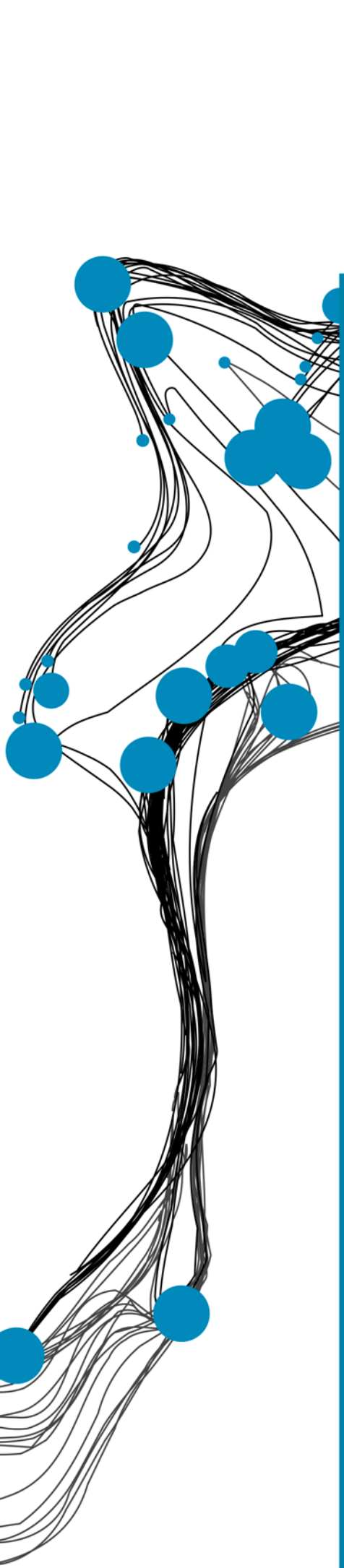

Bachelor Thesis

Optimising the ATQP-process at Company X

22-7-2020

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Industrial Engineering and Management

UNIVERSITY OF TWENTE.

Optimising the ATQP-process at Company X

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Preface

I would like to present my bachelor thesis for the Industrial Engineering and Management programme to you. This bachelor thesis was conducted at Company X and revolves around optimising the ATQP-process.

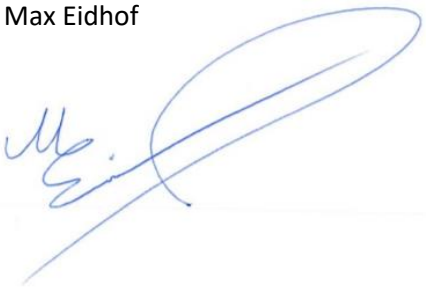
I was thrilled when I heard that I was allowed to perform my bachelor thesis at Company X; a pioneer in its field of business. I would like to thank Company X for facilitating this bachelor thesis.

I would like to thank my supervisor for supervising me at Company X. They gave me the opportunity to research the ATQP-process and supported me in my efforts. Furthermore, I would like to thank everyone that I have worked with within the Y department; I felt welcome and taken seriously within the department from the start. I would like to thank everyone who has contributed to my research by participating in interviews or in any other way.

Lastly, I would like to thank my UT-supervisors Mike Monson and Abhishta Abhishta for their valuable feedback that was used to improve this thesis. I would especially like to thank Mike for investing so much time in me and my research.

I hope you enjoy reading this thesis.

Max Eidhof



Hengelo, July 2020

Management Summary

Problem context
Company X is divided into several departments, such as department Y. The Alternative Training and Qualification Programme (ATQP) is a method of training pilots that allows Company X to deviate from the traditional method of training pilots. The goal of the programme is to create pilot training that meets the specific training requirements of the Company X pilot corps. This is done by analysing data from previous training sessions and using that data to tailor the training programme for the next year. The ATQP-process is the process of collecting and analysing the data from the training programmes and formulating new training programmes based on these analyses. According to Company X, the productivity of the ATQP-process is low. It was determined that this lack of productivity has multiple causes. However, the core problem of this low productivity is the limited usability of training data. To solve this core problem, the following research question was formulated: '*How can Company X improve the use of training data within the ATQP-process, in order to increase productivity?*'

Research Goal
The goal of this research is to find a method to improve the productivity of the ATQP-process by addressing the core problem. This is done by formulating a conceptual design of an information system, in which the content, structure and presentation requirements of the data are formulated. This conceptual design can inform the development of a solution that can then be implemented by Company X.

Research approach
The ATQP-process functions through people deploying IT-applications, therefore, this research is going to be executed from an Information Systems (IS) perspective. To structure the research, the Managerial Problem Solving Method (MPSM) and Design Science (DS) provide a theoretical perspective. Structured interviews were used to gather information for formulating a detailed description of the current situation and to determine requirements for the conceptual design.

Conceptual design
The Conceptual design consists of an information system that complies with recommendations on content, structure and presentation of the data within the context of the ATQP-process:

Content

- Make sure that the Power Point presentations made by the AET are available to the training design team.
- The training design team should determine the desired pass rates for the AFCAD-questions that they formulate.
- Correlations between AFCAD-questions can be calculated. These correlations can be shown to relevant stakeholders by means of a table.

Data structure

- Mention which SHAPE-aspect is being assessed with an AFCAD-question and save this in the question data.
- Describe the task that is being assessed with a certain AFCAD-question and save this in the question data
- Implement a method to grade crews on their performance on SHAPE-aspects. This scale should be ranging from 1 to 5, where 1 is poor and 5 is excellent. This should help to extract more concrete data from AFCAD-questions.

- Eliminate event data. This is an unnecessary complication of the ATQP-process. This can be done when the crews' performances on SHAPE aspects are assessed per question instead of per event.

Data presentation

- Implement a dashboard that is used by both the AET and the training designers. The dashboard consists of two tabs that give actors within the ATQP-process insight in data from previous years' training and data of one specific training.
- A dashboard is an excellent tool to resolve some data content issues. Data from the past can efficiently be presented and all AFCAD-questions can actually be read in a dashboard.
- A concept dashboard was made. This concept is an indication of what can be done with a dashboard. To have this dashboard fully functioning, the other recommendations should be followed, especially on data structuring.

Furthermore, Company X should assign a process owner to the ATQP-process who is responsible for the operation of the process. This should improve coordination between AET and the training design team.

Conclusion

Following this research, it can be concluded that there are several issues within the ATQP-process that should be resolved:

- Missing data content
- Poor data presentation
- Subjectivity of data
- Lack of coordination

These problems are addressed by the conceptual design. Implementing the conceptual design should therefore lead to improved productivity within the ATQP-process.

Recommendations

- Company X should implement the conceptual design. This should lead to higher productivity within the ATQP-process.
- Users of the dashboard should have access to a description of relevant events.
- Users of the dashboard should have the ability to view comments that were made by instructors
- Company X should consider implementing the conceptual design simultaneously with TOXX.
- Company X should continue to use Wieringa's (2014) engineering cycle to evaluate the implemented conceptual design and to continuously improve the ATQP-process.
- Calculating correlations between AFCAD-questions is the lowest priority issue of the conceptual design. This is not crucial and could potentially be very time intensive.

Table of Contents

1. Introduction

This bachelor thesis will focus on optimising the 'Alternative Training and Qualification Program' (ATQP) at department Y of Company X . Company X perceives that productivity within the ATQP-process is too low. Therefore, the aim of this thesis is to formulate a conceptual design of an information system that addresses this low productivity.

Department Y is a fairly new department within Company X. It has been established to optimise training execution and to make sure training quality is on point. The department also keeps track of administration; e.g. making sure pilot licenses are submitted for approval in time. Department Y is a sub-department of Company X Flight Operations, which in turn consists of all departments that work on keeping the Company X fleet in the air.

The ATQP is a method of training pilots and allows Company X to deviate from the traditional method of training pilots. The goal of the programme is to create pilot training that meets the specific training requirements of the Company X pilot corps. This is done by analysing data from previous training sessions and using that data to tailor the training programme for the next year. See appendix 1 for the complete description of ATQP according to the ATQP manual (2020).

A training session consists of multiple events that are divided into tasks that a crew has to execute. During a training session, an instructor assesses the crew that is being trained by answering predefined 'AFCAD-questions'[1] about the performance of the crew. The answers given by the instructor are stored in a central database. As there are thousands of pilots working at Company X, there are also thousands of training sessions conducted each year. The answers gathered in all these training sessions are combined in the AFCAD database.

The answers to the AFCAD-questions that are stored in AFCAD are used by the ATQP Expert Team (AET). The AET consists of 8 pilots; 2 representing each pilot division. Within Company X there are 4 pilot divisions, specialised on flying a specific aircraft type. Currently, the Company X pilot divisions can be split into B737, B777/787, B747 and A330. The AET analyses the answers to the AFCAD-questions. During this analysis, the AET determines which tasks in the training were executed well and which tasks in the training were not executed well by the flight crews. To verify that the analysis of results is in compliance with the rules set by the Dutch authorities, an ATQP-specialist of NLR (Netherlands Aerospace Centre) is present.

[1] AFCAD is the application that instructors use to answer questions. AFCAD-questions are the questions that instructors answer regarding the performance of the crew.

After analysing the data from previous training sessions, the AET reviews what is in the Task Database. In the Task Database, the training frequencies[2] of all tasks can be found. Based on the required training frequencies, the AET can determine whether a specific task has to be in next year's training.

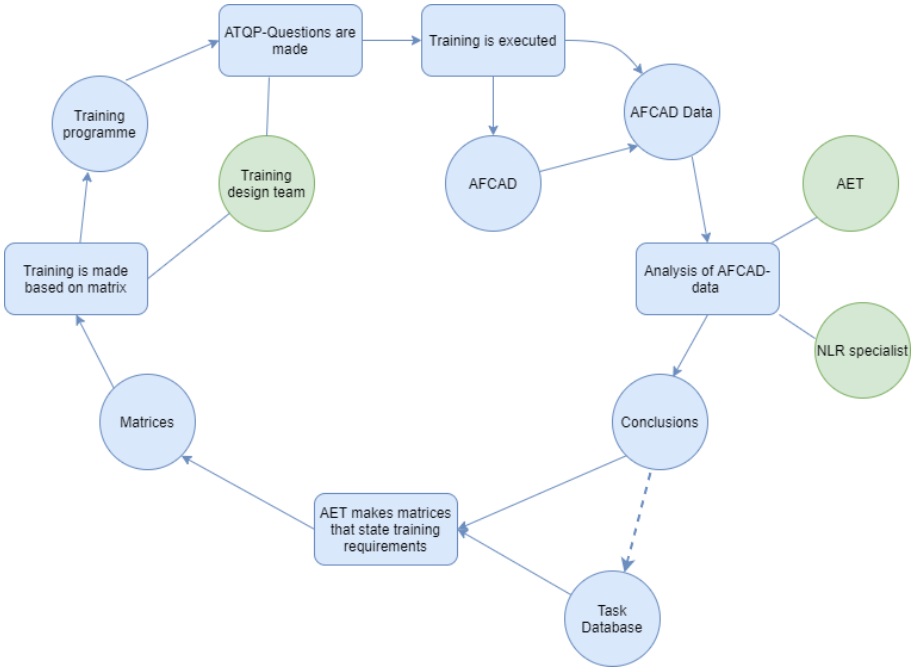


Figure 1: The ATQP-process visualised

The Task Database is subject to change. If many flight crews did not have any difficulty executing a certain task, it might be wise to decrease the training frequency of this task. If many crews did have difficulty executing a certain task however, it might be wise to increase the training frequency of this task. If a change in training frequency is deemed necessary, the training frequency of this task is changed in the Task Database.

When the AET has reviewed the Task Database and has determined which tasks have to be in next year's training, matrices are made. These matrices state what tasks should be in the next training.

After analysing the matrices from the AET, training designers start compiling a training programme consisting of the tasks stated in the matrices. After the training programme is set up, the training designers think of AFCAD-questions that instructors will answer during the new training session. The answers to these AFCAD-questions form the foundation of the next analysis by the AET. Therefore, it is of vital importance that these AFCAD-questions are formulated properly.

1.1 Problem identification

As mentioned earlier, Company X perceives that productivity within the ATQP-process is too low. However, the company has no system in place to measure productivity within the ATQP-process. People involved in the ATQP-process state that productivity within the process is low. This means that the evidence of the ATQP-process being unproductive is anecdotal. To determine what the main cause of the low productivity is, the ATQP-process was analysed and a visualisation of the current ATQP-process (figure 1) and a problem cluster (figure 2) were made. For a detailed description of problems that are arising in the ATQP-process, see appendix 3.

[2] The training frequency of a task determines how often it has to be in a training. This can be every year, every two years, or even every five years depending on the task.

1.1.1 Core problem

To visualise the problems occurring in the ATQP-process, the problem cluster in figure 2 was made. The red problems are potential core problems. The limited usability of training data lies at the core of most other problems in the ATQP-process. Solving it should thus lead to the most significant productivity improvement. For instance, the AET receives unedited data every time they analyse data, making the data hard to use. This unstructured way of working leads to AET-members spending too much time on figuring out how to visualise and subsequently analyse the data from training sessions. This in turn leads to a shortage of time to analyse the data, resulting in poor data presentation to the training designers in the matrices. Training designers do not exactly know what the AET wants to measure, due to information in the matrices being too vague. This leads to AFCAD-questions being vague or not measuring what the AET wants to measure.

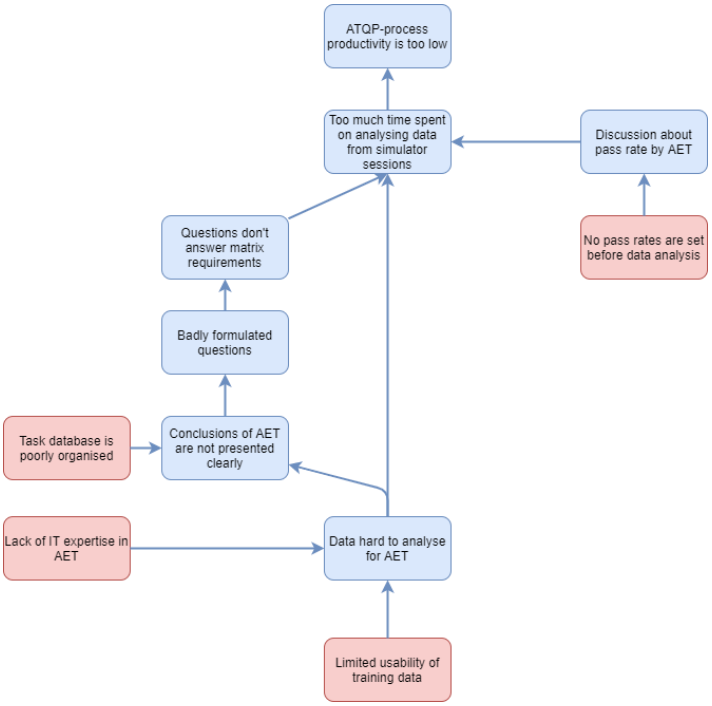


Figure 2: Problem cluster

It can be concluded that limited usability of training data causes disruptions throughout the whole ATQP-process. In the end, this leads to the ATQP-process being unproductive. Therefore, it is the core problem within the ATQP-process.

1.1.2 Research Question

To solve the core problem stated above, the following research question has to be answered: '*How can Company X improve the use of training data within the ATQP-process, in order to increase productivity?'*

2. Research

2.1 Problem approach

Before the main research question can be answered, the concept of 'training data' in the context of the ATQP-process has to be defined. In this case, training data consists of all information that is used to design the training programmes, which is ultimately the goal of ATQP. Think of the answers to the AFCAD-question, the matrices made by the AET and the AFCAD-questions itself. To address the core problem, the core problem should be classified. The ATQP-process consists of IT-applications and people who run these applications. According to Peffers, Tuunanen, Rothenberger, & Chatterjee (2008), '*Information Systems (IS) is an applied research discipline, in the sense that we frequently apply theory from other disciplines, such as economics, computer science, and the social sciences, to solve problems at the intersection of information technology (IT) and organizations (p. 46).'* As the ATQP-process lies at the intersection of IT and organisations, the research discipline best used to solve the core problem is Information Systems (IS).

To formulate a clear and concise answer to the main research question, the concept of data will be split up into content, structure and context. Splitting up the concept of data into three clear focus points should lead to research questions that are clear and to the point. Content, structure and context determine whether data can fulfill its desired functions. In the case of this research, the function that the training data needs to fulfill is a more productive execution of the ATQP-process. In the end, the goal of the research is to determine what content and what structure of the training data are needed in the context of the ATQP-process to increase productivity in the ATQP-process.

2.1.1 Activities

Before an answer to the main research question can be formulated, a clear overview of the ATQP-process is required. In order to fully understand the ATQP-process, the following has been done:

- Define Stakeholders within the ATQP-process.
- Interview Key actors within the ATQP-process.
- Describe the current situation and its problems.

After an overview of the ATQP-process in its current form was sketched, the roles and data needs of different actors in the process were defined. In order to discover the needs in terms of data and data presentation, structured interviews with important actors in the ATQP-process were conducted. The questions that were asked during these structured interviews can be found in appendix 2. After the interviews were conducted, a conceptual design was formulated on how the usability of data from training sessions can be improved in order to increase productivity within the ATQP-process. This is a conceptual design of an Information System. After the conceptual design was formulated, it was validated. This validation was done by expert opinion. The opinions of the experts within the ATQP-process were gathered by means of a focus group. During this focus group, the conceptual design was presented to relevant experts, who could express their views on the effects that this conceptual design would cause if implemented. After validation was completed, a conclusion was drawn. Based on these conclusions and the discussion, recommendations were made to Company X.

2.2 Research Design

To design a conceptual design of an information system that solves the core problem, three aspects have to be taken into consideration (Grabowski, Grein, Milde, & Weber, 1995):

- static aspects represented by the data structure;
- dynamic aspects (procedures) of the information system concept comprise both software features and operation mode;
- organizational aspects determining authorization and views within the information system.

In light of the three aspects mentioned above, two problem statements were formulated. Under these problem statements, their respective knowledge questions are described. These knowledge questions should lead to answers that are needed to formulate a conceptual design of an information system. In the table in appendix 4, the research design for every knowledge question can be found.

What does the ATQP-process look like in detail?

1. What functions exist within the ATQP-process and what is their purpose?
2. By whom and how are the different functions performed?
3. How is data transferred between different functions in the ATQP-process?
4. In what formats is data from previous training sessions currently stored in different stages of the ATQP-process?

What are the data-requirements of different teams to improve data usability within the ATQP-process?

5. What data structure is required by the AET?
6. What data content is required by the AET?
7. What data structure is required by training designers?
8. What data content is required by training designers?

Most questions can fully be answered by conducting interviews. Question 4 can be answered by investigating the data that is being used. The interviews should not lead to vague answers that need interpretation from the interviewer. Therefore, structured interviews were used as the method to interview respondents. Answers given by respondents should require as little need for interpretation as possible. To achieve this, the interview questions are tailored to determine the content and structure of the data that are needed to achieve the desired function. There are also some questions that highlight the context in which the data is going to be used. Tailoring the interview questions to a specific topic; content, structure or context in this case, should lead to more specific and useful answers from respondents. The interview questions can be found in appendix 2. In appendix 5, a matrix in which the goals of the questions asked is depicted.

Structured interviews were selected so answers to questions can be compared to each other and to minimise subjectivity. During a structured interview, a list of predetermined questions is asked to all respondents. By asking all respondents the same questions, answers to these identical questions can easily be compared. Furthermore, open-ended questions are avoided as much as possible, to minimise the need for interpretation of answers.

To make sure that the interviewees understand what is being meant with the questions, the current data and the way it is structured is shown to them. Also, the full ATQP-process is concisely explained. By doing this, interviewees have the data and the process fresh in their minds, giving them the ability to make useful suggestions for improvement.

2.2.1 Deliverable

The main deliverable resulting from this research will be an conceptual design on how the use of training data within the ATQP-process can be improved. This will be a conceptual design of an Information System. Company X can use this conceptual design to develop a solution to the core problem. As the ATQP-process is a process that takes a year to complete, it is very unlikely that Company X will be able to implement the information system that is described in the conceptual design and evaluate the results within the set time. To determine what the effects of the conceptual design will be if implemented, it is of vital importance that it is validated (Wieringa R. J., 2014). Therefore, the conceptual design is going to be evaluated by conducting a focus group with relevant experts. This focus group should give an indication of the expected performance if conceptual design

were to be implemented. Based on this validation, recommendations are made for Company X. Based on this recommendation, Company X can decide whether to develop a solution based on the conceptual design or not.

