

Applying Knowledge Codification in a Post-mortem Process

A Practical Experience

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Abstract: In information systems, acquiring experiences in projects can result in new knowledge to people or the organization. Knowledge Management analyzes such experiences as a significant resource to the organization. Through the Post-mortem analysis, people can remember experiences and situations that they had during a software development project. In order to support such analysis, the PABC-pattern structure proposes codifying knowledge, assisting practitioners in registering key elements to facilitate the understanding of that experience. This paper proposes a process of Post-mortem Analysis based on the KJ method. We have integrated the PABC-Pattern approach as a final product in order to record the experiences and gathered information.

1 INTRODUCTION

In software projects, the team members acquire new knowledge and experiences that can benefit future projects and their professional skills (Birk et al., 2002). Many businesses are human and knowledge intensive, such as software organization. Knowledge intensive organizations have been noticing that a large amount of problems is attributed to un-captured and un-shared product and process knowledge (Lindvall et al., 2003).

Knowledge Management is the process of creating, validating, representing, distributing and applying knowledge (Bhatt, 2001). Knowledge Management also refers to identifying and increasing the collective knowledge of an organization to help it keeping a competitive advantage (Alavi and Leidner, 2001).

Another common factor to Knowledge Management is learning with the past successes and failures. The goal of this learning is to improve the future of the software development (Dingsøyr, 2005). Identifying these experiences in projects and codifying them can help to prevent mistakes in future projects. By avoiding such mistakes, we can reduce re-work while repeating well-succeeded processes in order to increase productivity and the probability of achieving success (Rus and Lindvall, 2002).

Retrospective analysis (known as Post-mortem)

is one approach to support remembering knowledge from projects. According to Scott and Stalhane (2003), during a Post-mortem analysis the participants of an ongoing or finished project are reunited and they are asked to identify: (a) which aspects of the project went well and must be repeated, and (b) which aspects of the project went bad and must be avoided.

Once the Post-mortem captures the knowledge, it is necessary to codify it. There are techniques regarding capturing knowledge (Bjørnson and Dingsøyr, 2008). A solution proposed to capture and code knowledge is employing the PABC-Pattern (Rabelo et al., 2014). PABC-Pattern is an approach to codify the lessons learned in a structured form. The elements from such form aim to facilitate the knowledge storage in a software organization.

Adopting a Post-mortem approach combining with a coding method can lead to improvements in a project. This paper describes an experience of using retrospective Post-mortem analysis at the end of each of the iterations of a project, and applying the PABC-Pattern coding structure. By describing such Post-mortem analysis process, we intend to provide practitioners with an example they can replicate in other software projects.

The rest of this paper is organized as follows. Section 2 shows the background of this work. In Section 3, we present the definition of the Post-mortem process. Next, Section 4 describes the

application process in a case study while Section 5 discusses the case study results. Finally, Section 6 shows our conclusions and future work.

2 BACKGROUND

Individual knowledge is necessary for the development of the organizational knowledge (Bhatt, 2001). Knowledge within an organization is a collection of knowledge, experiences and information which people or groups use to carry out their tasks (Vasconcelos et al., 2005). In this section, we present the concepts that we applied as theoretical basis for this work.

2.1 Knowledge Management

The human resources is the main asset of many companies where knowledge has to be preserved and passed from the individual to the organizational level, allowing continuous learning and improvements (Lindvall et al., 2003). Companies generally understand the term “knowledge” as codified information with a high proportion of aggregated human value including perception, interpretation, context, experience and wisdom (Davenport and D'Neely, 2001).

Davenport and Prusak (1998) placed the knowledge in three distinct items: data, information and knowledge. Data is a group of distinct facts and goals related to events. Information aims at changing the way in which the receiver sees something, exercising some impact on his/her judgment and behavior. Knowledge is the fluid mixture of condensed experience, values, contextual information and experienced insight which gives us a structure to the evaluation and incorporation of new experiences and information (Davenport and Prusak, 1998).

Nonaka and Takeuchi (1995) characterized knowledge into two types: explicit and tacit. Explicit or codified knowledge can be articulated in formal or textual language. Tacit knowledge is the personal knowledge, incorporated to the individual experience and which involves intangible factors (e.g. personal beliefs, perspectives and value systems).

Knowledge Management is a method that simplifies the process of sharing, distributing, creating and comprehending a company's knowledge (Bjørnson and Dingsøyr, 2008). Its goal is to solve problems regarding the identification, localization and usage of the knowledge (Rus and Lindvall,

2002). Furthermore, Knowledge Management is concerned with aspects regarding how to collect and/or make explicit the experiences of the projects to be used by others (Dingsøyr et al., 2001).

In the case of finished projects, we can remember the experiences that the participants had during the project. Therefore, such knowledge can be reutilized. One approach to guarantee the collection of such experiences is through the Post-mortem Analysis.

