Agile Business Analysis

A Digital Assistant for Students at FHNW

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1. Introduction and Definitions

This report was realized as part of the module Agile Business Analysis in the program MSc in Business Information Systems at University of Applied Sciences Northwestern Switzerland (FHNW). During this module groups of 4 person were challenged to form agile teams and conduct agile business analysis projects. Each team member should perform in the role of a business analyst while solving together a concrete use case using agile project management methods. The Agile Business Analysis project is divided into four phases. The first phase is designated to find the problem, the team formation, selection of a use case and pitching the idea. Then there will be three sprints at which each team has to show intermediate results. The result of all sprints will be finally pitched at the end of the module. After each sprint, the lecturers provide students with feedback and suggestions for improvement. The whole progress is documented in this report, providing a coherent and consistent description of all sprints, explaining used techniques reflecting the Guide to the Business Analysis Body of Knowledge (BABOK) (International Institute of Business Analysis, 2015) and its Agile Extension Version 1 (International Institute of Business Analysis & Agile Alliance, 2013).

The project topic was provided by the FHNW and aims in solving a problem of an overwhelming number of various requests from students to the FHNW. It is foreseen that the number of requests reaching the FHNW's administration and requiring human involvement could be reduced with a digital assistant. More information was not given at the time being and therefore the scope was not clearly defined. It lied within the responsibility of the agile team to further define and plan the project activities. Digital assistant refers to a concept of a chatbot, which can be defined as follows:

"A computer program designed to simulate conversation with human users, especially over the Internet." (Oxford University Press (OUP), 2019).

2. Perspectives

As stated in the assignment, the project topic should cover at least one of the business analysis perspectives mentioned in the BABOK guide (2015, pp. 368–424). Aiming on simplify the processing of student requests applying a chatbot, the project covers clearly at least the following two business analysis perspectives:

- Information Technology (2015, pp. 394–407)
- Business Process Management (2015, pp. 424–439)

Furthermore, processing of student requests is an operational task and the chatbot should support operational, and not strategic or tactical, decisions. To have a clear focus within the project, the team decided to scope the project on the process level.

3. Initiative

This chapter describe the initial knowledge about the challenge. The information was gathered immediately after the initiative was accepted and therefore the information is expected to change due the iterative nature of selected methodology.

4. Current state

The FHNW receives a large number of requests from students regarding different aspects of their studies. The following three topics were communicated in the original problem statement:

- **Administrative questions**: module changes, questions about the curriculum, applications for study confirmations, etc.

- **Curriculum-related questions**: questions about the double degree, questions about pre-courses, etc.
- **Module-related questions**: support during lectures, filing documents in Moodle, questions about tasks, etc.

Answering these questions takes a lot of time and sometimes students must wait a long time for an answer.

4.1 Stakeholder Analysis

The stakeholders can be divided into two main categories.

- Students
  - Current Students: matriculated students who already studying at the FHNW
  - Potential Students: interested, considering, or applying students
- Employees of the FHNW
  - Administrative Employees: school's administration
  - Module Director / Lecturers

The stakeholder analysis aiming in identification of the students' needs and requirements is rationally limited to those students who are already studying at the FHNW, are already matriculated, and currently enrolled in some modules. The limitation is applied for the following two reasons: firstly, the serious data collection of interested students is difficult in the short-time period and secondly, the group does not want to get bogged down with too many different stakeholders. The second reason leads to further refinement of the stakeholder group to the Business Information Systems students. Since the FHNW employees are living the pain point having to answer the most questions, which are repetitive in nature, they are considered as the most important stakeholder. This due the believe that in the end a chatbot will facilitate the greatest value for this stakeholder group.

4.2 Desired State

The current state shows that the situation as it is today is not satisfactory for any of the stakeholders. With the use of technology this will no longer be necessary. The ABA-project team 02 has the following vision:

We want to reduce the effort for FHNW and its students related to administrative questions with the use of smart technology.

When fully functional, implemented and trained the solution, in the shape of a chatbot, will be able to answer questions related to all interlinked applications. While repetitive questions that need no further consultation can directly be answered with the correct information, request my need redirection. Some questions or request can only be processed by a FHNW employee. The registration or deregistration of modules outside of the registration period for example. Other requests can be done independent, but only through a specific application or tool. The download of transcripts of records for example. In this or other such cases the digital assistant will still be helpful by directing the student to the right person or tool in order to get his question answered or request processed.

The potential goes even further than simply for administrative tasks. When implementing Moodle, semester schedules of a module and the content of lecture, module-related questions can be

processed as well. One can easily imagine questions like when a deadline is or what day which topic will be thought. But when thinking further the content could be integrated and specific questions regarding it could be answered. Especially when studying for final exams or writing a summary that could be helpful, but also more complex to implement and therefore only possible in the long-run.

The chatbot is also one of the classic applications of artificial intelligence (AI). The more they get to answer questions, the more they can answer tricky and more complex questions. While some fear jobs being taken away by the AI-bots, FHNW does not have to fear such cases. Many tasks are not intended to be replaced by technology at the current state, apart from the answering of repetitive questions of students or recurring requests. The Mission, based on the Vision and future outlook is the following:

We want to increase the efficiency of the dialog between FHWN and students with administration-related questions by reducing the effort with a digital assistant.

4.3 Risk Assessment

The chart in Figure 1 shows the overview of the identified risks, which could endanger the success of the project. The chart puts probability and consequences into proportion and ranks the potential risks into unlikely (1) to almost certain (10) for probability and insignificant (1) to catastrophic (10) for consequences. The risk assessment is based on chapter 6.3 Assess Risks in the strategy analysis knowledge area.
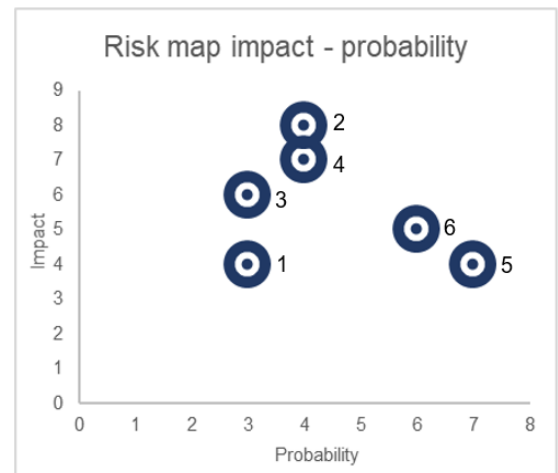

Figure 1: Risk map comparing impact and probability

The risks are executed into more detail in Table 1. The consequences are not only ranked on a scale, but also described into more detail. The preventive measures, which should minimize the potential risk and the severity of the consequences are outlined in the last column of the table.