2.2.2 Limitations

A clear limitation of this research is time. There are only 10 weeks available to finish the bachelor thesis and present it during the colloquium. Because of this time constraint, Company X is most probably not able to implement the conceptual design within the restricted time. Therefore, validation interviews instead of measurements are going to be conducted. Time can also be a limitation when conducting interviews. Interviews can be very time consuming, especially when they are un- or semi structured. This is mainly due to interviewees being able to elaborate on certain aspects and come with their own input. Using structured interviews should limit the time it takes to conduct interviews.

2.2.3 Validity

There are a couple validity threats to this research. Firstly, an interviewer might interpret the answer of an interviewee differently to what the interviewee actually meant (Alsaawi, 2014) . Also, different interviewees might interpret questions differently from one another. This leads to a threat to validity. To mitigate this validity threat, the interviewer should immediately intervene if the participant misunderstood a question. On top of this, if the interviewer is uncertain whether they have interpreted the answer of the respondent correctly, the interviewer should repeat what they have understood from a certain answer an interviewee has given. This gives the interviewee the chance to correct the interviewer if they have misinterpreted the answer the interviewee has given.

Shortly after research at Company X was started, the coronavirus spread worldwide and brought commercial aviation to a virtual standstill. Company X operates at only 10% of its original capacity at the moment of writing. This drastic decrease in capacity has huge implications on pilots and instructors, who make up almost the entire research population. Due to the virus and the crisis surrounding it, the research population might not take the research on ATQP seriously and think their priorities lie elsewhere. This might have an effect on participation or the quality of the answers. As such, extreme events like the coronavirus might be a threat to internal validity of surveys (Heerkens, 2015). To make sure that participants take this research seriously, structured interviews are going to be used instead of surveys.

This research is not geared towards developing a general theory or method that can be applied outside Company X's ATQP. Therefore, external validity is not as important in this thesis as construct- and internal validity. The results that follow from this thesis might be applicable to the handful of airlines that actually use ATQP. However, it is unknown in what way other airlines use ATQP. This makes it almost impossible to judge whether the proposed advice can be used in other circumstances; the environment of this research is unique (Heerkens, 2015).

2.2.4 Reliability

The main threat to reliability in interviews are open-ended questions. Some questions in the structured interview are open-ended. Therefore, reliability on the long term could become an issue. Answering an open-ended question twice will almost never lead to exactly the same answer. E.g. if a certain respondent is interviewed about the same topic multiple times, the outcome will never be exactly the same. The respondent might have changed opinion about a certain topic, or might have gained some insights that weren't available in the past. This poses a threat to the reliability of open-ended questions. Therefore, open-ended questions should be avoided as much as possible to obtain data that is as objective as possible.

2.3 Theoretical perspective

It is important to define the theoretical perspective that the research is going to be based on. A theoretical framework can be a guideline for setting up and conducting research, and should prevent a researcher from forgetting to execute crucial steps in their research.

2.3.1 MPSM

The first theoretical perspective that is going to be used is Heerkens' Managerial Problem Solving Method (MPSM). This methodology is going to be used, because it brings structure to the research and can be used as a framework to set up the research. The MPSM consists of the following steps (Heerkens & van Winden, 2017):

1. Defining the problem
2. Formulating the approach
3. Analysing the problem
4. Formulating (alternative) solutions
5. Choosing a solution
6. Implementing the solution
7. Evaluating the solution.

Aforementioned steps help to make a proper plan of approach for this bachelor thesis.

2.3.2 Design Science

The MPSM is not tailored to Information Systems (IS). As the ATQP-process is an Information System, it would be helpful to approach this problem from a theoretical perspective based on Information Systems. Design Science (DS) is a theoretical perspective that does just that. According to Hevner, Park & March (2004), *'Design Science creates and evaluates IT artifacts intended to solve identified organizational problems*' (p.77). According to Wieringa (2014), *'A design science project iterates over the activities of designing and investigating. The design task itself is decomposed into three tasks, namely, problem investigation, treatment[3] design, and treatment validation. (p.27)'*

Peffers et al. (2008) came up with the Design Science Research Methodology, or DSRM, that focuses on the production and presentation of DS research (p.48). The DSRM combines different elements from DS. The DSRM consists of the following activities:

1. Problem identification and motivation
2. Define the objectives for a solution.
3. Design and development.
4. Demonstration.
5. Evaluation
6. Communication.

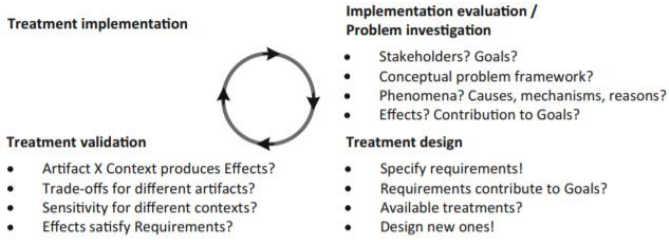


Figure 3: Wieringa's Engineering Cycle (Wieringa R. J., 2014, p. 28)

Wieringa (2014), came up with the Design Cycle, which consists of problem identification, treatment design and treatment validation. The Design Cycle is part of the Engineering Cycle, which can be found in figure 2.

Within this research, implementation of the conceptual design will not be possible due to time constraints. Within the available time, it is simply not possible to define the core problem, set

[3] Wieringa refers to treatment, because the word solution *'blinds us for the possibility that an artifact may solve a problem only partially or maybe not at all (p.28).'*

objectives and create and implement a fully functioning information system. Based on Wieringa's Design Cycle and the DSRM, the three DS activities that are going to be performed in this research were defined. These can be found in table 1. After evaluating the proposed advice and drawing conclusions based on this evaluation, it is up to Company X to decide whether to implement the conceptual design or not.

In the end, the MPSM will be used as the main guideline for the structure of this report and the way the research will be executed. Design Science on the other hand will be used as a guideline to set requirements for the conceptual design and therefore contribute to an advice on how to solve this specific IT-problem. Of course, there is some overlap between the MPSM and DS. Step 1 for instance is practically identical in both methodologies. However, while step 4 of the MPSM states 'Formulating (alternative) solutions, DS elaborates on how to specify requirements for potential solutions. All in all, these two theoretical perspective complement each other nicely. Table 1 depicts how the different steps of both methodologies complement each other.

Table 1: Overlap MPSM & DSRM

Chronological order during research	MPSM	DS
1.	Step 1: Defining the problem	Step 1: Problem identification and motivation
2.	Step 2: Formulating the approach	
3.	Step 3: Analysing the problem	
4.	Step 4: Formulating alternative solutions	Step 2: Specify requirements of solution
5.		Step 3: Evaluate the solution
6.	Step 5: Choosing a solution (This is up to Company X)	

3. Results of interviews

Members of both the AET and the training design team have been interviewed. The questions that were asked during these structured interviews can be found in appendix 2. The interviews were recorded with permission of the interviewees. The recordings were used to make an overview of the answers and to present the results. An overview of the results per interview question can be found in appendix 2. In this chapter, the results of the interviews are discussed. The total number of respondents is 13. This included 7 members of the AET, and 6 members of training design team.

3.1 Method

Within the interview, there are some open questions. To be able to analyse the answers to these open ended questions, certain elements that are present in these answers were listed. For instance, analysing the following answer to question 4 can be hard: 'Analysing results from previous training curricula and using this analysis to formulate matrices for the training designers.' This is just one of the 13 answers that were given to question 3. To be able to extract useful data from all these answers, the main points that were made in each answer are written down. In the case of this answer, these are 'Formulate matrices' and 'Analysing previous training results'. Whenever a respondent mentions something about making, formulating or creating matrices, this is counted as mentioning 'Formulate matrices'. The same holds for any of the other categories that can be found in appendix 2. To come up with categories of statements like this, the statements of respondents are analysed and key words that seem to capture the key thoughts of the respondents are highlighted. By applying this process over multiple responses, 'labels of codes emerge that are reflective of more than one thought' (Hsieh & Shannon, 2005, p. 1279). These 'codes' are then sorted into different categories, e.g. 'formulate matrices' or 'update task database'. These categories can then be used to analyse the open-ended questions of the interview. Respondents will have different ways of explaining the same phenomenon. Formulating categories of statements will help during the analysis of these answers. By formulating categories of statements, the frequencies of these categories occurring can be determined. By doing this, the priorities of the respondents on certain aspects can be determined. Defining categories and names for these categories during data-analysis can be described as conventional content analysis (Hsieh & Shannon, 2005).

3.2 Respondents

For this research, 6 training designers and 7 members of the AET were interviewed. Of these 13 respondents, most of them are Senior instructor (77%), followed by Basis instructor (15%), followed by pilot (8%). Senior Instructors are more experienced than basis instructors, who on their turn are more experienced than pilots. 61% of interviewees have been involved in the ATQP-process for 5 years or more, while the remainder of the interviewees (39%) has 2 years of experience within the ATQP-process or less. There is a clear division of more experienced and less experienced actors within the ATQP-process. There is also a clear division of more experienced and less experienced actors between the AET and the training design team. Within the AET, there is only one respondent who has been involved in the AET 1-2 years. All others (86%) have 5 years of experience or more. Within the training design team, 33% of respondents has 5 years of experience or more, while the other 67% has 2 years of experience or less.

3.3 Main duties

Every team member was asked to describe the main duties that their team performs. This question was asked to determine whether all team members have the same view of what their team is doing. As described in section 3.1, the answers that were given to question 3 were categorised into the statements that can be found in figures 4 and 5. All AET-respondents mentioned formulating matrices as one of their core duties, this indicates that all AET members agree that this is one of their core duties. Analysing previous results and updating the task database were not mentioned by all respondents. Most respondents agreed that analysing previous results is part of their duties. Opinions are mixed on updating the task database, only 3 of the 7 respondents mention doing this. This could be due to the fact that not all members of the AET have access to the task-database. If they want to alter the training frequency of a certain task, this needs to go through someone who does have access to the Task-database. One respondent mentioned that the AET is in charge of evaluating the whole ATQP-process.

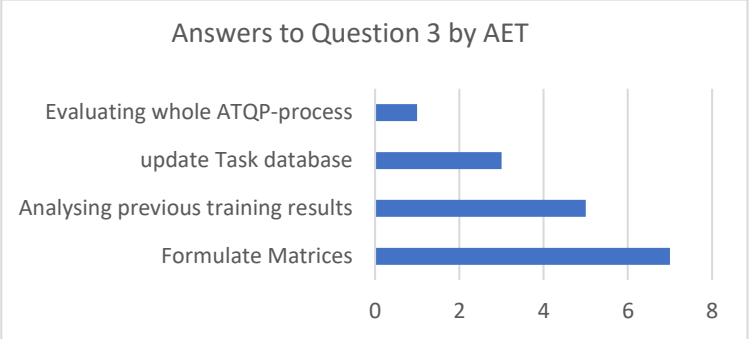


Figure 4: Answers to question 3 by AET

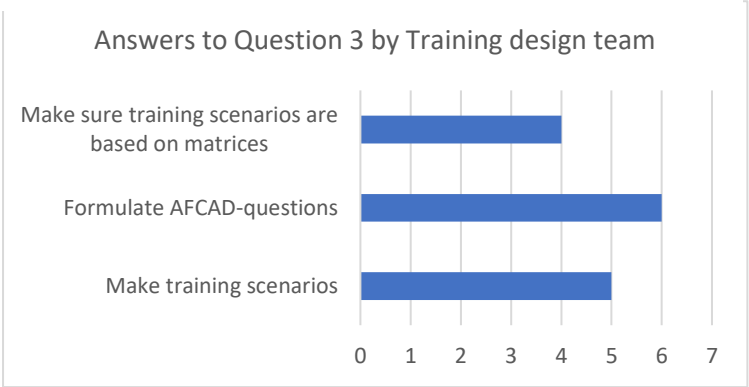


Figure 5:Answers to Question 3 by training designers

The training designers were pretty much unanimous in the description of their duties. Two respondents did not mention the matrices specifically.

3.4 Data presentation

Respondents were given five statements about the data that is being presented to them. 4 of which are about the way the data is presented to the respondents.

The AET is clearly more negative than the training designers when it comes to the presentation of digital data. 4 AET members disagreed with the statements that the data that they need to perform their duties is easily accessible, while 2 AET members even strongly disagreed. The same held for the ease of use of the applications that are used to analyse the AFCAD-data. This means that 86% of AET members think negatively about on-screen data presentation and ease of use of applications. When it comes to the written documents that the AET receives, most respondents were positive about these documents; 5 respondents stating that they agree that reports are clearly laid out, and 1 respondent even stating that they strongly agree. This comes down to 86% of AET members thinking positively about the lay-out of the received reports.

The training designers were more negative about the written data that they receive than about the digital data. This can be explained by the fact that the training designers use the matrices as input for their training designs. These matrices are not elaborate, according to respondents. The training designers rely fully on the data that they receive from the AET. As a result of this, training designers' opinions on the accessibility of the data, the on-screen presentation and the applications used to analyse the data were pretty scattered.

Respondents were also asked to indicate what they would like to see regarding data-presentation. To make sure that respondents would stay on track and to make sure their answers would be specific, they were presented a list of options of which respondents could select more than one answer (see appendix 2, question 7). Respondents could also leave one suggestion if they felt their preferred data-presentation element was not on the list.

The answer option that was selected most among all respondents was adding filters so actors can filter and tailor the presented data to their needs. This answer option was selected by 77% of respondents. More graphs and pre-filtering of the data were also mentioned often (54% of respondents), as well as sorting possibilities. (62% of respondents selected this option).

Members of the AET also selected the addition of filters most; 86% of respondents selected this answer option. Members of the AET were also positive about pre-filtering the data; 71% of AET-members selected this option. A majority of respondents (54%) selected adding more graphs in the data-presentation. The AET didn't seem as enthusiastic about adding sorting possibilities for the data as the training designers however. Only 43% of respondents selected this answer option, while it was the most selected answer in the training design team. Notably, all personal suggestions that were made came from members of the AET. 2 AET-members (28,6%) suggested giving instructors a couple of options when filling in comments instead of free text[4]. This would make presentation and thus interpretation of these comments much easier according to these two respondents.

In the training design team, 83% of respondents selected the option to add sorting possibilities in the data presentation. A majority of training designers also liked the idea of adding filters at 67%. The training designers were not at all enthusiastic about using a single application across the whole team. Not a single respondent selected this answer option.

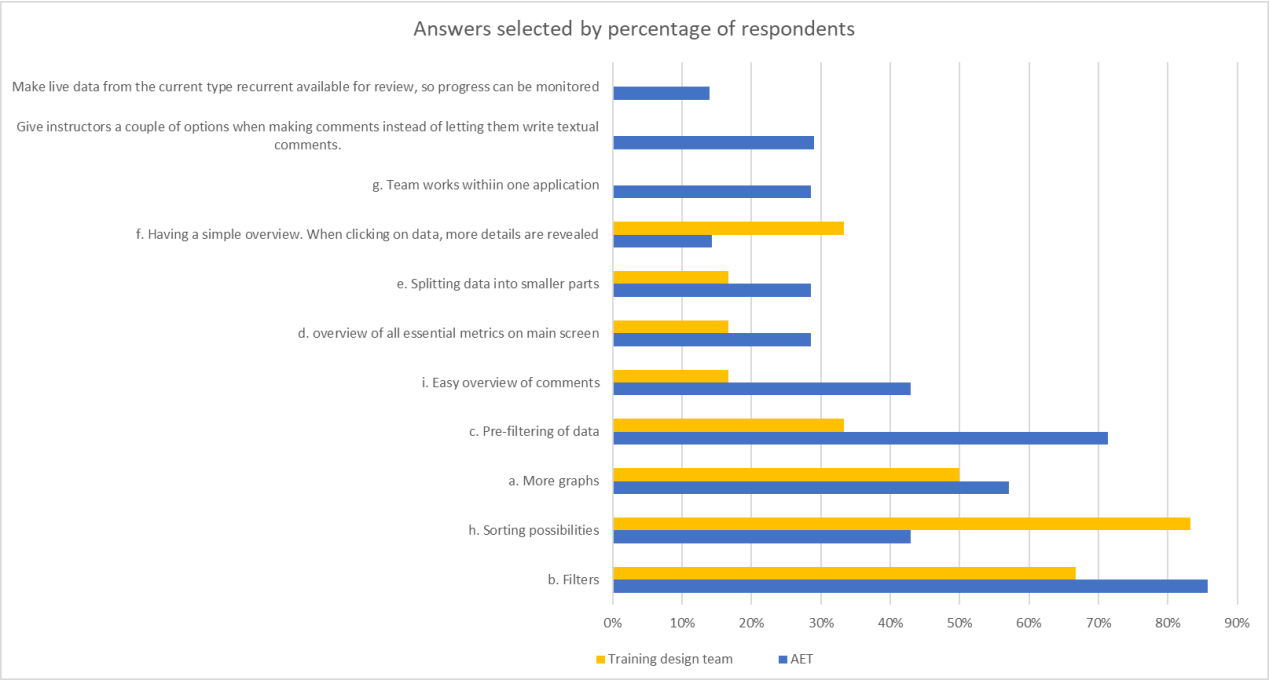


Figure 6: Data presentation requirements

[4] Instructors are asked to comment on why a certain crew scored a 'not-desired' score on a certain question. Some instructors write really long comments that take much time to read and interpret.

3.5 Data content

Respondents were asked to state whether they agreed with the statement that the data that is presented to them is complete. The AET was slightly divided on this issue. However, 3 respondents agreed with this statement, while 2 respondents stated they were neutral. In the end, the AET was more positive about this than negative. Within the training design team, there was a similar pattern.

Respondents were also asked to indicate how many data-items they were missing in the current data that they use as input for their analysis. Most respondents stated that they were missing three items (7) , while 4 respondents stated that they were missing 4 or more items during their analysis. 2 respondents stated that they are missing 2 data-items during their analysis. Both AET and training designers showed similar opinions.

After asking the number of items respondents are missing, respondents were also asked to come up with three data content-items they are currently missing and would like to have in the future. Respondents were asked to rank these items from 1 to 3. 1 being the most important item, 3 being less important.

The first priority for all but 2 respondents was having data from the past available. Currently, the training data that actors within the ATQP-process receive is based on only one year of training. Respondents would like to have access to data further in the past, so trends can be spotted. Seeing the development of the Company X pilot corps on different skills over time is a major part of the ATQP after all. Meanwhile, one member of the AET said having motivations of instructors on giving a certain score is the most important content that they are missing. One training designer stated that they would like to have access to the data in the first place, as they could not access this data.

When looking at the second most important content that is missing according to all respondents, being able to see AFCAD-questions itself was mentioned most often, followed by correlations between questions. All other suggestions were made once. Also, having data from the past available was mentioned again. Within the AET, correlations between questions and being able see the AFCAD-questions itself were mentioned twice, while being able to see percentages of desired/not desired observations and having data from the past available were mentioned once. Within the training design team there was a remarkable split in answers; every single respondent gave a different suggestion.

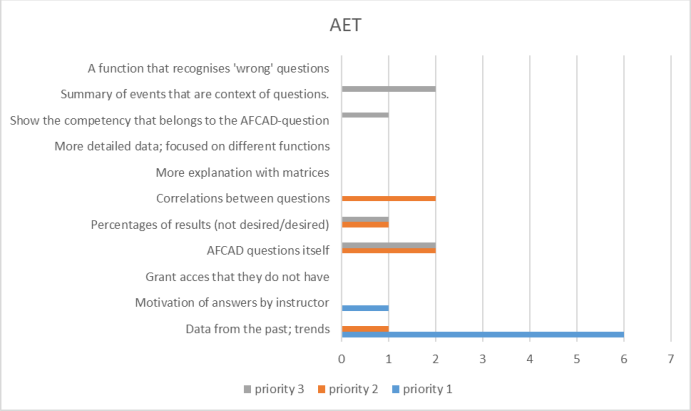


Figure 7: AET and their data content requirements

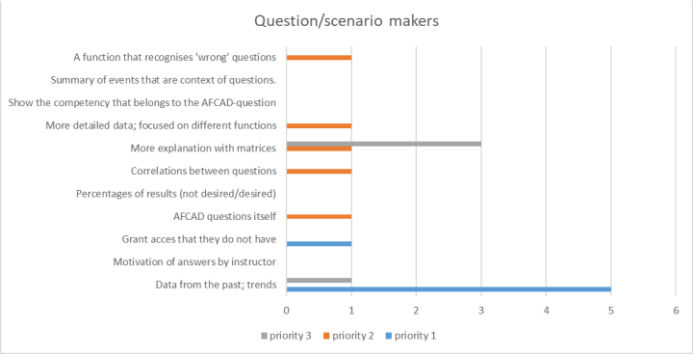


Figure 8: training design team and their data content requirements

As third priority, having more explanation with the matrices was mentioned most, followed by being able to see the AFCAD-questions. The suggestion of having a more detailed explanation with the matrices was made only by training designers. Notably, having data from the past available was mentioned again. This means that every single respondent mentioned having access to data from the past is desirable. Within the AET, seeing the actual AFCAD-questions and having a summary of

the events that took place in the training that is being analysed were mentioned twice, while Linking AFCAD-questions to competencies [5] and seeing percentages desired/not desired instead of absolute values were mentioned once. Within the training design team, 3 respondents suggested having more explanation with the matrices, while 1 respondent mentioned they would like to see data from the past.

