but differs in that it also focuses on what is accomplished together with the different standards.
- Triangle reflection, is about empathy. By asking question about an earlier experience students can become more aware how others are, before entering another project. If this is not worked well enough than probably learning effects did not land.
- Circle reflection, is all about the metacognition. Students reflect on their reflection process.

For adjusting reflection in higher education, it is of importance to keep repeating the reflection process. This will help students to know more about their experiences and more important they become more aware. Awareness of reflection under students is important for them to not see it as a must. Helping a student one on one can be of great value for this because they get attention. What also can help is to couple reflection to assignments. This is an easy way to integrate it to curriculum and students are more inclined to not see it as an obligation but as an added value.

APPENDIX D: INTERVIEW K. SLOTMAN

Slotman also helps teachers to get their BKO, reaches need this to educate students. During this BKO teachers learn how to design a subject, implement their knowledge and evaluate. Also they are reflecting, for example on their skills or how to go on with their skills. For reflection teachers have to write a reflection report, but this takes time. Which has as a cause that teachers do not reflect well enough. Currently Slotman is working on fastening this traject, by doing these reflections by interviews, this has as a result reflection is more authentic (it is more personal) and it is faster. Teachers seem to like these conversations, it makes more impression on them and suggest more. To get a well reflection process, the participants need to learn to grow, they need someone who helps them search for answers.

To conclude, having a reflection partner or someone who is interviewing the person who is reflecting makes a reflection process more authentic, instead of writing a

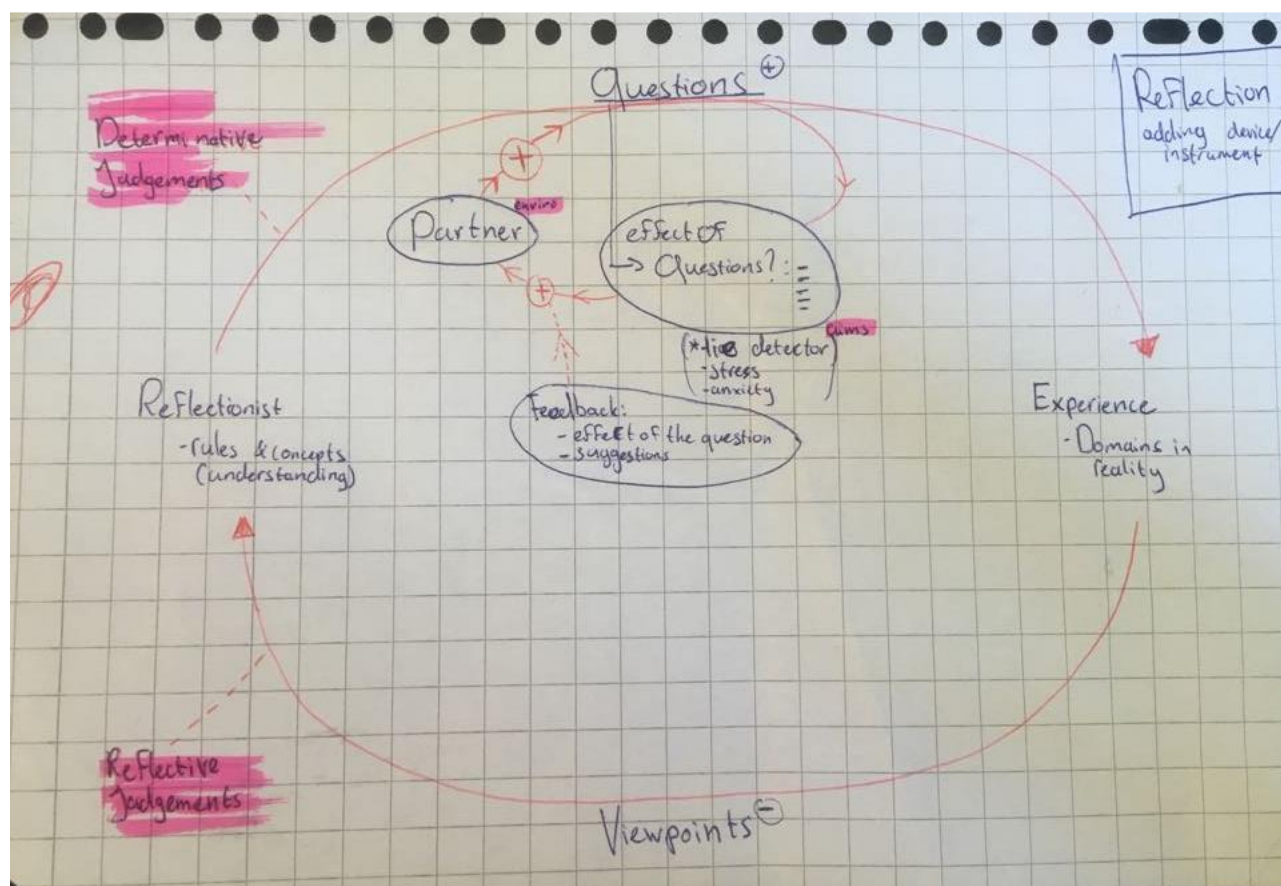
reflection report. This is an important finding that reflection can better be an interaction with someone instead of writing it down.

APPENDIX E: INTERVIEW A. SCHAAFSTAL

As a student of Creative Technology it is important to develop as a student, who knows what he wants. A student is reached different kind of knowledge to shape his or her own profession during the study. The study guides the student through different kind of fields. With the intention to combine students with or without a technical background to work towards creative innovations. Because technology is so important nowadays, students need to become able to understand and implement it. Therefore these different knowledge is reached so students can use them to shape their own profession during this study. Due to this important aspect what is asked of the students, it is of importance student need to think critical about their study process. Reflection can help students become critical thinkers.

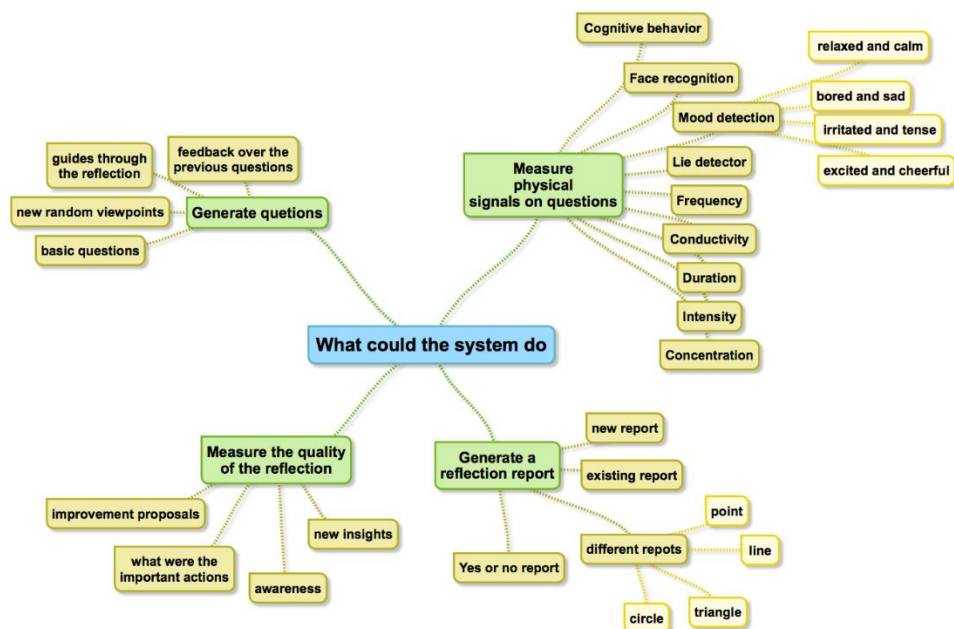
To conclude, one of the most important aspects of the study is that students become critical thinkers. So they know why they made certain choices during the study which will help them give guidance to form their professional development.

APPENDIX F: REFLECTION PROCESS DRAFT IMPLEMENTATION OF THE INSTRUMENT

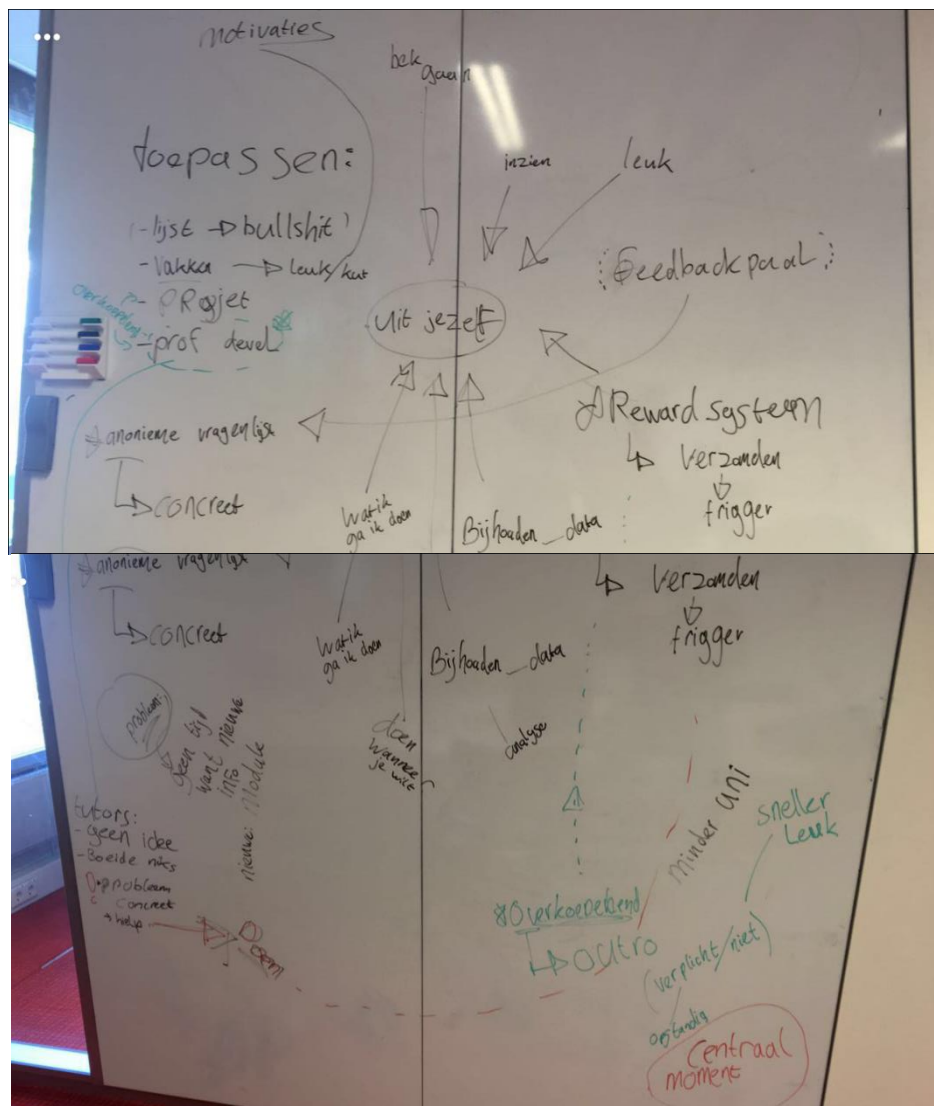


APPENDIX G: BRAINSTORMS

APPENDIX G.1: INDIVIDUAL BRAINSTORM



APPENDIX G.2: JOINT BRAINSTORM SESSION



APPENDIX G.3: BRAIN STORM E. FABER



APPENDIX H: SECOND INTERVIEW I. VISSCHER

Tijdens het gesprek met Irene waren dit de handvaten van het gesprek:

- Waarover ziet u de meeste opties over reflecteren?
 - Projecten
 - Professional development
 - Minor ruimte
 - Reflectie vak (supplementary)
 - Leerlijn
 - Specifieke vakken
 - GP
- Welke mogelijkheden zijn er om reflectie-onderwijs te implementeren binnen een bestaand curriculum?
- Hoe kun je de effecten van reflectie meten?
- Hoe zou je van reflecteren een academisch vak kunnen maken?;
- Hoe maak je reflectie aantrekkelijk voor studenten (dat ze ervaren dat ze er iets aan hebben) en haal je het “moeten” karakter eraf?
- (Wat is de basis voor een grond reflectiereport?)

GESPREK MET IRENE VISSCHER:

Irene begon met het vertellen over NARRA wat body en handvaten kan geven aan mijn project. Ze geeft aan dat Monique Engelbertink daar nu mee bezig is en als ik daar meer informatie over wil weten ik haar kan contacten. NARRA helpt bij het beoordelen van een geschreven reflectieverslag. Als het gaat over effecten van reflectie, is het kwaliteit belangrijk. NARRA kan daarbij helpen, het laat zien hoe goed iemand heeft

gereflecteerd. Zoals al een eerder gesprek gezegd was, was dat het gebruik van externe bronnen helpt bij het beter reflecteren. Dat wordt er momenteel te weinig gedaan en dat is er is er mis met het huidige reflecteren.