Risk	Probability	Impact	preventive measure
1. Team member drops out	3	4	Communication if there is a problem or if there is a plan to change classes
2. Stakeholders are not satisfied	4	8	Call for feedback of progress and current stat and execute stakeholder analysis carefully.
3. Lack of input from relevant stakeholders	3	6	Concrete needs are communicated and justified, open exchange and communication about how input is used and processed. Correct application of Elicitation and collaboration knowledge area
4. Solution is technically not realizable	4	7	Correct application of requirements analysis and design definition and solution evaluation knowledge area
5. Applied methods are not a good fit	7	4	Well planned and structured sprints with goals and reviews. Correct application of Business analysis planning and monitoring.
6. Saved time on solution is smaller than effort for maintenance	6	5	Reduce risk by evaluation and review the planned solution and management of the life cycle of requirements

Table 1: Risks with probability/impact assessment and the preventive measure against.

5. Methodology

The selection of appropriate methodology was guided by the Stacey-Matrix (Ballarin Latre, 2019), which helps to sort out the projects that particularly suit to the agile practices.
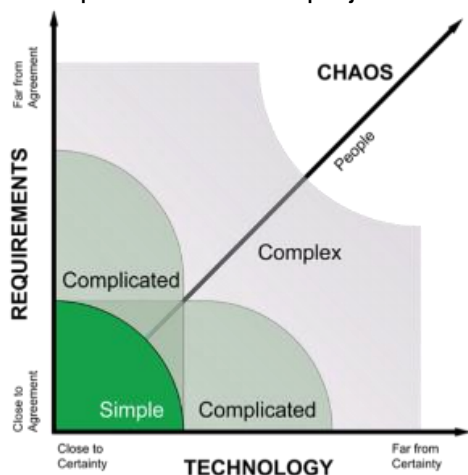

Figure 2: Stacey Matrix (Ballarin Latre, 2019)

The Stacey-Matrix brings the following three dimensions in correlation with each other:

- Requirements
- Technology
- People

The scale used goes from "Close to Certainty/Agreement", which means that almost all information that is required is already given, to "Far from Certainty/Agreement" which is the exact opposite, almost no information is given to start with.

Depending on the clarity of information and knowledge given for a project in relation to the dimensions mentioned above, it then can be classified in one of the following areas regarding to the complexity (see Figure 3):

Simple	Complicated	Complex	Chaotic
Waterfall	Waterfall / Agile	SCRUM	Kanban
Known Knowns	*Known Unknowns*	*Unknown Unknowns*	*Unknowables*
Routine	Domain of experts	No previous experience	No recognizable patterns
Sense - Categorize - Respond	Sense - Analyze - Respond	Probe - Sense - Respond	Act - Sense - Respond

Figure 3: Complexity Areas Stacey Matrix (Maretzke, 2019)

The group made following considerations while analysing the dimensions of the Stacey-Matrix:

Requirements: At the beginning the group had no idea about the possible requirements and as there is a variety of chatbot implementation possibilities, the team decided to shift the scale towards "Far from Agreement".

Technology: There was a better understanding of applicable technologies than the requirements, so the group placed the project quite in the middle of the scale between "Far from Certainty" and "Close to Certainty".

People: Team members summed up with totally different backgrounds and knowledge about the chatbots varied in the team. It was not clear at the beginning if technical implementation of a chatbot would be realizable at all.

Taking everything into account the project characterized as a "Complex". Furthermore, the timeframes and the probability of changes in the gathered requirements supported the constant readiness to a repetitive and rapid change. According to the second version of the agile extension to the BABOK guide (2017, pp. 8–9), agile frameworks have some common characteristics:

- respect for people and the importance of creativity in delivering value,
- the importance of rapid delivery, feedback, and learning to ensure the product or service being produced meets real customer needs,

- collaboration and communication among the team members and the stakeholder community in order to build shared understanding, and
- break work into small slices of business value and deliver them incrementally and iteratively.

This acknowledgement further assured the selection of agile methodology as a right choice. Meaning that an agile approach is recommendable, as it embraces learning, collaboration, incrementality and refinement of work, as well as iterative nature of the progress, thus preparing the team to the repetitive and rapid change. Applying this approach, the team aims in agile business analysis activities: learning and identifying what is truly valuable, what does not add value, and facilitate the learning and communication needed to continually deliver the right value to the stakeholders. (International Institute of Business Analysis & Agile Alliance, 2017, pp. 8–9).

Further business analysis approach, stakeholder engagement and information management are described. The business analysis governance and performance improvement plans, known from the BABOK guide, are not discussed as there is no governing organization involved, the team is small and autonomous, and aims in reduction of unnecessary formalities. The decision making is described in the stakeholder engagement part. Performance improvements are analysed and reviewed during each retrospective. (International Institute of Business Analysis, 2015, pp. 24–55)

Business Analysis Approach
The business analysis approach was defined pre and during the first sprint. The sprint planning started with a Kanban board exploring incremental and iterative principles of Scrum without daily stand-ups and with a strong self-initiative and autonomy of an individual. The Scrum roles were assigned (see chapter 6.1) and it was agreed that the team aimed in equal and fair work-load distribution. There are three roles in Scrum (International Institute of Business Analysis & Agile Alliance, 2017, p. 12):
- **Product Owner:** maintains overall vision and direction of the product and is responsible for defining and prioritizing the product backlog according to customer value.
- **Scrum Master:** ensures the team's Scrum processes are followed and the team functions well shielding them from external interferences.
- **The Team:** is responsible for developing and delivering the product in a collaborative manner according to the sprint goals and the definition-of-done.

Each team member should participate in each role, but the main responsibility, the ultimate decision power, is given to the person officially appointed to the role.

The team applies following Scrum-ceremonies and techniques (International Institute of Business Analysis & Agile Alliance, 2013, pp. 10–13; 17–18; 105–106):
- Backlog Refinement: a backlog is a list of things that should be done. The team agreed calling them items sticking to two types of them: user stories and requirements. The requirements are seen as sub-item of a user story, the acceptance criteria, which defines when the user story is fulfilled. Handling both requirements prioritization and change management is conducted over a Kanban board, which visualizes the progress and change management. MoSCoW-prioritization is applied whenever prioritization of the items is necessary. All requirements were traced with Trello, as it suited the needs for this project. Therefore, a template was defined so that all requirements had the same structure and were easy to manage and recognized as such. Additionally, all changes on a requirement could be

retraced, as Trello offers a ticket history for each ticket. Furthermore, the Trello Board can be filtered according to labels, e.g. User Stories, which would then give a clear overview the requirements and in which state they are. Last but not least, it is also possible to reuse the specified requirements for further development, as they can be easily exported e.g. as JSON or CSV for further reuse.

- Retrospectives: Retrospectives allow a team to reflect their ways of working and are applied for sprint reviews and planning as well. Feedback on the requirements and the improvement possibilities are analysed and the next sprint is adjusted accordingly.
- Weeklies: instead of daily scrum stand-ups, where the current status is shared, decisions are made and further steps are accepted collectively, the team was destinated to run weeklies. Each Friday after the lessons.
- The sprints were predefined according to the study plan (see module semester plan)

Each sprint has its own definition-of-done formulated in the Kanban board, which is based on the user stories initiated during the first sprint. Sprints are treated as milestones. It is expected that the user stories will mature during sprints as there will be more requirements and new acceptance criteria. By the end of the second sprint the Minimum Viable Product (MVP) in a form of a prototype (International Institute of Business Analysis, 2015, pp. 323–325) should be realized. The third sprint should therefore be used for further exploration and formulation of user stories, requirements and acceptance criteria.