2.2 Post-mortem Analysis

Post-mortem analysis is the most common name given to retrospective analysis (Myllyaho et al., 2004). Post-mortem is the activity of gathering knowledge which can be organized for a project that is in its final stage or finished (Dingsøyr, 2005). The goal of a Post-mortem must be to learn not to evaluate. In this sense, an evaluation can make people restrain their experiences because they might think that sharing such experiences could be embarrassing (Desouza et al., 2005).

There are many ways to apply a Post-mortem Analysis. Dingsøyr (2005) shows two different proposals of how to conduct a Post-mortem in small or medium companies:

1. Post project review process by Neal Whitten: (1) **Declare intent** – send a message to all participants indicating that a Project retrospective meeting will be made; (2) **Select participants** – the key project participants must be selected; (3) **Prepare for workshop** – the participants must prepare a presentation answering a series of question such as: “What was the productivity level achieved by your task?”; (4) **Conduct workshop** – the workshop must take from one to two days, the participants present their answers and a list of possible improvements regarding the project; (5) **Present results** – the results of the post-mortem are presented to the project leaders and then, to all project members; (6) **Adopt recommendations** – A post-mortem report is created, containing all the information of the workshop and recommendations to the project leaders.
2. Retrospective Meeting by Collison and Parcell: (1) **Call to the meeting** – right after the Project ends, the participants are summoned; (2) **Invite the right people** – the key people are selected by priority; (3) **Appoint a facilitator** – a person who is not close to the project is chosen to conduct the meeting; (4) **Revisit the objectives and deliverables of the project** – find the

original success criteria and ask if they were achieved; (5) **Revisit the project plan or process** – this step must be useful in the construction of a flow where the activities, deliveries and decisive points will be showed; (6) **Ask “What went well”** – an answer list must be generated and complemented with a “why?”; (7) **Find out why these aspects went well, and express the learning as advice for the future** – identify the success factors and recommendations; (8) **Ask “What could have gone better?”** – it must start with the project leader and then continue with the rest of the people in the meeting; (9) **Find out what the difficulties were** – identify problems and barriers that must be avoided; (10) **Ensure that the participants leave the meeting with their feelings acknowledged** – ask each person regarding his/her impressions on the meeting; (11) **“What next”** – if someone starts a new project, a session is recommended showing the retrospectives; (12) **Recording the meeting** – a structure must contain all the main aspects, artifacts and documents that characterize that project.

Birk et al., (2002) defined the Post-mortem analysis in three phases:

1. **Preparation:** during the preparation phase, a whole project retrospective will be made to provide a better understanding. All project documents like reports and project plan will be reviewed. Also a goal for the Post-mortem will be defined, for example, “Identify the bigger achievements and improvements on the project”.
2. **Data Collection:** all the relevant experiences of the Project are collected. The project participants and other stakeholders will make a group session. Some techniques can be applied in that phase such as: (a) **Semi-structured Interviews** – the facilitator will make a list of questions to the participants; (b) **Facilitated group discussion** – the facilitator will conduct the discussion while (s)he documents the main results on a whiteboard; (c) **KJ Method** – the participants will write 4 positive and negative experiences regarding the project in notes. This method will be furthered detailed in the next section.
3. **Analysis:** The facilitator conducts a feedback session with the participants aiming to identify if (s)he understood what they said and if (s)he discussed all the relevant facts. When the data is sufficient, an Ishikawa’s diagram is created to find the causes to the positive and negative

experiences. The Ishikawa’s diagram will be further detailed in Section 2.4.

The Post-mortem reports may vary in size, variety, scope and deepness (Desouza et al., 2005). According to Birk et al., (2002), the facilitator writes the Post-mortem analysis results in an experience report which must contain:

- A description of the project, including the developed product, development methods, time and necessary effort.
- The project’s main problems, with diagrams representing the problems (e.g. an Ishikawa’s diagram).
- The project’s success factors, also with diagrams representing them.

Transcribing what was said in the meetings helps to contextualize the information for future readings (Dingsøyr, 2005). The person responsible for writing the Post-mortem report can be someone of the group, or the own group reunited, or even an external facilitator, depending on project’s nature. (Desouza et al., 2005).

2.3 KJ’s Method

KJ’s Method, also known as the Affinity Diagram, is a discussion tool created by Jiro Kawakita (Kim and Kim, 2014). The KJ’s Method usually employs individual descriptions on notes (e.g. stick notes) or cards. Then, with the help of the other participants, the notes are grouped by similar points (Widjaja and Sawamura, 2014).

The KJ Method’s application includes four steps (Scupin, 1997): (1) Card creation, (2) Card grouping, (3) Card unification by similar patterns, and (4) Written or oral explanation. In the literature, the way in which these four steps are applied may vary according to the process by each author, as shown in the following approaches:

Kokogawa et al., (2012) describe the standard process to perform KJ’s Method as follows: (1) Prepare the cards with ideas referring to a specific theme; (2) Form a group of cards with similar ideas; (3) Identify each group with a name; (4) Position each group into a diagram, showing the relationship between them; (5) Describe sentences to express what the diagram means.