Een ander effect dat gemeten kan worden is een verbeteringsvoorstel, dat kan een docent zicht geven wat een student geleerd heeft. Bij een evaluatie kan dat er ook uit komen maar dat werkt anders: bij evaluatie ga je kijken naar of je eigen handelen voldoen om een bepaald product of uitkomst te verwerkelijken. Terwijl je bij reflectie juist ook kijkt naar jezelf als uitkomst, naar jezelf kijken word duidelijk herhaalt. Kort gezegd, evaluatie is extern en reflectie is intern.

Waar reflectie ook interessant is, als het gaat over verbeteringsvoorstellen, om bij aan te sluiten zijn leerlijnen. Na een ervaring kan een docent vragen naar de belangrijkste acties/leerpunten, wat kan leiden tot nieuwe inzichten die vervolgens ook ingezet kunnen worden.

Wat ook al eens eerder gezegd is, een studieloopbaangeleider kan daarbij goed helpen. Die houdt door de tijd in de gaten, 'wie ben ik als professional'. Dat slaat weer aan op die leerlijn die helpt bij het verbeteringsvoorstel of als het gaat om bepaalde leerlijnen. Een vier deling van vragen kan ook altijd gesteld worden over elke ervaring, die een duidelijk overzicht geven over de ervaring: wie ben ik, wat wil ik, wat kan ik; en wat doe ik.

De naam Huub Schult Fisschedick wordt genoemd die laats een kaartspel gemaakt heeft waar nieuwe vragen op staan. Dat is ook een methode om goede nieuwe vragen te stellen.

Er wordt gekeken naar de research questions en aangegeven dat, het verstandig is om toe te voegen dat het over kritische reflectie gaat.

Een vervolg kan zijn hoe kan een student beoordeeld worden op zijn kwaliteit? Of ontwerp maken over welke punten belangrijk zijn voor deze kwaliteiten.

Stel je maakt als vak reflectie dan is het belangrijk om eerst de basis techniek uit te leggen, vervolgens dat meerdere malen toepassen (dit geeft een leerlijn) en als uitkomst maakt de studenten een leerlijn door zijn studie. Dit sluit ook aan bij het eerder genoemde leerlijnen die van pas kunnen bij het meten van de kwaliteiten van reflectie. Als hier regelmaat in zit dan zullen studenten er ook meer van leren. Want volgens leren studenten ongeveer tien keer sneller als er tussen pauzes in zitten en herhaalt wordt.

Hierna word er gesproken over reflectieverslagen omdat dit helpt bij het meten van reflectie. De vraag, 'is een reflectie verslag over het reflectie proces altijd nodig?' wordt gesteld waarover het antwoord is dat het een duidelijke methode is hoe reflectie gemeten kan worden. Hoe ver helpt een reflectie verslag schrijven, een student echt reflecteren. Een voorbeeld wordt genoemd over een student die super goed kon reflecteren maar het niet kon documenteren. Hoe belangrijk is een reflectie verslag dan nog? Irene is van mening dat het dan nog steeds van toegevoegde waarde kan zijn, want een student leert het schrijven.

Het doel van reflectie kan zijn meer te weten komen over jezelf. Dat doe je door goede vragen te stellen en eigenlijk gedwongen echt goede antwoorden te geven. Het is proces over je eigen leerervaring: wat moet je doen om jezelf wijzer te maken.

Voor het gesprek met Henk Procee krijg ik nog paar tips en vragen mee:

- Wat zijn manieren en kwaliteiten van reflectie die zichtbaar zijn? Of hoe kan je die kwaliteiten zichtbaar maken?
- Hoe laat je zien dat je iets geleerd hebt? Is het enige antwoord daarop een verslag?
- Wat is het meest tastbare?

APPENDIX I: INTERVIEW H. PROCEE

Tijdens het gesprek met Irene waren dit de handvaten van het gesprek:

Doel van reflectie is meer te weten over jezelf.

Het gaat daarbij om je eigen leerervaring: Wat moet je doen om jezelf wijzer te maken (toevoeging van Procee) ook in projectervaringen.

Graag wil ik een reflectie instrument gaat maken dat studenten helpt te reflecteren op studie gerelateerde ervaringen.

- Waar zou u verbetering willen hebben in het huidige reflecteren in het hoge onderwijs?
- Het instrument kan helpen op verschillende manieren:
 - ➔ Vragen genereren
 - ➔ Reflectie report maken
 - ➔ Kwaliteit van de reflectie achteraf meten
 - ➔ Kwaliteit tijdens de reflectie meten
- Ziet u hier mogelijkheden in?
- Hoe kan je goede vragen stellen tijdens een reflectie?
 - ➔ Zijn er elementen die altijd terug komen in bepaalde reflectievragen?
 - ➔
 - ➔ Tot hoe verre zou dit over kunnen genomen worden door een machine?
- Ook ben ik opzoek naar waar ik het kan implementeren, de mogelijkheden hiervoor zijn:
 - ➔ Projecten
 - ➔ GP
 - ➔ Oriëntatie mogelijkheden
 - ➔ Professionele development
 - ➔ Minor ruimte
 - ➔ Een specifieke reflectie vak
 - ➔ Leerlijnen door studie
 - ➔ (vakken)
- Waarin ziet u mogelijkheden?
- Wat zouden mogelijke intended learning outcomes kunnen zijn?
- Wat zijn manieren om kwaliteiten van reflectie zichtbaar te maken?
 - ➔ Hoe laat je zien dat je iets geleerd hebt?
 - ➔ Wat is het meest tastbare?

Hoe zou je van reflectie een academisch vak van kunnen maken?

Overige vragen:

Wat is het oordeelsvermogen?

Is het oordeelsvermogen te trainen?

Tot hoeverre bepaald metacognitie hoe goed een student kan reflecteren?

GESPREK MET HENK PROCEE:

Als je het hebt over reflectie zijn er twee kanten op te reflecteren, toekomst naar nu en vice versa. Als u student op de grond ergens iets wat van vind, is het een overtuiging. Daarom is reflectie heel breed en heeft niet 1 domein. Zoals gezegd was tijdens het gesprek met Brand van der Gaast dat reflectie alleen focust op filosofische reflectie is volgens Henk een verkeerde interpretatie, reflectie gaat meer dan alleen over 1 domein praten. Het is doormiddel van de juiste vragen iemand laten na denken en tot nieuwe inzichten laten te komen.

Tegenwoordig is het model van Korthagen, erg dominant in het hoger onderwijs. Het is een schema dat werkt als volgt, wat heb ik gedaan, wat ging niet goed, dat analyseren en hoe kan ik dat in het vervolg beter doen. Om vanuit het punt te werken 'wat ging er fout' is moeilijk. Omdat de vraag wat je fout gedaan hebt, negatief is en dat je dat moet oplossen. Het maakt geen gebruik van professioneels gereedschap wat belangrijk is in reflectie. Henk stelt dat als je het hier over hebt er twee domeinen zijn, gesloten domein waar je alleen kan leren van je fouten en open domein waarin je open staat voor echte reflectie.

In het speciaal onderwijs laat Henk als ze reflecteren kinderen tekeningen maken, dit is natuurlijk niet iets voor dit project. Maar het zijn wel alternatieven voor reporten schrijven, kinderen moesten aan de hand van een tekening laten zien waarover ze gereflecteerd hadden. Wat daarom interessant kan zijn is mindmappen maken als manier om te reflecteren. Dit kan helpen om studenten nieuwe aanleg routes te laten zien en nieuwe relaties te kunnen leggen.

Henk vindt dat het essentieel is bij reflecteren dat studenten erachter komen hoe ze professioneel ontwikkelen. Een capaciteit van reflecteren is om verbanden te kunnen leggen, die andere niet zagen.

Irene wees erop dat Henk juiste vragen kon stellen, waarop Henk zei dat als hij vragen stelde meestal studenten in de war bracht. Wat vervolgens leidde tot de wat betekent het nou precies.

Een oordeel van het instrument werd vervolgens besproken. Het is niet raar als studenten niet zeker zijn van wat ze zeggen. Studenten die open zijn kunnen dommen dingen zeggen daar worden ze onzeker van. Een machine, zo gezegd interesseert het niets wat een student zegt. Daarom kan een student daar alles in/aan kwijt, met andere woorden een student kan daar alles aan delen. Om vervolgens zelf het juiste eruit te filteren wat de student wilt delen met de docent/begeleider.

Het instrument dat helpt bij reflectie kan helpen bij vragen stellen. Juiste vragen stellen helpt bij het ontwikkelen van professionele vaardigheden, het zorgt ervoor dat je meer grip krijgt over je professionele ontwikkelingen.

Voor reflectie is er altijd een slim intellect nodig. Er zijn verschillende soorten studenten opgevallen door Procee: speelse die reflecteren gemakkelijk, hard werkende

die reflecteren moeilijker en studenten die weten dat ze niet goed werken en daar werkt reflectie het beste.

Bij alle is er meestal als uitkomst een toename in zelfvertrouwen. Ook kan gezegd worden het is een reductie van onzekerheid, waardoor dus de onzekerheid kleiner wordt. Ook dit kan een insteek zijn, de onzekerheid over een vakgebied.

Nogmaals de doelen van reflectie is professionele ontwikkeling en kwaliteiten ontwikkelen. Voorbeelden zijn onderzoeken in kwalitatieve of kwantitatieve vaardigheden of hoe leer je van interventies.

Het meten van reflectie is lastig. Een reflectie partner kan daarbij handig zijn, die is altijd nodig. Maar een partner kan zowel extern als intern zijn, jezelf kan ook als partner dienen. Het instrument kan ook dienen als gesprek partner, waardoor je de partner een betere rol kan laten spelen.

Procee vertelde over hoe hij studenten hielp met reflecteren. Problemen die studenten vaak bij reflecteren hadden was dat het niet past bij hun verwachtingen, hun verwachtingen zijn dat je veel weet. Dit staat haaks op hun verwachtingspatroon, omdat we gaan onderzoeken wat er in hun hoofd omgaat, door ze bijvoorbeeld in de war te brengen.

Een goede toevoeging zou volgens Procee bij projecten zijn. Omdat bij projecten gebeurt er professioneel veel, er zijn verschillende processen en je werkt met verschillende soorten mensen samen. Als je over projecten reflecteert heb je verschillende soorten diepgang. Bij reflecteren is het belangrijk dat studenten niet meteen een oordeel hebben ergens over. Met je oordeelsvermogen denk je na over concepten, theorieën en ervaringen. Het doel is om je oordelen op te schorten.

Procee stelde voor dat het instrument 'gekke' vragen kan stellen. Dat wil zeggen dat het kan helpen keuzes expliciet maken, zorgen dat het geen vanzelfsprekendheden zijn. Het kans steun verlenen om daar en daar hulp te bieden. Gelaagdheid bieden door een soort diepgang geven, twee methodes die daarbij helpen zijn lijn en driehoek reflectie. De ander twee methoden punt en cirkel zijn lastiger daarin toe te passen. Met punt is de methode te los en kan het te lastig zijn. Cirkel kan wel helpen bij re reflectie achteraf, een report schrijven bijvoorbeeld. Wat zijn nieuwe inzichten en wat zijn de toekomst plannen. Een andere mogelijkheid is een pilot opstellen waar de tool te implementeren valt.

Reflectie kan leiden tot het maken van nieuwe plannen en inzichten. CELT is hiermee bezig en zou informatie kunnen verschaffen.

Het onderwerp over kwaliteit tijdens en achteraf de het proces. Tijdens het reflecteren, zijn goede vragen en vragen waar iemand verder mee komt. Waarbij het kan lijden dat studenten niet eerder het gezien hebben. Dit biedt mogelijkheden om het te koppelen aan lijn- en driehoekreflectie, verder vragen door vragen. Kwaliteit achteraf is lastiger, omdat er geen absolute maatstaaf is en een computer geen oordeel kan geven.

Het is belangrijk tijdens het proces aan te houden wat heeft kwaliteit, dat gaan we onderzoeken. Een student moet niet in zichzelf blijven hangen, daar komt een gesprekspartner weer aan te pas, ook literatuur kan daarbij helpen.

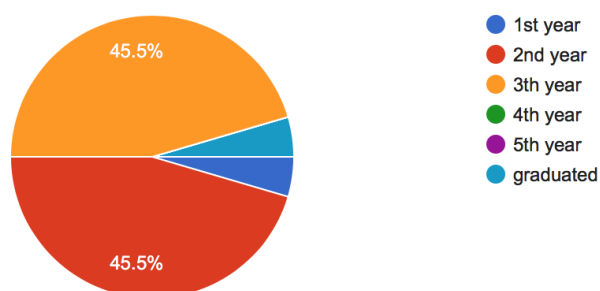
Belangrijke aspecten worden vervolgens opgenoemd: over het implementeren, dit kan nog te vroeg zijn om te bepalen. Het is beter als een instrument gemaakt wordt en dat dat vervolgens word uitgetprobeerd. Dan kan het ook meteen meer studieafhankelijk worden, omdat verschillende studies anders reflecteren vanwege de verschillende professionele doelen. De tool kan bieden (wat ook effect heeft) helpen met verdiepen (door vragen), systematiek bieden (lijn en driehoek methodes) en helpen met het schrijven van een report. Een belangrijk criterium is als een student iets leert wat diegene nog niet kon, goed of fout speelt hier geen rol in.