Stakeholder Engagement

The stakeholder engagement is conducted as follows:

- **Students**: The team decided to focus only on current students as the potential students are out of the reach and would require extensive effort for successful engagement. As the team consists of current students, team members can self-reflect remarkable amount of input. To confirm the emerging assumptions, the team can always bring these to the fellow students for evaluation. In this case the assumptions validating information can be elicited by interviewing or with a questionnaire. The current students are engaged periodically during each iteration on a weekly basis. They are often busy with their group works and therefore it has to be evaluated on a situation basis when it is the best moment for elicitation.
- **Employees of the FHNW**: Each FHNW employee group is interviewed separately on weekly basis. The interviews are conducted in non-structured, semi-structured and structured formats directly and via mail. As the initiative is owned by the FHNW, each stakeholder is motived to participate in elicitation. These elicitations should be planned and agreed upon ahead.

The situation is optimal, as the owner of the initiative, as well as, the majority of the stakeholders are available during each weekly meet-up. There is a possibility to review, align and confirm the results on a weekly basis. Weeklies are devoted to standard and routinized decision making.

Business Analysis Information Management

The information is managed applying the following technologies:

- Communication: Email, Skype, Whatsapp
- Kanban, Sprint Management (Scrum), Requirement Management: Trello
- Detailed Documentation: Dropbox, Github, Word

The team is relatively small and therefore applying simply information management and decision-making patterns in order to avoid waste.

6.   Sprints

The following chapters will give an overview of the three Sprints that have been conducted. It will give insights about the different stages that our team has gone, which methods have been used and the results of each Sprint will be discussed.

6.1 Sprint 1

6.1.1 Sprint Planning & Task Description

Sprint 1 served us to get an initial idea about the requirements of the different stakeholders, to get a first impression of the tools we use (especially Trello and Github) and to create our first dialogue with the chatbot to improve our ability to estimate further development in the subsequent Sprints.

As a first task we set up our Product Backlog in Trello with all Tasks that came into our minds and to have a clear overview we structured the Trello board by introduction a new list element "Milestones / Explanation" (see Table 2 and Figure 4):

Initial Pitch:	All cards that define tasks concerning the initial pitch.
Sprint 1:	All cards that define a task shall be done for Sprint 1.
Sprint 2:	All cards that define a task shall be done for Sprint 2.
Sprint 3:	All cards that define a task shall be done for Sprint 3.
Final Pitch:	All cards that define tasks concerning the final pitch.
Deliverable:	All cards that represent some sort of deliverable/artefact.
Meetings:	All cards that include a specifically planned meeting to be conducted.

Table 2: Descriptions of Milestones/Explanation elements in Trello

All cards created have been marked with at least one of the elements listed in Table 2. Furthermore, the roles of our team have been defined as follows due to the fact that Anton and Marc already had some experience with agile methods and Scrum:

- Anton: Product Owner
- Marc: Scrum Master
- Anton, Lorenzo, Luca, Marc: Development Team

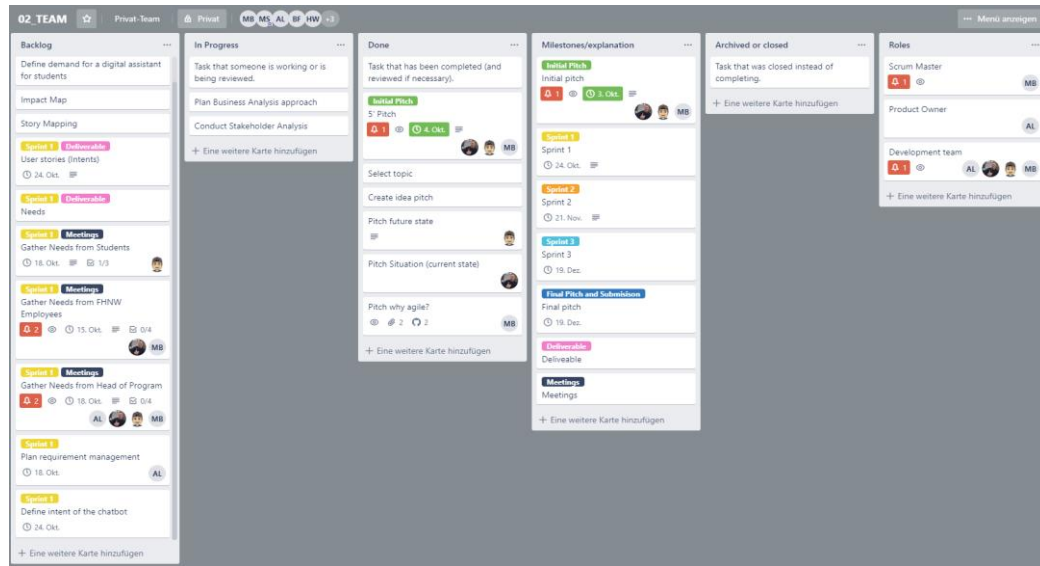The initial Product Backlog looked as follows (see Figure 4):

Figure 4: Initial Product Backlog in Trello

All tasks concerning the initial pitch already have been done before the first Sprint Planning and are therefore already marked as "Done".

Having a look at the tasks in the Backlog and the BABOK guide, we had a clear focus on the knowledge areas "Business Analysis Planning and Monitoring" as well as "Elicitation and Collaboration":

Knowledge Area:	Tasks:
Business Analysis Planning and Monitoring	• Plan Business Analysis Approach: Was discussed during the creation of the Product Backlog and the corresponding tasks. We decided to perform a survey with the students of the ABA class and have an interview with an administrative FHNW employee, as representative of a FHNW employee, who is responsible for answering the student requests. The goal was to involve the stakeholder at a very early stage to get a first impression regarding their needs. • Governance: Roles have been defined within the team and how we should make decisions to enable us to work as efficient as possible as a team. • Plan Business Information Management Approach: We've also discussed the possibilities of requirements management. As it was very hard to find requirements engineering tools without having to pay for licensing fees, we decided to work just with Trello and to create a ticket template for requirements in the form of User Stories. Therefore, all requirements are available in Trello marked with the label "User Story" and all of them have the same structure for organization reasons. • Identify Business Analysis Performance Improvements: At the end of the Sprint we conducted a Sprint Review with our Agile Business Analysis Coaches and a Sprint Retrospective to clarify weaknesses in the processes we used during our work.
Elicitation and Collaboration	• Prepare for Elicitation / Conduct Elicitation: We've created a survey for students with a questionnaire (see Github: 02_TEAM\Sprint 1\students survey answers) including questions about the stakeholder's previous experiences regarding their administrative

	requests. The results of the survey have been used to derive the needs of the students. Additionally, a structured interview with an administrative FHNW employee has been planned and conducted to get the needs of an FHNW employee. So, both sides have been considered. • Confirm Elicitation Results / Communicate Business Analysis Information / Manage Stakeholder Collaboration: Based on the identified needs a first simple chatbot iteration was developed. To confirm the elicitation results and to communicate the BA information, the chatbot iterations are shown to the stakeholders and based on the collaboration with them the subsequent development is planned.
Strategy Analysis	• Analyse Current State: Before even starting our first Sprint, we've already had a look at the current state of how students get information at the FHNW by speaking to our sponsor Knut. And that according to him, he already was looking for a solution so simplify the access to information to students for quite some time. • Define Future State: After analysing the current state with its problems, we've defined the desired state how students should get the required information easily (see 4.2).