Kim and Kim (2014) describe the steps in a similar way to Kokogawa et al., (2012), adding some new steps: (1) A topic is selected for discussion; (2) Participants generate ideas through brainstorming; (3) A card is created for each of the participant’s ideas; (4) After all ideas have been discussed, the cards that are similar are grouped (in case an idea

does not fit any of the previously created groups, it enters a new group separately); (5) Each group of cards is given a representative name; (6) The groups are classified as “main”, “superior”, “medium” and “minors”, and the similar groups are combined; (7) The classified cards are then reorganized in a board or a big sheet of paper.

The advantage of the KJ’s Method is that it allows the discovery of problems even in chaotic situations. Such method can help generating new ideas and identifying the essence of the problems correctly, breaking any stereotypes (Kim and Kim, 2014).

2.4 Ishikawa’s Diagram

Ishikawa’s Diagram, also known as the fishbone diagram (due to its shape), is a diagram that aims at showing the causes and effects of a problem (Stålhane et al., 2003). In the diagram, a line is drawn indicating a problem to be discussed. Then, other diagonal lines are drawn pointing to the main line (Dingsøyr et al., 2001). The attached lines (in fishbone form) represent the causes that led to the problem or experience (Birk et al., 2002).

2.5 PABC-Pattern

The literature presents different approaches such as formal routines, causal map, concept map, models with case-based reasoning and other proprietary tools (Rabelo et al., 2014). Additionally, we decided to apply PABC-Pattern because this technique is not associated with a tool or specific software process. Thus, it is possible to integrate it with other approaches or processes that work with knowledge, such as a Post-Mortem Analysis.

PABC-Pattern is an approach to codify the lessons learned in a structured way. Its elements aim to facilitate knowledge storage in a software organization (Rabelo et al., 2014). The knowledge codification process can enable registering the lessons learned for further consultation in order to achieve personal learning or to apply it in new projects. The elements that compose the structure of the PABC-Pattern are:

- **Title:** the lesson’s name and a brief description;
- **Problem:** a detailed description of a problem or a question that the lesson learned tries to solve;
- **Cause of the Problem:** details the cause of the problem, this description must contain what caused the problem;
- **Consequence(s) of the Problem:** description of the consequences of the problem. In other words,

what happened after the problem occurred;

- **Action:** provides details of the solution to the problem, (i.e. highlights of an activity that was applied to solve the problem);
- **Benefit:** description containing the effects (positive and/or negative) caused by the action;
- **Keyword:** it describes the keywords that identify the lesson;
- **Relation with Other Lessons:** lists the identification code of other lessons that are related to the described lesson;
- **Context:** characterizes the environment in which the action was executed. The context can be described in terms of:
 - **Project Type:** Selection of the Project type (development project, maintenance project, or both);
 - **Project Size:** Selection of the project’s size (small project, medium project, or big);
 - **Project Phase:** Indication of the Project phase (requirements elicitation, analysis, coding, test, implantation, management activities, supporting activities, others);
- **Role of the Lesson’s Creator:** description of the role of the person who created the lesson;
- **Related Domain:** description of the domain where the lesson can be applied;
- **Other Relevant Information:** description of other information that the lesson’s creator judges necessary.

We chose this approach based on the positive empirical results collected regarding the PABC-Pattern (Rabelo et al., 2014). According to the subjects of the empirical studies, the reasons for these positive results of the PABC-Pattern are:

- A more detailed description of the knowledge scenario, becoming more enlightening;
- The possibility to acquire more information applying less effort;
- The ability to describe the problem and the solution in the same record.

The experience collected in a post-mortem needs to be storage in order to help other projects in the future. Therefore, a knowledge codification technique can be necessary.

3 THE POST-MORTEM PROCESS

The Post-mortem is an important activity in a project’s retrospective. Executing a process means

following the steps to achieve a goal, in this case, remember and register experiences. The process of Post-mortem applied in this work is based on the works by Birk et al., (2002) and Dingsøyr (2005). The process will be composed of 3 stages:

- (1) **Data Collection** – where data from the participants will be collected;
- (2) **Data Analysis** – once the information is collected, it will be analyzed, interpreted and codified;
- (3) **Results** – creation of an experience report, final corrections and feedback from the members of the project.

3.1 Data Collection

As suggested by Dingsøyr (2005), a facilitator is placed to conduct the four activities of the Post-mortem data collection. According to Birk et al., (2002), (s)he can be someone from outside the project whom the participants trust. (S)he will be responsible to let the session flow and intervene whenever a problem arises.

The facilitator’s role is to guide the project’s participants so that the session flows clearly. The facilitator will be answering any doubts that occur and organizing people in the environment to promote the participants’ interaction in the best way possible. Also, (s)he may interfere if necessary (i.e. when (s)he finds problems that could interrupt the meeting).

Figure 1 shows the first activity of the data collection stage, “1 – Preparation of the Participants”. This activity starts the Post-mortem process. In this activity, we explain to the participants, through a presentation, how the Post-mortem process will be made, why it is important and what they should do.

