

Reflection in Agile Retrospectives

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Abstract. A retrospective is a standard agile meeting practice designed for agile software teams to reflect and tune their process. Despite its integral importance, we know little about what aspects are focused upon during retrospectives and how reflection occurs in this practice. We conducted Case Study research involving data collected from interviews of sixteen software practitioners from four agile teams and observations of their retrospective meetings. We found that the important aspects focused on during the retrospective meeting include obstacles, feelings, previous action points, background reasons, areas of improvement, different ideas and perspectives and generating a plan. Reflection occurs when the agile teams embody these aspects within three levels of reflection: reporting and responding, relating and reasoning, and reconstructing. Critically, we show that agile teams may not achieve all levels of reflection simply by performing retrospective meetings. One of the key contributions of our work is to present a reflection framework for agile retrospective meetings that explains and embeds three levels of reflection within the five steps of a standard agile retrospective. Agile teams can use this framework to achieve better focus and higher levels of reflection in their retrospective meetings.

Keywords: Agile retrospective meeting, reflection, levels of reflection, teams, agile software development, reflective practice

1 Introduction

Retrospective meetings embody the ‘inspect and adapt’ principle of Agile Software Development (ASD) [1, 2]. They are designed to enable agile teams to frequently evaluate and find ways to adjust their process [3]. There are several purposes for retrospective meetings, such as to evaluate the previous work cycle or sprint; to determine the aspects that need to be focused on as areas of improvement; and to develop a

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team action plan [4]. The purpose and the techniques of the retrospective meeting have been stated and described clearly as a guide for agile teams [2, 5-7].

Much of the existing research has also focused on the techniques of performing retrospective meetings and provides lesser detail about the reflection process involved [6-10]. The Reflective Agile Learning Model (REALM) [8] classified reflection in ASD practices into *reflection-in-action* or reflection that occurs during a practice, and *reflection-on-action* or reflection that occurs post a practice based on definitions of the same by Argyris and Schön [11, 12]. A retrospective meeting was seen to embody reflection-on-action where the agile teams reflect post finishing their sprint [8]. However, what is actually focused on during retrospectives and how reflection occurs in this practice is not well understood.

To address this gap, we conducted Case Study research by observing four agile teams and interviewing 16 of their members guided by the following research questions:

RQ 1: What aspects are focused on during the retrospective meeting?

RQ 2: How does reflection occur in the retrospective meeting?

The rest of the paper is structured as follows: details of the research method are presented in section 3. The findings are presented in section 4. This is followed by a discussion of the findings, implications and limitations of this research in section 5. The paper concludes in section 6.

2 Related Work

2.1 Reflective Practice

Reflective practice according to Osterman and Kottkamp [13], is defined as “*a means by which practitioners can develop a greater level of self-awareness about the nature and impact of their performance, an awareness that creates opportunities for professional growth and development*”.

Bain et al. [14] classified reflection into five levels: reporting, responding, relating, reasoning and reconstructing. Level 1 and 2 are *reporting and responding* and enable learners to share brief descriptions of their experience, their feelings about events, facts or problems that they encountered. Level 3 is *relating* and involves connecting past experience with personal meaning. Understanding at this level occurs when learners try to highlight good points (e.g. their ability, successful work) and negative points (e.g. mistakes, failure) in order to learn and identify areas of improvement. Level 4 is *reasoning* where learners explore the information shared as well as background knowledge related to the occurrences. Level 5 is *reconstructing* which signifies a high level of learning where learners form the general framework of thinking, which is specified in a particular plan or action for responding to similar obstacles in the future.

Our study refers to levels of reflection proposed by Bain et al. [14] and adjusts the levels into three main levels, i.e. *reporting and responding*, *relating and reasoning* and *reconstructing*, based on our observations of the agile retrospectives in practice. *Reporting and responding* are grouped together as the first level as these levels close-

ly related to reviews sharing and discussions at the beginning of the retrospective meeting. *Relating and responding* are grouped as the second level as agile teams participate in further discussion after they reported and responded to the reviews. The third level, the *reconstructing* level is embodied when agile teams discuss to formulate a plan as an improvement for the next sprint.