Table 3: Knowledge area coverage sprint 1

6.1.2 Survey with Students

In order to get an input from the stakeholder group students we decided to use the approach of a survey to reach the numerous persons efficiently. The full documentation of the questions and answers is uploaded to Github in an excel spreadsheet. For space reasons, there will no graphics or tables be shown in the documentation but can be found in the folder on Github. Some findings of relevance for the definition of the needs and user stories are summarized in the following:

1. Only one student has never contacted the administration. The majority contacted the administration between 1 and 5, and 27.3% contacted them even more than 5 times.
2. Answering time varies greatly. While sometimes it only takes a day it for 38.1% also took more than 5 days in at least some case. Some E-Mails have even never been answered.
3. Almost 2/3 have resent the answer
4. Reasons for contacting the administration are (descending by numbers of mentions): Module enrolment or cancelation, Request for documents or confirmations, change of address, miscellaneous questions about curriculum, invoice, process or reservations.
5. Positive are perceived that in most cases the question was answered, or the request processed
6. Negative perceived was the long waiting time, the need to send reminders or putting others on CC, lack of communication in case of delays and that the answer not always was helpful

6.1.3 Interview with Administrative Employee

Neyyer Sheikh is one of the administrative employees of the FHNW. He is responsible for the BIS programme and answers students' questions accordingly. In an interview with him we found out that these requests are most frequently asked:

• Date on various topics of education (exams, results, etc.)
• Change of module registration

- Change of billing delivery address
- Registration confirmations
- Questions about the interview (assessment)

According to Neyyer Sheikh foreign students have more concerns than local (swiss) students. With regards to data sources, Mr. Sheikh mentions the following two instruments that are very important to him:

- Academic calendar
- Eventoweb

The "academic calendar" is a list of all dates relevant to the FHNW. These are made available to administrative employees as hard copies but can also be requested as Excel files. It is worth mentioning that the administrative employees from the respective study programmes only receive those appointments which are relevant for their study programme.

"Evento" is a software package with a database. It manages all the modules that are available in a study programme. The software "Evento" is administered by a department in Brugg.

6.1.4 Stakeholder Needs & User Stories

Based on the students survey and the FHNW employee interview (see Github: 02_TEAM\Sprint 1\Interview FHNW employee), we've tried to derive and sort the needs of the stakeholders in an evaluation session (see Figure 5):

During the evaluation session we were able to identify the following needs:

- Get an answer to my question
- Timely response
- Consistent answers -> Same answer to the same question
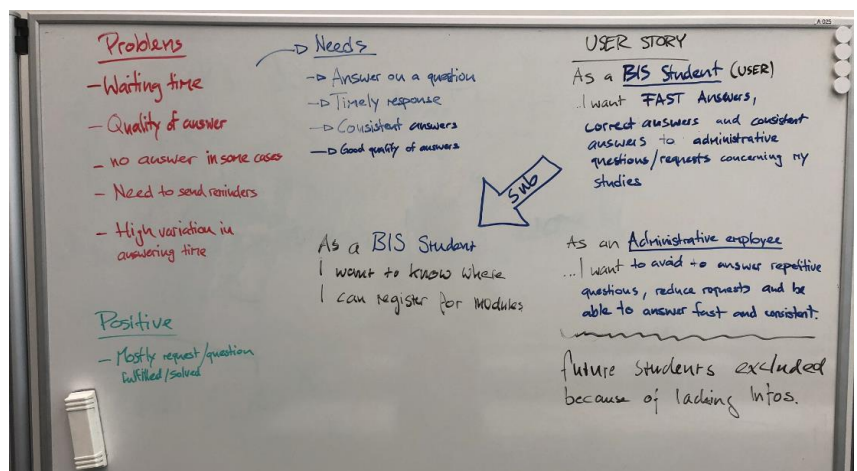- Good quality of the answer -> Correct information given

Figure 5: Evaluation Overview Stakeholder Problems, Needs and possible User Stories

Out of these needs we created two top level User Stories one from the view of a student and the other one from the view of the FHNW employee:

"As a BIS student…

- *…I want fast answers,*
- *…correct answers,*
- *…consistent answers to administrative questions/requests concerning my studies."*

"As an administrative employee at FHNW…

- *…I want to avoid answering repetitive questions,*
- *…reduce students requests I have to answer,*
- *…be able to answer fast and consistent."*

As both User Stories are formulated at a very high level, it was not yet possible to make clear estimations about the effort and probability to develop a possible solution. Therefore, we decided to create a Sub-User-Story which we could use for the development of the first chatbot iteration as a deliverable of Sprint 1:

"As a BIS student … I want to know where I can register for modules."

6.1.5 First Chatbot Prototype

Based on this Sub-User-Story we developed our deliverable of Sprint 1, which is a simple chatbot prototype (see Figure 6: Dialogflow - Registration for Modules) that it only able to provide an answer to the question above. As the team members were all already familiar with the Dialogflow (http://www.dialogflow.com/), the evaluation of potential alternatives was skipped and the focus was shifted from the technology to the business requirements. In the other words, the team acknowledge the risk of technical debt and applied the spike method using the simplest possible program to explore potential solutions. Link to the chatbot prototype: https://fhnw-aba.herokuapp.com/
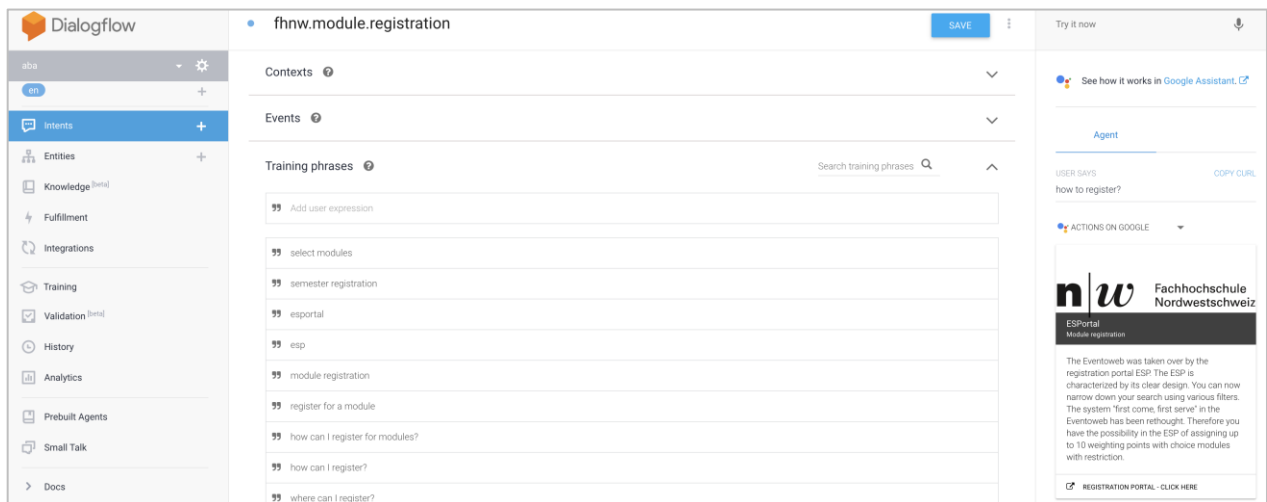Use key words: hi, registration, module

Figure 6: Dialogflow - Registration for Modules

6.1.6 Sprint Retrospective

For the first Sprint Retrospective a simple method has been chosen, as there is a generally lack of knowledge in the team in how to perform a Sprint Retrospective. The general idea in the Quick Retrospective is, that the team is asked direct questions regarding the last Sprint (Morales, 2017):

1. What was good in the last Sprint?
2. What was bad in the last Sprint?
3. Which ideas exist to improve the next Sprint?
4. Which actions will be tried out in the next Sprint?