The total number of times every statement was mentioned was determined as well. As mentioned before, every single respondent mentioned that having data from the past available to them is something they would like to see. The statement mentioned the second most in total, was having the AFCAD-questions available instead of just the question numbers. However, within the AET, this was found more important than within the training design team; The AET accounted for 80% of the recorded statements about having AFCAD-questions available. The statement mentioned third most often in total was having a more detailed explanation of the tasks in the matrices. All statements regarding more explanation with the matrices were made by training designers. As a result, this was the second most mentioned statement within the training design team. Curiously though, 75% of respondents who mentioned that they would like more explanation with the matrices stated this as their third most important issue.

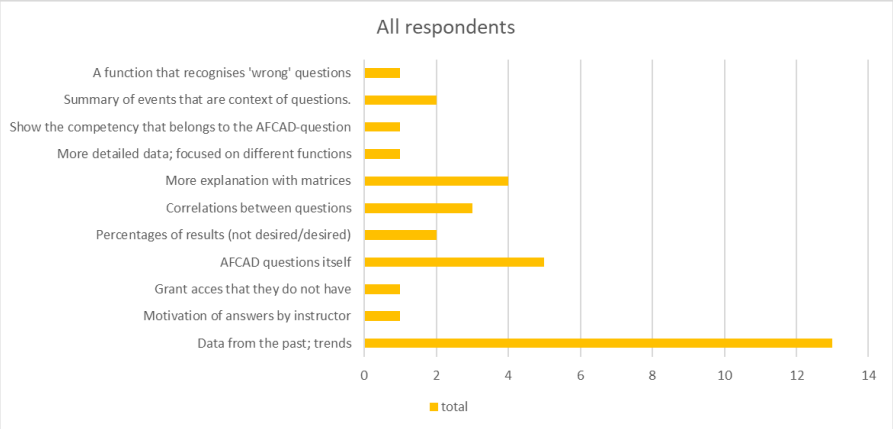


Figure 9: Unprioritised content requirements of all respondents

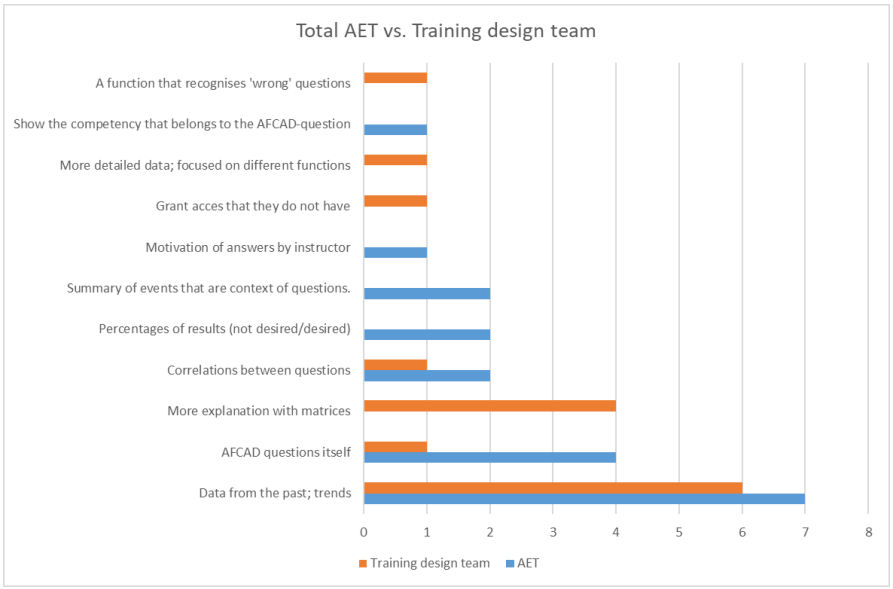


Figure 10: Unprioritised content requirements, AET vs. training design team

A striking difference in content requirements is the fact that 67% of training designers stated that they would like more explanation with the matrices. 0 AET-members stated this, as they make the matrices. Furthermore, 1 member of the training design team mentioned having the actual AFCAD-questions themselves would be helpful. At the same time, 4 AET-members (57%) stated this would help them execute their ATQP-duties. Having insight in the percentage of desired vs. not desired outcomes instead of only the absolute numbers was requested by two AET members, while none of the training designers thought this is something they are missing. The same holds for having a summary of the events that took place during the training that is being analysed. The other suggestions that were mentioned by only one of the two teams only had one response.

[5] All competencies are described in 'SHAPE'. These SHAPE-aspects can be linked to a specific AFCAD-question.

3.6 Time consuming activities

Respondents were asked to think of the activity that takes most time to execute within their duties. Within the AET, 57% of respondents stated that interpreting data is the most time consuming activity within the duties of the AET, followed by working with the Task database and editing data so it is usable.

Within the Training design team, 50% of respondents stated that formulating questions takes most of their time, followed by writing the instructor document. One respondent said setting out requirements for the upcoming training takes most time. In their statements, training designers mentioned that the difficulties in formulating questions and setting out requirements are mainly due to difficulties in interpreting the matrices. Therefore, data interpretation is the main time consuming activity for both the AET and the training design team.

Table 2: Time consuming activities for the AET

AET	Number of statements	Percentage of statements
Editing data	1	14%
Interpreting data	4	57%
Working with the Task database	2	29%
total	7	100%

Table 3: Time consuming activities for training design team

Training design team	Number of statements	Percentage of statements
Formulating questions	3	50%
Writing instructor document	2	33%
Set out requirements for training (sprint 1)	1	17%
total	6	

3.7 Activities that cause problems

Respondents were asked to think of the activity that causes most problems in their opinion. Responses were varying quite a lot. It was not really possible to group statements together more, as this would not justify the meaning of the statements. Therefore, multiple categories with relatively little observations were made. Within the AET, 2 respondents noted that interpretation of AFCAD-data and discussions due to differing interpretations of the data caused most problems. Again, interpretation of data is an issue for the AET here. The other statements were mentioned only once.

A similar thing happened when asking this question to the training designers. 2 respondents said formulating AFCAD-questions and sticking to the schedule cause problems. The other two statements were both only mentioned once.

Table 4: Problematic activities for AET

AET	**Number of statements**
Editing the data	1
Interpretation of the AFCAD-data	2
Discussions due to differing opinion	2
Planning is left too late, causing availability issues	1
Making a conclusion due to lack of data from previous years.	1
Total	7

Table 5: Problematic activities for training design team

Training design team	**Number of statements**
Having access to data from previous years.	1
Formulating AFCAD-questions	2
Sticking to the schedule, some pilots tend to go into detail too much	2
Determining why a certain task is in the matrix	1

3.8 Passing on conclusions

As some training designers remarked that the matrices are not clear and that there should be more explanation with them, it is quite interesting to see how the different teams make sure that their conclusions end up at the next team.

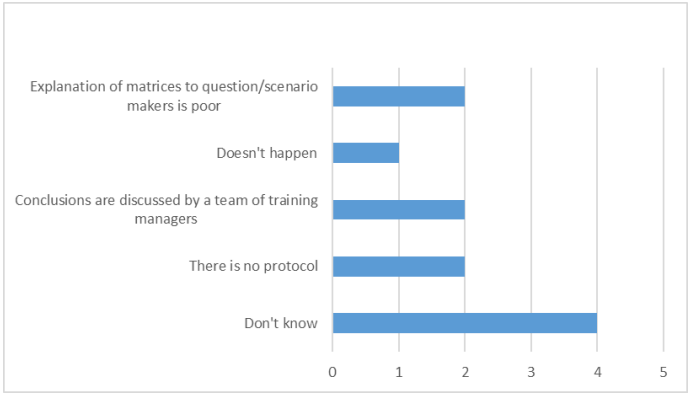


Figure 11: The way the AET pass on conclusions

Within the AET, 57% of respondents stated that they do not know how their conclusions are passed on to the training designers. On top of this, 29% of respondents reported that there is not protocol for passing on the conclusions made by the AET. Another 29% stated that the explanation of the matrices to the training designers is poor. Lastly, one AET-member even argued that the conclusions of the AET are not passed on to the training designers at all. 2 AET-members stated that the conclusions are passed on to a team of Training Managers[6]. These training managers then discuss the matrices and conclusions. The respondents did not elaborate on how the training managers make sure that the conclusions are passed on to training designers. In the end, 82% of statements made on passing on conclusions is negative from the AET's side.

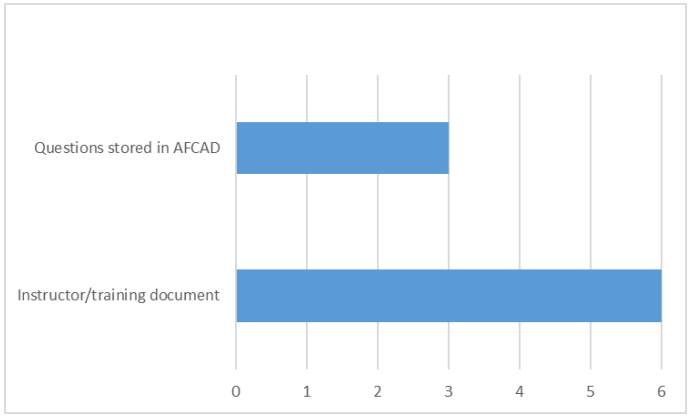


Figure 12: The way training designers pass on conclusions

The training design team on the other hand seem much more united on the way they are passing on conclusions. All respondents mention that an instructor document is created. This is a document that describes the events and the AFCAD questions that form the training programme. This document is then made available to the instructors conducting the training programme. 50% of training designers reported storing questions in AFCAD.

[6] Every pilot division has a Training Manager, who is responsible for the operation of the training programmes.

3.9 Time spent on ATQP-process

Within the AET, most respondents state that they spend 5 working days on their AET-related duties per analysis that is made. One respondent states they spend 6 days, while another respondent states 3 days are spent on the AET-duties.

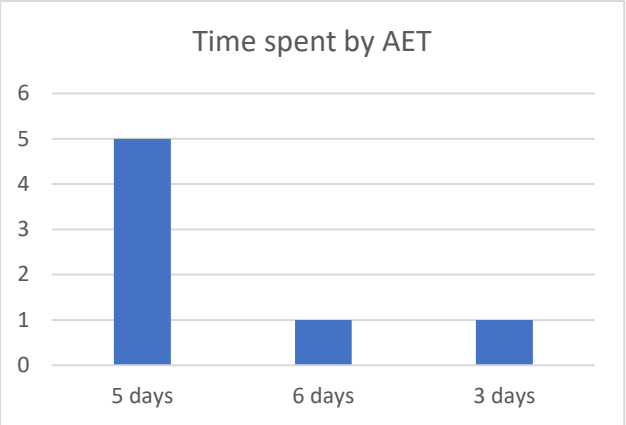


Figure 13: Time spent by AET

Within the training design team, the situation is not that clear. 3 respondents state that they spend 7 working days per training that is constructed, while three other respondents all report different working time spent. This could be explained by the fact that within the training design team, there is a division between Seniors and scenario makers who have different responsibilities and therefore different working times. Despite this, all respondents were able to give an estimation of the time they spent, as well as an estimation of the time that was spent by the whole team.

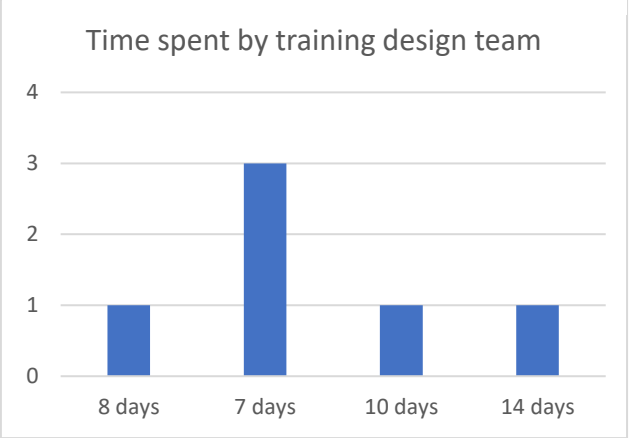


Figure 14: Time spent by training design team

3.10 Main findings

The answers to the interview questions lead to insights in context, presentation, structure and content of the data. Questions that are context related increase knowledge about the current situation within the ATQP-process, while questions related to content, presentation and structure answer what is required to improve productivity within the ATQP-process. In table 6 on the next page, an overview of the requirements on data content and data presentation can be found. The requirements are numbered 1 to 3. 1 being most important, 3 being less important.

When looking at the current situation within the ATQP-process based on the interviews that were conducted, there are a couple of things that should be noted. Firstly, there seems to be no structure or oversight in the process of making sure that conclusions made by the AET are sent to the training designers. 82% of AET-respondents reports negatively about this issue. Furthermore, it seems that there is a general lack of explanation with the matrices. Both members of the AET and training designers state that explanation of the matrices is lacking.

3.10.1 Content requirements

Currently, training designers do not really work with the AFCAD-data, they only use the matrices. To improve their understanding of the matrix however, they indicated that it would be beneficial if the training designers were also granted access to the AFCAD-data.

The single most important content that is currently missing in the eyes of both the AET and the training designers is data from the past. The whole idea of ATQP is to tailor pilot training to the Company X pilot corps based on trends. Without AFCAD-data from past trainings available to actors within the ATQP-process, this is simply not possible. Therefore having data from past training easily available is a very important requirement.

For the training designers, an important content requirement is a more detailed explanation of the matrices. Training designers often wonder how the AET came to the list of tasks described in the

matrix. On top of this, the description of the tasks is very broad, making it quite difficult to create events and corresponding AFCAD-questions that actually measure what the AET has intended.

Especially for AET-members, the actual AFCAD-questions should be easily available. Currently, only question are present in the AFCAD-data. Another content requirement for the AET is the ability to see correlations between questions. This would help them to determine whether certain questions are intertwined.

3.10.2 Presentation requirements

There are some key aspects that both the AET and the training designers require in order to improve their work productivity. Regarding data structure, both a majority within AET and training designers indicated that they would like to see filters in the data. Members of both teams indicated that this would be helpful, because filters can help them to tailor the data they receive to their own division-specific needs. Within the AET, having filters was mentioned the most, while within the training design team, this was mentioned second most often.

Furthermore, both teams indicated that having more graphs to visualise results would be helpful during their analysis. Some respondents indicated that it would be helpful to have a couple of visuals in an overview. When clicking on this overview, more details about the visual are revealed. Interactivity like this should be integrated into the graphs, to give actors within the ATQP-process more flexibility in analysing the training data.

Pre-filtering of the data is something that was suggested by 71% of AET members, but only 33% of training designers. Therefore, pre-filtering the data is an AET-specific requirement. With pre-filtering, the AET meant that they would like to have the data ready for analysis as it is presented to them. They should not have to perform many steps to get to the data they would like to see. When looking at the AFCAD-data and how it is currently presented to the AET , big improvements can be made on this aspect; currently there is no editing or pre-filtering of the data at all.

Within the training design team, sorting possibilities were mentioned most, while only 43% of AET-members suggested this as a requirement for future data-structuring. This requirement is specific to the training designers.

Based on the content and presentation requirements and the current context in which the data is going to be presented, a suitable presentation method should be determined.

Table 6: Main content and presentation requirements

Content	1	2	3
AET	Data from the past, so trends can be spotted.	AFCAD-questions itself	Correlations between questions
Training design team	Data from the past, so trends can be spotted.	More explanations with matrices	Grant access to data
Structure			
AET	Filters, so data can be tailored to needs of user	Pre-filtering of data	More Graphs
Training design team	Sorting possibilities for data	Filters, so data can be tailored to needs of user	More Graphs

3.10.3 Data structuring

To be able to present data properly, it should be structured in an effective manner. Based on the content- and presentation requirements, there are some structuring recommendations that can be made.

Respondents mentioned that it takes a lot of time to interpret the AFCAD-data. This is partly due to the fact that it is hard to interpret the comments that are made by instructors. These comments have no structure at all and therefore, it takes a lot of time to read these comments and use them in the analysis of the AFCAD-data. To make interpreting these comments less time-intensive, a way to structure these comments should be determined.

3.10.4 Other requirements

Both AET and training designers indicated that the way conclusions from the AET are passed onwards is not optimal. From the interviews it can be concluded that this is due to a lack of oversight and coordination. A majority of AET members does not even know how their conclusions are passed on and used.

Also, there is no one who has an overview of the ATQP-process and when certain meetings should be planned. As a result of this, there is no concrete protocol or schedule that actors within the process adhere to. This leads to planning difficulties. For instance, the last Type Recurrent sprint 1 was announced just a couple of days in advance, while the AET did not even know that this meeting had taken place. This indicates lack of planning and coordination within the process. In the end, the whole ATQP-process requires more overview and better coordination between the different teams.

4. Current Situation

This chapter will sketch a detailed overview of the current ATQP-process. The data used within the ATQP-process, the current way of working within the ATQP-process, the problems that arise in the ATQP-process and the different stakeholders active within the ATQP-process are discussed. To sketch a clear overview of the ATQP-process in a systematic way, it is assumed that every sub-process of the ATQP-process consists of input, process and output (Long, Keng, & Ling, 2005). This chapter answers the problem statement: What does the ATQP-process look like in detail?

4.1 Training programme

The ultimate goal of the ATQP is to formulate high quality pilot training programmes. Before the ATQP-process can be explained in detail, the contents of training programme should be explained. A training programme consists of multiple 'events', such as a crosswind landing at Amsterdam, or flying through a storm for instance. During these events, crews have to perform tasks such as windshear avoidance, or flying with only 1 engine. These tasks are linked to different 'SHAPE components'. Every shape component represents another competency that a pilot has to master. During a training, an instructor assesses the crew that is being trained. This is done by answering AFCAD-questions.

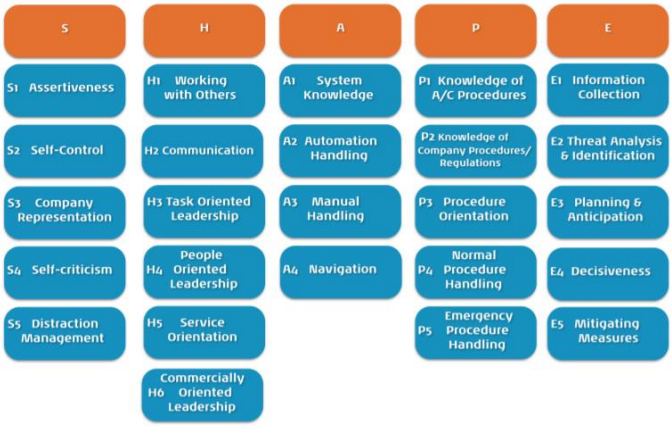


Figure 15: SHAPE components (van Rooij, 2015, p. 21)

4.2 Data within ATQP-process

To fully understand the current ATQP-process, the data that is used to operate that process is described below. Some data is used as input and some data is output of the ATQP-process. The use of data within the ATQP-process is explained in more detail under 'ATQP-process'.

4.2.1 AFCAD-questions

The AFCAD[7]-questions that instructors have to answer during training are linked to the tasks mentioned under 'training programme'. The answers to these questions form the Question data. The AFCAD-questions can be answered with 'yes', 'no' or '?'. In Appendix 8, an example of an AFCAD-form that instructors fill in during a training can be found.

4.2.2 AFCAD-data

AFCAD-data is used by the AET during their analysis. AFCAD-data can be split up into question data and event data.

Question data

When an instructor answers 'yes' on an AFCAD-question, this is stored as 'desired' in the question data. When an instructor answers 'no' on a certain question, this is stored as 'not desired' in the question data. When an instructor answers '?', this is stored as 'unknown' in the question data. When a training programme is finished, the answers of all AFCAD-forms have been recorded and are ready for analysis. The question data can be retrieved from AFCAD in CSV-format.

Event data

[7] AFCAD is the application that instructors use to answer questions. Within AFCAD, the answers to the questions are also saved.