Ook wordt nog het aspect competitie genoemd, studenten houden er niet van af te gaan voor andere. En dat er moet afgebakend worden anders verzuip ik.

APPENDIX J: QUESTIONNAIRES

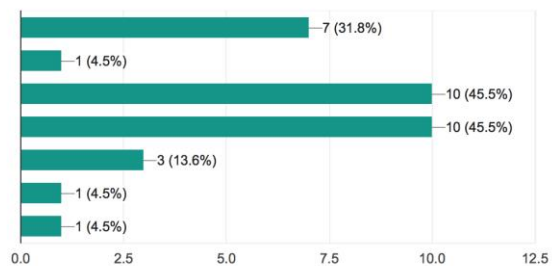
I am currently in my

22 responses



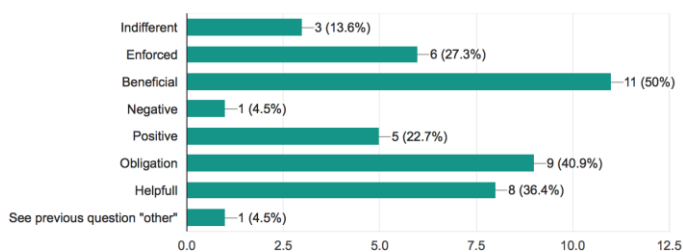
What kind of association(s) do you have towards reflection. Reflection during CREATE is ...

22 responses



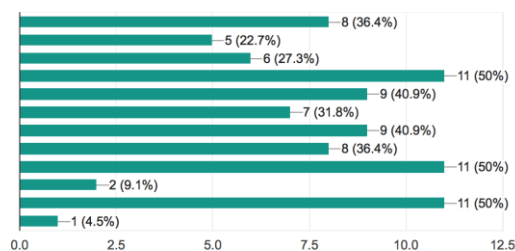
What are/is your viewpoint(s) about reflection. (what is your attitude towards reflection in the CREATE curriculum) It is...

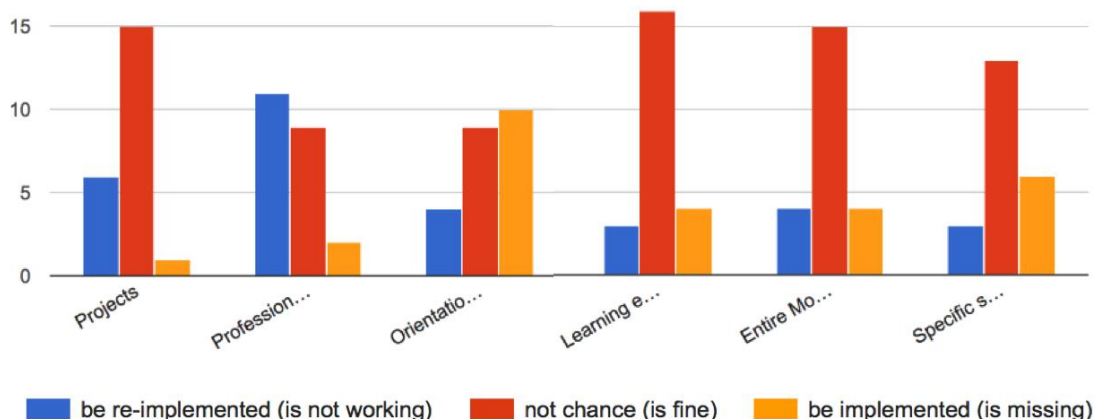
22 responses



These elements must be in reflection in higher education.

22 responses





APPENDIX K: PERSONAS

1 The orientation student

- Name: Sophie
- Age: 20
- Education: Second year Creative Technology student
- Origin: German
- Work: -

“Study hard and get good marks is important for me, because I want to learn everything I like. However, sometimes studying is not my strongest aspect, therefore I work hard!”

Motivation:

- Want to be ambitious, but finds it hard to work
- Caring about the environment
- Wants to perform well on school
- Wants to become independent

Frustrations:

- Getting a poor result
- Do not know what to do
- Competing with other students
- Seeing other students getting their marks easier, with less effort

Characteristics:

Sophie is an ambitious student who wants to learn as much as possible. Always attending all the lectures, and making most of the homework. She does this because she wants to get the full potential out of her study. She has large and a very honest group of friends, where she does everything with when she is not studying. Two of them are living with her and one these two is also studying the same study in the same year. Both did everything together the first two years. Sophie always wants to perform well at school but finds it hard to get high marks, and especially a well result. She is willing to work

hard but her hard work is not always paid off. Sometimes she sees other students putting less effort in work than her. She is on the moment to go on and explore but she would like to learn other things than what they learn in Creative Technology. Therefore she is doubting which minor she is going to do, her only concern is that her best friend wants to go on a business minor, this is a way she does not like. Therefore, she is doubting what she would do.

2 The pre (technical) master student

- Name: Pascal
- Age: 20
- Education: Second year Creative Technology student
- Origin: Dutch
- Work: Bartender

“Because there is a well job perspective I want to go to do a technical premaster, I want to be successful and respected.”

Motivation:

- Getting a well job perspective
- Being social
- Becoming successful
- Earning money
- Getting respect from fellow students
- Having a good time and explore

Frustrations:

- Do not getting any respect what he is doing
- Do not get any good marks
- Making bad choices

Characteristics:

Pascal is a student who has ambition to go and study in a well job perspective. He wants to learn more about technical subjects because he knows that there are well job perspectives. He thinks he is knowing this for sure, because this is his aim to become successful. Besides this ambition, Pascal also likes to party with friends, most of the time this causes conflicts with his study and social life. He thinks being social is also important if he want to become successful. This will give him the respect he thinks he deserves. When people do not like him he will get frustrated and become more focused to try even harder. This is helping him to have a good time with other, secretly he is enjoying it when he is having a good time instead of only working. He knows he wants to be successful but on the other hand he also wants to enjoy life. However, he is anxious to tell others because he thinks otherwise they would not respect him anymore.

This dilemma is also coming back in his minor choice, because he wants to do a good study and on the other hand he also wants to have fun. Maybe for his minor he wants to do an committee or go on an exchange. He is still doubting what will be a wise choice, and talking with people about him will maybe put him in a position where people do not respect him.

3 Gap minor space

- Name: Erik
- Age: 22
- Education: Second year Creative Technology student
- Origin: Dutch
- Work: Study coaching

“I want to work as hard as possible, but at the same time also enjoy my student time. Therefore, working effective is important for me.”

Motivation:

- Wants to get the most out of his student life
- Does not want to miss anything
- Wants to finish his bachelor in three years
- Needs money because his parents do not give him lots of money

Frustrations:

- Not reaching all his EC's at once
- Missing a nice party
- Becoming less important with his friends
- Making wrong decisions, he finds it hard to make choices, because he likes everything

Characteristics:

Erik is a late student, who wants to finish all his three years at once. He is living with 6 friends who he met during his stay these two years in Enschede. Also he has other friends from his study where he does a lot with, these friends he made during activism at a student association. With these group of friends he has lots of parties and does many activities, which are nice only his study is suffering from it. The consequence was that he had to resit one module with caused a gap of a module in his next year. This is bothering him, because he is already a late student, he wants to get to finish as soon as possible. At this moment he has to choice for his minor, because he has to make a right decision what he will do. Because he maybe thinks about doing a premaster which will takes 2 modules after each other. Or he will do one module separated from the other and will maybe let him not follow this pre master. Because he does not have a clue what he really wants, finish his study earlier or doing a premaster he is doubting too much.

4 The exchange student

- Name: Marlot
- Age: 21
- Education: Second year Creative Technology student
- Origin: Dutch
- Work: Photographer

“Because meeting new people and experience as much as possible, I want to see as much as possible from the world.”

Motivation:

- Making others happy
- Finding out more about the world
- Wants to create her own opinion
- Doing spontaneously actions
- Getting well results at school

Frustrations:

- People who are judging
- Thinking too much
- Accepting other judgements too easy
- Not working correctly, not following the rules

Characteristics:

Marlot is an explorer, a well student and social. She is a student who wants to make her own judgements and not depend on other people. She does this to perform well at school and achieve a well result. But also to work, she likes to make pictures and she is doing this pretty good. For this reason she is also selling her pictures and is asked on certain occasions to make pictures. Beside this hobby which got out of the hand, it can be said her study is also almost a hobby. Due, she wants is performing well and likes to work hard for her study and is willing to do everything to get a good result. Now she is in her second year and wants to make to go on a minor. She is for sure she is going on an exchange, but is not sure where she wants to go. Is it going to be a technical study or a more social and which country will it be? She decided that is not going to be near the Netherlands, but is does not need to be a warm country. Lots of people say she has to go to Australia, however because everyone is saying she has to go there she is not sure if she wants it or her friends. For her it is important to create her own opinion and if every is saying she has to do it, most of the time she wants the opposite of it. Therefore she doubting what she really wants. Is this her own opinion or from the others?

APPENDIX M: LOFI

LoFi test – Study Experience

The goal of this reflection process is to let you think creative about your future plans. In this case specific your minor situation, to optimize your choice.

Name: _____

Age: _____

Year: _____

Made minor choice: ☐ Yes ☐ No

Email: _____

(If you do not want to give answer, for any reason please say)

Experience
Choose an experience concerning your study:

- Project, in module ...
- Study choice, for the study
- Specific subject, namely
- Professional development, during module

Experience
How do you see the experience, as something ...?:

☐ positive, go to positive experience -> option 1
☐ problematic, go to problematic experience -> option 2

Option 1, positive

- What surprised you in the situation?
.....
- About what where you positive surprised?
.....
- What is essential in this situation?
.....
- What is giving you a strong feeling in this situation?
.....
- (Can you describe this feeling?)
.....

Option 2, problematic

- What is holding back in this situation?
.....
- What was bordering the most in this situation?
.....
- What do you want to prevent the next time in this situation?
.....
- What is essential in this situation?
.....
- What is giving you a strong feeling in this situation?
.....
- (Can you describe this feeling?)
.....

Delve into the experience¹

- Is it clear what and why I think this?
.....
- Do I understand myself correctly?
.....
- What do I mean with it exactly?
.....
- Do I really know everything or did I forget something?
.....
- Are this all the important reasons?
.....
- Why am I doing and saying this?
.....
- What would someone else ad?
.....
- What is the origin of this judgement?
.....
- Can I rephrase this? So with other words but totally the same meaning.
.....
- In how far am I totally open in what I was saying?
.....

¹ <https://www.vraagcn.nl/2017/12/het-stellen-van-verhelderingsvragen.html>

Categorizing

- Actor**
.....
- Process** (What will be made?)
.....
- Result** (What is the goal and the crucial factors it will be achieved?)
.....

Qualities of each category

- Actor**
.....
- Process** (What will be made?)
.....
- Result** (What is the goal and the crucial factors it will be achieved?)
.....

Essentials of each category

- Actor**
.....
- Process** (What will be made?)
.....
- Result** (What is the goal and the crucial factors it will be achieved?)
.....

Optimizing each category

- Actor**
.....
- Process** (What will be made?)
.....
- Result** (What is the goal and the crucial factors it will be achieved?)
.....

1. Project, in module ...

- Qualities:
 - * Actor:
 - What qualities do you need to have, according to your project coordinator?
 - Which qualities would your project members want you to have, if you working together?
 - What qualities should your teacher think you have mastered, if you work on your project?
 - * Process:
 - What did you need to make this project manageable?
 - What were your milestones for this project?
 - What was your plan B, if the project failed?
 - * Results:
 - When were you satisfied and happy during the project?
 - Which requirements (that are set by the university) did you mastered during the project?
 - What kind of feedback did you want to get at the end of the project?
- Essentials:
 - * Actor:
 - In what way were you intrinsic motivated to organize your planning during the project?
 - Describe with one word the most important quality of you during the project.
 - What kind of quality would be the most important to have according to your project coordinator?
 - Describe all outcomes in one sentence.
 - * Process:
 - What was THE important quality of having a good time during the project?
 - Described in a max five words what includes all good qualities during project?
 - Which actions made you proud during the project?
 - Describe all outcomes in one sentence.
 - * Results:
 - About which quality would were your project members the most proud of?
 - What was the core of all the good qualities?
 - What was supposed to be the best outcome?
 - Describe all outcomes in one sentence.
- Optimization:
 - * Actor:
 - Which actions and attitude would a role model have to achieve that results?
 - Think about other projects, how other student made choices, how can you optimize them?
 - Which actions would you tell your parents and your student coordinator, you made during the project?
 - * Process:
 - What do you want to see if your best friend would be in this project?
 - What are the alternatives, you never thought of during this project?
 - What do you need to do get a better result for your project next time?
 - * Results:
 - Which results will you share with everyone, even if you didn't achieve them?
 - What are core results everyone wants to achieve, at the end of the project?
 - What actions would your project members like to see next time?