2.2 Agile Reflective Practice

There is a standard format commonly used to conduct an agile retrospective meeting which involves *setting the stage, gathering data, generating insight, deciding what to do and closing the retrospective meeting* [2]. *Setting the stage* involves welcoming and explaining the aim of the retrospective meeting. *Gathering data* involves agile teams sharing their review and feedback, reporting on what happened during the previous sprint and briefly discussing with other team members. In *generating insight*, agile teams participate in further discussion and making agreements about what issues to focus on, and then on how to solve those issues and what areas that need to improve in the *deciding what to do stage*. *Closing the retrospective* involves summarizing the retrospective meeting and appreciating all team members' efforts.

There are several recommendations for embedding reflective practice within standard agile practices as it is related to team performance improvement [8-10, 15]. Cockburn [9] introduced a reflection workshop which involves collecting issues and generating tasks and decisions. This workshop is performed regularly during or after the post-iteration workshop. Babb et al. [8] investigated reflection in agile practices based on Argyris and Schön's [11] classification and introduced the Reflective Agile Learning Model (REALM). REALM describes how some agile practices embody reflection-in-action and reflection-on-action. Retrospective meetings were seen to embody reflection-on-action where the agile teams reflect post finishing their sprint [8].

Most of the existing research focuses on the techniques of performing a retrospective or identifying a broad classification of the type of reflection that occurs, e.g. reflection-on-action [8]. What actual topics or aspects are discussed during a retrospective and how reflection occurs, however, is not well understood. We build upon these works by investigating the retrospective meeting in depth.

3 Research Method

The aim of this study is to investigate how reflection occurs in retrospective meetings. Understanding this is particularly important as agile teams are reported to focus more on their technical progress and tend to pay less attention to how reflection is performed thereby compromising their potential for improvement [8, 16].

This research is conducted by implementing the Case Study research method as depicted in Fig.1. First, existing studies related to reflection in retrospective meetings were reviewed, as summarized in the previous section. The research gaps identified provided guidance on formulating the interview questions. In order to gain rich data from interviews, we developed semi-structured questions consisting of main questions and follow-up questions. The complete data collection method is described in section 3.1 and participant demographics summarized in Table 1. All interviews and observa-

tion data were collected by the first author in person. The raw data and emerging findings from the analysis were discussed in detail with the supervisory team (remaining authors) who provided feedback and guidance.

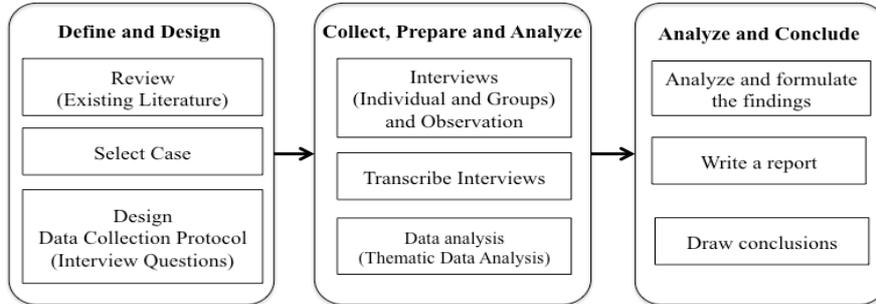


Fig. 1. Research Method (Case Study [17])

Table 1. Team and Team Members Demographics (RMD: Retrospective meeting duration in minutes; P#: Individual Participant Number; FAP: first agile project)

Team Name	Inter-viewed / Total Members	Agile Method	RMD	P#	Role	Agile Experience (Year)	Agile Projects (Total)
Jupiter	5 out of 10	Scrum	65 mins	P1	UI Designer	1	6-8
				P2	Developer	0.5	1
				P3	Developer	7+	6-7
				P4	Business analyst	7+	20+
				P9	Tester	3+	10+
Saturn	6 out of 10	Scrum	55 mins	P4	Business analyst	7+	20+
				P5	Developer	3	10+
				P6	Designer	1 month	FP
				P7	Designer	0.5	FAP
				P8	Tester	3+	6
Uranus	2 out of 3	Kanban	45 mins	P9	Tester	3+	10+
				P10	Tester, Developer	1	2
				P11	Scrum Master, Business Analyst, Product Owner	6	6
Neptune	4 out of 6	Scrum	15 mins	P12	Tester	2	1
				P13	Developer	1.5	FAP
				P14	Developer	1	FAP
				P15	Tester	<1 year	FAP
Working across all four teams				P16	Test chapter lead	7	10+

3.1 Data Collection

Participants. The participants of this research were elicited from the largest online auction company in New Zealand, Trade Me. Its headquarters are located in Wellington and the regional offices are in Auckland and Christchurch. They had been practicing agile for over three years.