The task is then that all participants list their thoughts for questions 1-3 in the corresponding section. Afterwards, the team discusses what shall be tried out in the next Sprint which is then recorded in the "Actions" box.

After conducting the Sprint Retrospective with the team, using the method described above, the whiteboard looked as follows (see Figure 7):

What was good?

The team discussed that the usage of the toolset like Github, Trello etc. has been working quite well although some team members didn't have any experience yet with the tools. We also decided as a team that Github is not the right solution for us, as we were working with Microsoft Word documents and not plain text files e.g. using LaTeX and Github is not able to merge Word documents. Therefore, we started working with Dropbox instead as a shared document storage. Furthermore, the agile methods as well as the coverage of the BABOK knowledge areas has been done in a good and suitable way. Especially the stakeholder engagement has been done quite successful by conducting the students survey as well as the interview with Neyyer.

What was bad?

Weaknesses have been discovered as well. Some members within the team had the feeling, that the workload of the project had not been distributed evenly within the team. By no means in an extreme way, but as some team members already had experience in agile methods, they were leading the introduction into the agile project in this first Sprint. Also due to the fact, that not all team members were used to regularly use an issue tracking system like Trello, the Backlog sometimes had not been in the actual state that it should have been regarding the progress that had already been made. During the meetings, there were often extensive discussions regarding the terminology or the methodology that should be used although some team members had the impression that everything already had been clarified. This led to the feeling that there were too many discussions ongoing. As a final weakness of Sprint 1 the requirements verification had been noticed by the whole team.
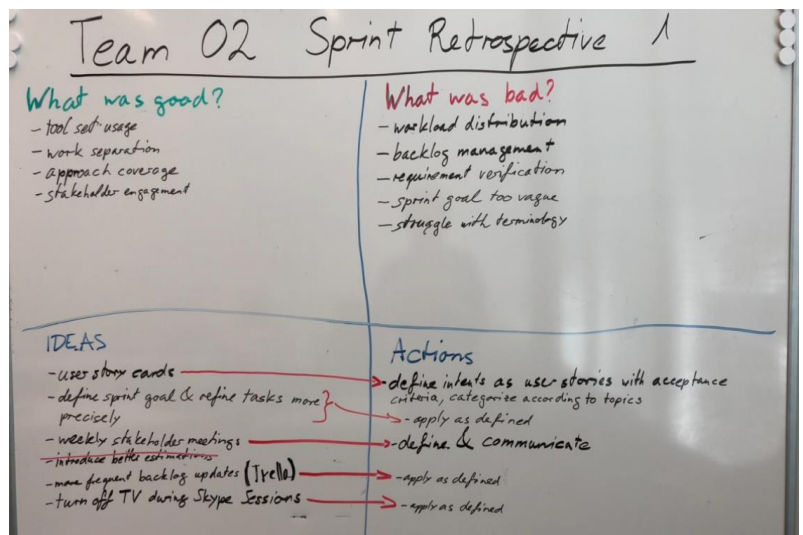
Figure 7: Sprint Retrospective Output

Ideas how to improve the next Sprint? Actions to take.

With a short Brainstorming session, possible improvement ideas were collected by the team. As most of them sounded easy to implement, we decided to try to implement most of them for the next Sprint. We decided to define the Sprint Goal of the next Sprint more clearly and refine the tasks in the Backlog more precisely to have a better understanding what we try to achieve within the Sprint. Also, the Trello board should be updated more frequently, so that it represents the real state of the project. Furthermore, we defined that we should include the stakeholders even more, by conducting weekly stakeholder meetings. So, that the stakeholder requirements can be verified regularly. As a third point that is taken to the next Sprint, there should no TV be running during meetings to have a clear focus on the meeting topics. The idea to have a more comprehensive effort estimation process for the Backlog items, had been clearly rejected by the team, as the effort vs. the expected gain ratio for the team had been expected to be not high enough.

6.2 Sprint 2

Based on the Sprint Retrospective of Sprint 1 we tried to make things a bit differently during Sprint 2. We had to go through the forming and storming phase of building a new team, during Sprint 1 and therefore our focus was not that clear only on the topic. We often had a quite technical focus, as we had to get our hands on the tools first and as we had two technical team members.

6.2.1 Sprint Planning & Task Description

In Sprint 2 we wanted to have a clearer focus on the main customer of our chatbot, the students. So, we focused more on tasks regarding customer involvement instead of only technical implementation. The Product Backlog after Sprint Planning of Sprint 2 looked as follows:
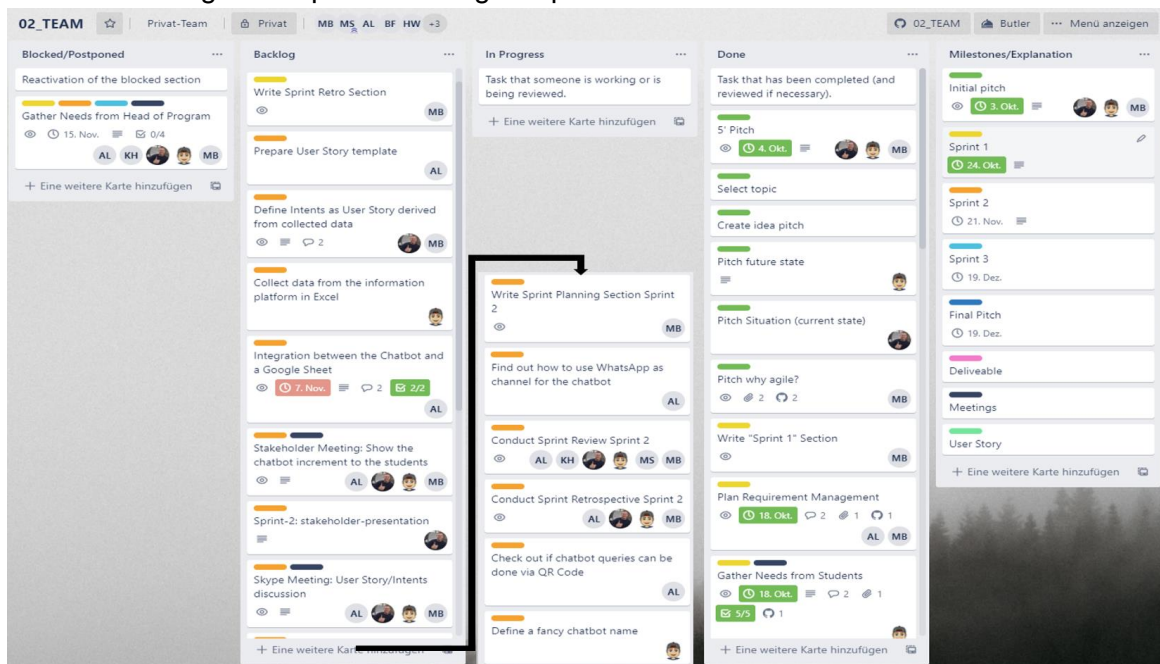