Next to answering the AFCAD-questions, instructors can comment on the behaviour of the crew during a certain event. All these comments together can be described as Event data. These comments are linked to a certain SHAPE component (figure 3). E.g. Desired component a3: *'Controls the aircraft manually with accuracy and smoothness as appropriate to the situation'*, not desired component p3: *'Does not notify others of intended actions when deviating from procedures, rules and regulations'.* These comments give a detailed description of what went well or not during a certain event. Linking the comments to the different SHAPE components makes it easier to compare different comments and see which competencies were executed well and which were executed poorly by the crews. The Event data can be extracted from AFCAD in CSV-format.

4.2.3 Matrices

A matrix is a list of tasks that should be in the new training programme. The AET formulates matrices that state the tasks that should be in the next training programme. These tasks are going to be executed by the crew that is going to be assessed during the new training. There are multiple matrices because the tasks differ slightly per aircraft type.

4.2.4 Presentations

The AET's main findings are summarised in power point presentations; 1 presentation for each analysed training programme and aircraft type.

4.2.5 Instructor document

The instructor document describes the training programme in detail and allows instructors to get a full understanding of the newly created training programme. The instructor document describes the different events that take place within the training and describes which tasks are to be executed during each event for instance.

4.2.6 Task database

In the task database, the training frequencies of all tasks can be found. Based on these training frequencies, matrices for new trainings are formulated. Training frequencies of specific tasks can be changed based on the performance of the Company X pilot corps on this specific task.

4.3 Stakeholders

Within the ATQP-process, there are multiple stakeholders with different perspectives and opinions about the ATQP-process. When making changes to the ATQP-process, the impact of these changes on different stakeholders should be taken into account.

AET

The AET is a major team of stakeholders within the ATQP-process. This team consists of 8 pilots (2 for each aircraft type within Company X). All members of the AET perform their duties within the team next to their main jobs as pilot or instructor. The AET is mainly interested in improving the quality of trainings and living up to the standards set by the ILT[8]. It is probably wise to listen to suggestions coming from the AET to ensure quality of trainings is maintained and the ATQP thus complies with ILT-regulations. It might be tough to convince them to change their way of working though.

Training design team

Additionally, training designers are an important stakeholder group. This group consists of pilots, mostly instructors. Like the members of the AET, the training designers perform their duties for the team next to their regular job as pilot or instructor. They want to make training programmes that

[8] The Dutch Civil Aviation Authority (Inspectie Leefomgeving en Transport)

match the AET's set requirements as accurately as possible. Again, this stakeholder-group is mainly focused on quality of training and creation of good training programmes.

Director Department Y
This is an important stakeholder, as they are the head of department Y. Their department is responsible for an efficient execution of training. Keeping training processes efficient and of high quality is an important aim of department Y. Therefore, making the ATQP more efficient contributes towards the goals of the director of department Y

Pilots
Other important stakeholders are pilots who are being trained; they want their trainings to be effective and of good quality. Changes to the ATQP will most certainly influence training curricula and thus the way pilots are trained.

Instructors
Instructors are important stakeholders as well; they execute the trainings that are being made through ATQP and are vital to collect all data necessary to execute ATQP in the first place. Instructors are generally happy to help make the ATQP-process more efficient, as long as training quality is on point. However, workload has increased for instructors since implementing ATQP, as they have to fill in more forms during training sessions for data collection. Changes in data collection should be communicated to instructors, as they will eventually provide data for the whole feedback loop.

When looking at the different stakeholders within the ATQP-process, it can be concluded that there is no person who is responsible for the proper execution of the ATQP-process. Sure, the Director of department Y is responsible for smooth operation and creation of trainings. However, the Director of department Y is not directly responsible for the operation ATQP. Having no person responsible for the efficient and effective operation of the ATQP-process could lead to poor cooperation between different teams of the process and poor planning within the process.

4.4 ATQP-process

The ATQP-process for constructing one training is visualised in figure 16. ATQP is used to construct 3 types of trainings: Type Recurrents (TR), Line Oriented Evaluations (LOE) and Line Oriented Quality Evaluations (LOQE) (ATQP Manual, 2020). Every year, there are 4 trainings that are being executed year round: 2 TRs 1 LOE and 1 LOQE. With 4 trainings made every year using the ATQP-process, the analyses by the AET and the training design are not executed very often. The Analysis by the ATQP-expert Team is conducted twice yearly, while the training design is executed once yearly for every training type; TR1, TR2, LOE and LOQE. The execution of the 4

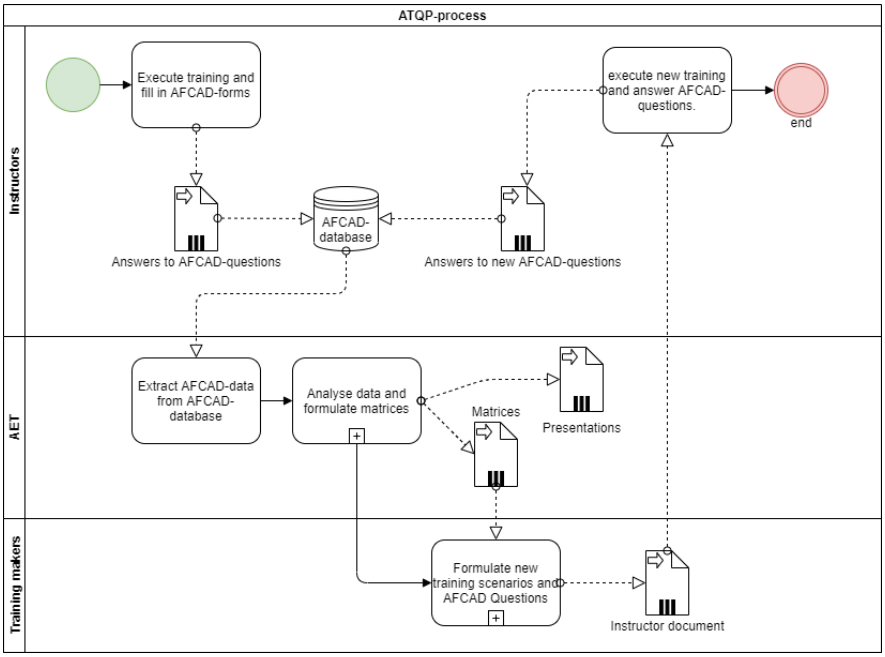


Figure 16: the ATQP-process for making one training

trainings is a year-round operation though. Therefore, Formulating poor training programmes or ill-defined AFCAD-questions have big implications.

Within the ATQP-process, two sub-processes can be defined. The first one being the analysis of the answers to the AFCAD-questions by the ATQP expert team (AET). The second one being the process of formulating a new training programme

4.4.1 Analysis by AET

The input for the analysis by the AET is the question- and event data retrieved from AFCAD. The AFCAD-data is not easy to use for people with little IT-expertise, such as the members of the AET.

Once a training programme has been fully executed and all data has been collected, the AET will plan a sprint[9], during which the question- and event data are analysed. From this analysis, the AET should be able to determine which tasks were executed well during this training, and which tasks were performed below expectation.

When the AET is done with their analysis, their findings are summarised in Power Point presentations; 1 presentation for each aircraft type. The presentations clearly describe what the AET noticed during their analysis and to what conclusions they have come. These conclusions are used to determine whether the task database needs to be changed. If there are tasks that crews executed poorly in the analysed training, the training frequency of this task can be changed in the task database. The task database has already seen some significant design and layout improvements. It can still be quite hard to find the required data however. Once the task database has been updated, matrices are formulated based on the task database. These matrices are then sent to the training designers, who use the them to formulate a new training programme and the AFCAD-questions that go with the training. All in all, the output from analysis by the AET is:

- Power Point presentations that summarise the AET's findings
- Possible changes to the Task Database
- Matrices that state training requirements

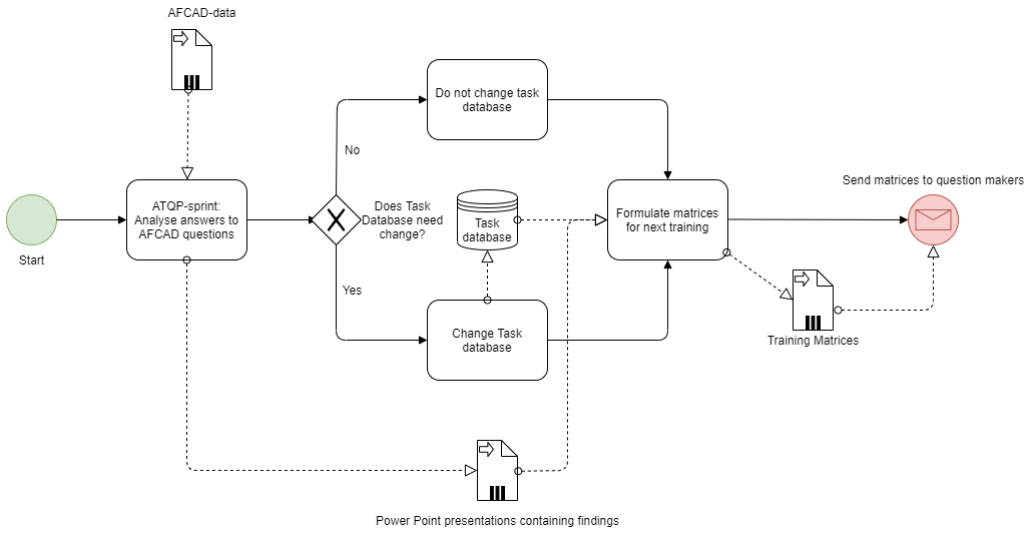


Figure 17: Analysis of AFCAD-data by AET

[9] Within the ATQP-process, Company X decided to implement an 'agile' way of working. Within the agile methodology, a sprint is an iteration of the process. (Cervone, 2011)

4.4.2 Formulating a new training programme

To formulate a new training programme, the matrices made by the AET are used. The training design team can be split up into a team of 'Seniors' and a team of 'Scenario makers'. The seniors focus on setting requirements for the new training and formulating the actual AFCAD-questions. The scenario makers focus on formulating scenarios, which consist of one or multiple events. These scenarios are based on the requirements set by the seniors. Within the training design team, 1 senior instructor from each pilot division works on formulating new scenarios and AFCAD-questions. These senior instructors each have one or two scenario makers in their team, dependant on the size of their pilot division. The B737- and B777 divisions are much larger than the A330 division for instance. Therefore, both the B777 and B737 divisions consist of 1 senior and 2 scenario makers, while the A330 division consist of 1 senior and 1 scenario maker. The process of Formulating AFCAD-questions and training scenarios consists of 5 so called sprints (VP Crew Training, 2018).

Sprint 1

During sprint 1, only the seniors are present. During sprint 1, the seniors use the matrices made by the AET to come up with a framework for the next training. The framework consists of an indication of what content should be in the eventual training. This framework includes a broad definition of what future AFCAD-questions should answer. The first sprint lasts 1 day.

Sprint 2

During sprint 2, a 'minimum viable product' (MVP) of the training programme is made. The first step of sprint 2 is to formulate scenarios based on the output of sprint 1. This is done by the scenario makers for each pilot division (B737, B777/787 and A330). After the scenarios have been defined, AFCAD-questions are formulated based on these scenarios. AFCAD-questions are mainly formulated by the seniors. However for some divisions, one scenario maker is also present. Seniors are involved in this sprint for 2 days, while scenario makers are working on sprint 2 for 5 days.

Sprint 3

After sprint 2 is finished, the MVP for the training programme is tested in simulator. During sprint 3, scenario makers are working for 3 days on testing the proposed scenarios and writing feedback on these scenarios. This can take longer than three days though, especially when one or multiple scenarios are deemed unviable. Then the team has to go back to the drawing board.

Sprint 4

In sprint 4, the output of sprint 3 is used to change the training programme where necessary. Sprint 4 lasts 3 days. During which both seniors and scenario makers are involved. The goal of this sprint is to finalise the new training programme and the AFCAD-questions that go with it. The finalised training programme is then submitted for approval.

Sprint 5

After the training programme has been approved, it will be used in practise. During the first three months, feedback on the training programme is collected in a so called 'snow ball session'. During these snowball sessions, feedback from instructors on the training programme is collected. This feedback is based on the actual execution of the training programme in practice. After three months, feedback from these snowball sessions is used to make minor changes to the training programme during sprint 5. The programme cannot change drastically, due to the approval that was given after sprint 4. Sprint 5 lasts 1 day, during which only the seniors for each aircraft type are present.

After sprint 5, the process of making the training programme and the AFCAD-questions that go with it is finished. It will start again as soon as a new training programme has to be made again.

The output from the process of formulating a new training programme are the instructor document and the AFCAD-questions. The instructor document describes the training programme in detail and allows instructors to get a full understanding of the newly created training programme. The AFCAD-questions are programmed into the AFCAD-form that the instructors fill in during the training programme to assess the crew that is performing the training. Therefore the main output from formulating a new training programme is:

- The instructor document
- The AFCAD-questions

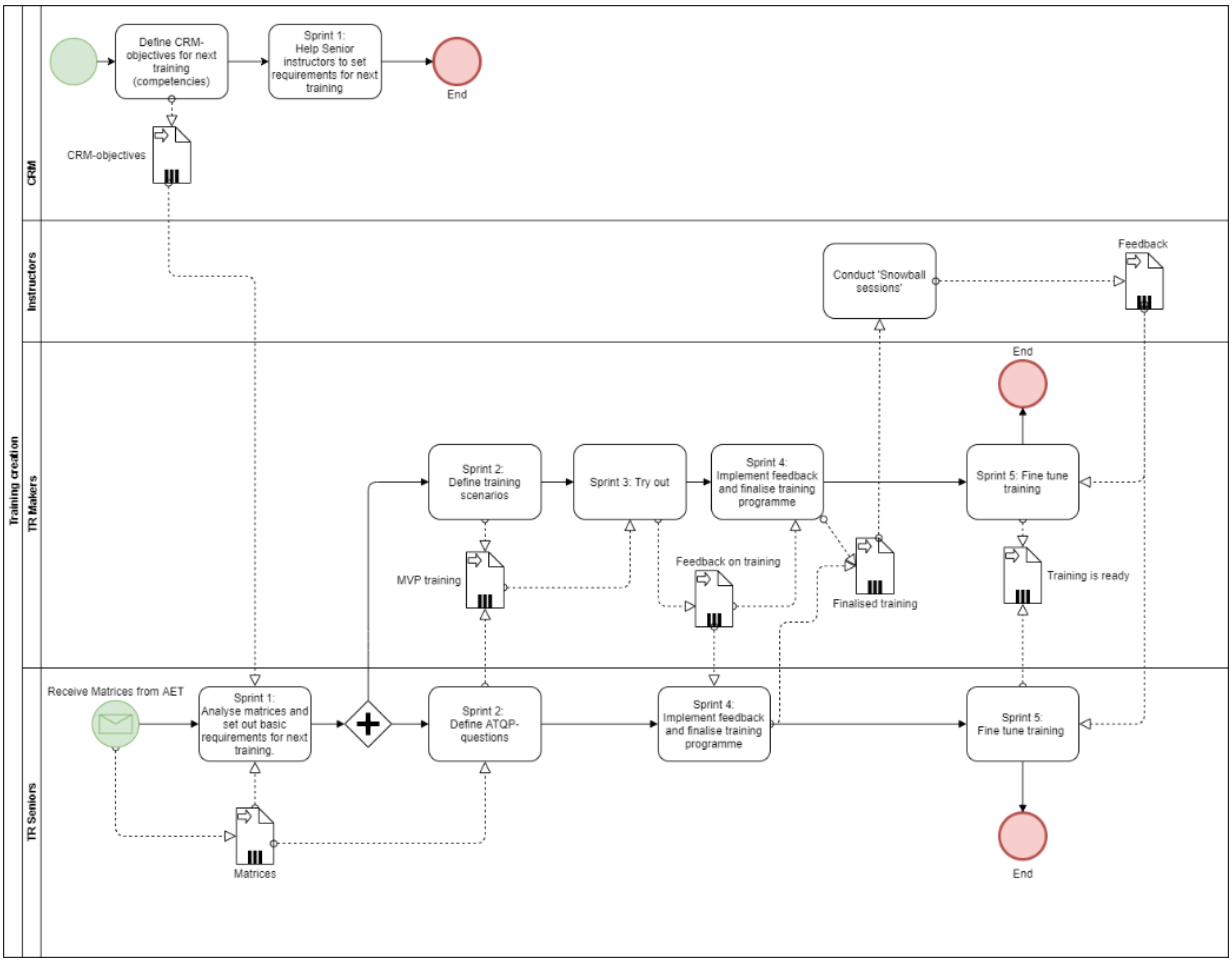


Figure 18: The process of formulating a new training programme

4.4.3 Data transferring

Within the ATQP-process, different teams create new data that is then used by another team. In other words, the output of one part of the process, is the input for the next. This is visualised in figure 6. To achieve this, data needs to be transferred between the different teams that exist within the ATQP-process. When the AET meets to analyse the AFCAD-data from last year's training sessions, data is transferred from the AFCAD-database to the AET. As mentioned before, there is no step between the collection of the AFCAD-data and the receiving of the data by the AET. The AET receives raw AFCAD-data that came straight from the training sessions. The AET just downloads the AFCAD-data in CSV-format from the database and starts working with this unedited data.

Training designers only use the matrices made by the AET as input for the process of formulating a new training programme. Presentations by the AET are not taken into consideration. The AFCAD-questions are stored in AFCAD, so they are available to the instructors when the new training has to be conducted. The training programmes themselves are described in a manual called a 'instructor document' that is sent to all instructors. Data-transferring between training designers and the instructors conducting the training programmes seems to be going smoothly.

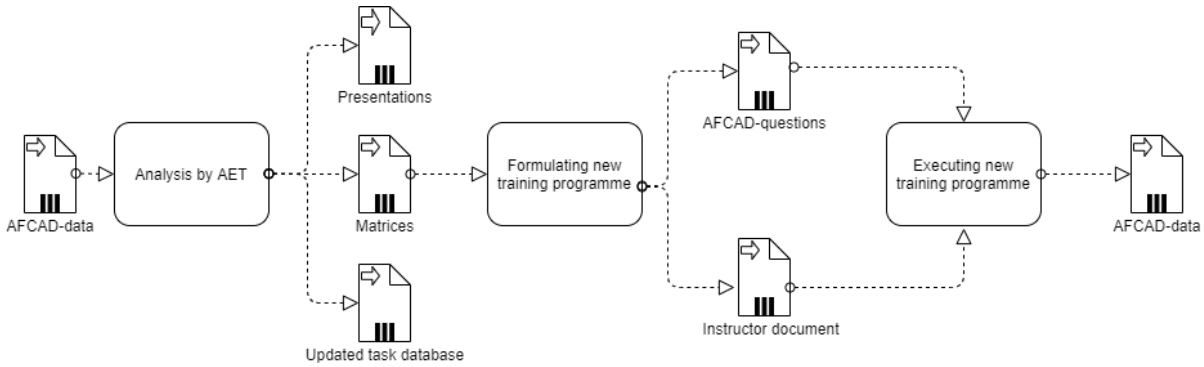


Figure 19: Data input and output within the ATQP-process

In the end, the AFCAD-data can be seen as the most fundamental data within the ATQP-process. All other data can be traced back to the AFCAD-data. Therefore, it is of vital importance that the AFCAD-data is used properly.

4.5 Problems

There are several problems within the ATQP-process that hamper efficiency of the process. They are caused by poor missing data content, poor data presentation, subjectivity of the data and a lack of coordination.

4.5.1 Missing content

Not all content that is required to draw a useful conclusion from the data is currently available . Especially data from the past is necessary to make progress with the ATQP. The AET is supposed to base their findings on trends in the data. E.g. a certain task is performed worse over the course of the years. Right now, the AET only has access to one years' data, prohibiting them from spotting trends over the years. The training design team struggles with a similar problem. Currently, they can't see AFCAD-questions that were asked in the past and the results that were achieved on these questions. This could give the training designers a good indication of what good and bad-questions look like.

The data from the past, and much of the other content that is currently lacking, actually exists already. The problem is that it is not made available to relevant stakeholders upon analysis. Not all required content is presented to them, while it does exist in the AFCAD-database. Properly presenting actors within the ATQP-process the data that they require to execute their jobs properly is the most logical step to undertake before adding even more content that is not being used in the first place.

4.5.2 Poor data presentation

The data presentation of the currently available data is not done effectively. Basically, no effort is put into visually presenting the question- and event data. The AET just receives some CSV-files and has to figure out themselves how to extract useful information from these files. The AET consists of pilots, who have limited or no IT-skills. This means that the AET is wasting a very big portion of their time on figuring out how to use and visualise the data.