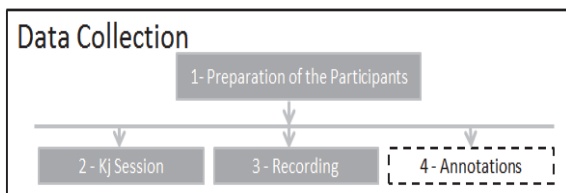


Figure 1: Data Collection Process.

The “2 – KJ Session” activity uses the KJ Method, one of the techniques that we can apply to make the information gathering in a Post-mortem process (Birk et al., 2002). It is complemented in parallel with the “3 – Recording” and “4 – Annotations” activities. The KJ session will be

detailed in Subsection 3.3.1.

The “3 - Recording” activity registers all KJ session. The recording depends on the environment, as it is preferable that the environment is calm. Each participant must be requested to keep a voice level that can be recorded by the recording tool.

The “4 - Annotations” activity aims at highlighting ideas, conclusions or facts that can be relevant to be further recorded in the Data Analysis stage. This activity is optional; the facilitator can choose to keep notes (or not) of anything during the KJ session or only focus in other activities.

3.1.1 KJ Session

The session using the KJ method is based on the steps presented in Kim and Kim (2014). Figure 2 shows the steps of the KJ method that are adopted in our work:

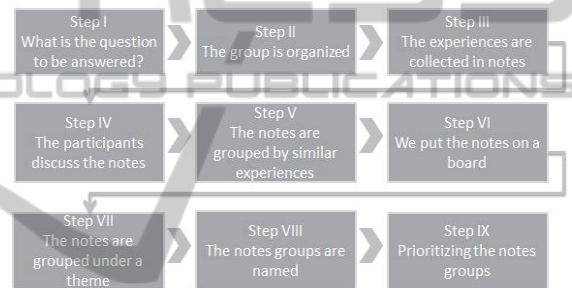


Figure 2: KJ Session Steps.

Step I – “What is the question to be answered?” - The participants are guided to answer a question. In our work, the question was “What were the positive and negative experiences learned in this project?”. Thus, the participants were guided to answer this question. By guiding the participants, we intend to gather specific data to solve the problem.

Step II – “The group is organized” - In projects with many participants it may not be able to have all participants in a session. Therefore, the participants must be chosen in a way that diverse points of view of the project are collected. In addition, time must be planned accordingly to the organization’s context. In our work, all participants were invited and this guaranteed that all points of view of the project were visited. Also, we planned the session for one hour.

Step III – “The experiences are collected in notes” – In this step, we distributed a predefined number of notes to all participants so they could write their experiences. As suggested by Birk et al. (2002) we initially provided four notes to be filled. Then, we informed the participants that they had 20

minutes to fill the notes in order to answer the question from step I. However, as some participants requested more notes, we allowed them to feel free in writing further notes answering the question.

Step IV – “The participants discuss the notes” One by one, the participants should choose a note and discuss it with the team. The team starts a debate of ideas regarding such note. The process is repeated until all the notes or the estimated time for the meeting ends.

Step V – “The notes are grouped by similar experiences”, the facilitator identifies the described experiences on the notes that might be similar and should ask the group if they agree with this interpretation. In case of disagreement, the notes are grouped in a different way. This step must be made until every note is discussed.

Step VI – “We put the notes on a board” - Discussed notes are pasted on a board so all the participants can see them. Notes that describe similar experiences notes are put close to each other. The participants are free to disagree on any decision at any moment.

Step VII – “The notes are grouped under a theme” - Here we will decide if the experience happened in a common context and after, they are grouped under a common theme.

Step VIII – “The notes groups are named” The groups are named with words or texts that identify and generalize such group of experiences.

Step XI – “Prioritizing the notes groups” At the end, the participants must prioritize the experiences. Making the participants visualize the negative experiences guides them to tackle the main problems of the project. Positive experiences that must be replicated are exhibited aiming to show the evolution and the success of the team.

3.2 Data Analysis

Data analysis is the process of gathering all the acquired information and codifying it to a model, form or document. In our work, we chose the PABC-Pattern approach. We employ the term “codifier” to refer to the person who is going to analyze the recorded data, notes, annotations and to write the codified experience. Figure 3 presents the data analysis process.

The “**4 – Mapping notes, recordings and notifications**” activity results in a transcription of all notes gathered in the KJ’s session. Each note, the transcription of what the participant wrote, and the starting time of the recording in which it was discussed must be stored. After the codifier analyses

the information and then, executes activity 7, (s)he must map the identification of the codified document with the note.

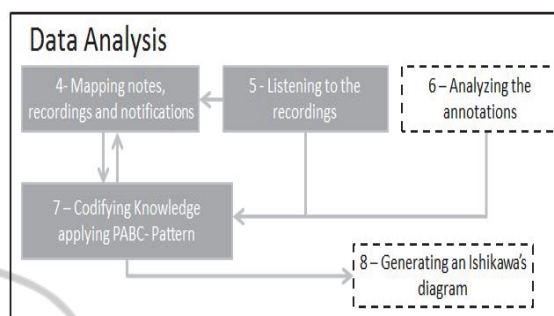


Figure 3: Data Analysis Process.