For confidentiality purposes, the teams are named Jupiter, Saturn, Uranus, and Neptune. The team names and team members' details can be seen in Table 1. There were four teams included in the data collection. Each team consisted of between 3 and 10 members. All teams held retrospective meetings, which lasted for between 15 and

60 minutes. Sixteen individual practitioners from the four team participated in the interviews and the observations. All team members had a particular role in their team and there were three participants that committed across different teams: P4 was not only fully committed as a Business Analyst in Team Jupiter but also supported Team Saturn. Similarly, P9 was a tester in Team Saturn and a half tester in Team Jupiter. P16 worked as a test lead across all four teams.

Interviews and Observations. We conducted two types of interviews: individual one-on-one interviews with all participants (P1-P16) and one group interview with Team Jupiter. The duration of individual interviews varied from 35 to 50 minutes. We asked some semi-structured questions about their experiences and perspectives related to reflection in a retrospective meeting. The group interview was conducted immediately after the retrospective meeting of Team Jupiter. As the meeting time and the work time were fixed, it was difficult to gain full team availability for group interviews with the remaining three teams.

Observations were conducted during the retrospective meetings of the teams and of their general workplace. Photographs were taken during the observations in order to document the actual situations in the meetings and the report presented by the agile team members. Notes were taken to highlight the important aspects being shared. The duration of each observation depended on how long the team conducted the retrospective meeting. Three out of four teams conducted the meeting for around 40-60 minutes each and one team, Neptune, had a shorter 15 minutes retrospective. Observational data (photos and notes) were used to support the findings from the interview data analysis thereby strengthening them.

3.2 Data analysis

Thematic analysis is a method that aims to recognize, analyze, evaluate and report patterns in data [18], which enables researchers to search across a data set, such as focus group or interviews. Braun and Clarke [18] classify the analysis into six phases: transcribing data, generating initial codes, searching for themes, reviewing themes, defining and naming themes and producing a report.

Transcribing data involved importing the interview transcriptions into NVivo software to facilitate coding and thematic analysis. Generating initial codes involved code identification by analyzing each sentence in the interviews. Interesting features of a sentence were highlighted and added as a node in NVivo representing a new code. Searching for themes involved comparing data with different codes to see whether they have similar meanings or aspects, classified as a theme. Reviewing themes involved generating a thematic model to define the links and the relationships between the themes (see Fig. 2). Defining and naming themes involved the generation of a number of themes that emerged from the analysis, representing the topics or aspects discussed during retrospective meetings (described in the next section.) Producing the report generated a report of the formulated findings, which are included in this paper.

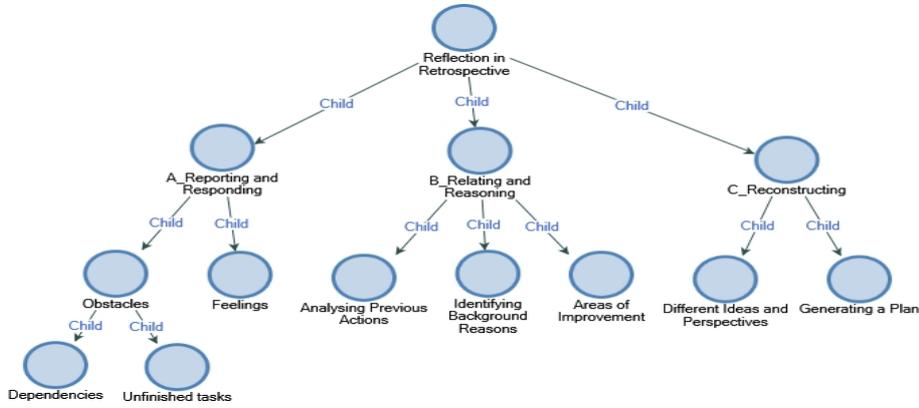


Fig. 2. Levels of Reflection in Retrospective Meetings: a Thematic Map (using levels of reflection from Bain et al. [14])

Table 2. Themes representing topics discussed during retrospectives, their description, examples and mapping to levels of reflection based on [14].