4.5.3 Subjectivity

Within the ATQP-process, there are multiple moments when subjective data is used. In the question data, the 'uknown' answers are up to interpretation. Why did an instructor mark a certain question as 'uknown'; it is up to the AET to determine this, which is of course not objective. Furthermore, question data shows a number of 'desired' and 'not desired' behaviour for each executed task. The pilots in the AET have to discuss what pass-rate is acceptable for each task, as this pass rate is not predefined. This keeps the team from objectively and efficiently analysing the data and drawing conclusions. Additionally, the number of 'desired' or 'not desired' observations of a certain task do not give a complete indication of the skill level of the assessed pilots. Therefore, the AET uses the comments from the event data to determine what exactly went well or wrong during the last training programme. These comments are free text and are sometimes very long sentences. It is hard to compare the scores of different crews on different SHAPE aspects when textual data has to be compared. This is up to interpretation and therefore not objective either.

The training designers use the matrices they receive from the AET to formulate an instructor document and AFCAD-questions. The training designers fully depend on the matrices, as this is currently the only data they receive to formulate a new training programme. The matrix is a list of tasks that have to be in the new training curriculum. There are no specifications as to how the AET came to this list and in which circumstances (the future events) these tasks should be assessed. This makes it hard to formulate a training programme in exactly the same manner as the AET intended. As the matrices are up to interpretation as well, the conclusions that follow from these matrices are somewhat subjective as well.

In the end, the subjectivity of different data-elements within the ATQP-process makes it necessary to interpret this data. Interpreting data is time-consuming and leads to low productivity within the ATQP-process.

4.5.4 Lack of coordination

There is a lack of coordination between AET and training designers. From the interviews that were conducted with AET-members, it became clear that a majority of the AET has no clue what happens to the matrices and the presentations after they are finished. It seems like there is no real protocol for sending the conclusions from the AET to the training designers. Also, there are planning difficulties within the ATQP-process; meetings are planned at the last moment, leaving key stakeholders out or reducing the time available to conduct the meetings.

4.6 Hours worked in ATQP-process

Within the AET, 8 senior instructors from each pilot division work on analysing old trainings and formulating new matrices. This process starts with a three day 'sprint' during which conclusions from the data that was extracted from the AFCAD-database are drawn. After this three day sprint, the whole AET meets again to construct matrices. The analysis of the AFCAD-data takes place twice a year. The analysis takes 3 days per year, while making matrices costs an additional 2 days. This makes 10 working days per year for each AET member. This boils down to 640[10] working hours per year.

Determining the total number of hours worked when formulating a new training programme and the AFCAD-questions that go with it is less straightforward. Within the training design team, not all team members are present at every meeting. During sprint 1, 3 seniors work on determining the basic outline for the next training for a full working day. During sprint 2, every senior is present for an average of 2 working days. During sprint 4, every senior is present 3 working days. During sprint 5, all

[10] 8 hours per day * 8 AET members * 10 days = 640 working hours.

seniors meet up again to finalise the training. In total, this boils down to 21 senior-working days, or 168 senior-working hours[11] per new training being made.

The scenario makers spend more working hours during the formulating of the new training programme. Scenario makers are involved during the full 5 working days of sprint 2. During sprint 3, the average number of days they are involved is 3. This is relatively variable though, as problems can arise while testing the proposed scenarios in the simulator. After sprint 3, the scenario makers are working on sprint 4 for 3 days. As there are 5 scenario makers, this boils down to 55 scenario maker-days, or 440[12] training designer-hours per new training being made.

Lastly, instructor hours are a significant part of the ATQP-process. However, the number of pilots that has to be trained is not subject to change in the future. In fact, training is fully operational now pilots have more time off due to the coronavirus-pandemic. This thesis is focused on improving productivity within the ATQP-process. As the number of instructor hours cannot realistically be changed, it is not useful to determine the total number of hours worked by instructors.

[11] 8 hours per day * 3 seniors * 7 working days = 168 working hours.
[12] 8 hours per day * 5 makers * 11 working days = 440 working hours.

5. Conceptual design

To improve the productivity of the ATQP-process, a conceptual design of an information system was formulated. To achieve an increase in productivity, the main problems in the ATQP-process have to be tackled. As can be read in chapter 4, the main problems within the ATQP-process are:

- Missing data content
- Poor data presentation
- Subjectivity of data
- Lack of coordination

This conceptual design tackles these problems by addressing solutions and explaining how they can be realised within the context of the ATQP-process. These solutions are focused on data content and data structure. Furthermore, an efficient method to present the required data within the context of the ATQP-process is explained. Lastly, the assignment of a process owner to the ATQP-process is proposed to solve the coordination issues that exist within the ATQP-process.

5.1 Content

As mentioned in chapter 4, most content that is required by respondents to improve their work productivity already exists. The following data content already exists and should be made available to relevant stakeholders:

- Data from previous years' trainings
- AFCAD-questions itself
- More explanation with matrices

Despite the fact that the data items above do already exist, they are not presented properly or made available relevant stakeholders. Both the AET and the training design team need access to data from the past and need to be able to easily see the AFCAD-questions itself. During the last iteration of the ATQP-process, only question numbers were shown in the question data. To determine what question was actually asked, the instructor document had to be read, which of course cost precious time. Lastly, the training design team requires more explanation with the matrices, so they can write a training programme that complies with the requirements set by the AET. This can be fairly easily achieved by making presentations that the AET makes to explain conclusions available to the training design team.

Content that does not exist in the current data and should be added to the data are pass-rates for certain tasks. Right now, the AET discusses what a desirable pass rate (the percentage of 'desired' observations) for a certain task is, after the training has been executed. This does not result in an objective judgement of the pass rate, as the actual pass rate is already known. Therefore, the pass rates should be determined by the training design team. The training design team should look at the results on a certain task in the past, and determine the desired pass rate based on these past results. This should lead to a more objective measurement of performance of the flight crews. Furthermore, it should lead to time savings on the AET's side, as the discussion about the correct pass rate is eliminated.

Other data content that is required but does not exist, are correlations between different AFCAD-questions. To create an overview of correlations, there are several steps that need to be performed. All responses 'not desired' and 'desired' should be translated to 0 or 1. Then, from the question data in AFCAD, each unique response to the question should be shown in a table, such as in figure 20. By comparing different columns to each other, the correlations between questions can be calculated. An efficient way of doing this, is by using Microsoft Excel. The correlations are mainly required by the AET; they stated this requirement more during the interviews than the training design team.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
2	272182	1	0	1	1	1	1	1	1	1	0	1	0	0	1	0	1	0	0	0	0	0	0	1	0	1
3	282834	1	1	1	1	0	0	1	1	1	1	1	1	1	0	0	1	0	0	1	0	1	0	0	0	0
4	288207	1	0	0	0	1	1	1	1	0	0	0	1	1	1	0	0	1	1	1	1	1	0	0	1	0
5	289289	1	0	1	0	0	1	1	1	1		1		1	1	1	1	1	1	1	1	1	1	1	1	1
6	291570	1	0	1	0	0	0	0	1	0	1	0	0	0	1	1	1	1	1	0		0	0	1	1	1
7	292223	1	1	0	1	1	0	0	0	0	0	1	0	0			0	0	0	0	1	1	1	1	0	
8	293091	0	1	0	1	1	1	1	1	1	1	1	0	1	1	0	1	0	1	0	0	1	0	1	0	1

Figure 20: organised data for correlations

5.2 Data structure

Currently, stakeholders spend a considerable amount of time on interpreting subjective data. The comments made by instructors in the event data and the number of 'unknown' answers in the question data are subjective data within the ATQP-process. The comments are free text and do not have any sort of structure to them. Besides, it is not clear why an instructor has chosen '?' instead of 'yes' or 'no' in the AFCAD-from (appendix 8).

To tackle this issue, a change in data-structure is needed for the question data. As can be seen in figure 21, the AFCAD-questions are linked to a certain SHAPE aspect, indicating what kind of competency is being assessed with the AFCAD-question. Currently this is only done for AFCAD-questions of the Boeing 737. To make sure that performance on SHAPE-aspects can be measured for every aircraft type, the SHAPE aspect that is being assessed in a certain question should be mentioned in every AFCAD-question.

Similarly, a description of the task should be saved in the question data. Currently, there is no description of the task that a certain AFCAD-question is about. Currently, these have to be added manually to the question-data by going through the instructor documents of the respective trainings. This can easily be added to the question data.

Event 4: RNP approach (3D)

Start: Beginning of approach briefing

End: After landing

		YES	NO	?
Task:	**RNP approach (3D)**			
13	(E3) Does the crew mention the possibility of a high vertical speed due to temperature	○	○	○
14	(E1) Does the PM actively monitor the aircraft flight path during the approach?	○	○	○

Figure 21: example of two AFCAD-questions in the AFCAD-form

To make it easier to measure performance on different SHAPE-aspects, a form of grading should be added to each AFCAD-question. Next to the 'yes', 'no' and '?' options, a sub question should be asked. This sub-question should be focused on the SHAPE-aspect that is linked to the AFCAD-question. The sub-question can be formulated as follows: 'How would you rate the crew's performance on Shape Component E3 (Planning and anticipation)?'. This question can then be answered by grading the crew's performance on a scale from 1 to 5:

1. Poor
2. Sub-standard
3. Satisfactory

4. Good
5. Excellent

By adding this new dimension to the AFCAD form, more specific and less subjective answers are created. The grading scale should help the AET and the training designers to determine performance of crews on certain SHAPE aspects and enables them to compare performance on SHAPE aspects over the years. Next to a more objective and concrete analysis of AFCAD-data, this should lead to time savings, because the data does not require much interpretation anymore.

Additionally, adding the grading scale eliminates the need for event data altogether. The event data only exists to store the comments that were made by instructors. In the event data, these comments are linked to a certain event instead of a specific question, which makes it hard to know what the comments are referring to. Therefore, adding a method to grade crews on their performance on certain SHAPE-aspects makes handling the data easier, as there is no more need for event data; only the question data will be enough.

To make sure that instructors can still explain why they made certain choices, a comment box should be added after each individual question in the AFCAD-form. These comments are then stored in the question data, linked to every individual question. However, the need to interpret comments should be avoided as much as possible, as they are subject to interpretation and take much time to interpret.

5.3 Data presentation

During the interviews, respondents mentioned different data presentation requirements that would help them to execute their work more effectively. The most important requirements that were mentioned are the following:

- Filters
- Sorting possibilities
- More graphs
- Pre-filtering of the data

Respondents also mentioned several data items that are required to do their work more effectively. Most of these data items are actually available. However, they are currently poorly presented, or not available to the different stakeholders of the ATQP-process. Therefore, good data presentation also resolves some data-content issues.

5.3.1 Dashboard

According to Few (2006): '*Analytical dashboards should support interactions with the data, such as drilling down into the underlying details, to enable the exploration needed to make sense of it – that is, not just to see what is going on but to examine the causes. (p. 31)'* This is exactly what especially the AET aims to do. They try to spot patterns and understand why certain scores occur and how they can be improved. According to Pappas and Whitman (2011) Analytical dashboards use drill-down and visual exploration to discover patterns and trends in the data (p. 252). Furthermore, they state that '*By examining current trends, business analysts can model outcomes by adjusting variables to recommend actions to optimize results' (p.252).* Therefore, an analytical dashboard would be an excellent tool to use within the ATQP-process. Especially for presenting data and making sure that the right content is available to the right users.

Based on the content and presentation requirements, a concept dashboard was made. This was done using PowerBI. For now, the dashboard only includes data from 2019, as the dashboard is a concept to show stakeholders what the possibilities of a dashboard are. Both the AET and the training design team should use this dashboard. For the training design team, this will immediately grant them

access to big amounts of data that they previously did not even use in their analysis. On top of this, using one dashboard will give training designers the opportunity to look into the same data as the AET. This will show the training designers what data the AET used to reach their conclusions.

The dashboard is going to be used by both the AET and the training design team. As mentioned in section 5.3, there are different requirements from both the AET and the training design team. Interactivity of the dashboard should address these issues.

Implementing a dashboard frees up time especially for the AET, as AET-members do not need to download files from the AFCAD-database, convert them from CSV to Excel workbooks and then add all kinds of graphs manually, whilst having virtually no IT-skills. Having a dashboard that is linked to the AFCAD-data should free up time for the AET and make their analysis more efficient.

5.3.1.1 Concept

To make sure that the dashboard can be used by both the AET and the training designers, a proper dashboard lay-out is needed. The AET and training designers have some differing requirements that should be taken into account. The best way to have the AET and the training designers use the same dashboard is by using two tabs. One tab focusing on results of all trainings in the past and one tab focusing on the results of one specific training.

The AET can use the tab that focuses on one specific training to analyse the results from the trainings that were executed this year. Then, they can compare the results of this training to the results in the past that are in the other tab.

The training designers can use the tab focusing on all trainings to determine previous results on AFCAD-questions. By doing this, the training designers can determine what a reasonable pass-rate on a new AFCAD-question is. This should in turn eliminate some discussion on the AET's side when analysing the training. Lastly, when training designers see a lot of 'unknown' on a certain question, they should be able to determine that this was not a good question.

Every AFCAD-question is linked to a certain task, such as 'Windshear encounter' or 'Circling approach'. As it is pretty rare to encounter exactly the same question in a previous training, it is best to sort results of previous trainings per task. Within the dashboard, users should be able to easily see what results were on a certain task in the past. For instance, if a member of the AET wants to know what test results were on 'Windshear encounter', they should be able to easily find what results on old questions about windshear were. By doing this, users can spot trends over time, which is priority number 1 for both the AET and the training designers. The same can be done with SHAPE-aspects. A user can select a certain SHAPE aspect and see what the average score of the crews on that SHAPE aspect in a certain year was.

By offering users of the dashboard the opportunity to see results per task and/or SHAPE-aspects, it should be easier to compare performances of crews over time. This in turn should lead to higher quality training programmes.

5.3.1.2 Future development

In order to have a lasting impact on the ATQP-process, the dashboard should be developed further. The dashboard as it stands now is a concept. Part of the data that was used to create it was made up; the average scores on the SHAPE-aspects for instance. This was done because this data does not exist yet and is part of the data-structure recommendations that were made. Therefore, the first step in developing a fully-functional dashboard is implementing the recommendations data structure and -content made in this chapter.

Furthermore, the dashboard should be linked to the AFCAD-database and be automatically updated every once in a while. To link a dashboard to the AFCAD-server so it automatically updates, full access to the AFCAD-database is needed. With the access granted in AFCAD right now, only the user interface is visible, while not the whole database itself is accessible. When using the user interface, the data needs to be downloaded on the device that is being used. When linking this data to the dashboard, it is only as recent as the last download of the data from AFCAD. To update the dashboard, data from AFCAD needs to be downloaded all over again. When this has to be done for a couple of years' worth of data, this costs a lot of unnecessary time. When full access is granted to AFCAD, the database can be linked to dashboard-software such as PowerBI or Spotfire by means of queries.

5.4 Process owner

the ATQP-process lacks clear overview and coordination between different teams. The AET and the training design team rely on each other to formulate a good analysis of results and to formulate a high quality training programme respectively. As the ATQP-process relies on different teams working together and passing on data to each other, good coordination and overview within the ATQP-process are crucial.

To resolve the lack of coordination within the ATQP-process, a process owner should be assigned to the ATQP-process. Assigning a process owner to the ATQP-process should improve coordination within the process. According to Kohlbacher & Gruenwald (2010): '*managers should put their effort into establishing process owners as well as process performance measurement as both process management concepts are needed in order to achieve firm performance improvements (p.709).'*

Additionally, the process owner should be the one keeping track of the performance of the ATQP-process productivity wise. A relatively simple method of keeping track of productivity within the ATQP-process is by making the process owner responsible for planning in meetings within the ATQP-process. By doing this, the process owner knows the number of hours that is worked within the ATQP-process. If a team needs more time to perform a certain task, this will go through the process owner, as they will be responsible for scheduling meetings. By doing this, the process owner will also know the actual number of hours that was spent on the process and therefore the productivity within the ATQP-process.

The process owner can use the BPMN figure that can be found in appendix 6 to lead the ATQP-process. In appendix 6, the desired ATQP-process is depicted. The process owner can also use the BPMN figures about the ATQP-process (Chapter 3) as help to get an overview of the process. The description of the current situation could also help the process owner to determine how the process operates and what problems are currently present.

The process owner does not have to work on the ATQP-process full-time, as this is simply not required given the number of meetings that occur within the process per year. A process owner probably only needs a couple of working days per year to manage planning, coordination and the performance of the ATQP-process. Especially during this COVID-19-crisis, there are plenty of employees within the company that do not have enough work but are being paid anyway. Therefore, implementing a process owner should not cost a lot of additional money in the near future.

5.5 Summary

There are several problems that are currently occurring in the ATQP-process. By implementing improvements on content and structure of the data as described in this chapter and by implementing

a dashboard to present the required data, the problems can be solved. Summarising; increasing productivity by improving the use of training data can be achieved by implementing the following recommendations on content, structure and presentation of the data:

Content

- make sure that the Power Point presentations made by the AET are available to the training design team.
- The training design team should determine the desired pass rates for the AFCAD-questions that they formulate.
- Correlations between AFCAD-questions can be calculated. These correlations can be shown to relevant stakeholders by means of a table.

Data structure

- Mention which SHAPE-aspect is being assessed with an AFCAD-question and save this in the question data.
- Describe the task that is being assessed with a certain AFCAD-question and save this in the question data
- Implement a method to grade crews on their performance on SHAPE-aspects. This scale should be ranging from 1 to 5, where 1 is poor and 5 is excellent. This should help to extract more concrete data from AFCAD-questions.
- Eliminate event data. This is an unnecessary complication of the ATQP-process. This can be done when the crews' performances on SHAPE aspects are assessed per question instead of per event.

Data presentation

- Implement a dashboard that is used by both the AET and the training designers. The dashboard consists of two tabs that give actors within the ATQP-process insight in data from previous years' training and data of one specific training.
- The dashboard is an excellent tool to resolve some data content issues. Data from the past can efficiently be presented and all AFCAD-questions can actually be read in a dashboard.
- The dashboard concept is an indication of what can be done with a dashboard. To have this dashboard fully functioning, the other recommendations should be followed, especially on data structuring.

Furthermore, Company X should assign a process owner to the ATQP-process who is responsible for the operation of the process. This should improve coordination between AET and the training design team.

6. Validation

The effect of the conceptual design, if implemented, should be determined. According to Wieringa (2014), validation is in place *'to justify that it would contribute to stakeholder goals if implemented. In the engineering cycle, validation is done before implementation (p.31).'* As the conceptual design formulated in chapter 5 has not been implemented yet, validation is the best method of determining what the effects of implementing said conceptual design will be. Wieringa also states that *'The goal of validation research is to develop a design theory of an artifact in context that allows us to predict what would happen if the artifact were transferred to its intended problem context (p. 59).'*

There are several methods of validating artifacts. *'The simplest way to validate an artifact is by expert opinion. The design of an artifact is submitted to a panel of experts, who imagine how such an artifact will interact with problem contexts imagined by them and then predict what effects they think this would have. If the predicted effects do not satisfy requirements, this is a reason to redesign the artifact (p. 63).'* As there are plenty of experts[13] that operate within the ATQP-process, expert opinion is an excellent validation method for the conceptual design formulated in chapter 5.

'Note that the goal of expert opinion is not to give a survey of all opinions of all experts. Rather, the experts are used as instruments to "observe," by imagining, a validation model of the artifact. The model exists in the imagination of the experts. Validation by expert opinion only works if the experts understand the artifact, imagine realistic problem contexts, and make reliable predictions about the effects of the artifact in context. Positive opinions may indicate socially desirable remarks, or they may indicate that the experts cannot imagine why this artifact would not work in practice. To rule this out, you have to ask the experts to explain their predictions in terms of the mechanisms that they think will produce the effects. (pp. 63-64).' Wieringa also states that use of expert opinion is similar to the use of focus groups (p. 64). Therefore, a focus group is going to be conducted with both members of the AET and training designers (the experts).

6.1 Focus group

The goal of this focus group is to determine the effects of implementation of the conceptual design. The focus group is used to determine the views of the AET and the training design team on the proposed conceptual design and the effects it might cause. *'Compared to the individual interview method, the main strength of the focus group method is the group dynamic created by the participants* (Hallas, 2014, p. 520)*.'* Especially as the conceptual design impacts both the AET and the training designers, it is important that both teams have their input in a meeting. Furthermore, for future cooperation it is vital that both teams understand each other's needs and views. According to Hallas (2014*), 'the purpose of a focus group is to bring people together, in order to listen, and capture their attitudes, experiences or perspectives on a focused topic, or specific set of objectives (p. 519).'* Also, the moderator of a focus group should strive for consensus (Lichtenstein & Swatman, 2003, p. 222). Therefore, the goal of this focus group is to let all experts have their input, while striving for consensus on the validation of the conceptual design.