2. Study choice, for the study

- Qualities:
 - * Actor:
 - What qualities do you need to have, according to your dean/study coordinator?
 - Which qualities would your fellow students want you to have, during this choice?
 - What qualities should your teacher think you have mastered, if you made a well choice?
 - * Process:
 - What did you need to make this choice manageable?
 - What were your milestones for making this choice?
 - What was your plan B, if this choice was not the one you want?
 - * Results:
 - When were you satisfied and happy during the choice?
 - Which requirements did you mastered before this choice?
 - What kind of feedback did you want to get at the end of this choice?
- Essentials:
 - * Actor:
 - In what way were you intrinsic motivated to organize your planning during the choice?
 - Describe with one word the most important quality of you during this choice.
 - What kind of quality would be the most important to have according to your study coordinator/dean?
 - Describe all outcomes in one sentence.
 - * Process:
 - What was THE important quality of wanting to have a good time at the end of your choice?
 - Described in a max five words what includes all good qualities what helped you making this choice?
 - Which actions made you proud after this choice?
 - Describe all outcomes in one sentence.
 - * Results:
 - About which quality would were your friends the most proud of?
 - What was the core of all the good qualities?
 - What was supposed to be the best outcome?
 - Describe all outcomes in one sentence.
- Optimization:
 - * Actor:
 - Which actions and attitude would a role model have to achieve that results?
 - Think about other choices, how other student made choices, how can you optimize them?
 - Which actions would you tell your parents and your student coordinator, you made during this choice?
 - * Process:
 - What do you want to see if your best friend would be have made this choice?
 - What are the alternatives, you never thought of during making this choice?
 - What do you need to be more confident about your choice next time?
 - * Results:
 - Which results will you share with everyone, even if you didn't achieve them?
 - What are core results everyone wanted to achieve, at the end of this choice?
 - What actions would your fellow students like to see next time?

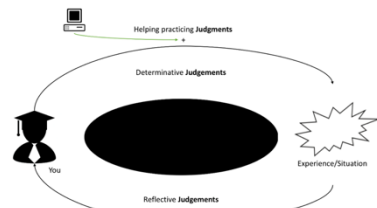
3. Specific subject, namely

- Qualities:
 - * Actor:
 - What qualities do you need to have, according to your teacher?
 - Which qualities would your fellow students you to have?
 - What qualities should your teacher think you have mastered?
 - * Process:
 - What did you need to make this subject manageable?
 - What were your milestones for this subject?
 - What was your plan B, if you failed the subject?
 - * Results:
 - When were you satisfied and happy after this subject?
 - Which requirements (that are set by the university) did you mastered during the subject?
 - What kind of feedback did you want to get at the end of the subject?
- Essentials:
 - * Actor:
 - In what way were you intrinsic motivated to organize your planning during this subject?
 - Describe with one word the most important quality of you during this subject.
 - What kind of quality would be the most important to have according to your teacher?
 - Describe all outcomes in one sentence.
 - * Process:
 - What was THE important quality of having a good time during this subject?
 - Described in a max five words what includes all good qualities during subject?
 - Which actions made you proud during this subject?
 - Describe all outcomes in one sentence.
 - * Results:
 - About which quality would were your friends the most proud of?
 - What was the core of all the good qualities?
 - What was supposed to be the best outcome?
 - Describe all outcomes in one sentence.
- Optimization:
 - * Actor:
 - Which actions and attitude would a role model have to achieve that results?
 - Think about other students, how other student made choices, how can you optimize them?
 - Which actions would you tell your parents and your teacher, you made during the subject?
 - * Process:
 - What do you want to see if your best friend would be in this subject?
 - What are the alternatives, you never thought of during this subject?
 - What do you need to do get a better result for your subject next time?
 - * Results:
 - Which results will you share with everyone, even if you didn't achieve them?
 - What are core results everyone wants to achieve, at the end of the subject?
 - What actions would your fellow students like to see next time?

4. Professional development, during module

- Qualities:
 - * Actor:
 - What qualities do you need to have, according to your mentor?
 - Which qualities would your students want you to have?
 - What qualities should your parents think you have mastered, during the professional development?
 - * Process:
 - What did you do to pass professional development?
 - What were your milestones for professional development?
 - What was your plan B, if you failed professional development?
 - * Results:
 - When were you satisfied and happy during professional development?
 - Which requirements (that are set by the university) did you mastered during professional development?
 - What kind of feedback did you want to get at the end of professional development?
- Essentials:
 - * Actor:
 - In what way were you intrinsic motivated to organize your planning during professional development?
 - Describe with one word the most important quality of you during professional development.
 - What kind of quality would be the most important to have according to your mentor?
 - Describe all outcomes in one sentence.
 - * Process:
 - What was THE important quality of having a good time during professional development?
 - Described in a max five words what includes all good qualities during professional development?
 - Which actions made you proud during professional development?
 - Describe all outcomes in one sentence.
 - * Results:
 - About which quality would were fellow students the most proud of?
 - What was the core of all the good qualities?
 - What was supposed to be the best outcome?
 - Describe all outcomes in one sentence.
- Optimization:
 - * Actor:
 - Which actions and attitude would a role model have to achieve that results?
 - Think about other professional development students, how other student made choices, how can you optimize them?
 - Which actions would you tell your parents and mentor, you made during professional development?
 - * Process:
 - What do you want to see if your best friend would be in same position during professional development?
 - What are the alternatives, you never thought of during professional development?
 - What do you need to do get a better result for professional development next time?
 - * Results:
 - Which results will you share with everyone, even if you didn't achieve them?
 - What are core results everyone wants to achieve, at the end of professional development?
 - What actions would your best friends like to see next time?

LoFi test – Minor Situations



The goal of this reflection process is to let you think creative about your future plans. In this case specific your minor situation, to optimize your choice.

Name:

Age:

Year:

Made minor choice: ☐ Yes ☐ No

Email:

(If you do not want to give answer, for any reason please say)

Minor

What situation describes your situation best?

1. I want to go on an exchange, how can I choose the right university?
2. I want to do a pre master, what kind of pre master do I want to choose?
3. I want to do an internship, how can I choose for the right internship?
4. I want fill up 15 ECs, what will fit me?
5. I do not know what kind of minor I want to do, how can I make a wise minor choice?
6. I made a choice, how went my minor choice?

Situation

How do you see the situation, as something ...?:

- ☐ positive, go to positive experience -> option 1
- ☐ problematic, go to problematic experience -> option 2

Option 1, positive

1. What will surprise you in the situation?
.....
2. About what will you positive surprised?
.....
3. What is essential in this situation?
.....
4. What is giving you a strong feeling in this situation?
.....
5. [Can you describe this feeling?]
.....

Option 2, problematic

1. What is holding back in this situation?
.....
2. What will be bordering the most in this situation?
.....
3. What do you want to prevent the next time in this situation?
.....
4. What is essential in this situation?
.....
5. What is giving you a strong feeling in this situation?
.....
6. [Can you describe this feeling?]
.....

Delve into the experience¹

1. Is it clear what and why I think this?
.....
2. Do I understand myself correctly?
.....
3. What do I mean with it exactly?
.....
4. Do I really know everything or did I forget something?
.....
5. Are this all the important reasons?
.....
6. Why am I doing and saying this?
.....
7. What would someone else ad?
.....
8. What is the origin of this judgement?
.....
9. Can I rephrase this? So with other words but totally the same meaning.
.....
10. In how far am I totally open in what I was saying?
.....

¹ <https://www.vraagijn.nl/2017/12/het-stellen-van-verhelderingsvragen.html>

Categorizing

1. **Actor**
.....
2. **Process** (What will be made?)
.....
3. **Result** (What is the goal and the crucial factors it will be achieved?)
.....

Qualities of each category

1. **Actor** (What will a good actor do?)
.....
2. **Process** (Where does a well process consists of?)
.....
3. **Result** (Where is this goal consisting of?)
.....

Essentials of each category

1. **Actor** (What is essential for the actor in this situation?)
.....
2. **Process** (What is essential for the process in this situation?)
.....
3. **Result** (What is essential for the results in this situation?)
.....

Optimizing each category

1. **Actor** (What is necessary to achieve this for the actor, in terms of actions and attitude?)
.....
2. **Process** (What is necessary to achieve this for to optimise the process, in terms of actions and attitude?)
.....
3. **Result** (What is necessary to achieve and optimise the results, in terms of actions and attitude?)
.....

1. I want to go on an exchange, how can I choose the right university?

- Qualities:
 - * Actor:
 - What qualities do you need to have, according to your exchange coordinator?
 - Which qualities would your parents want you to have, if you went on an exchange?
 - What qualities should your friends think you have mastered, if you went on an exchange?
 - * Process:
 - What do you need to make this choice manageable?
 - What are your milestones?
 - What is your plan B, if you are not accepted at the university?
 - * Results:
 - When are you satisfied and happy?
 - Which requirements (that are set by the university) should at least be part of your result?
 - What kind of feedback do you want if you go on an exchange?
- Essentials:
 - * Actor:
 - In what way are you intrinsic motivated to organize your own exchange project?
 - Describe with one word the most important quality of you during this exchange.
 - What kind of quality would be the most important to have according to your exchange coordinator?
 - Describe all outcomes in one sentence.
 - * Process:
 - What will be THE important quality of having a good time on an exchange?
 - Described in a max five words what includes all good qualities of making the right choice?
 - Which actions will make you proudest in this situation?
 - Describe all outcomes in one sentence.
 - * Results:
 - About which quality would your parents be proud of?
 - What is the core of all the good qualities?
 - What will be the best outcome?
 - Describe all outcomes in one sentence.
- Optimization:
 - * Actor:
 - Which actions and attitude would a role model have to achieve this results?
 - Think about previous actions of student who made this choice, how can you optimize them?
 - What actions will make you, your parents and your student coordinator the most proud?
 - * Process:
 - What do you want to see if your best friend would make this choice?
 - What are the alternatives, you never thought of?
 - What do you need to do to not get a negative result?
 - * Results:
 - Which results will you share with everyone?
 - What are core results everyone wants to achieve?
 - What actions would your parents like to see?

2. I want to do a pre master, what kind of pre master do I want to choose?

- Qualities:
 - * Actor:
 - What qualities do you need to have, according to your study coordinator?
 - Which qualities would your parents want you to have, if you made a pre master choice?
 - What qualities should your friends think you have mastered, if you have chosen for a premaster?
 - * Process:
 - What do you need to make this choice manageable?
 - What are your milestones?
 - What is your plan B, if you this is not the right premaster?
 - * Results:
 - When are you satisfied and happy?
 - Which requirements (that are set by the university) should at least be part of your result, at the end of your premaster?
 - What kind of feedback do you want if you made a pre master choice?
- Essentials:
 - * Actor:
 - In what way are you intrinsic motivated to organize your pre master choice?
 - Describe with one word the most important quality of you need to make this choice.
 - What kind of quality would be the most important to have according to your study coordinator?
 - Describe all outcomes in one sentence.
 - * Process:
 - What will be THE important quality of being satisfied with your pre master choice?
 - Described in a max five words what includes all good qualities of making a satisfying pre master choice?
 - Which actions will make you proudest if you made a good minor choice?
 - Describe all outcomes in one sentence.
 - * Results:
 - About which quality would your parents be proud of, if you are doing a fitting pre master?
 - What is the core of all the good qualities, when making a pre master choice?
 - What will be the best outcome, when you are doing the premaster?
 - Describe all outcomes in one sentence.
- Optimization:
 - * Actor:
 - Which actions and attitude would a role model have to achieve the result you want to achieve?
 - Think about previous actions of student who made a pre master choice, how can you optimize them?
 - What actions will make you, to show your parents and your student coordinator you are satisfied with your choice?
 - * Process:
 - What do you want to see if your best friend would make a pre master choice?
 - What are the alternatives, you never thought of if you need to make a pre master choice?
 - What do you need to do to not get a negative result, in other words to make sure you will be satisfied?
 - * Results:
 - Which results will you share with everyone, if you made a pre master choice?
 - What are core results everyone wants to achieve when choosing a minor?
 - What actions would your parents like to see you are satisfied with your choice?