Figure 8: Product Backlog after Sprint Planning for Sprint 2

Considering our goal to further involve the students and having a look at the tasks in the Backlog, we've used the following knowledge areas from the BABOK guide:

Knowledge Area	Task
Elicitation and Collaboration	• To further investigate the stakeholder needs, we've further analysed the stakeholder needs identified during Sprint 1. This has been done by defining multiple User Stories more in detail to be able to build up the implementation in the form of intents for the chatbot, according to them. • Further elicitation has been done by a second students survey, where the students have been asked, which questions they would ask a chatbot. This provided us with further data in form of training phrases which we could use to train the chatbot and therefore enable it to answer students' questions more accurately.
Requirements Life Cycle Management & Requirements Analysis and Design Definition	• The requirements were written down as User Stories after they had been conducted. Therefore, we created a ticket template in Trello for a User Story, which allowed us to express all requirements in the same form to simplify further maintenance. • The prioritization of the User Stories was done very simple by just using the prioritization technique from Kanban, by placing them in

	the right order in Trello. The highest prioritized User Story was then placed at the top of the backlog and the User Story with the lowest priority at the bottom of the backlog. • Additionally, we've verified the User Stories with the students in the form of a Sprint Review, where we showed the current chatbot implementation to the students and let them give feedback for further improvements. • All changes on the User Stories were done directly in Trello, as it offers a clear change history and commenting possibility, which was good enough for our purposes. • To recheck if the implemented intents and the training phrases used to train the digital assistant, another student survey has been conducted, where the students paraphrased their actual questions, they had e.g. for the student's administration. This allowed the team to validate the requirements for the defined user stories which had been implemented.
Solution Evaluation	• To assess the first draft of the developed digital assistant, a showcase and feedback round with the project sponsor, Knut Hinkelmann, was conducted. This allowed the team to get a feeling if the sponsor was happy with the progress or not. As the current features were already quite valuable, it was decided that further features shall be implemented to further improve the value for the student and to leave the current state as it is. • The current state of the implementation allowed the team to see limitations of the current solution. As the data used for the implementation is not provided in a consistent way, it would be quite costly to continue implementing further data driven features. Therefore, a possible improvement plan for a consistent database could help driving this solution.

Table 4: Knowledge area coverage sprint 2

6.2.2 User Stories

In Sprint 2, we continued to focus on expanding the chatbot. In the further development we have orientated ourselves on the findings from the interview, which we conducted with the administrative employee Neyyer Sheikh, and the survey with the students from the ABA class. We have developed user stories to make the various questions and necessary answers more tangible by the chatbot and to place them in an overall context. We put a template for a user story on Trello and every team member could develop a suitable user story with the help of this template. In the end, up to 11 user stories came together. The template for the user story looked like this:

Figure 9: User story template

The following user stories have been written on this basis of:

- US-00001: Registration for Modules (template)
- US-00002: Ask for exam dates
- US-00003: Ask for exam results
- US-00004: Registration for Modules
- US-00005: Chatbot features
- US-00006: FHNW event dates
- US-00007: Ask for diploma ceremony
- US-00008: Ask for holidays
- US-00009: Module Information
- US-000010: Phone Number
- US-000011: Semester Start

All user stories have been featured in the chatbot except the user story "US-00006: FHNW event dates". In the Kanban-Board this has been explained as follows (Trello): Blocked due to the fact that data is not available in a suitable way. A lot of effort would be required to collect all data and consolidate it. Therefore, an adjustment in the current data format is recommended to be done by FHNW.

6.2.3 Implementation Challenges

For the implementation we considered and tried different tools and methods. We started the project on Dialogflow but observed that the static answers cause some problems when data changes – such as dates. Therefore, the use of dynamic answers, with the use of Integromat in combination with Google sheets was the solution on hand.

We evaluated if, instead of a web client, a messaging service solution could be implemented. As widely used, WhatsApp was the preferred platform as also discussed with our stakeholder and sponsor Knut Hinkelmann. After evaluation the technical possibilities we concluded that it would be possible to use, although only with a big effort. As the use of a web client offers the possibility to access the bot with any device and without use of additional applications, we thought this is the better solution to start with. With the use of a QR-code, the bot interface can be accessed faster and easier than via WhatsApp where the contact first has to be saved before you can start communicating. The complete solution context is available here:
https://github.com/AgileBusinessAnalysis/02_TEAM/wiki/Solution-Context

After implementing multiple intents using mainly static answers for the chatbot answers and then switching to dynamic answers for the "exam dates" intent, we observed, that getting all the currently available information in a suitable format is very hard at the moment as there is no standardized format of all the different information sources. This was also the reason that we collected the data of the exam dates on our own and created a new Google Sheet on our own to have a consistent database for this chatbot intent. We then postponed the implementation of further dynamic answers for other intents, because we would have needed to collect and consolidate all the information on our own for each intent. So, we suggested that a consolidated database should be created an provided by FHNW first, to simplify further intent implementations. If a consolidated database would be established and maintained, the maintenance of the chatbot would also be seriously simplified, as the data would always be accurate.

Missing exception handling was raised as an issue as well. To offer students and the administrative staff a solution that is as good as possible, the assistant should be able to handle exceptions and provide information for statistical analysis. A further study should be conducted about how the chatbot could collect and forward requests that it is not pre-configured to handle independently, so

that missing intents can be recognized and addressed for further improvements. Our plan is to further tackle these issues in Sprint 3 of this project.