Before the focus group is conducted, participants for the focus group have to be selected. The focus group should be multidisciplinary and participants should have expertise on the subject of the focus group (Lichtenstein & Swatman, 2003, p. 220). The participants of the focus group that was used to validate the conceptual design consisted of Training designers and members of the AET, who are all experts in their roles within the ATQP-process. These participants were all sent the conceptual design as it is described in chapter 5. Additionally, the concept dashboard was sent to them. It is important

[13] Officially, members of the AET are officially called 'Subject Matter Experts' (SMEs) (ATQP Manual, 2020)

that the model (in this case the conceptual design) that is to be validated is available to participants before and during the session (Lichtenstein & Swatman, 2003, p. 221).

During the focus group, the moderator who leads the focus group should make sure that participants feel at ease and are not afraid to speak up. Therefore, the moderator should start by welcoming the participants and introducing the reason for the focus group. During this focus group, the conceptual design is going to be explained once more, to make sure that it is fresh in the participants' minds. The moderator should make especially clear that there are no right or wrong answers during the focus group; the goal is to let every participant have their input and later discuss this input. There should be room for discussion during a focus group to highlight different perspectives (Lichtenstein & Swatman, 2003, p. 221). The questions that were asked during the focus group can be found in Appendix 7.

6.2 Results

All things considered, participants were mainly positive about the conceptual design. They stated that the recommendations and the dashboard are beneficial to the ATQP-process and would have a positive effect on the productivity of the process. However, there were some critical remarks that can be found in the paragraphs below. These remarks should be used to improve the conceptual design and make it of even more use within ATQP-process.

On correlations, opinions were mixed. In general, participants stated that adding correlations between questions would be a nice addition to the conceptual design. However, this is not something that they see as a high priority issue. Furthermore, the relevance of these correlations was questioned, as it is hard to prove whether two questions are actually causally related.

Participants stated that it is good to have a change in data structure. Especially the fact that event data can be eliminated using the proposed data structure was received positively. However, respondents had some reservations about grading flight crews on their performance on SHAPE-aspects. Participants stated that it would be good to have fewer comments and have an indication of the performance on SHAPE aspects. However, the option to give comments should remain available next to the option to give a grade.

Participants were very positive about assigning a process owner to the ATQP-process. A process owner could especially be helpful in the communication between AET and training designers. A process owner should make sure that conclusions are passed on properly and explain the conclusions and matrices that were made by the AET. However, participants agreed that 'process owner' might not be the right terminology to use. It was suggested to call this person the process- or operational manager. As their tasks are focused on the operational side of the ATQP-process. Furthermore, participants agreed that the process owner should be someone who is familiar with the ATQP. This will probably result in someone from the AET being preferred, as the AET members are more experienced than the TR makers.

Appointing a process owner leads to more time being spent on the ATQP-process. However, participants indicated that appointing a process owner should decrease the time spent on the process as a whole. This is due to the fact that appointing a process owner should lead to better planning and better cooperation between different teams.

Regarding the dashboard, participants stated that they need more context to properly analyse the data that is presented in the dashboard. More specifically, participants stated that they would like to see during which event a certain question was asked. By doing this, it can be determined whether the task was asked during a very high workload, or less intensive moment of the training. Naturally,

events that are very high in workload usually result in lower rates of desired behaviour than events that have are low in workload. Furthermore, participants stated that the addition of showing a ‘grade’ on SHAPE aspects is useful. However, to eliminate any doubts about the grading, participants would like to have the option to see the comments, which is currently not present in the dashboard.

Participants indicated that the implementation of the conceptual design would lead to more effective use of the training data. Less time would be wasted on non-essential activities such as searching for data and organising this data, making more time available to perform the actual analysis of the data. According to participants, this should lead to higher quality of the analyses and therefore to better training programmes and higher quality AFCAD-questions.

7. Conclusion, recommendations and discussion

This research was executed to optimise the ATQP-process at Company X. As optimising the whole ATQP-process was not realistic within the given timeframe, the core problem within the ATQP-process was identified and a research question to solve this core problem was formulated: '*How can Company X improve the use of training data within the ATQP-process, in order to increase productivity?'* This research question is answered in this chapter

7.1 Conclusion

To answer the main research question, the MPSM of Heerkens & van Winden and Design Science provided a theoretical framework. The research involved structured interviews to determine the current state of the ATQP-process and to determine the requirements to improve productivity within the ATQP-process.

Following this research, it can be concluded that there are several issues within the ATQP-process that should be resolved:

- Missing data content
- Poor data presentation
- Subjectivity of data
- Lack of coordination

These problems are addressed by a conceptual design of an information system. This conceptual design tackles these problems by addressing solutions and explaining how they can be realised within the context of the ATQP-process. These solutions are focused on data content and data structure. Furthermore, an efficient method to present the required data within the context of the ATQP-process is explained.

Content

- make sure that the Power Point presentations made by the AET are available to the training design team.
- The training design team should determine the desired pass rates for the AFCAD-questions that they formulate.
- Correlations between AFCAD-questions can be calculated. These correlations can be shown to relevant stakeholders by means of a table.

Data structure

- Mention which SHAPE-aspect is being assessed with an AFCAD-question and save this in the question data.
- Describe the task that is being assessed with a certain AFCAD-question and save this in the question data
- Implement a method to grade crews on their performance on SHAPE-aspects. This scale should be ranging from 1 to 5, where 1 is poor and 5 is excellent. This should help to extract more concrete data from AFCAD-questions.
- Eliminate event data. This is an unnecessary complication of the ATQP-process. This can be done when the crews' performances on SHAPE aspects are assessed per question instead of per event.

Data presentation

- Implement a dashboard that is used by both the AET and the training designers. The dashboard consists of two tabs that give actors within the ATQP-process insight in data from previous years' training and data of one specific training.

- The dashboard is an excellent tool to resolve some data content issues. Data from the past can efficiently be presented and all AFCAD-questions can actually be read in a dashboard.
- The dashboard concept is an indication of what can be done with a dashboard. To have this dashboard fully functioning, the other recommendations should be followed, especially on data structuring.

Furthermore, Company X should assign a process owner to the ATQP-process who is responsible for the operation of the process. This should improve coordination between AET and the training design team.

Implementing the conceptual design should lead to more effective use of training data by actors within the ATQP-process. This can be concluded from the positive reactions of experts on the conceptual design during validation. More effective use of training data should lead to a more complete analysis of the data, which improves the output of the ATQP-process. This leads to increased productivity of the ATQP-process. Therefore, the conceptual design can be used to increase productivity within the ATQP-process; answering the main research question.

7.2 Recommendations

Company X is recommended to implement the conceptual design. Actors within the process make better use of the training data and use their time more effectively if the conceptual design were implemented. This leads to higher productivity, which is desired by Company X.

Company X should make sure that users of the dashboard presented in the conceptual design have access to the context in which the tasks, SHAPE aspects or AFCAD-questions were asked. This context consists of the event number in which these tasks, SHAPE aspects or AFCAD-questions were present. Next to the event number, a concise description of the event should also be made available to the users of the dashboard. During validation, experts stated that this is one of the main shortcomings of the dashboard.

In the dashboard, there should be a possibility for users to view comments that instructors made. In some situations, this helps users to understand the data that is presented to them.

Company X is planning to move away from AFCAD and implement a new system: TOXX. It is not fully clear when this transition is going to happen. However, the plan is to have TOXX in place by the end of 2020. If this is the case, the implementation of the conceptual design should go hand in hand with the implementation of TOXX. TOXX is a new system, and therefore the way that data is going to be structured in this new system still has to be designed. This is an ideal opportunity to optimise the way the data is structured and implement the conceptual design.

Looking at the theoretical framework that was used for this research, Company X should continue to use the engineering cycle designed by Wieringa (2014). The engineering cycle causes people to continuously search for problems in the implementation of the conceptual design, or the ATQP-process in general. After these problems have been identified, a solution to this problem is designed. By using the engineering cycle during and after the implementation of the conceptual design, the ATQP-process should eventually be optimised. The future process owner would be the ideal person to execute these engineering cycles.

When implementing the conceptual design, calculating correlations between different AFCAD-questions should be the lowest-priority item. During validation, it turned out that correlations might be helpful, especially for the AET. However, it is hard to fully proof that two question are causally related. Furthermore, Implementing these correlations will be a be a time-intensive process.

7.3 Discussion

Subjectivity of data is one of the problems in the current ATQP-process. However, subjectivity is never going to be fully eliminated within the ATQP-process. To determine the contents of training programmes in the matrices, there is always going to be some form of interpretation of the AFCAD data necessary. For this purpose, Subject Matter Experts (SME's) like the AET members remain needed within the process.

Structured interviews were used to enhance comparability of answers and to minimise the need to interpret answers. The downside of structured interviews is the fact that there is no possibility to ask follow up questions, as the interviewer should stick to the script. If the interviewer would have had the ability to ask follow up questions, more valuable information might have been extracted.

During the focus group, there were several open-ended questions. These open-ended questions do encourage discussion and cause participants to think about the conceptual design. However, open-ended questions are somewhat up to interpretation and can lead to long answers. Furthermore, the focus group is a sample of members of both the AET and the training design team. However, the results from the focus group are used to validate the whole conceptual design. The views of the sample of people in the focus group do not necessarily align with the views of those who were left out.

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Appendix

Appendix 1: Detailed description of ATQP according to ATQP-manual (2020)

Company X describes the Alternative Training and Qualification programme as follows:

'To improve general safety of flight and the quality of training, operators are allowed to deviate from legacy training and checking requirements and introduce an operator specific Alternative Training and Qualification Program (ATQP).

An Alternative Training & Qualification Program (ATQP) allows operators a more effective and more operator-specific recurrent training and checking package for its crews. The program ensures a higher level of flight safety over the legacy system by utilizing improved training and evaluation. The program is a company specific alternative to traditional training. Data collection must be developed into a responsive program that can adapt to the changing requirements of an operator, such as new equipment, new technology or a differing route network. Focusing on specific needs of fleets and groups of pilots, targeted training can enhance performance.

Within Company X, ATQP is implemented for recurrent training and checking (i.e. Line Oriented Evaluations, Line Checks, Line Oriented Quality Evaluations and Recurrent Training). (ATQP Manual, 2020)

Appendix 2: Structured interview

Questions

Below, the questions that are going to be asked to members of the AET and the training designers can be found. Introduce interviewer and the purpose of the current research. Point out that this conversation is totally confidential and that no transcript or recording are going to be published; the interview is fully anonymous.

1. What is your current role at Company X?
2. How long have you been involved in the ATQP?
3. What is your current role within the ATQP-process?
4. What are the main activities of your team in the ATQP-process?
5. Do you agree with the following statements?

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The data that I need is easily accessible.					
The data that I need is clearly presented on screen.					
The applications that are used to analyse the data are easy to use.					
The written reporting that I receive is clearly laid out.					
The data that is presented to me is complete.					

6. How many items of data are you currently missing during your analysis?
    a. 4 or more
    b. 3
    c. 2
    d. 1
    e. 0
7. From the list below, what would you like to see in the way the data is presented to you? (you can select multiple answers)
    a. More graphs
    b. Filters so I can tailor the presented data to my needs
    c. Pre-filtering of the data, so it's tailored to our needs.
    d. An overview of all essential metrics in the main screen.
    e. Splitting data into smaller parts. E.g. split different aircraft types or different crew compositions.
    f. Having a simple overview/home screen. When clicking on data in this overview, more details are revealed.
    g. The whole team receives one file or application to work with, so analysis is similar for all aircraft types
    h. Sorting possibilities for the data (ascending, descending, alphabetical etc.)
    i. Easy overview of comments made by instructors, sorted per question. This way, the reason why a certain score was achieved on the selected question.
    j. Other, namely:
8. Could you name the 3 most important items of data that would help you to perform your tasks, that are currently unavailable? Please rank them from least important to most important (1 is most important, 3 is least important).
    1)
    2)
    3)
9. What activity that your team performs is most time-consuming?
10. What activity that your team performs causes most problems?
11. What output-data is created while performing your duties and how is it structured?
12. How do you make sure that your conclusions are passed on to the next team?
13. How much time do you currently spend on your work for the ATQP?

Thank the respondent for their cooperation and clarify that they can always contact the interviewer during the research to ask questions or make clear that the respondent does not wish to have their interview used for the research.

Results

Question 1: What is your current role at Company X?

Figure 24 depicts the responses of all respondents, while figure 25 and 26 respectively depict responses of AET-respondens and training designers.

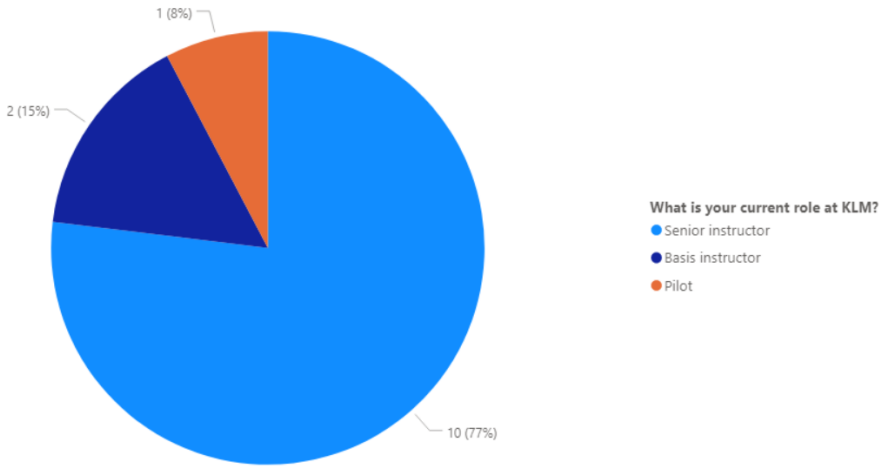

Figure 22:Functions of all respondents

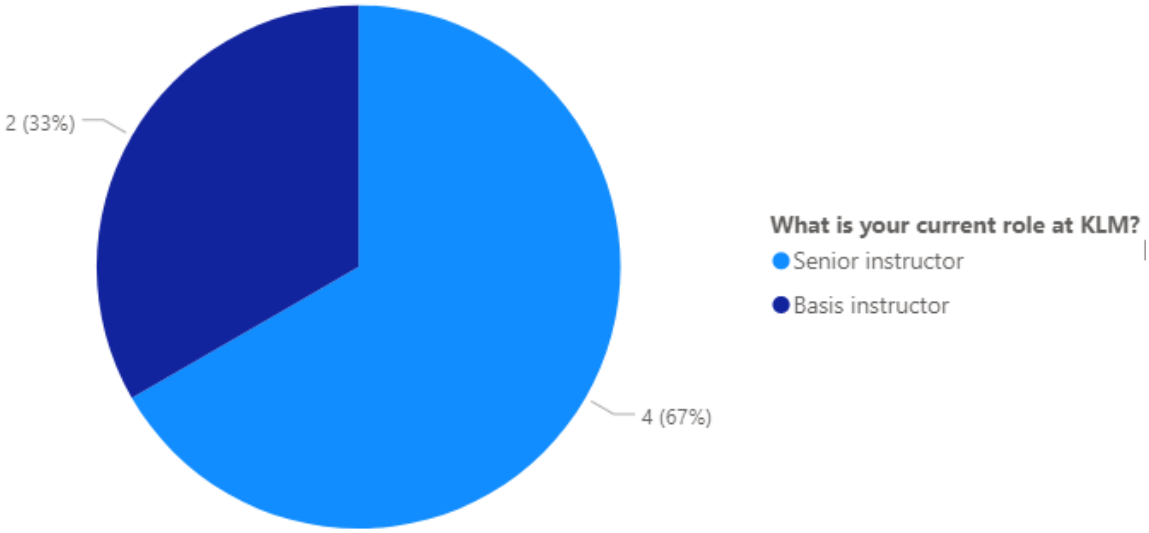

Figure 23: Functions of Training designers

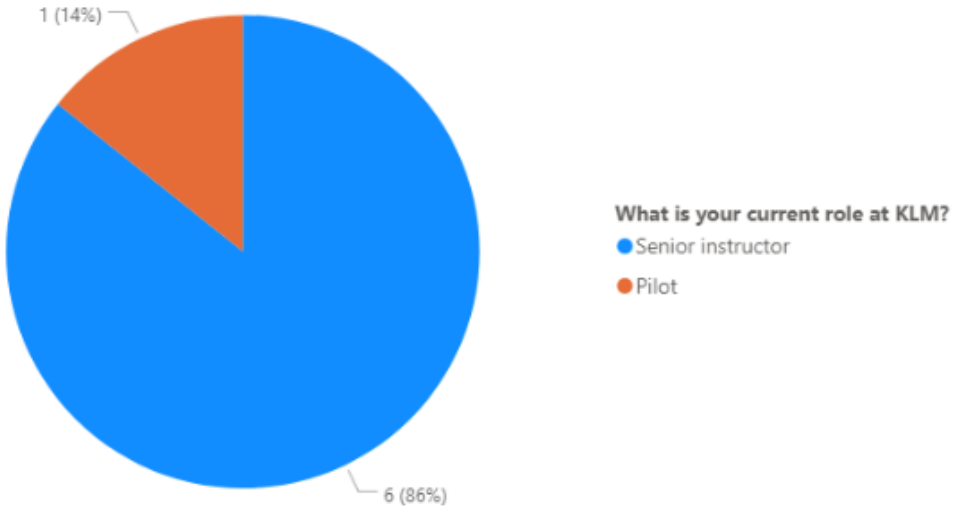

Figure 24: Functions of AET members

Question 2: How long have you been involved in the ATQP?

The responses were grouped into intervals of 1 year. Figure 27 represents all responses, while figure 28 and 29 respectively represent response from AET-members and training designers.

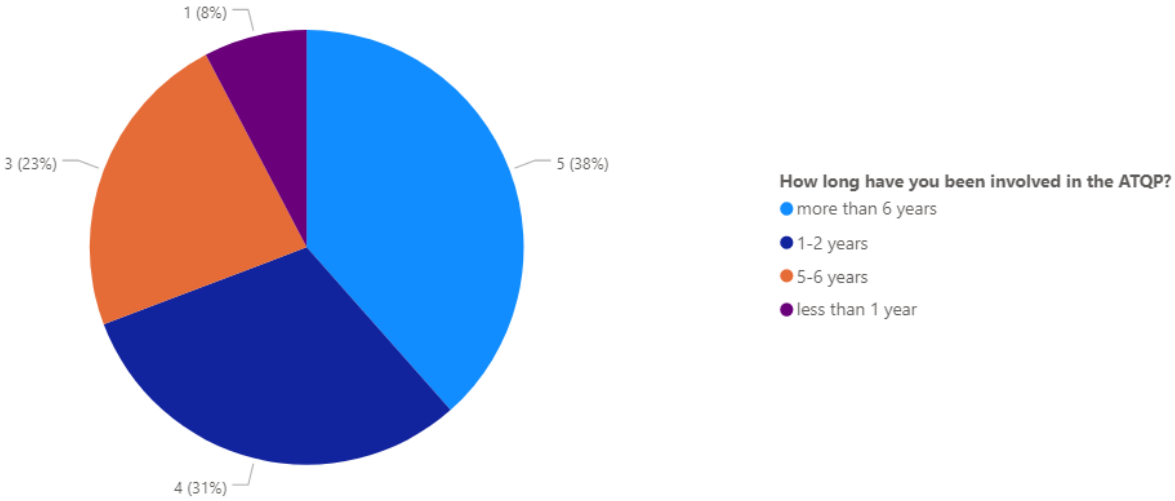

Figure 25: Time involved in ATQP, all respondents

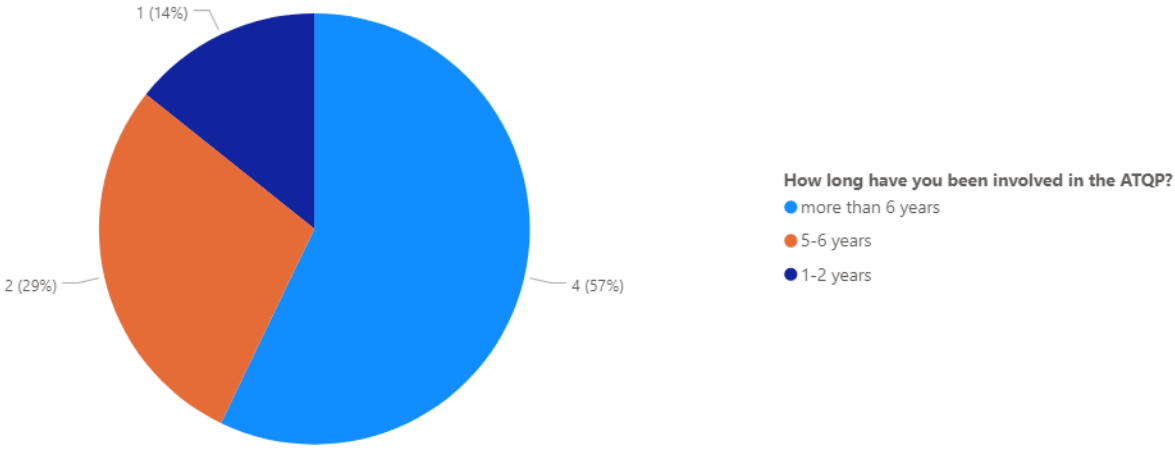

Figure 26: Time involved in ATQP, AET

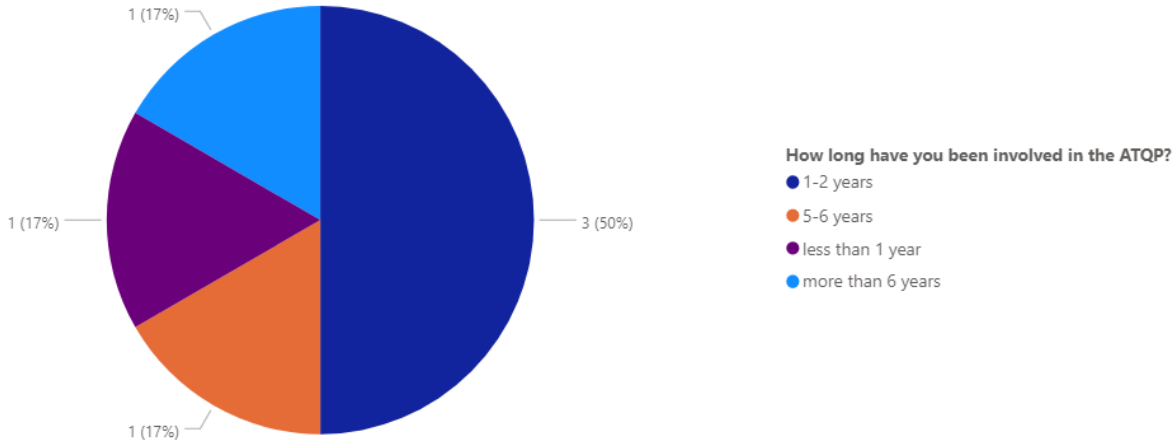

Figure 27: Time involved in ATQP, training designers

Question 3: What is your role within the ATQP-process?