The “**5 – Listening to the recordings**” activity will be the process of listening to the KJ’s session recordings. It will serve also as a complement to the first codifications in order to generate new ones. During the discussions, the participants might report some new tacit experiences that were not written in the notes.

The “**6 – Analyzing the annotations**” activity will bring support to the codifications in a sense of remembering a related fact that the facilitator pointed out during the session or some relevant information that was not in the notes from the participants. This activity is optional, because the facilitator might choose not to write annotations during the Post-mortem session.

The “**7 – Codifying Knowledge applying PABC-Pattern**” activity is in constant execution during the stage of data analysis. The codifier, based on activities 4, 5 and 6, has the role of describing the experiences in the PABC-Pattern in an impartial way and relating them to all the points discussed in the post-mortem session.

The optional “**8 – Generating an Ishikawa’s diagram**” activity is an option for the codifier when (s)he does not understand an experience. This misunderstanding might be caused due to difficulties in understanding or when the participants have many different points of view regarding an experience. The diagram will map all the opinions, reports or solutions, in order to find what problem is being approached. The codifier will have at his disposal a general view of the causes for the experiences and then, complete the codification.

3.3 Results

After finishing all the codifications to the PABC-Pattern, a report with the Post-mortem results will be

generated (see Figure 4). We chose a traditional way to generate the Post-mortem report, based on the advantages and disadvantages presented by Desouza et al., (2005). The main advantages in a traditional report are that it is highly structured, easy to comprehend and low codification cost. On the other hand, conclusions are less easy to remember.

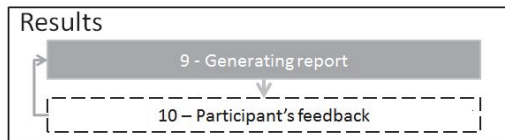


Figure 4: Detailed process of results and experiences.

The “**9 – Generating report**” activity resulted in the Post-mortem report of the project. In our work, to compose the report’s structure, we have chosen the following topics from the literature (based on Dingsøyr et al., 2001; Birk et al., 2002; and Dingsøyr, 2005): (1) a general description of the project, (2) the time of the project execution, (3) the developed product, (4) the main problems, (5) the improvement opportunities., (6) the key artifacts, (7) the people involved, and, (8) a list of positive and negative points, in our case, the codified experiences.

The “**10 – Participant’s feedback**” activity is a last review made by members of the project. They can add or change something that has not been discussed in the Post-mortem meeting. This activity is optional, because it is necessary to allocate extra time with all the project participants. However, the results will pass through a detailed review. After the end of the results stage, the final report is delivered to the organization.

4 CASE STUDY: APPLICATION OF THE POST-MORTEM PROCESS IN A SMALL-SIZED PROJECT

The case used in this research is regarding a software development project on a system focusing in supporting the daily care of the elderly. Two distributed teams were involved in the system development. One team was located in the north of Brazil and it was responsible for the user interface design. The other team was located in the south of the same country and it was responsible for the software implementation (coding). The information exchange between both teams was done through the

project managers and leaders. Thus, meetings were made possible by online conferences and documents, information or questions exchange were made by e-mail. Both teams responded to the representatives of a transnational company.

The Post-mortem was applied on the team responsible for modeling the user interface. The team was composed of six members and the project duration was six months. Each month, the team delivered the results from a set of activities defined by the project schedule. The term “Sprint” was applied by the project team to denote the activities to be performed in a month, including its results. When a Sprint ended, a Post-mortem session was scheduled and attended by all project participants.

4.1 Planning the Post-mortem Session

The first post-mortem session was held in a meeting room with a white board on the wall. The participants received a presentation from the facilitator and tools like the whiteboard, a notepad and a recorder were used. The time limit to the first post-mortem session was free, because the process hasn’t been defined yet.

Based on the average time of the other teams meetings, it had been stipulated a time length of 60 minutes on the second and third Post-mortem session where 20 minutes were reserved to the filling of the notes and 40 minutes to the debate and discussion of the notes. It also has the assistance of a projector to the presentation which served as a visual guide visual to the participants.

4.2 Post-mortem Session in Sprint 1

The first Post-mortem session was made with empirical purposes; the process had not been defined yet. The participants gathered in a meeting room where the whole session was recorded, the session took around 26 minutes to be made. In the experiences capture process, some aspects related to applying a Post-mortem were employed, for example, the intervention of a facilitator and the recordings where:

1. A list of pre-defined topics was written on a whiteboard. Those topics had a group of activities made in the work as basis;
2. For each topic, each participant was asked to answer what the experiences (s)he had regarding such topic;
3. The participant explained to everyone his/her experience, and everyone was free to complement or debate the presented ideas;

4. The facilitator took annotations in a notepad about the experiences that the participants described.

There were difficulties in executing the Post-mortem session. The participants needed a method that assisted them in remembering their experiences. Allowing the participants to talk freely was not resulting in a dynamic enough session to capture the experiences. After the session it was evident that a more structured Post-mortem session needed to be adopted.