6.2.4 Student Involvement

We have mainly created user stories around administrative questions. So that we can improve these administrative questions and answers even better, we conducted a live question session with the students. In this question session the students were asked via menti.com to submit administrative questions they would ask a chatbot. We would like to train our chatbot prototype with these questions and extend or adapt our user stories. In short, this quick session helps us to see and understand if we are on the right track. The following is a small sample of questions asked by the students:
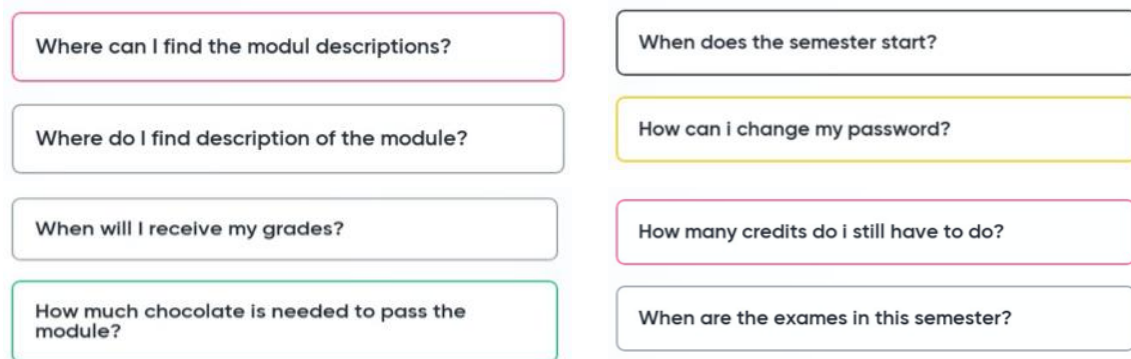
Figure 10: Sample questions of the students

6.2.5 Sprint Review

Knut Hinkelmann is the sponsor of the project. With him we went through our achievements in the last sprint. He found it good that we have already implemented many intents. He was impressed by the fact that we can already offer intents where students can access personal content. This is linked to the registration at the FHNW website.

Since we already offer a wide range of intents with our developments, we have suggested to Knut that we concentrate on how data can be processed in the next sprint so that the chatbot can be well operated and further developed. In Sprint 2 we have identified the data model as one of the most important aspects. Only with consistent, logical and systematic data management is it possible to maintain the chatbot well in the future. Our sponsor Knut Hinkelmann, however, is more concerned that we follow the approach of bringing more functionality to the chatbot, because this also brings more benefits to the students. An optimized data model would mainly benefit the developers. So, this can only be seen as a secondary goal for the next sprint.

The primary goal of our sponsor was to increase the usability of the chatbot. In addition to training the chatbot and thus increasing the quality of the answers, we have suggested that we concentrate on cases where the chatbot cannot give an answer (exception handling). This gave rise to the idea that a chatbot could automatically trigger an e-mail (e.g. to the administrative worker). We will now concentrate primarily on this functionality (automatic e-mail dispatch) in the next Sprint.

6.2.6 Sprint Retrospective

For the sprint retrospective we decided to use another tool than in sprint one and our choice fell on the sailboat method (see **Error! Reference source not found.Error! Reference source not found.**). It displays the <u>ship</u> that represents the <u>project</u> and the <u>island</u> which represents the <u>goals</u> we work towards. The <u>supporting factors</u> are represented by the <u>wind</u> and the <u>hindering factors</u> by the <u>anchor</u>. The <u>rocks</u> show the <u>risks</u> (Morales, 2017). While reviewing our documentation we noticed that we have not yet described in our report the risks and the assessment of them. That was one of the factors that brought us to use the method that includes the risks. In Figure 11 the retro-perspective we did with the Sailboat method is shown. The individual points will not be repeated as displayed in the figure. The experience was very positive with this method and we agreed to continue exploring with new methods also in the retrospective of sprint 3.
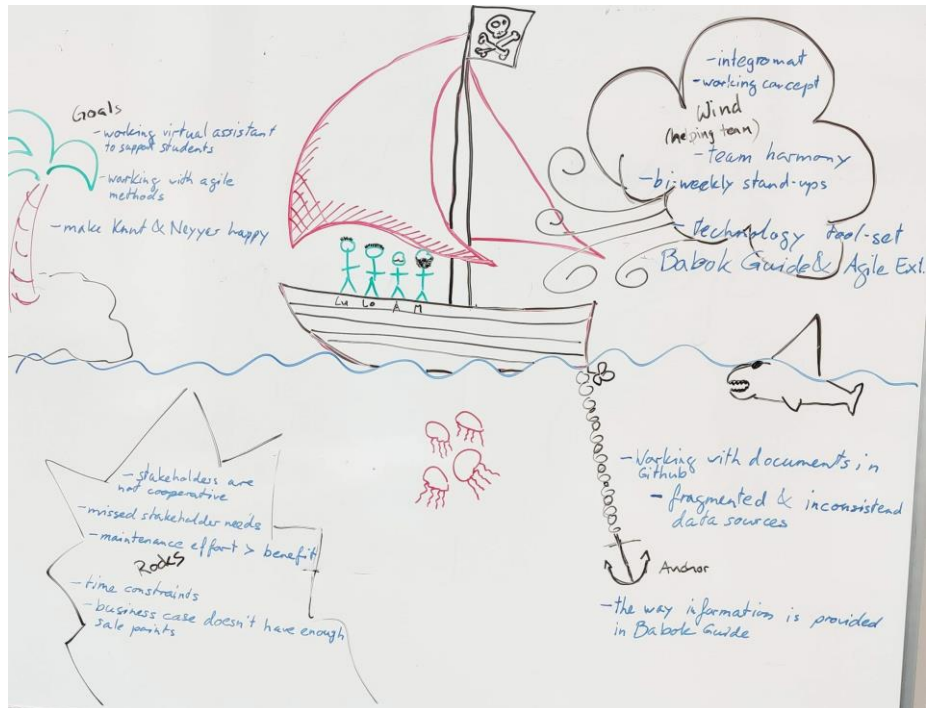

Figure 11: Sprint 2 Retrospective with sailboat method

6.3 Sprint 3

After conducting the Sprint Review of Sprint 2 with the Sponsor of this Project, Knut, it was decided that Sprint 3 shall be used to further improve the value for the students provided by the virtual assistant. As a sprint goal for Sprint 3 the following has been defined:

Improve the value of the digital assistant for the students by adding more functionality to the assistant e.g. to automatically send an e-mail to the administration if the assistant cannot directly answer the request.

6.3.1 Sprint Planning

As mentioned above the main goal of this Sprint was to further improve the value for the students, therefore the Sprint Backlog had been defined accordingly. Furthermore, tasks had been added to the Sprint Backlog that were identified during Sprint Retrospective of Sprint 2, which had not been or not sufficiently been done so far, e.g. Risk Assessment. The Sprint Backlog for Sprint 3 looked as follow:
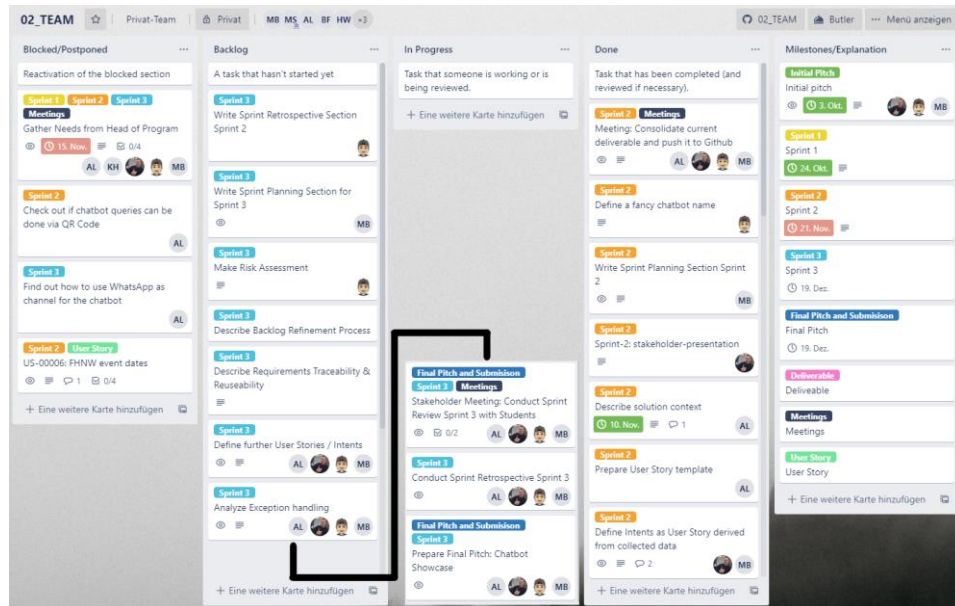
Figure 12: Sprint Backlog after Sprint Planning for Sprint 3