There were two groups within this research: Training designers and AET-members. There were 7 AET-members (54%) and 6 Training designers (46%)

Question 4: What are the main activities of your team within the ATQP-process?

Statements that different respondents made were grouped into categories, the method that was used to do this is described in chapter 4: Results of Interviews. Below; responses are depicted graphically.

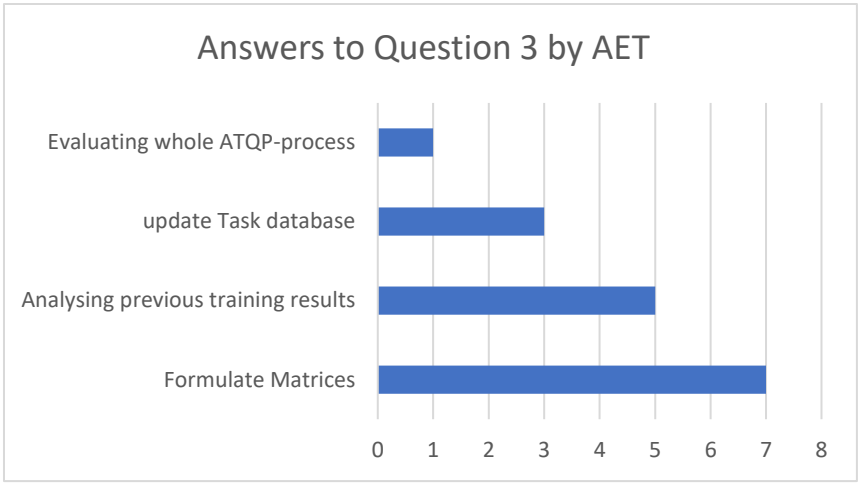

Figure 28: Answers to question 3 by AET

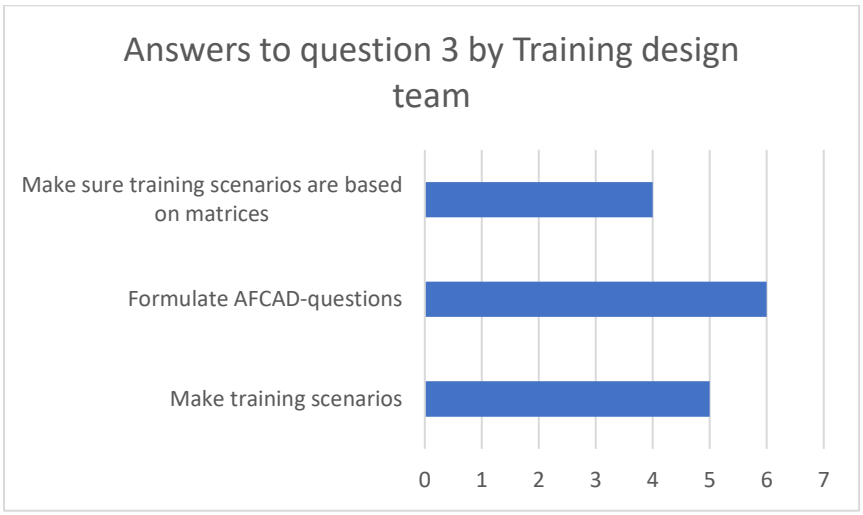

Figure 29: Answers to question 3 by Training design team

Question 5: Do you agree with the following statements?

Table 7: Answer matrix question 5, AET

AET	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The data that I need is easily accessible.		1	4	2	
The data that I need is clearly presented on screen.	2	4	1		
The applications that are used to analyse the data are easy to use.	2	4	1		
The written reporting that I receive is clearly laid out.			1	5	1
The data that is presented to me is complete.	1	1	2	3	

Table 8: Answer matrix question 5, training design team

Training designers	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The data that I need is easily accessible.	1	2		2	1
The data that I need is clearly presented on screen.	1	1	1	3	
The applications that are used to analyse the data are easy to use.	1	1	2	2	
The written reporting that I receive is clearly laid out.		4	1	1	
The data that is presented to me is complete.	1	1	2	2	

Question 6: How many data-items are you currently missing during your analysis?

AET:

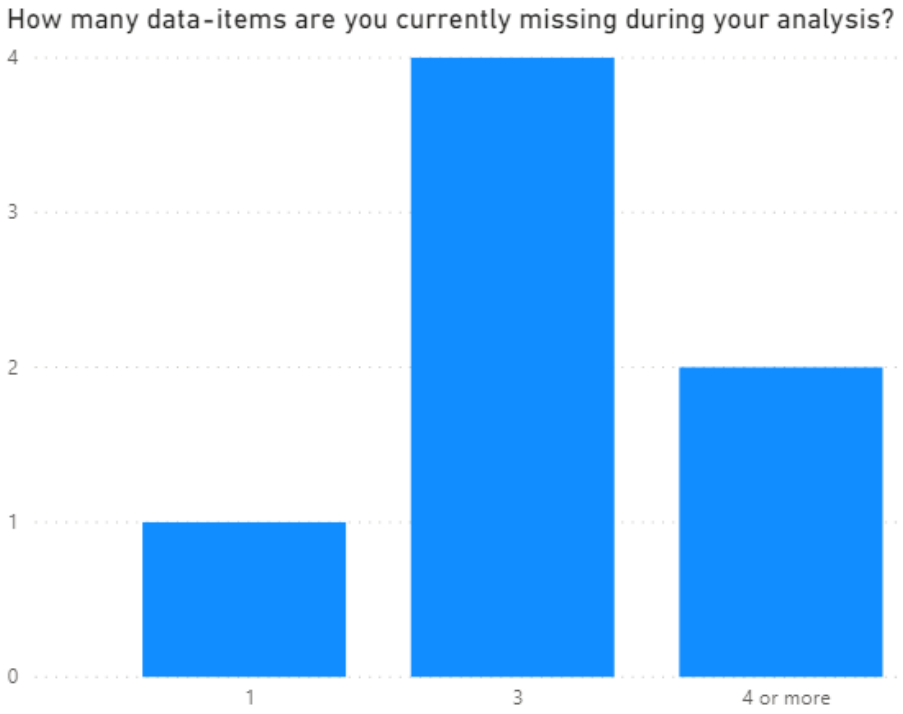

Figure 30: Frequencies of answers to question 6, AET

Training designers:

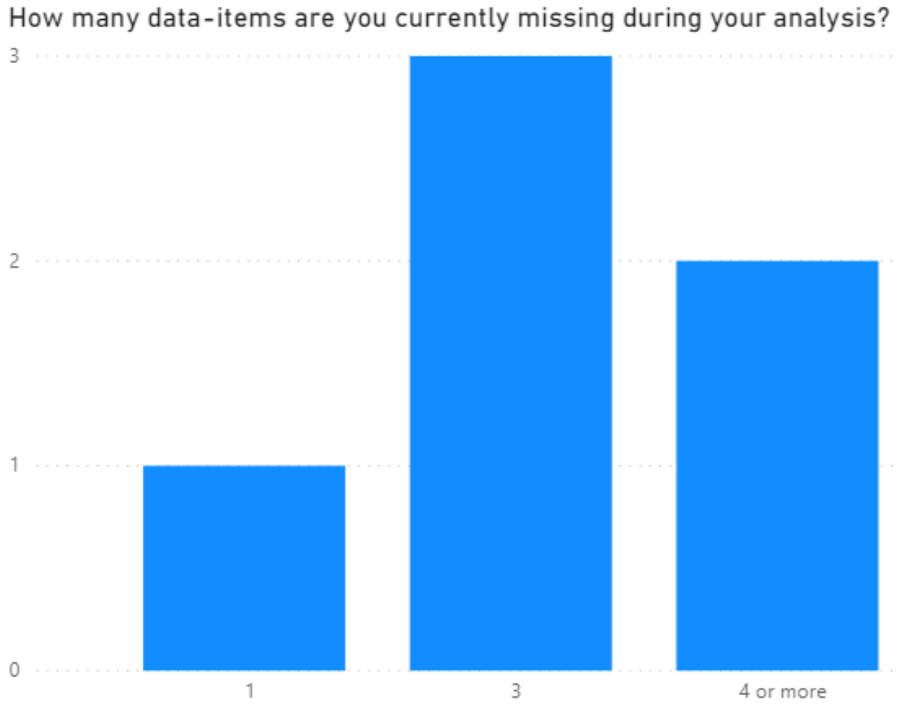

Figure 31: Frequencies of answers to question 6, training design team

Question 7:

Table 9: data presentation suggestions made by all respondents

TOTAL

Answer	Number of answers	RATIO
b.	10	77%
h.	8	62%
a.	7	54%
c.	7	54%
i.	4	31%
e.	3	23%
Other:		
Give instructors a couple of options when making comments instead of letting them write textual comments.	2	15%
Make live data from the current type recurrent available for review, so progress can be monitored	1	8%
d.	3	23%
f.	3	23%
g.	2	15%

Table 10: data presentation suggestions made by AET

AET

Answer	Number of answers	RATIO
b.	6	86%
c.	5	71%
a.	4	57%
i.	3	43%
Other	3	43%
Give instructors a couple of options when making comments instead of letting them write textual comments.	2	29%
Make live data from the current type recurrent available for review, so progress can be monitored	1	14%
h.	3	43%
g.	2	29%

e.	2	29%
d.	2	29%
f.	1	14%

Table 11: data presentation suggestions made by training design team

Training design team

Answer	Number of answers	RATIO
h.	5	83%
b.	4	67%
a.	3	50%
c.	2	33%
f.	2	33%
i.	1	17%
d.	1	17%
e.	1	17%
Other	0	0%
g.	0	0%

Question 8: Could you name the 3 most important items of data that would help you to perform your tasks, that are currently unavailable? Please rank them from least important to most important (1 is most important, 3 is least important).

In the figures and tables below, the statements and the number of times that they were mentioned are shown. In the three figures, the number of times a certain statement was mentioned as number 1, 2 or 3 is shown. Again, this is split up into all respondents, the AET and the Training designers. Furthermore, there is an overview of the total number of times every statement was made by each group of respondents (AET and Training designers). In the last graph, priorities are not distinguished. The number of 1st, 2nd and 3rd priority statements is not the same. This is the case because not all respondents could specifically think of three items of content that they were missing.

Table 12: number of statement per data content requirement, all respondents

All respondents	priority 1	priority 2	priority 3	total
Data from the past; trends	11	1	1	13
Motivation of answers by instructor	1			1
Grant acces that they do not have	1			1
AFCAD questions itself		3	2	5
Percentages of results (not desired/desired)		1	1	2

Correlations between questions		3		3
More explanation with matrices		1	3	4
More detailed data; focused on different functions		1		1
Show the competency that belongs to the AFCAD-question			1	1
Summary of events that are context of questions.			2	2
A function that recognises 'wrong' questions		1		1
total	13	10	10	

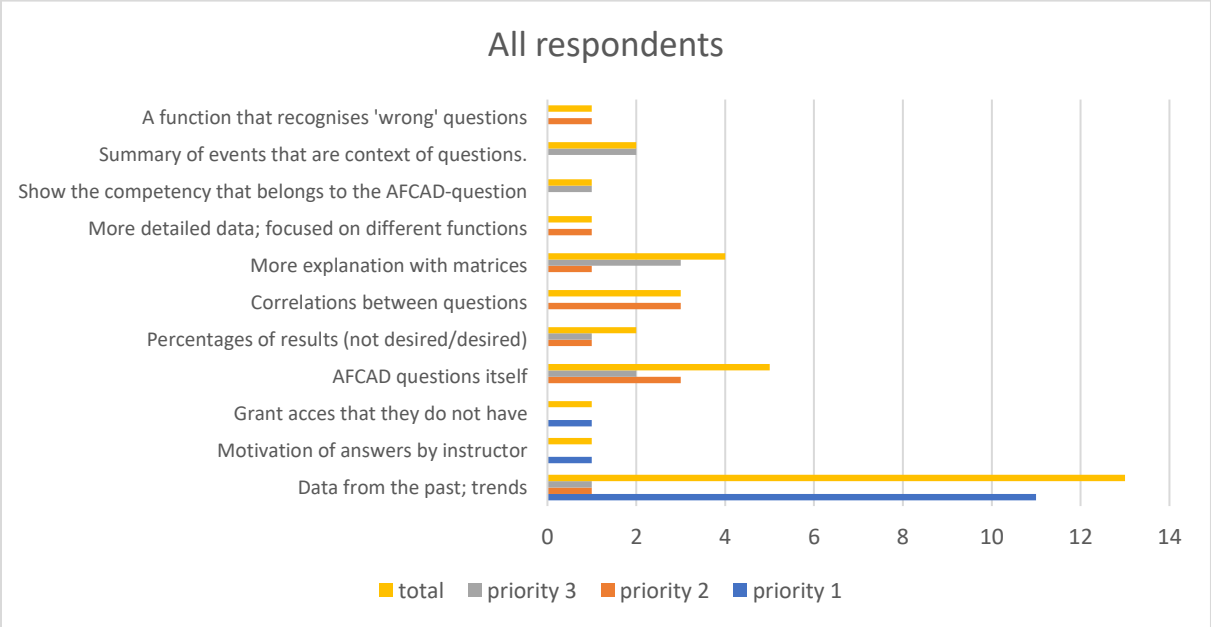

Figure 32: Number of statement per data content requirement, all respondents

Table 13: Number of statement per data content requirement, AET

AET	priority 1	priority 2	priority 3	total
Data from the past; trends	6	1		7
Motivation of answers by instructor	1			1
Grant acces that they do not have				0
AFCAD questions itself		2	2	4
Percentages of results (not desired/desired)		1	1	2
Correlations between questions		2		2
More explanation with matrices				0
More detailed data; focused on different functions				0
Show the competency that belongs to the AFCAD-question			1	1
Summary of events that are context of questions.			2	2
A function that recognises 'wrong' questions				0
total	7	6	6	

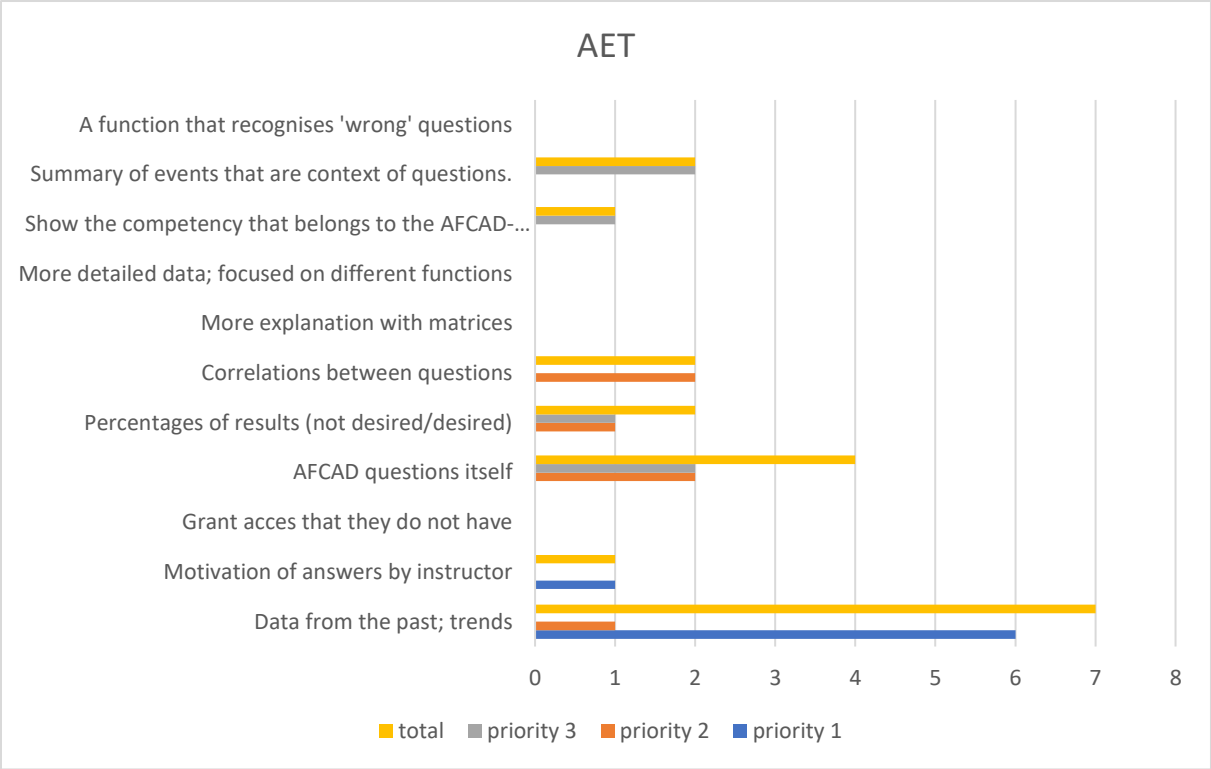

Figure 33: Number of statement per data content requirement, AET

Table 14: Number of statement per data content requirement, training design team

Training design team	priority 1	priority 2	priority 3	total
Data from the past; trends	5		1	6
Motivation of answers by instructor				0
Grant acces that they do not have	1			1
AFCAD questions itself		1		1
Percentages of results (not desired/desired)				0
Correlations between questions		1		1
More explanation with matrices		1	3	4
More detailed data; focused		1		1

on different functions				
Show the competency that belongs to the AFCAD-question				0
Summary of events that are context of questions.				0
A function that recognises 'wrong' questions		1		1
total	6	5	4	