4.3 Post-mortem Session in Sprint 2

In the second Post-mortem session that had been made for Sprint 2, we used the first version of the Post-mortem process (Birk et al., 2002) described in this work. The use of the KJ's method to guide the session was chosen for being the most disseminated method in the results from our literature review regarding this work. The session took around 1 hour. The steps of the process were described to the participants in a presentation and all participants were asked to stand up and explain his experience.

The gathered experiences after the session demonstrated that the use of notes between the participants stimulated them to discuss more than in the previous session. On the other hand, during the data analysis stage, codifying the experiences to the PABC-Pattern became problematic since the data in the notes was not enough to fill some fields of the PABC-Pattern form. For example: when a participant described a problem, (s)he (and the rest of the team) did not discuss the action(s) that could solve that problem.

Another problem with the second session was the wrong use of the whiteboard. The notes were exhibited on a table and notes for the generated groups were not created, as seen in Figure 5. That led to the non-execution of the "Prioritize groups" step. The missed step generated an absence of information in the report where improvements opportunities in future sprints and projects should be described.

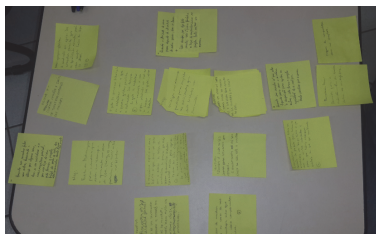


Figure 5: Experience notes disposed on a table in the Sprint 2.

4.4 Post-mortem Section in Sprints 3 and 4

The third Post-mortem session was employed for Sprints 3 and 4 simultaneously. This decision was made as there was not time to make a session between Sprint 3 and 4 due to deadlines and the need for developing the deliveries of the project. In this session, one of the team members left the team, which caused a difference in terms of data collection. That means that the maximum number possible generated notes was reduced by four (since the team member that left was not contributing for the generation of ideas) and there would be one less point of view during the debate and discussions. The whiteboard was improved with the use of a cardboard and tape. Also, notes with different colors were used to differentiate the groups names, as showed in Figure 6.

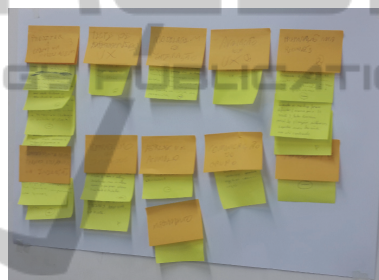


Figure 6: Whiteboard for Sprint 3 and Sprint 4.

During the filling of the notes, a participant finished filling the four notes and asked if (s)he could fill one more, besides the already four filled notes. The facilitator allowed it and gave him/her another blank note to be filled. In this case, the participants were still employing the 20 minutes given for filling the notes. The facilitator must know when (s)he should or should not allow the filling of more notes by considering requirements such as available time for the meeting, the dynamism between the participants and others.

The facilitator now had a group of pre-established questions to ask to the participants. (S)he could use these questions while a participant was reporting his/her experience if (s)he noticed a lack of information that could make it difficult to condify the knowledge using the PABC-Pattern. The questions were:

1. What were the causes of this experience?
2. What were the consequences of this experience?
3. What would you do to solve it?
4. What should your team do to solve it?

5. What were the benefits of doing it?

The groups names were created by the facilitator. (S)he suggested a name and the team decided if that name was proper. After the end of the Post-mortem session, a questionnaire was given to the participants aiming at gathering the impressions and opinions about the post-mortem sessions completion until that moment. Table 1 shows the questionnaire that was used.

Table 1: Feedback Questionnaire of the Post-mortem.

Id	Question
Q1	Regarding the usage of the notes to remember experiences, do you believe that notes helped you to remember your experiences? Please comment.
Q2	Still regarding the notes, what is your opinion about the limit of 4 notes per participant? Do you think this limit helps the Post-Mortem session to be more dynamic or this limits the number of experiences that you would like to write?
Q3	About the use of brainstorming for each note. Does explaining the note to the group help to pass the experience correctly? If you disagree or agree, please, explain why.
Q4	The discussion about a note helps you to complete your understanding about an experience? With the discussion, do you feel that you would remember new facts that would help you to complete that experience?
Q5	Using a Whiteboard with attached notes is important to you? And does prioritizing experiences help you understand the main problems of the project?
Q6	In your opinion, which aspects were positive and negative during the Post-mortem session applying the KJ method?
Q7	Would you change any step or activity of the Post-mortem session applying the KJ Method? Any suggestions for improvement?

4.5 Analysis from the Session’s Data

The first analysis from the Post-mortem session of Sprint 1 had as data the collected annotations made in paper by the facilitator and the recordings. We tried to verify and identify positive and negative experiences only on the data collection’s stage. In the end, a document was created using the PABC-Pattern structure.

The lesson learned through the data analysis was in identifying if the experience was positive or negative in the recordings. The description of the experience became very dependent of the interpretation of whom analyzed the data on the

recordings and because of that, it was transferred to the data collection stage.