Levels of Reflection	Themes/Topics Discussed	Description of themes	Examples
Reporting and Responding	Obstacles	Problems, issues and concern causing blockages.	Unfinished tasks and dependencies (e.g. expertise, activity, resource or entity and technical.)
	Feelings	Subjective response that reflects the situation, fact or events from the previous sprint.	Negative and positive feelings.
Relating and Reasoning	Previous action	Looking back activities using a reference (e.g. action points) to measure team members' improvement.	Some improvement achieved or persisting obstacles.
	Background reasons	Analyzing some causes and aspects related to issues on team improvement.	Testing environment issue related to external person in different location, who is difficult to contact
	Areas of improvement	Evaluating what areas need to be focused on more.	Evaluate successful stories and failures.
Reconstructing	Different ideas and perspectives	Gathering different perspectives and ideas from all team members to formulate alternative ways to solve the obstacles and consider whether the solution is the best approach.	Alternative solutions, such as a change in performing retrospective meeting.
	Generating a plan	Define some action points for the next plan.	Action points

4 Findings

Following the thematic data analysis process, we identified seven themes that present the answers to *RQ1: What aspects are focused on during the retrospective meeting?* We found seven important topics or aspects discussed in the retrospective meetings. These include: *obstacles, feelings, previous action points, background reasons, areas of improvement, different ideas and perspectives and generating a plan.* These aspects of reflection provide the knowledge that is needed as a reference to surface problems, critique the status quo and to develop a plan for improvement. These were then mapped to the five levels of reflection [14], which answers *RQ 2: How does*

reflection occur in the retrospective meeting? We found that the reflection occurs in retrospective meetings within three levels of reflection [14], *reporting and responding, relating and reasoning, and reconstructing*. The topics or aspects of reflection discussed during retrospective meetings (e.g. obstacles, feelings etc.) were seen to be associated with these levels of reflection based on the definitions of each level summarized earlier in 2.1.

Table 2 summarizes these themes along with their mapping to the reflection levels. These themes and levels are described below along with pertinent quotes and photographs from observations (see Fig. 3 and Fig. 4).



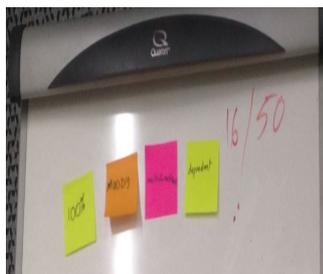
Fig. 3. Team Jupiter's Retrospective



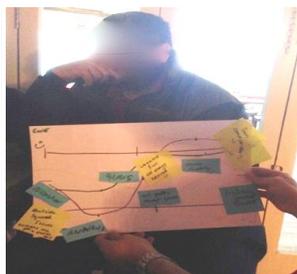
Fig. 4. Team Saturn's Retrospective

4.1 Reporting and Responding

Reporting and responding occurs when an agile team shares some aspects (e.g. obstacles and feelings) while providing reviews and feedback on the previous sprint. Each team had different ways of performing their reviews. For example, Team Jupiter reported their feedback by defining some words (e.g. *100%*, *muddy*, *multidimensional*, *dependent*) on sticky notes (see Fig. 5 (a)) Teams Saturn and Uranus used journey lines as a strategy to express their feelings followed by brief explanations of the lines. The journey lines were used to show the ups and downs situations (i.e. negative aspects that made them down, they made line from sad section and vice versa) during their two-week sprint (Fig. 5 (b) and (c)).



(a) Team Jupiter



(b) Team Saturn



(c) Team Uranus

Fig. 5. (a) Words to describe obstacles and feelings in the Retrospective meeting; (b) and (c) Journey lines visualized in Retrospective meetings.

All teams were seen to engage in the reporting level of reflection by actively reporting obstacles and feelings. Similarly, all four teams were seen to be actively involved in responding in their retrospective meeting discussions by providing brief comments on the obstacles and feelings being shared. Teams were seen to report on obstacles such as dependencies and unfinished tasks and respond with negative and positive feelings based on the previous sprint, described below.