3. I want to do an internship, how can I choose for the right internship?

- Qualities:
 - * Actor:
 - What qualities do you need to have, according to your coordinator?
 - Which qualities would your parents want you to have, if you want to do an internship?
 - What qualities should your friends think you have mastered, if you do an internship?
 - * Process:
 - What do you need to make this choice manageable?
 - What are your milestones?
 - What is your plan B, if you are not accepted at the internship?
 - * Results:
 - When are you satisfied and happy?
 - Which requirements (that are set by the university) should at least be part of your result?
 - What kind of feedback do you want if you go on an internship?
- Essentials:
 - * Actor:
 - In what way are you intrinsic motivated to organize your own internship?
 - Describe with one word the most important quality of you during an internship.
 - What kind of quality would be the most important to have according to your internship coordinator?
 - Describe all outcomes in one sentence.
 - * Process:
 - What will be THE important quality of having a good time on the internship?
 - Described in a max five words what includes all good qualities of making the right choice?
 - Which actions will make you proudest in this situation?
 - Describe all outcomes in one sentence.
 - * Results:
 - About which quality would your parents be proud of?
 - What is the core of all the good qualities?
 - What will be the best outcome?
 - Describe all outcomes in one sentence.
- Optimization:
 - * Actor:
 - Which actions and attitude would a role model have to achieve the result you want to achieve?
 - Think about previous actions of student who did an internship, how can you optimize their choice?
 - What actions will make you, to show your parents and your student coordinator you are satisfied with your choice?
 - * Process:
 - What do you want to see if your best friend would go on an internship?
 - What are the alternatives, you never thought of if you need to make an internship choice?
 - What do you need to do to not get a negative result, in other words to make sure you will be satisfied?
 - * Results:
 - Which results will you share with everyone, if you are doing an internship?
 - What are core results everyone wants to achieve when doing an internship?
 - What actions would your parents like to see you are satisfied with your choice?

4. I want fill up 15 ECs, what will fit me?

- Qualities:
 - * Actor:
 - What qualities do you need to have, according to your mentor?
 - Which qualities would your parents want you to have, if you want to have making a right choice?
 - What qualities should your friends think you have mastered, if you do choice a quartile minor?
 - * Process:
 - What do you need to make this choice manageable?
 - What are your milestones?
 - What is your plan B?
 - * Results:
 - When are you satisfied and happy?
 - Which requirements (that are set by the university) should at least be part of your result?
 - What kind of feedback do you want if you go on an internship?
- Essentials:
 - * Actor:
 - In what way are you intrinsic motivated to organize this 15 EC minor?
 - Describe with one word the most important quality why you should make this choice.
 - What kind of quality would be the most important to have according to your favorite teacher?
 - Describe all outcomes in one sentence.
 - * Process:
 - What will be THE important quality of having a good time during this study period?
 - Described in a max five words what includes all good qualities of making the right choice?
 - Which actions will make you proudest in this situation?
 - Describe all outcomes in one sentence.
 - * Results:
 - About which quality would your parents be proud of?
 - What is the core of all the good qualities?
 - What will be the best outcome?
 - Describe all outcomes in one sentence.
- Optimization:
 - * Actor:
 - Which actions and attitude would a role model have to achieve the result you want to achieve?
 - Think about previous actions of student who need to make this choice, how can you optimize their actions?
 - What actions will make you, to show your parents and your student coordinator you are satisfied with your choice?
 - * Process:
 - What do you want to see if your best friend would make a choice for this?
 - What are the alternatives, you never thought of?
 - What do you need to do to not get a negative result, in other words to make sure you will be satisfied?
 - * Results:
 - Which results will you share with everyone, if you made the right choice?
 - What are core results everyone wants to achieve when choosing to fill this minor space in?
 - What actions would your parents like to see you are satisfied with your choice?

5. I do not know what kind of minor I want to do, how can I make a wise minor choice?

- Qualities:
 - * Actor:
 - What qualities do you need to make a wise minor choice, according to your study coordinator?
 - Which qualities would your parents say you have to make a satisfying minor choice?
 - What qualities should your friends think you have mastered, if you make a minor choice?
 - * Process:
 - What do you need to do to make a wise minor choice manageable?
 - What are your milestones to make a minor choice?
 - What is your plan B if this is not the minor you are satisfied with?
 - * Results:
 - How would you be satisfied and happy with your minor?
 - Which requirements (that are set by the university) should at least be part of your result, at the end of your minor choice?
 - What kind of feedback do you want if you made minor choice?
- Essentials:
 - * Actor:
 - In what way are you intrinsic motivated to organize your minor choice?
 - Describe with one word, the most important quality of you need to make a satisfying minor choice.
 - Without which quality would you not be able to make a satisfying minor choice?
 - Describe all outcomes in one sentence.
 - * Process:
 - What kind of quality would be important to have during the orientation process according to your study coordinator?
 - Described in a max five words what includes all good qualities of making a satisfying minor choice?
 - Which actions will make you proudest if you made a good minor choice?
 - Describe all outcomes in one sentence.
 - * Results:
 - About which quality would your parents be proud of, if you made a well minor choice?
 - What is the core result of all the good qualities, when making minor choice?
 - What will be the best outcome, when you are doing a minor?
 - Describe all outcomes in one sentence.
- Optimization:
 - * Actor:
 - Which actions and attitude would a role model have to achieve the result you want to achieve?
 - Think about previous actions of student who made a minor choice, how can you optimize them?
 - What actions will make you, to show your parents and your student coordinator you are satisfied with your minor choice?
 - * Process:
 - What steps do you want to see if your best friend would make a minor choice?
 - What are the alternatives, you never thought of if you need to make a minor choice, to optimize your choice?
 - What do you need to do to not get a negative result, in other words to make sure you will be satisfied?
 - * Results:
 - Which results will you share with everyone, if you made well minor choice?
 - What do you need to do to get the core results everyone wants to achieve when choosing a minor?
 - What actions would your parents like to see you are satisfied with your choice?

6. I made a choice, how went my minor choice?

- Qualities:
 - * Actor:
 - What qualities did you need to make a wise minor choice, according to your study coordinator?
 - Which qualities would your parents say you had to make a satisfying minor choice?
 - What qualities should your friends think you had to master, if you make a minor choice?
 - * Process:
 - What do you need to do to make a wise minor choice manageable?
 - What were your milestones to make a minor choice?
 - What is your plan B if this is not the minor you are satisfied with?
 - * Results:
 - What made you satisfied and happy with your minor choice?
 - Which requirements (that are set by the university) should at least be part of your result, at the end of your minor choice?
 - What kind of feedback do you get after your minor choice?
- Essentials:
 - * Actor:
 - In what way were you intrinsic motivated to organize your minor choice?
 - Describe with one word, the most important quality of you, you had, to make this a satisfying minor choice.
 - Without which quality would you not be able to make this minor choice?
 - Describe all outcomes in one sentence.
 - * Process:
 - What kind of quality during the process was important to have for a good orientation process, according to your study coordinator?
 - Described in a max five words what includes all good qualities of making a satisfying minor choice?
 - Which actions made you proud during this minor choice?
 - Describe all outcomes in one sentence.
 - * Results:
 - What is an essential result are your parents proud of, after your minor choice?
 - What was the most important result you had, when you made minor choice?
 - What will be the best outcome, when you are doing a minor?
 - Describe all outcomes in one sentence.
- Optimization:
 - * Actor:
 - Which actions and attitude would a role model have to achieve a more optimized result, compared with yours?
 - Think about previous actions of student who made a minor choice, how can you optimize them?
 - Which actions you made will you tell your parents and your mentor what satisfaction?
 - * Process:
 - What steps do you want to see if your best friend would make a minor choice?
 - What are the alternatives, you never thought of if you need to make a minor choice again, to optimize your choice?
 - What do you need to do to not get a negative result, in other words to make sure you will be satisfied?
 - * Results:
 - Which results will you share with everyone, if you made well minor choice?
 - What do you need to do to get the core results everyone wants to achieve when choosing a minor?
 - What actions would your parents like to see, when you are satisfied with your choice?

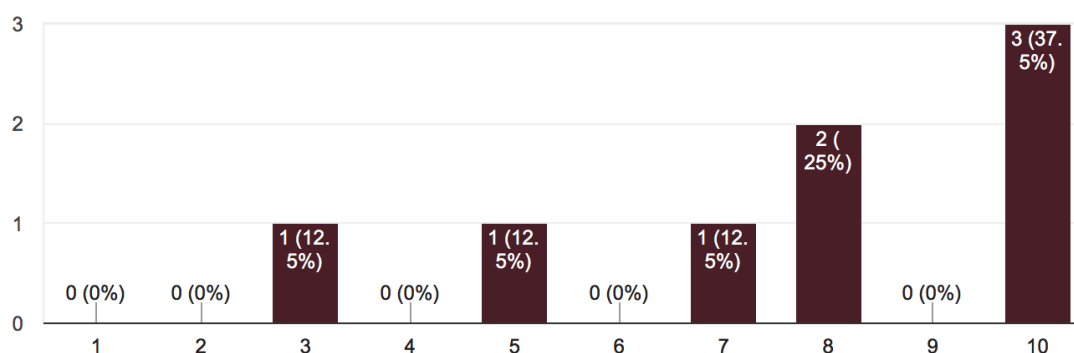
APPENDIX N: LOFI-TEST RESULTS

Quantitative results

LoFi quantitative data for question 1:

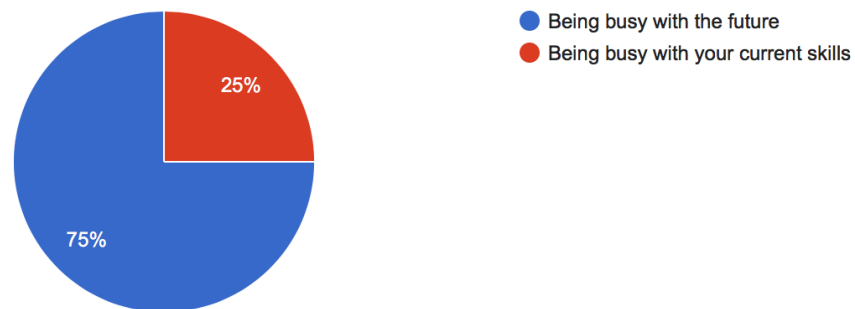
How sure are you about what you want for your minor? Are you confident?

8 responses



What do you think is important?

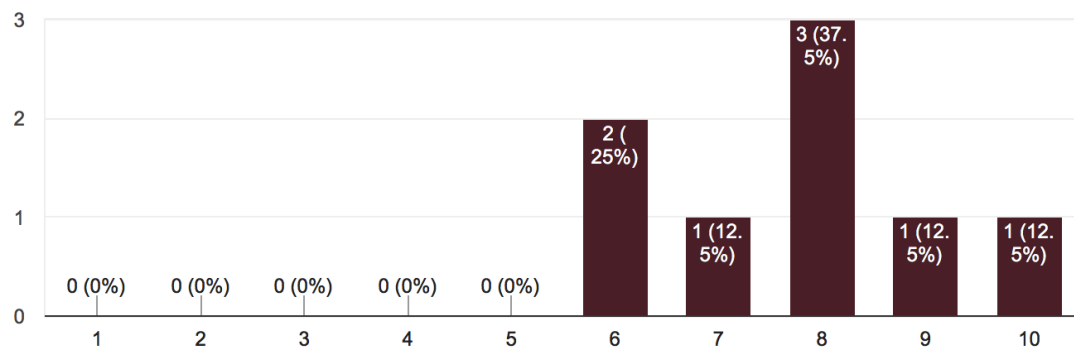
8 responses



Experience

This helped me to be more confident about my minor choice, with respect to your previous attitude?

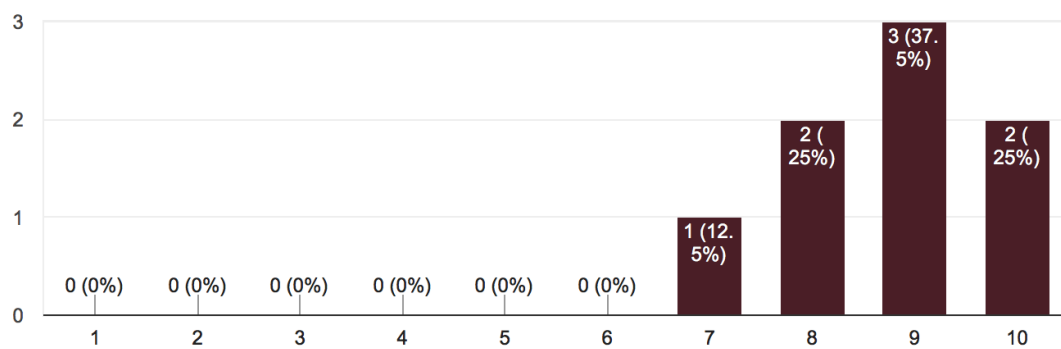
8 responses



Situation

This helped me to be more confident about my minor choice, with respect to your previous attitude?