Another lesson learned from the data collection was the use of the Ishikawa’s Diagram when mapping the experiences with many points of view from the participants. Since by using the Ishikawa’s Diagram it was possible to understand different points of view, we attached it to the Post-mortem process.

On the second data analysis from the Post-mortem session in Sprint 2, the analysis process was changed. We included a step to transcribe the recordings and codifying what the participants had said. A second version of the PABC-Pattern document was generated considering that there were mistakes on how the structure was crafted. For example, the document did not correctly highlight the context structures and the identification field was omitted.

The lesson learned on the data analysis stage was related to the transcription step. The transcription was hard and time demanding with little benefits. Analyzing and codifying the recordings has high cost – low effectiveness activity. Also, only listening to the recordings was enough to retrieve the data. Therefore, the Post-mortem process was altered again by excluding this activity.

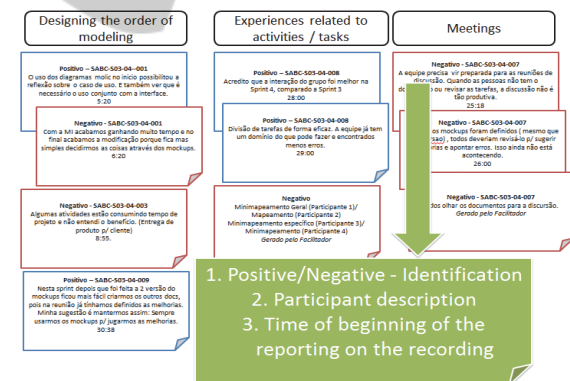


Figure 7: Sample of transcription notes from Session 3.

The third data analysis from the Post-mortem session in Sprints 3 and 4 was described in this work (see Section 4.4). In this third analysis, the notes were transcribed to a slideshow tool where the notes were mapped. As shown in Figure 7, the group title stays above the notes. Each note is identified with a positive/negative id defined by one of the participants of the post-mortem session. Next to the identification, their respective codifications in PABC-Pattern were made. After that, we added what was written on the participant’s note followed by the beginning time of the recording. Notes with similar

descriptions of experiences were piled one over another and have the same identification on the PABC-Pattern.

The lesson learned through the data analysis was that with this mapping it was possible to identify a note with its respective codification and it became more intuitive.

5 RESULTS

In this section, we show the results obtained in the Post-mortem process defined in this work. We also present the results regarding the opinion of the participants.

5.1 Results of the Data Collection: Post-mortem Sessions

In this subsection, we will show the results obtained from the questions in Table 1. Table 2 shows a summary of our key findings. We present the details of such findings below. For confidentiality reasons, people's names and organizations will be omitted on the data presentation of this research.

Table 2: Findings of the Post-mortem session.

Key Findings
Using notes helps remembering experiences.
The limit of notes did not make it difficult for the participants to describe their experiences
Describing a note helps to transfer the experience to the group
Discussions help to complement the experience
The prioritization of notes is an important step
Regarding the use of the white board, the participants' opinion were divergent.
Mentioning other people's mistakes can be uncomfortable to the participants
The discussion can be an obstacle to shy people
A weekly e-mail is necessary to support remembering of experiences.

Did the notes help you remember the experiences? (Q1): Two participants agreed that **the use of notes help remembering experiences**, but there were improvements that could be applied:

"Yes, because they made me think. But if the same notes had small sentences guiding me to remember experiences it could be better".

Participant 3

Does the notes limit help the session be more dynamic? (Q2): All participants described that **the limit of notes did not trouble make it difficult to**

describe the experiences. As described in Section 3, the participants were allowed to describe more experiences in case there still was time for this task: One of the participants (participant 2) who used this exception claimed that:

"In fact, there was not such limitation, because I was told that I could fill more or less notes".

Does the explanation of the note help to correctly transfer an experience? (Q3): All participants agreed that **describing a note helps to transfer the experience to the group.** Only writing could not be enough for a participant to describe the situation nor for the group to understanding it. By describing the note, the participants can complement with something that they did not write on the note:

"I think it helps because people explain what they wrote (because it might not be so clear). It helps to remember other experiences."

Participant 1

Does the discussion complement the understanding about the experience? (Q4): Again, all participants agreed that **the discussion helped them complement the experience.** Discussing a note made the other participants complement it with their point of view:

"The advantage of discussing a note is that the member (participant) has got the team's general view about the referred experience and I believe that this makes him/her remember about related experiences and think about them". Participant 4

Regarding the usefulness of the whiteboard and the prioritization of the notes (Q5): two participants agreed with using the whiteboard while another one thought it could be inconvenient. Furthermore, all of the participants were unanimous about the opinion that **the prioritization of the notes is an important step**, because prioritizing makes the team have a general view of what the main problems are to be solved in the next stages of the project:

"Yes, I believe that prioritizing [notes] helps a lot, because then I define what we have to pay more attention to during the project's execution". Participant 3