Having a look at the tasks that were defined for Sprint 3, the following Knowledge Areas of the BABOK guide were laid focus on:

Requirements Life Cycle Management & Requirements Analysis and Design Definition	• Based on the discussion with Knut Hinkelmann in the last Sprint Review, the backlog was adjusted. Some open points were moved to "Postponed" lane, as the priorities from Knut changed. Additionally, the team added new requirements to the backlog like "Exception Handling" as the Sponsor, Knut Hinkelmann, decided that the team should focus on those topics. All adjustments were done directly in Trello, as it offers all required possibilities for this project.
Solution Evaluation	• To further evaluate the digital assistant solution that was developed, a demo was done with the ABA class, as the students are the most important stakeholders and Knut Hinkelmann, the sponsor of the project. Based on the questions that were collected from the students during Sprint 2, the team did a showcase of the digital assistant, that it is able to answer the questions from the students. Afterwards, a feedback round was conducted where the students and the sponsor were able to suggest further improvements. According the feedback, further development could be done.

Table 5: Knowledge area coverage sprint 3

6.3.2 Implementation Challenges

The main idea to extend the digital assistant was to directly send e-mails from the assistant to the administrative staff in case the required task has to be done by them and cannot directly be handled by the digital assistant, e.g. for module registration/deregistration. To implement this new handling the module (de-)registration user story was chosen. This user story offered the possibility to further improve the digital assistant to be able to handle follow-on intents where more information has to be collected for further intent processing. In this case it was first checked if the module registration

period is open or not and depending on the outcome of this first intent, either the follow-on intent registration.closed or registration.open was then processed. In case of registration.open, the link to the ESP is provided to the user of the digital assistant. For registration.closed, the handling was quite more difficult, as there has to be more information collected from the user and then sent to the administrative staff. After further research and failed tries, it was decided that the direct e-mail integration was not easy to be realized within the given timeframe. Therefore, another solution was implemented. Possible tasks the Neyyer would need to perform were added to a Google Sheet like a workflow management system and different information of the user was collected according these given steps, starting with the requested user action registration or deregistration, afterwards info like matriculation number etc. was requested by the assistant. The whole user request with the given input would then be saved in the Google Sheet and could be used for further processing. As a better solution the integration with a workflow management system could be further analysed.

6.3.3 Sprint Review

Also, for Sprint 3 the team conducted a Sprint Review with the Sponsor, Knut Hinkelmann. The final solution of the digital assistant PoC was shown and the development journey was explained by the team:

1. Static answers for the digital assistant which were defined by the team.
2. Direct links to important documents and websites were added.
3. Google Sheet queries were added to be able to read preformatted data from a specific Google Sheet, based on the input given by the user.
4. At last, not only queries but also the possibility to save new entries in a Google Sheet was added for the module (de-)registration user story.

Both, the team and the sponsor, see this project as a PoC to see which information could be handled by a digital assistant. So, it could be used for further research and development regarding the use of a digital assistant for students at FHNW. According the sponsor, he was pleased with the outcome of this project, as the team identified and demonstrated the possibilities of a digital assistant for students.

Further serious development would need to take place, if a real solution should be implemented and further consolidation with internal FHNW IT would be required. There were no further intents defined by the sponsor right away for further development, but more that the integration would need further attention, also regarding security.

6.3.4 Sprint Retrospective

For the third sprint again, a different method to review the performance and collaboration in the group has been chosen. The chosen method Start-Stop-Continue categorizes the review into things that the team wants to begin to do in the next sprint, the things that will be discontinued and the things that should remain unchanged (Morales, 2017). While performing the continue and start was easier than the stop. Based on the experience of the team member this was considered a rather positive signal. The content will not be repeated in text, in order to not repeat and on request of the lecturers. In Figure 13 the result of the conducted retrospective is displayed.
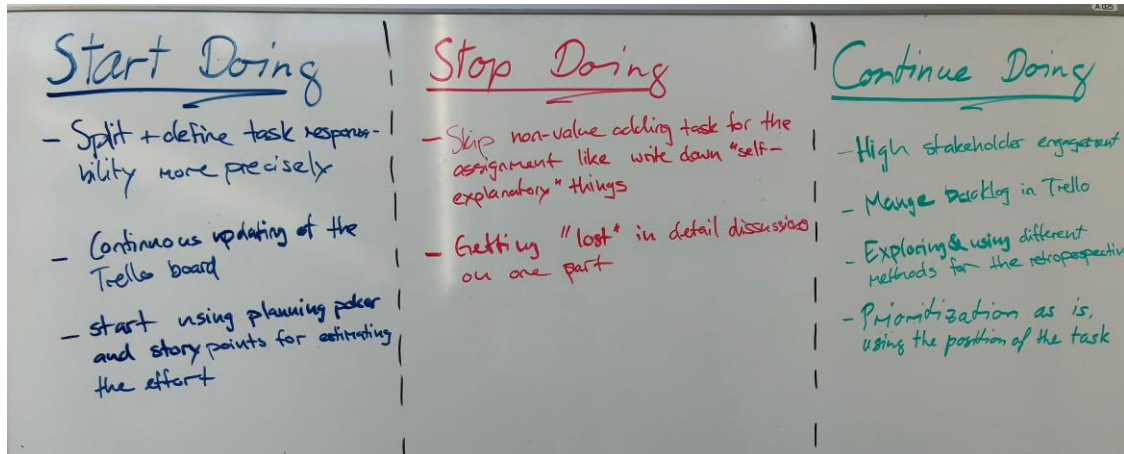
Figure 13: Sprint Retrospective of Sprint 3

7. Conclusion

One could say that this project went very well. The team was able to create a digital assistant PoC to see what is possible and find out where the difficulties are for further development. Not only the team was happy with the outcome and could conduct a project based on an agile approach by applying knowledge from the BABOK guide, but also the sponsor was satisfied, as there is now a clearer view what could be realised and how could be the development continued.

Further development steps could then cover the following points:

- More intents: Adding a path to the room reservation tool or add (de-)registration for FHNW events like BIS'n'Beer.
- Check integration possibilities for a digital assistant within the FHNW digital ecosystem, also for regarding security reasons.

List of figures and tables

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