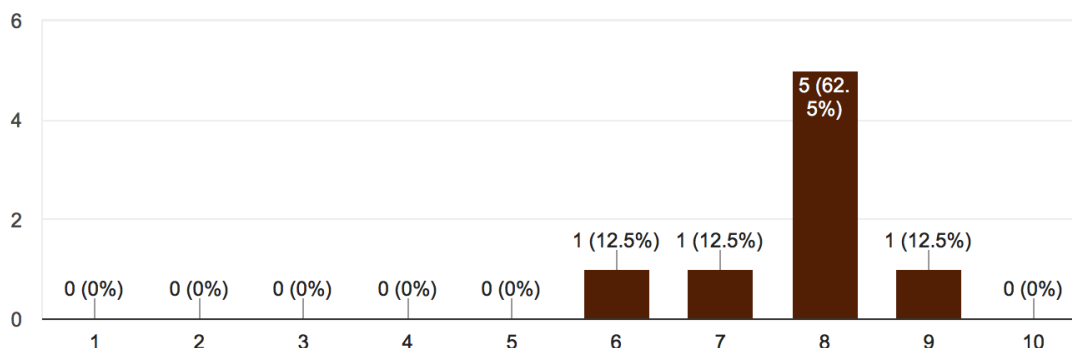
8 responses



LOFI QUANTITATIVE DATA FOR QUESTION 2:

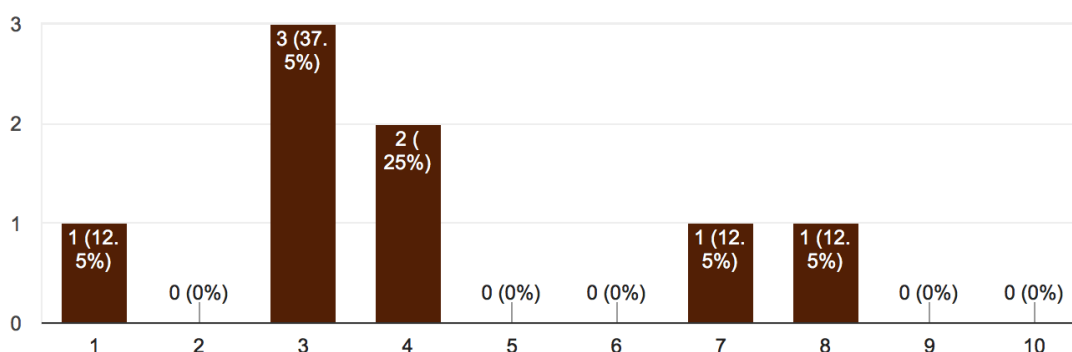
Did you felt you explored more about the experience or situation?

8 responses



Did you think filling this in costed you unnecessary time?

8 responses



APPENDIX O: VARIABLES

Situation:

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Clarification:

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Results: <text name="step_3_categories_ex.categorising.textfragment2"/>

Qualities:

Actor: <text name="step_4_qualities_ex.qualities_actor.textfragment"/>

Process: <text name="step_4_qualities_ex.qualities_process.textfragment"/>

Results: <text name="step_4_qualities_ex.qualities_results.textfragment"/>

Essentials:

Actor: <text name="step_5_essentials_ex.essentials_actor.textfragment"/>

Process: <text name="step_5_essentials_ex.essentials_process.textfragment"/>

Results: <text name="step_5_essentials_ex.essentials_results.textfragment"/>

Operationalizing:

Actor: <text name="step_6_operationlising.operationalize_actor.textfragment"/>

Process: <text name="step_6_operationlising.operationalize_process.textfragment"/>

Results: <text name="step_6_operationlising.operationalize_results.textfragment"/>

APPENDIX P: EXPERT EVALUATIE H. PROCEE

Waarom:

Studenten reflecteren tegenwoordig minder effectief en worden daardoor er lui in (reflectiemoeheid). Wat resulteert dat ze minder goed weten wat ze willen en er niet goed de tijd voor nemen, maw zichzelf niet meer leren motiveren.

Hierdoor gaat het oriënteren binnen de studie ook minder, daarom is reflecteren een mogelijke oplossing om beslissingen te kunnen maken binnen hun studie.

Hoe:

Door te reflecteren op een studie ervaring of een toekomst situatie die te maken heeft met hun professional development. Dit zal helpen met het oriënteren en helpen keuzes te maken. Wat uit zal vallen dat er een plan van aanpak komt hoe ze de kwaliteiten kunnen benutten, die ze nodig kunnen hebben om een goede keuzes te maken.

Wat:

Om een student hiermee te helpen heb ik een reflecteer instrument gemaakt. Het instrument interacteert met studenten, dit door het genereren van vragen die passen bij de situatieschets die is gegeven door de student. Samen met de student doorloopt het instrument zes stappen, deze zijn gebaseerd op de lijnreflectie methode. Tijdens deze stappen wordt verschillende per stap vragen gesteld aan de student. De antwoorden van de student worden opgeslagen, en uiteindelijk verwerkt in een lijn reflectie verslag. Die kan de student achteraf aanpassen om vervolgens te gebruiken tijdens het oriënteren.

The Evaluation:

1. Uitleg van het instrument:
 - a. De student:
 - i. Doorloopt de stappen die zijn gegeven.
 - ii. Antwoordt vragen die het instrument stelt.
2. Uitleg waarom keuzes gemaakt zijn:
 - a. Korte uitleg voor keuzes.
 - i. Oriënteren, minor
 - ii. Methode, lijn reflectie
 - iii. Keuzeboom
 - iv. Document, reflectie report

Henk:

Aandachtspunten van ons vorige gesprek:

- Doormiddel van de juiste vragen iemand laten na denken en tot nieuwe inzichten laten te komen.
- Henk stelt dat als je het hier over hebt er twee domeinen zijn, gesloten domein waar je alleen kan leren van je fouten en open domein waarin je open staat voor echte reflectie.
- Het essentieel is bij reflecteren dat studenten erachter komen hoe ze professioneel ontwikkelen. Een capaciteit van reflecteren is om verbanden te kunnen leggen, die andere niet zagen.
- Een voordeel van het instrument werd vervolgend besproken. Het is niet raar als studenten niet zeker zijn van wat ze zeggen. Studenten die open zijn kunnen dommen dingen zeggen daar worden ze onzeker van. Een machine, zo gezegd interesseert het niets wat een student zegt. Daarom kan een student daar alles in/aan kwijt, met andere woorden een student kan daar alles aan delen. Om vervolgens zelf het juiste eruit te filteren wat de student wilt delen met de docent/begeleider.
- Het instrument dat helpt bij reflectie kan helpen bij vragen stellen. Het zorgt ervoor dat je meer grip krijgt over je professionele ontwikkelingen.
- Studenten:
 - Speelse die reflecteren gemakkelijk vinden;
 - hard werkende die reflecteren moeilijker vinden;
 - en studenten die weten dat ze niet goed werken en daar werkt reflectie het beste.
- Bij alle is er meestal als uitkomst een toename in zelfvertrouwen.
- De doelen van reflectie is professionele ontwikkeling en kwaliteiten ontwikkelen.
- Twee methodes die daarbij helpen zijn lijn en driehoek reflectie. De ander twee methoden punt en cirkel zijn lastiger daarin toe te passen. Met punt is de methode te los en kan het te lastig zijn.
- Waarbij het kan lijden dat studenten niet eerder het gezien hebben. Dit biedt mogelijkheden om het te koppelen aan lijn- en driehoekreflectie, verder vragen door vragen. Kwaliteit achteraf is lastiger, omdat er geen absolute maatstaaf is en een computer geen oordeel kan geven.
- Het is beter als een instrument gemaakt wordt en dat dat vervolgens word uitgetoetst. Dan kan het ook meteen meer studieafhankelijk worden, omdat verschillende studies anders reflecteren vanwege de verschillende professionele doelen.

- De tool kan bieden (wat ook effect heeft) helpen met verdiepen (door vragen), systematiek bieden (lijn en driehoek methodes) en helpen met het schrijven van een report.
- Een belangrijk criterium is als een student iets leert wat diegene nog niet kon, goed of fout speelt hier geen rol in.

Evaluatie met het gesprek met Henk:

- Wat is uw reactie als u dit instrument ziet.
- Sommige speerpunten doorlopen.
- In wat voor opzichten ziet u hier nut in? Voorheen zei u dat het interessant kan zijn dat een student meer kwijt wil aan een systeem dan een mens.
- Hoe zou dit systeem nog beter uw idee van lijnreflectie kunnen vertegenwoordigen?
- In wat voor opzichten denkt u dat dit toepasbaar zou kunnen zijn?
- Punten voor verbetering?
- Wat voor vervolg onderzoek zou u nog aan willen raden?
- Wat heb ik over het hoofd gezien in het maken hiervan?

3. Toekomst van het instrument

- a. Implementeren in canvas
- b. Mogelijk verder onderzoek door andere studenten
 - i. Studenten voelen zich vrij om te antwoorden wat ze willen, ook geven ze aan dit makkelijker te vinden.
 - ii. Dat er een report eruit met wat ze gedaan hebben vinden ze prettig, en het geeft duidelijk hun reflecteer proces aan.
 - iii. De vragen zouden nog beter kunnen.

APPENDIX Q: EXPERT EVALUATIE KAREN

Waarom:

Studenten reflecteren tegenwoordig minder effectief en worden daardoor er lui in (reflectiemoeheid). Wat resulteert dat ze minder goed weten wat ze willen en er niet goed de tijd voor nemen, maw zichzelf niet meer leren motiveren.

Hierdoor gaat het oriënteren binnen de studie ook minder, daarom is reflecteren een mogelijke oplossing om beslissingen te kunnen maken binnen hun studie.

Hoe:

Door te reflecteren op een studie ervaring of een toekomst situatie die te maken heeft met hun professional development. Dit zal helpen met het oriënteren en helpen keuzes te maken. Wat uit zal vallen dat er een plan van aanpak komt hoe ze de kwaliteiten kunnen benutten, die ze nodig kunnen hebben om een goede keuzes te maken.

Wat:

Om een student hiermee te helpen heb ik een reflecteer instrument gemaakt. Het instrument interacteert met studenten, dit door het genereren van vragen die passen bij de situatieschets die is gegeven door de student. Samen met de student doorloopt het

instrument zes stappen, deze zijn gebaseerd op de lijnreflectie methode. Tijdens deze stappen wordt verschillende per stap vragen gesteld aan de student. De antwoorden van de student worden opgeslagen, en uiteindelijk verwerkt in een lijn reflectie verslag. Die kan de student achteraf aanpassen om vervolgens te gebruiken tijdens het oriënteren.

1. Uitleg van het instrument:
 - a. De student:
 - i. Doorloopt de stappen die zijn gegeven.
 - ii. Antwoordt vragen die het instrument stelt.
2. Uitleg waarom keuzes gemaakt zijn:
 - a. Korte uitleg voor keuzes.
 - i. Oriënteren, minor
 - ii. Methode, lijn reflectie
 - iii. Keuzeboom
 - iv. Document, reflectie report

Karen, speerpunten:

- Het beter is om met iemand persoonlijk te spreken. Meer authenticiteit.
 - Wat is u mening over het gebruik van dit instrument? Uw reactie?
 - Wat zou u aanraden om te verbeteren?
 - Wat heb ik niet goed gedaan?
 - Wat is uw mening over de toepasbaarheid van dit instrument?
 - In welke opzichten zou dit instrument nog verder onderzocht kunnen worden?
3. Toekomst van het instrument
 - a. Implementeren in canvas
 - b. Mogelijk verder onderzoek door andere studenten
 - i. Studenten voelen zich vrij om te antwoorden wat ze willen, ook geven ze aan dit makkelijker te vinden.
 - ii. Dat er een report eruit met wat ze gedaan hebben vinden ze prettig, en het geeft duidelijk hun reflecteer proces aan.
 - iii. De vragen zouden nog beter kunnen.

APPENDIX R: USER EVALUATION

APPENDIX R.1: USER EVALUATION STRUCTURE

For the logbook different collars are used to highlight the finding and keep a simple overview of the results

Positive argument

Negative argument

Design mistakes

Before:

If your mentor would ask you to use a reflection instrument to be help you with your minor choice, would you use it? – Why:

What would motivate you?:

Start time

During:

Exp or Sit:

Logbook:

After:

What did you noticed the after the use? Direct feedback:

What do you think about the ...?:

- Questions:
- Layout:
- Design:

Go to forms.

What do you think about how much time it cost? *Time:*

In what way did it helped you, become more self-confidence?

How would you be more motivated? Example seeing the report?:

What is your opinion about the report and what is noticing you? Do you may feel you want to rephrase sentences?

If your mentor would ask you to use a reflection instrument to be help you with your minor choice, would you use it? – Why

If time is on my side I want to conduct a small research after, to check if the reflection was effective. Would you like to help me? – Yes, can I save your document, name and mail?

Name:

Mail:

Docu:

APPENDIX R.2: USER EVALUATION - QUALITATIVE

User 1 – 3th year

Before:

If your mentor would ask you to use a reflection instrument to be help you with your minor choice, would you use it? – Why:

Wel, soms heb je ook blik van zij nodig. Verplicht meer moet, je bent zelf bewuster van goede keuze. Iemand anders kan beter inschatten wat je wil. Iemand anders kan je misschien beter helpen, beter helpen.

Start time

During:

Logbook:

Exp or sit:

- Onduidelijk voor exp of sit
- Wat bedoel je met de situatie.
- Niet duidelijk welke vraag je moet opschrijven.