Regarding positive and negative aspects of the applied post-mortem (Q6) complementing with some alterations of the KJ session (Q7) we observed that **the discussion can be an obstacle to shy people.** These people have experiences that they want to express to the group, but talking to people is an obstacle that can make them feel uncomfortable when remembering the experiences:

“I can never remember the four things. I don’t like going in front of everybody to speak. However, I do think that the discussion helps other people”. Participant 1

Another negative issue refers to **mentioning other people’s errors, because it can be uncomfortable to the participants**. Additionally, exposing that a participant had a negative result can create omissions:

“Sometimes having to expose someone is annoying and uncomfortable”. Participant 3

Finally, a suggestion is a weekly e-mail about the experiences that the participant would have liked to share, but could not remember from the Post-mortem experiences:

“I think that a weekly e-mail could be necessary (...) that can motivate the participants to describe their experiences”. Participant 4

5.2 Results of the Data Analysis

Through the first data analysis of the Post-mortem session for Sprint 1 it was possible to obtain 10 experiences that were codified through the PABC-Pattern approach. In the first analysis, there were data recordings and annotations, but only listening to the recordings without any visual guide made the analysis costly. It was very difficult to understand where it finished and where the experience report from another participant started.

The usage of Ishikawa’s Diagram aimed at identifying what was the problem of an experience where many participants commented and each one explained from a different point of view. It allowed us to obtain a general view of all opinions and conclusions about the problem. After understanding the problem, it was possible to codify to the PABC-Pattern, easily. Figure 8 presents an example of the usage of the Ishikawa’s Diagram.

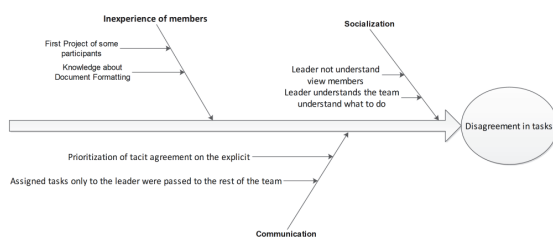


Figure 8: Ishikawa’s Diagram for the Sprint 1 Post-mortem.

The second data analysis from the Post-mortem session for Sprint 2 resulted in a total of 15 codified

experiences. With the use of notes and recordings, it was easy to know what the experience was, including when each participant described his/her note. Also, it became easier to locate the experience on the recordings to know about what experience (s)he referred to.

Two Ishikawa’s Diagrams were needed to understand two experiences. Even without the notes aid, there were situations in which the notes were incorrect to reflect a situation. Also, the point of view changed through the discussion between the participants. Additionally, by mapping the diagram with all the participants’ opinions, it was possible to discover and conclude what was the problem that they were referring to.

The third data analysis from the Post-mortem session regarding Sprints 3 and 4 resulted in a total of 12 codified experiences. In the Ishikawa’s Diagram that was created for this analysis, we did not have difficulties in understanding the described experiences.

After mapping the notes in a slideshow presentation, the process of the analyses from the data became easier and faster. It was possible to know which codification on the PABC-Pattern belonged to each note and when was the time in which the note was explained in the recordings, which means that reviewing the experiences was made easier.

6 CONCLUSIONS AND FUTURE WORK

A process for a Post-mortem analysis helps us to more easily carry out the knowledge collection so we can codify it later. The first conclusion is that mentioning wrong experiences with other participants is still an obstacle to be avoided during the Post-mortem sessions. The fear of causing personal problems makes them retain those sorts of experiences in the post-mortem sessions. Even if the facilitator reinforces that the goal of the post-mortem session is not to judge the participant’s acts but to think about the project’s errors, this situation is not reversed.

Regarding shy participants, we observed that they do not like to talk to large crowds, even knowing about the benefits of the debate. This type of participants needs to have a better treatment by the facilitator, because they need to be constantly stimulated to expose their experiences so that they feel comfortable to speak.

During the step of creating the names for the groups of experiences on the whiteboard, the facilitator wrote a name and asked if the team agreed with that title. We conclude that the participants must propose the name of the theme of the groups on the whiteboard. After that, the participants attach their experiences in the group that they think is more relevant.

Finally, an issue that was raised is how to know that using an Ishikawa's Diagram before codifying through the PABC-Pattern is necessary in a data analysis process. The advantage of using an Ishikawa's Diagram was that understanding problems with multiple points of view became easier. If we needed to codify the lessons learned directly into the PABC-Pattern structure, the understanding process would have taken longer and mistakes would have been introduced.

As future work, the process proposed in this work will be evolved to make it more adequate to capturing experiences. Some of the identified improvement opportunities are:

- To stimulate shy participants so they expose their experiences. It is necessary to find ways to help these participants in remembering and externalizing their experiences to the group. Identifying isolated experiences is not an alternative solution since describing an experience to the group helps everyone understand the experience (Section 4).
- Remembering the main points of the project before the description of the experiences. It may help the participants write better notes and help the facilitator to better understand the project's context.
- To carry out the results stage of the Post-mortem process and finish the experiences report of the project. After finishing, carry out an evaluation to know if the chosen report structure to this work is efficient.

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