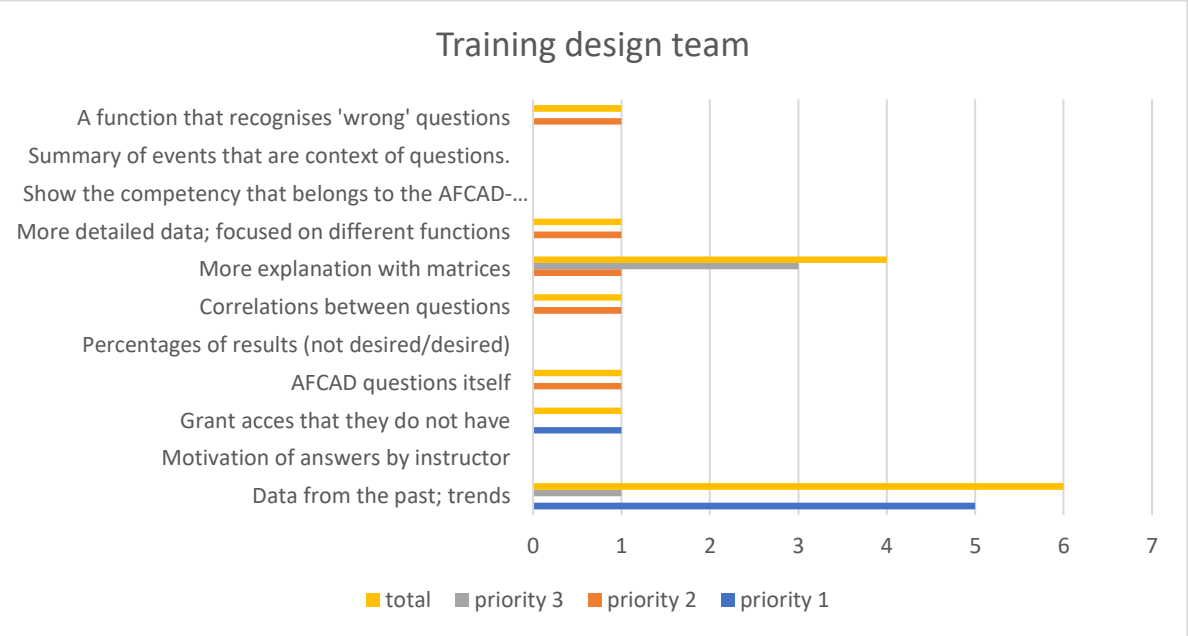

Figure 34: Number of statement per data content requirement, training design team

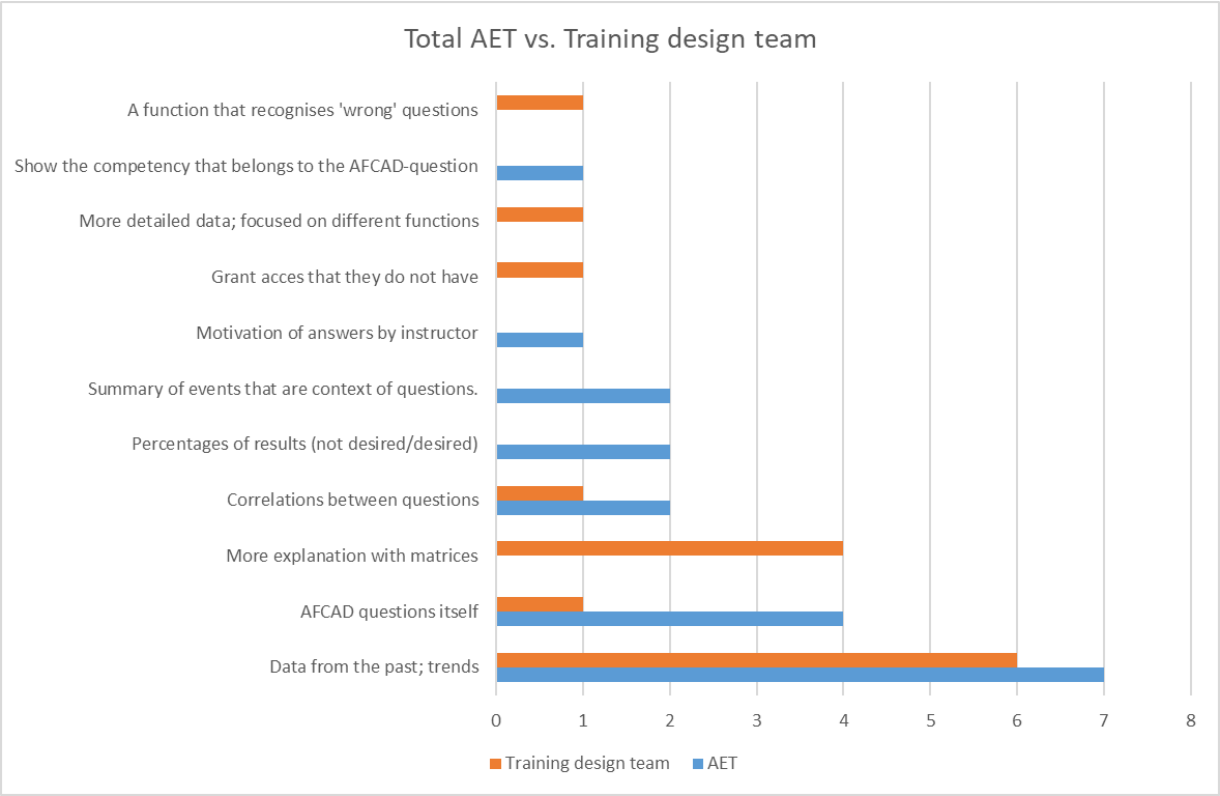

Figure 35: Number of statements per data content requirement, AET compared to training design team

Question 9: What activity that your team performs is most time consuming?

Table 15: Number of statements per time consuming activity, AET

AET	Number of statements	Percentage of statements
Editing data	1	14%
Interpreting data	4	57%
Working with the Task database	2	29%
total	7	100%

Table 16:: Number of statements per time consuming activity, training design team

Training design team	Number of statements	Percentage of statements
Formulating questions	3	50%
Writing instructor document	2	33%
Set out requirements for training (sprint 1)	1	17%
total	6	100%

Question 10: What activity that your team performs causes most problems?

Table 17: Number of statements per activity that causes problems, AET

AET	Number of statements
Editing the data	1
Interpretation of the AFCAD-data	2
Discussions due to differing opinion	2
Planning is left too late, causing availability issues	1
Making a conclusion due to lack of data from previous years.	1
Total	7

Table 18: Number of statements per activity that causes problems, training design team

Training design team	
Having access to data from previous years.	1
Formulating AFCAD-questions	2
Sticking to the schedule, some pilots tend to go into detail too much	2
Determining why a certain task is in the matrix	1
total	6

Question 11: What output-data is created while performing your duties and how is it structured?

This question was answered virtually unanimously in both groups. It can be concluded that the AET formulates matrices. A matrix is a list of tasks that have to be assessed during the next training programme. The AET also formulates power point presentations containing their main findings after the analysis. Lastly, the AET makes sure that the Task database stays up to date.

The Training designers write an extensive instructor document, in which the new training programme is described in full detail. This document also contains the AFCAD-questions for the new training. The AFCAD-questions are also uploaded to AFCAD.

Question 12: How do you make sure that your conclusions are passed on to the next team

Table 19: Ways conclusions are passed on according to AET

AET	
Don't know	4
There is no protocol	2
Conclusions are discussed by a team of training managers	2
Doesn't happen	1
Explanation of matrices to training design team is poor	2

Table 20: Ways conclusions are passed on according to training design team

Training design team	
Instructor/training document	6
Questions stored in AFCAD	3

Question 13: How much time do you currently spend on your work for the ATQP?

When asking this question, especially the training designers gave pretty different answer from one another. This can be explained by the fact that within the training design team there is a division between Seniors and scenario makers who have different responsibilities and therefore different working times. Despite this, all respondents were able to give an estimation of the time they spent, as well as an estimation of the time that was spent by the whole team. The answers to this question can be found in the table below.

Table 21: Time spent on ATQP according to AET members

AET (per round of analysis)	number of observations
5 days	5
6 days	1
3 days	1

Table 22: Time spent on ATQP according to training designers

Training design team (per training)	
8 days	1
7 days	3
10 days	1
14 days	1

Appendix 3: Problems in the ATQP-process

When looking at the current ATQP-process loop, there are a couple of things that are not going well. Firstly, raw data from simulator sessions is sent to the AET without further editing or fine-tuning. The AET consists of pilots, who have limited or no IT-skills. This means that the AET is wasting a very big portion of their time (might be as high as 50 per cent) on figuring out how to use and visualise the data. On top of this, data from simulator sessions shows a percentage of 'desired' and 'not desired' behaviour for each executed task. The pilots in the AET have to discuss what pass-rate is acceptable for each task. Again, this keeps the team from efficiently analysing the data and drawing conclusions. It might be more efficient to determine this pass rate as the AFCAD-questions are made, before the training starts.

After analysing the data from previous training sessions and reviewing the Task Database, the AET makes matrices. The task database that the AET uses to determine the contents of the new trainings is not laid out perfectly either. The task database has already seen some significant design and layout improvements. It can still be quite hard to find the required data however.

When the matrices are finished, the AET sends the matrices to another expert team. This team then makes scenarios and AFCAD-questions that are going to be used in the new training curriculum, based on the content of the matrices. Training designers expressed that data they receive from the AET in matrices is not always clear. Training designers regularly receive data that is very broad and can be interpreted in multiple ways. This in turn leads to AFCAD-questions and possibly even scenarios that result in answers that are not useful for the AET, who have to analyse the answers to the AFCAD-questions in the end. On top of that, some members of the AET expressed their concerns about AFCAD-questions being too vague or badly formulated, making it almost impossible to analyse the results that follow from these questions.

Appendix 4: Overview of research designs per research question

Table 23: Research design for each research question

Research question	Type of research	Research population	Operationalisation	Data gathering method	Type of data	Data analysis method
1.	Cross-sectional, descriptive research.	All actors in the ATQP-process. Research subject: key people in ATQP-process who have an overview of different aspects of the process.	Make an overview of the different functions within the ATQP-process.	-Structured interviews with relevant ATQP-actors.	Quantitative.	List different functions within the ATQP-process
2.	Cross-sectional, descriptive research.	All actors in the ATQP-process. Research subject: key people within the ATQP-process.	Describe the tasks that the different functions found after answering question 1 fulfill. Include the duration of the tasks.	-Structured interviews with relevant ATQP-actors. -Observation during meetings.	Qualitative & Quantitative	Group statements and link them to the different functions that exist within the ATQP-process.
3.	Cross-sectional, descriptive research	Different teams within ATQP-process.	What formats are used and what is used to transfer data?	Structured interviews with relevant persons in different teams.	Quantitative.	Analyse interview data and list key statements that were made.
4.	Cross-sectional, descriptive research	Database where training data is stored	Determine the format the data is stored in	Investigate training data in database.	Quantitative	Review datasets stored in database.
5	Cross-sectional, descriptive research	AET.	Present answers in graphs to visualise results.	Structured interviews with key AET-members. The interview is based on the data obtained about the ATQP-process in its current form.	Qualitative & Quantitative.	Analyse answers on predefined questions and visualise these results.
6.	Cross-sectional, descriptive research.	AET.				

7.	Cross-sectional, descriptive research	Training design team	Present answers in graphs to visualise results.	Structured interviews with key training designers. The interview is based on the data obtained about the ATQP-process in its current form.	Qualitative & Quantitative.	Analyse answers on predefined questions and visualise these results.
8.	Cross-sectional, descriptive research.	Training design team				

Appendix 5: Goals of interview questions

Table 24: Goals of the different questions in the structured interview

Question	Answer should increase knowledge about	Presentation of answers	Way data is going to be used	Comments
1	Context	Show graph of the frequency of a specific answer.	The composition of the different teams.	Most actors in the ATQP-process are not working on it full time. Most actors are pilots or instructors as well. It could be useful to know whether pilots view certain aspects differently than instructors for instance.
2	Context	Show graph of the frequency of a specific answer. This is grouped per year.	Gain knowledge about the types of people involved in the ATQP-process; are they all veterans with many years of experience, or are there some new people with a fresh and new view on the situation.	There are people that have been involved in the ATQP-process for a long time. They might view the process in a more favourable way than people who have only been involved for a short period of time, say 1 to 3 years. Asking this question should clarify whether the time involved in the ATQP-process influences responses.
3.	Context	Show with team and frequency of the answer.	The number of participants per team within the ATQP-process	Determine to which team the respondent belongs. This is important since different teams might have different data requirements.
4.	Context	Group statements and count frequencies.	Show whether members of the same team have similar views on their duties.	Determine what the main activities of the different teams within the ATQP-process are.
5.	Current Structure of data. The last statement is about current data content.	Count frequencies of certain grades.	The grades can help to show what respondents think of the current data-presentation to them. This should point out what the different teams think of the way data is presented to them. If grades are poor, data presentation is something that needs to be worked on. If grades are relatively good, it might be smart to prioritise other issues such as the content of the data.	Get an idea of the satisfaction of team members.

6.	Current content of data	Count frequencies of answers.	This indicates whether all needed content is available.	
7.	Required Structure of data	Write down all statements that respondents made. Group statements that are reasonably similar and analyse results	The results should show what the most pressing issues on data presentation are. Making respondents rank their top three most important issues should also clarify what issues are being prioritised over others. Analysing the statements should bring to light what data structure both teams require to increase their working productivity. This is key to formulating the eventual conceptual design.	This question can help to think of the data presentation that is required by both the AET and the Training designers. These presentation requirements should help to determine the needed structure of the data
8.	Required content of data	Write down all statements that respondents made. Group statements that are reasonably similar and analyse results	The results should show what the most pressing issues on data content are. Making respondents rank their top three most important issues should also clarify what issues are being prioritised over others. Analysing the statements should bring to light what data content both teams require to increase their working productivity. This is key to formulating the final conceptual design	This question can help to think of content that should be available to both the AET and the training designers.
9.	Context	Write down all statements and group statements that are similar.	Finding out what activities cost most time for both teams should help to determine on which aspects most time can be won. This can be a factor in the final advice. It also helps in understanding the current operation of the ATQP-process.	The biggest productivity improvements can be made on the activity that consume most of the team's time.
10.	Context	Write down all statements and group statements that are similar	An activity that causes problems has a reason why it is causing problems. If this reason can be solved by improving training data use, it should be taken into account in the final advice.	
11.	Current data content and structure	Write down all statements and	This should indicate what data content is created in every step in the process and in what way it is structured.	

		group statements that are similar		
12.	Context and structure of current data	Write down all statements and check whether they align.	If different members of the same team report differently here, there is a serious communication issue. Also, this question will help to improve knowledge about the current operation of the ATQP-process. It should clarify how data is presented to the next team.	
13.	Context	Add up the time statements.	Clarify the number of hours worked within the process.	

Appendix 6: Desired ATQP-process (BPMN)

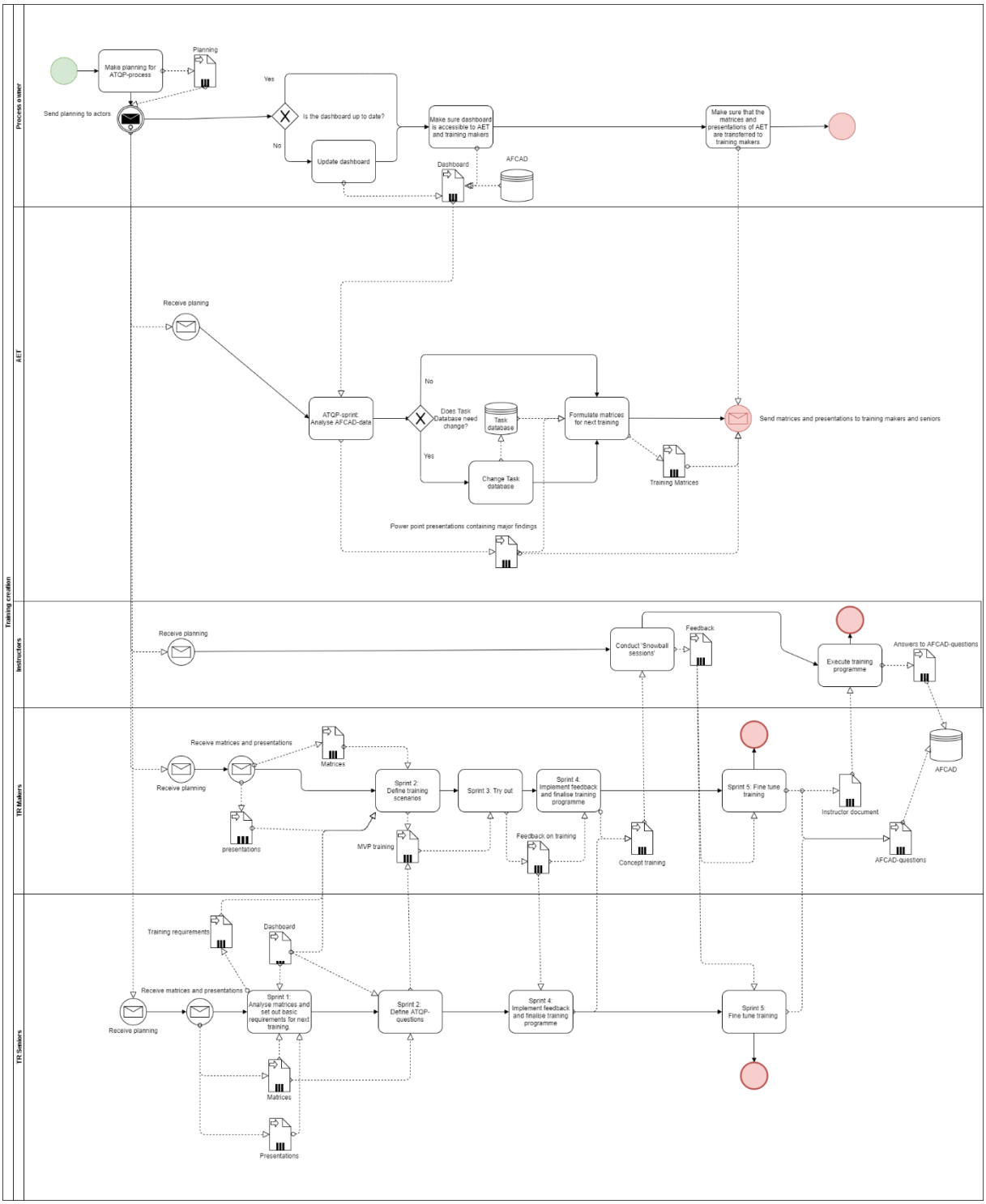

Figure 36: the desired ATQP-process

Appendix 7: Focus group

Before the focus group commenced, participants were asked whether they agree to the recording of the focus group per e-mail. After a brief welcome and the presentation of the conceptual design, the focus group started by asking the questions that can be found below. As can be read in chapter 6, participants were encouraged to speak up and state anything that came to their minds. Moreover, discussion between participants is encouraged. The questions were formulated based on Krueger's paper on focus groups (2002).

Questions

1. Starting with the dashboard that was presented; Would this dashboard help you to spend your time more usefully? Please explain why (not). Please know that negative comments are just as useful, if not more useful than positive comments.
2. If you could name one thing that you are missing in the current dashboard, what would it be?
3. In the Conceptual design that was presented to you, granting the training designers with the power point presentations was mentioned. Do you think this will benefit the ATQP-process?
4. The appointment of a process owner is something that is advised to Company X. Do you think having one person responsible for the operation of the ATQP-process (planning meetings and making sure files are in the right place at the right time) would be beneficial compared to the current way of working?
5. Looking at the recommendations that were made as a whole, what would be the one thing you would change or remove?
6. Looking at the recommendations that were made as a whole, can you name the thing you would definitely keep?
7. Do you think the proposed conceptual design would reduce the time that is needed to perform your duties within the ATQP-process? Would the analysis be more effective, because there are less non-core duties to take care of?
8. What do you think of the current way of working, compared to the conceptual design?
9. Looking back at our discussion, what is most important to you?
10. Did we miss anything?

Event 4: RNP approach (3D)

Start:	Beginning of approach briefing			
End:	After landing	YES	NO	?
Task:	**RNP approach (3D)**			
13	(E3) Does the crew mention the possibility of a high vertical speed due to temperature	◯	◯	◯
14	(E1) Does the PM actively monitor the aircraft flight path during the approach?	◯	◯	◯
15	(P4) Does the crew comply with the recommended stabilized approach criteria?	◯	◯	◯
16	(E4) If the approach was not stabilized did the crew decide to perform a Go Around?	◯	◯	◯
Task:	**Crosswind landing (on operational limits)**			
17	(A3) Does the F/O use the prescribed crosswind landing technique?	◯	◯	◯
	Did you observe any other desired behavioural SHAPE components in this event?	◯	◯	
	Did you observe any other not desired behavioural SHAPE components in this event?	◯	◯	

Event 5: PRM approach

Start:	Start of PRM approach			
End:	After breakout procedure	YES	NO	?
Task:	**PRM approach including breakout - sim training**			

Select desired SHAPE components

Observation

S1 Assertiveness

S2 Self-control

S3 Company Representation

S4 Self-Criticism

S5 Distraction Management

H1 Working with others

H2 Communication

H3 Task Oriented Leadership