Spel: “you be positive way suprised”

- Text box groter
- “Actor moet ik mezelf opschrijven?”
- Waarom zet je niet student – vergeet best snel
- Goede vragen
- Goed proces begin tot eind?
- Spellings check
- Leuke vraag -reflecteert wat heb ik als keuze gehad, bewust wat ga ik er leren. Dit is de keuze zie ik wel wat ermee gebeurd. Nuttig voor later als je het gedaan hebt.
- Duidelijkheid wat van je verwacht wordt.
- De steps zijn duidelijk weet je hoever je bent
- HAHA leuke vraag
- Duidelijke vraag, mijlpaal
- Tekst erboven te zetten want je loopt er niet lekker doorheen
- Wat helpt -> introductie warm maakt
- Categorieën herhalen
- Onduidelijk over stap 6
- Vermoeid na een tijd – 30 min
- Wow grappig
- Leuk van report
- Niet verwacht – leuk want je bent dingen aan het doornemen, stappen aan volgt

After:

What did you noticed the after the use? Direct feedback:

Niet verwacht – leuk want je bent dingen aan het doornemen, stappen aan volgt

Begin, vak termen die gebruikt werden. Achteraf duidelijker. Misschien opwarmen zodat je vaktermen, als je hebt over process. Definieren waar je hebt over hebt! Gaaf waar je het over hebt.

What do you think about the ...?:

- Questions: nog niet duidelijk lay out, reflective vragen had kunnen vragen. Hebt antwoord in je hoofd ga je voor deze weg.
- Layout: niet chill
- Design: hoe ver je al bent in het process.

Rode draad qua woorden dat duidelijker wordt.

Begin eind lang antwoord vs kort antwoord. Motivatie

Go to forms.

What do you think about how much time it cost? Time: 32.58

Process prima, dus moest terug halen hoe je de keuze had gebaseerd. Als je middenin zit.

In what way did it helped you, become more self-confidence?

Niet zou denken bepaalde mijlpalen zet, niet weet wat je kan verwachten. Beeld voor mezelf 30 punten halen, ik zie wel hoe het loopt.

What is your opinion about the report and what is noticing you? Do you may feel you want to rephrase sentences?

De kernwoorden definiëren in survey. Wat er van je gevraagd wordt. De phases weg laten meer verassend. Maar de stappen niet uitleggen.

If your mentor would ask you to use a reflection instrument to be help you with your minor choice, would you use it? – Why

Ja denk wel dat het goed is voor je results.

Geeft plan van aanpak en aanleiding om je keuze te maken.

If time is on my side I want to conduct a small research after, to check if the reflection was effective. Would you like to help me? – Yes, can I save your document, name and mail?

Name: Rachelle Kraal

Mail: r.e.kraal@student.utwente.nl

Docu:

Vervolg stappen, plan van aanpak moet je als conclusie.

Doorheen liep wiebelig vragen waar je niet van verwacht.

Kern woorden duidelijk

Opwarming

Wat je wil

User 2:

Before:

If your mentor would ask you to use a reflection instrument to be help you with your minor choice, would you use it? – Why:

Prima, nee

Start time

During:

Logbook:

- Pijltjes
- Afgekapt van tekst onderaan
- Wit ruimte
- Zijn beide niet verbonden?
- Je weet minor maar hoeft geen pre master
- Vragen naar stap 2
- Doel van verassen?
- Verassen in de toekomst
- Clar snap niet waar de vragen op slaan?
- Tekst vak moet groter, (bij because ...)
- Schrijft op!
- Tekst die er al staat weg halen?
- Proces wordt niet goed begrepen (of wel)

Klikt als eerste vragen aan

- Refl questions, pop up van onder verwacht je dat iets verschijnt. Onduidelijk
- Maakt opmerking klopt niet in volgorde ben lekker aan het typen
- eerst pop up balk daarna pas vraag
- essentieel 1 vraag moet veranderen, moet 1 antwoord of meerdere?
- Leest vragen en denkt erover na

After:

What did you noticed the after the use? Direct feedback:

- Lay out wit ruimte!
- Veel effectiever
- vragen dubbelop
- wat betekent het kopje

What do you think about the ...?:

- Questions: dubbelop
- Layout: wit ruimte
- Design: stanard programma

Go to forms.

What do you think about how much time it cost? Time: 20.40

Vond meevallen

In what way did it helped you, become more self-confidence?

Je was al zeker

What is your opinion about the report and what is noticing you? Do you may feel you want to rephrase sentences?

Diepgang, niks

If your mentor would ask you to use a reflection instrument to be help you with your minor choice, would you use it? – Why

Optie aankaarte

If time is on my side I want to conduct a small research after, to check if the reflection was effective. Would you like to help me? – Yes, can I save your document, name and mail?

Name: Kevin Folkertsma

Mail: k.folkertsma@student.utwente.nl

Docu:

User 3:

Before:

If your mentor would ask you to use a reflection instrument to be help you with your minor choice, would you use it? – Why:

I would like it, there little guidance at the moment.

Start time

During:

Logbook:

- Arrows, what is next?...
- Is keeping nice track is understanding
- Also write down??
- Type in the block
- Not sure about the first question,

Heeft nog steun nodig bij het antwoorden van de eerste vraag. Valt terug op de partner.

Ziet hem even moeilijk denken over de vraag.

- Clar -> what do I need to answer, can I pick one

Is nodding yes, is understanding it

- Would the actor be me?

Gaat eerst naar tekstbox en vult het in. En klikt daarna pas de andere vragen. -> lay out

Which question do I need to answer... The order has to chance

- Make it clear what the reflective questions are.

Wordt moe na 20.13 raakt uitgeput.

After:

What did you noticed the after the use? Direct feedback:

Big white space, centered in the screen

Refl be on top box

What do you think about the ...?:

- Questions: repetitive
- Layout: white space
- Design: highlite important of question

Go to forms.

What do you think about how much time it cost? Time: 25.06

Many question, cut on the questions.

In what way did it helped you, become more self-confidence?

Well taken the whole process, to reflect on process. The fact that you are doing it.

Guiding questions new aspects

What is your opinion about the report and what is noticing you? Do you may feel you want to rephrase sentences?

Color scheme, colors good and bad scale

I would rephrase some aspects changing scentence not meaning

If your mentor would ask you to use a reflection instrument to be help you with your minor choice, would you use it? – Why

If no mentor than would you

Good first step

I made already my choice, if you already made one is less effective (reflection)

If time is on my side I want to conduct a small research after, to check if the reflection was effective. Would you like to help me? – Yes, can I save your document, name and mail?

Name: jannis brand

Mail: j.brand@student.utwente.nl

Docu:

User 4:

Before:

If your mentor would ask you to use a reflection instrument to be help you with your minor choice, would you use it? – Why:

Advise more components to research, to explore and find out more aspects.

Start time

During:

Logbook:

- Do not understand the question, how do I interpreted it?
- Same as other questions

Skipped questions he did not know how to answer them.

Is going well through the questions.

- The refl questions have to be above the answers in order to help the students to think about them.

After:

What did you noticed the after the use? Direct feedback:

Introduction was not clear. The important points were not highlighted. The important parts.

White space, lay out. Design

Clarification questions, needs to be random, because they related the things before

Questions were confusing -> confused, order of the questions

What do you think about the ...?:

- Questions: order, the questions is not much to adjust thy were fine. Only the order was weird.
- Layout: white space
- Design: has to be better

Go to forms.

What do you think about how much time it cost? Time: 19.30

Time was not an issue. It did its job

In what way did it helped you, become more self-confidence?

No, because did not clarify

More specific, intergrate which minor information. Much more clearly.

What is your opinion about the report and what is noticing you? Do you may feel you want to rephrase sentences?

It should be alright, example might color the options. If they are given -> example outside the answer box

If your mentor would ask you to use a reflection instrument to be help you with your minor choice, would you use it? – Why

Nice state to development, it is an option. It is time consuming, because it works faster that could make it more appealing.

If time is on my side I want to conduct a small research after, to check if the reflection was effective. Would you like to help me? – Yes, can I save your document, name and mail?

Name: Chulakit Dumnoenchavanit

Mail: c.dumnoenchavanit@student.utwente.nl

Docu:

User 5:

Before:

If your mentor would ask you to use a reflection instrument to be help you with your minor choice, would you use it? – Why:

Alweer zon ding... hangt ervan af of je er problemen mee hebt gehad. Mening.

Start time

During:

Logbook:

Step 2 vragen

- Veel keuzes welke past er hebt beste bij
- Lastige clar vragen, niet even uit mn hoofd
- Het is moeilijk om te weten wat je in de toekomst gaat verassen.

Blijft lang in stap 2 vragen hangen

- Is niet zeker van antwoorden
- Clar vragen - “gewoon random 1 aanklikken?”
- Heeft problemen tijdens het invullen met grote van vak
- Step 3 vragen – wat wordt hiermee bedoeld?

Toont bij stap 4 tekenen van luiheid

Drukte eerst op tekstbalk eronder

- Step 4 snapte niet goed wat het inhield

Is goed bezig met het process en kijkt naar alle vragen, lijkt meer focus te hebben

- Beantwoord alle refl vragen en kijkt er goed naar
- “tja...” lastig om antwoord te geven
- “Geeft aan dat het makkelijk is om als je aan het begin zit dit makkelijker te doen
- Lastige te vragen, “ik weet het antwoord niet! Heb er nooit over nagedacht”
- “mag ik dat ook specifiek voor mijn minor invullen?”

!!! MOET duidelijk zijn dat alles ingevuld mag worden

After:

What did you noticed the after the use? Direct feedback:

Thermologie, zinsbouw en makkelijker

Lastige vragen, in mijn situatie. Meer gericht waren op mensen die geen keuze gemaakt hebben

What do you think about the ...?:

- Questions: gericht sitautie
- Layout: vraag en refl vragen
- Design:

Go to forms.

What do you think about how much time it cost? Time: 27.54

Duurde wel wat lang

In what way did it helped you, become more self-confidence?

Zelfverzekerder geworden, je denkt meer na

What is your opinion about the report and what is noticing you? Do you may feel you want to rephrase sentences?

Tijd zou hebben dingen te veranderen.

If your mentor would ask you to use a reflection instrument to be help you with your minor choice, would you use it? – Why

Zou wel nuttig zijn, forceert je beter na te denken over keuzes

How would you be more motivated? Example seeing the report?:

Denk niet dat me dat zou helpen, misschien door gehad wat het met elkaar te maken had.

If time is on my side I want to conduct a small research after, to check if the reflection was effective. Would you like to help me? – Yes, can I save your document, name and mail?

Name: Jasper Peetsma

Mail: jasperpeetsma@gmail.com

Docu:

User 6:

Before:

If your mentor would ask you to use a reflection instrument to be help you with your minor choice, would you use it? – Why:

Oh weer een instrument, geloof daar niet zo in. Komt door middelmadere school verleden.

What would motivate you?:

Goede verhalen van andere

Start time

During:

Logbook:

- Pijltje daarna klikken? Welk pijltje
- Step 1, wat moet ik hier invullen is onduidelijk
- Step 1, po que 4 wat bedoel je hiermee?
- Clar, is wederom niet duidelijk wat hiermee bedoeld word. Dacht dat het gerelateerd was aan de vorige vragen
- Clar 5 onduidelijke vraag

Is even aan het denken wat er moet gebeuren

- “Hoe werkt dit?? Bij refl vragen”
- Process over het reflecteren, is niet duidelijk dat het over de situatie gaat

Vind het makkelijk

After:

What did you noticed the after the use? Direct feedback:

Gericht je moet kiezen, had al gekozen. Paar vragen klopte niet.

Wat denk je te kiezen?

What do you think about the ...?:

- Questions: situatie gericht zijn,
 - Layout: text bloke groter, hulp vragen boven
 - Design: midden, kleur knopje
- Go to forms.*

What do you think about how much time it cost? Time: 18.30

Tijd prima, voorbeelden van minor

In what way did it helped you, become more self-confidence?

Zelfde gebleven

What is your opinion about the report and what is noticing you? Do you may feel you want to rephrase sentences?

Weet niet of een mentor hier iets mee kan, hier een mentor iets meek an. Intresse test.

If your mentor would ask you to use a reflection instrument to be help you with your minor choice, would you use it? – Why

Nee, liever niet. Een lijst hebben

How would you be more motivated? Example seeing the report?:

Stel je hebt per minor, iets stel je hebt dit gemaakt. Vak specifiek, als je een keuze wilt maken.

If time is on my side I want to conduct a small research after, to check if the reflection was effective. Would you like to help me? – Yes, can I save your document, name and mail?

Name: Niek Boersen

Mail: n.boersen@student.utwente.nl

Docu:

User 7 – 3th year:

Before:

If your mentor would ask you to use a reflection instrument to be help you with your minor choice, would you use it? – Why:

Denk dat het wel een goede is om meet te starten.

What would motivate you?:

Iets minder kaal interface, inhoudelijk wel klopt

Start time

During:

Exp or Sit:

Lasting om te doen want heb het al gedaan

Logbook:

- “wat moet ik hier doen?” – vak invullen
- Interface -> niet duidelijk dat je daar moet gaan typen
- Clar -> waar slaat dit op.

Gaat snel door de vragen heen

- Wat heb je aan de clar vragen?
- Sommige zijn abstract
- Bij essen -> wat moet ik met die vragen? Moet ik ze goed voorbereiden of wat moet ik doen?
- “ik snap deze vraag niet” essen -> resul
- Formulering
- Stap 6 snap ik niet -> thermologie

After:

What did you noticed the after the use? Direct feedback:

Developer om een goed programma te maken, geen zin heb om serieus genomen te worden.

Intrinsieke motivatie om al een keuze gemaakt te hebben.

Report is leip, overzichtelijk

What do you think about the ...?:

- Questions: kan helpen tot antwoord
- Layout: is lasting lijdt af is niet logisch
- Design: report design is goed

Go to forms.

What do you think about how much time it cost? Time: 18.45

Tijd prima

In what way did it helped you, become more self-confidence?

Reeding different viewpoints about the situatioan

What is your opinion about the report and what is noticing you? Do you may feel you want to rephrase sentences?

Report is heel gaaf, erg duidelijk en nuttig. Heel gaaf

If your mentor would ask you to use a reflection instrument to be help you with your minor choice, would you use it? – Why

Helpt zeker aan de begin fase om te onderzoeken

If time is on my side I want to conduct a small research after, to check if the reflection was effective. Would you like to help me? – Yes, can I save your document, name and mail?

Name: Wouter Drion

Mail: w.r.b.drion@student.utwente.nl

Docu:

User 8 - 3th year:

Before:

If your mentor would ask you to use a reflection instrument to be help you with your minor choice, would you use it? – Why:

Ja ik zou het wel gebruiken

What would motivate you?:

Omdat ik wil mijn reflectie wil doen over mijn studie

Start time

During:

Exp or Sit:

Duidelijk omschreven

Logbook:

Valt op dat ze meteen kan gaan typen

- Slaat vraag over omdat ze op elkaar lijken
- Step 2 , po que 4, onduidelijk
- Clar, is random, niet duidelijk wat bij wat hoort
- Lay out vragen is erg onduidelijk
- De vragen zijn goed en heb ik al eerder ook gedaan
- “overzicht van wat je hebt gedaan”, thermologie is niet duidelijk, wat zijn de categorieën.

Gebruikt de vragen balk goed en denkt erover na

Vind voorbeelden die gegeven staan goed.

Heeft moeite met het nadenken over de antwoorden, maar denkt er wel over na alleen gaat er te snel overheen.

After:

What did you noticed the after the use? Direct feedback:

Fijn dat je dingen op een rij zet, dat je op een rij zet, wat je doel is. Is fijn

Verwarrend met programma -> grotere tekst bokks

Reflective overzicht. Nog niet opties! Moet koppelen

What do you think about the ...?:

- Questions: goed alleen veel op elkaar lijkende vragen
- Layout: tekst box groter
- Design:
Go to forms.

What do you think about how much time it cost? Time: 12.05

Perfect, niet te vee

In what way did it helped you, become more self-confidence?

Wil niet dat het zekerder, zeg meer op een rij

What is your opinion about the report and what is noticing you? Do you may feel you want to rephrase sentences?

Niet aanpassen

Fijn dat je een overzicht hebt

If your mentor would ask you to use a reflection instrument to be help you with your minor choice, would you use it? – Why

Kan sowieso, alle tools gebruiken die kan

Report vooraf zal helpen om het in te vullen

If time is on my side I want to conduct a small research after, to check if the reflection was effective. Would you like to help me? – Yes, can I save your document, name and mail?

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Mail: j.m.hoedemakers@student.utwente.nl

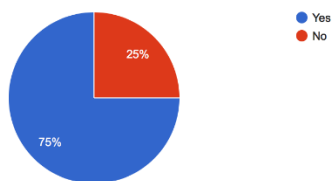
Docu:

APPENDIX R.3: USER EVALUATION – QUANTITATIVE

Before use:

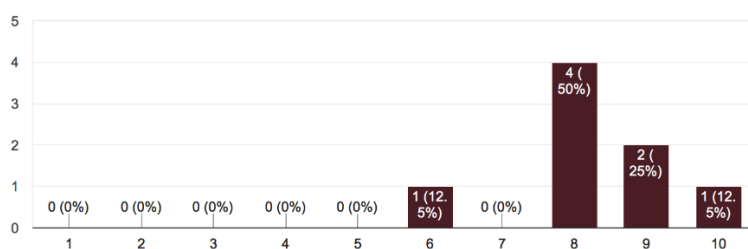
Have you ever reflect about your minor choice?

8 responses



How confident are you currently about your minor choice?

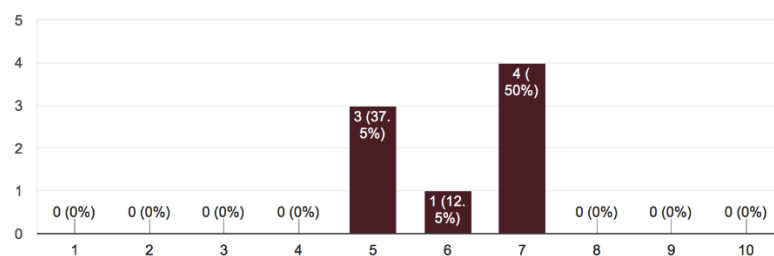
8 responses



After use:

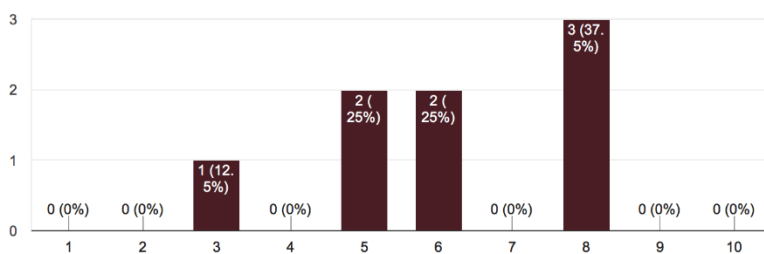
Did you enjoyed using of this instrument?

8 responses



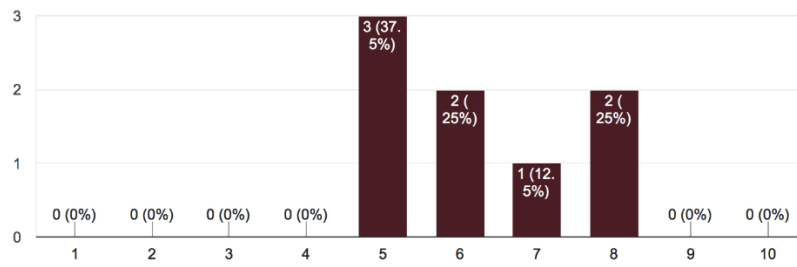
Can you rate you enthusiasm ?

8 responses



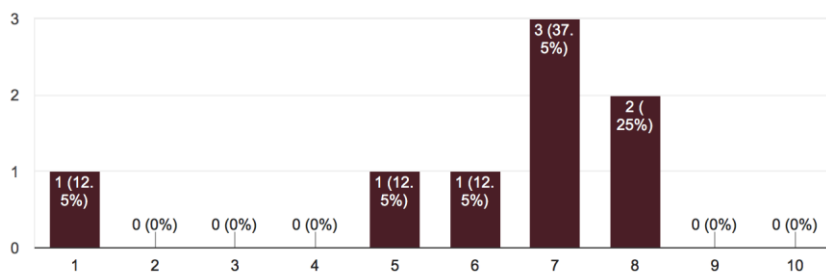
Did you think it cost too much time?

8 responses



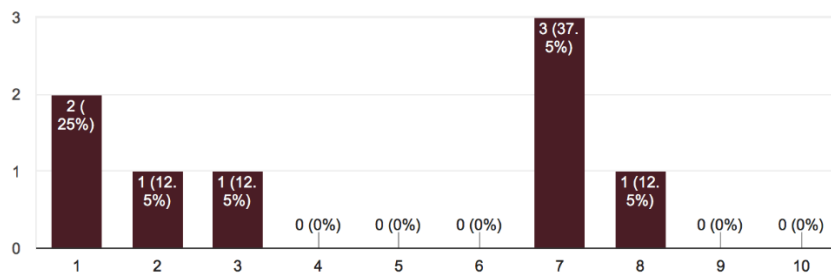
Did you become more (self)confident about your minor choice?

8 responses



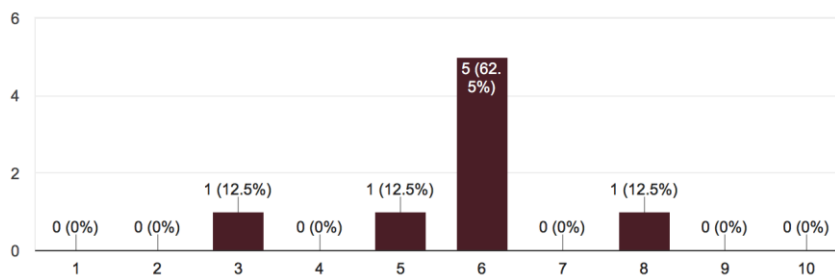
Do you feel you got new insights after using?

8 responses



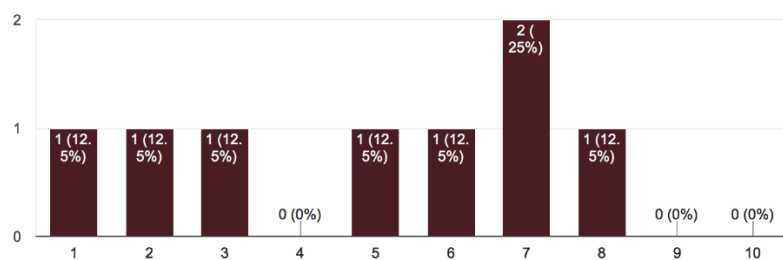
Do you thought about new viewpoints considering your minor choice?

8 responses



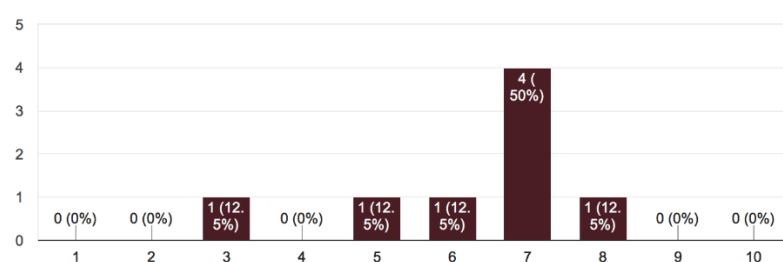
Are your choices more explicit?

8 responses



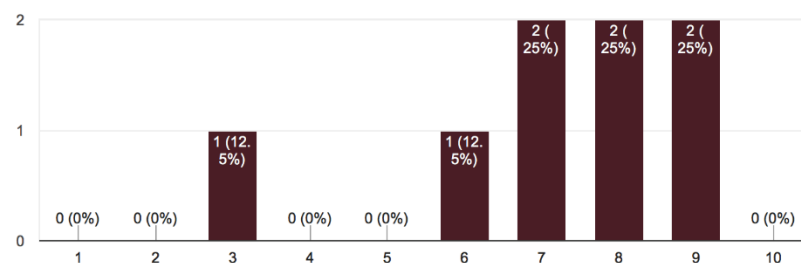
Will this help develop the quality of your situation?

8 responses



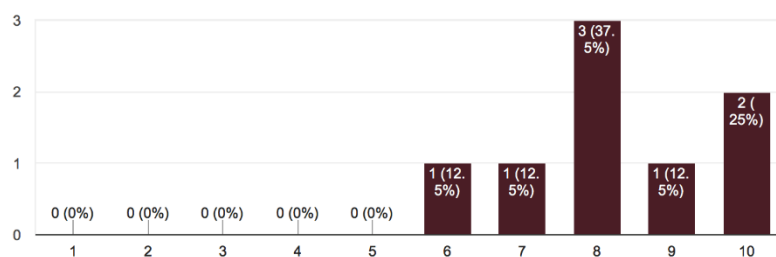
Is the report representative for your reflection?

8 responses



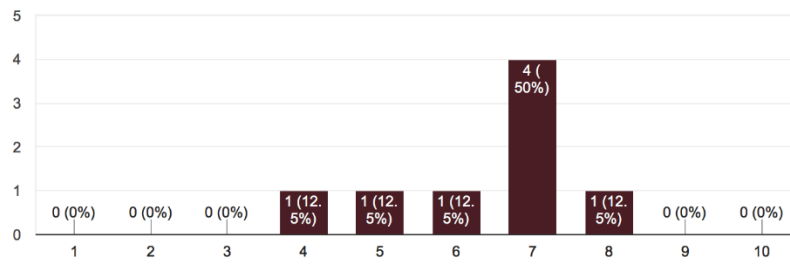
Did you feel free to give all the answers you want?

8 responses



How would you rate the questions?

8 responses



How would you rate the flow and style?

8 responses