Obstacles. Obstacles reported in the retrospective meetings related to the aspects that hindered the team from making progress. During the retrospective meeting, agile teams gathered all the problems that occurred in the previous sprint, which would be useful for the teams to highlight areas of improvement. There were two specific obstacles reported: *dependencies and unfinished tasks*.

Dependencies. Most of participant (11 out of 16) mentioned dependencies as the specific type of obstacle most commonly reported in the retrospective meeting.

“If it's delayed at the first point, if something is wrong at the first point the next person feels it. So if one brings it up [in the retrospective] and if it's a true concern you will have support because it does affect people.” P16 - Test Chapter Lead (Across All Teams)

By sharing problems about dependencies team members became aware of the other team members' tasks and how they related to their own tasks. By being aware of this issue the team could think about ways to solve the dependency problems.

Unfinished tasks. Unfinished tasks were mentioned by three participants as an obstacle reported in retrospective meetings. An unfinished task was a problem where team members could not accomplish the tasks they had planned or considered the team to be making slow progress.

“We were not achieving that daily goal and it is a kind of demotivating... let's say you plan 10 stories for the sprint and you achieve just two or three. The rest we couldn't complete for whatever reason. So we say that is one thing which didn't go well.” P12 – Tester, Team Neptune

Surfacing this type of obstacle was helpful for teams to understand how much more effort was required to finish the tasks, what tasks were challenging and why the tasks were difficult to finish. For example, when Team Neptune faced a problem with a requirement that delayed finishing tasks, they asked for clarifications from the product manager. It was evident that dependencies led to unfinished tasks in some cases.

Feelings. Besides obstacles, agile teams also shared their feelings which were visualized in several forms, e.g. as drawings or journey lines. The feelings shared by team members represented the sense of facts and occurrences from the previous sprint, such as when they were feeling down or happy.

There was an example of positive feelings shared, which had a positive impact on the team's productivity, where their work can be distributed well. Team Neptune recruited an additional tester, after they had a problem with tester resource. They felt really happy because their team was complete and balanced between developers and testers.

“We do put down smiley. When we got a new tester on board, a new person we had a happy smiley saying that our squad is complete.” P12 - Tester Team Neptune

4.2 Relating and Reasoning

Relating and reasoning occurs when agile teams compile the obstacles and the feelings shared (from the previous *reporting and responding level*) and investigate the relationship between those aspects. These levels consisted of activities such as *analyzing previous action points, identifying background reasons and identifying the need for improvement*.

Analyzing Previous Action. Analyzing previous action is a process applied to build a relationship between what happened in the previous sprint and how the team had progressed in that time. Most teams identified these aspects by referring to previous action points. During action points analysis, team members elaborated on their improvements referring to their burn-down chart to see the breakdown of tasks and some actions that need to be achieved from the previous sprint with regards to progress.

“...some teams who’ve got the burn-down and burn-up chart, spread breakdown, we’ll review the point that we will achieve, what other points that we are committed to.... and now we didn’t achieve this sprint goal and how many daily goals that we achieve, how many daily goals we do not achieve, how much time do we spend working outside of the sprint.”

P4 - Business Analyst, Team Jupiter and Saturn

From the example above, it can be seen that team evaluated previous action points to measure whether they were performed by team members. If the same problem still persisted, it would mean that further investigation was needed. The investigation would be focused on how they performed and why they could not improve.

Identifying Background Reasons. As explained above, when teams were not actively progressing, they would explore the reasons why and what blockers were related to this problem. By identifying the background reasons, teams would understand what aspects needed to be improved. Three out of the four teams tried to look back at the causes of the obstacles.

“And then I will be talking about “I was feeling within the sprint that I was really occupied with a lot stuff” so maybe next time, next sprint, we need to look out as to how we can have the proper estimation about the work.”

P8 – Tester, Team Saturn,

There was an example where bad estimation was one background reason that made a team member feel unable to finish their work.

Areas of Improvement. Areas of improvement were generated from the previous discussions. In the retrospective meetings, most teams highlighted problems with meetings, such as retrospectives and daily stand-ups or lack of resources that delayed the team progress. For example, a team member explained about their team’s attempts to find ways to improve their retrospective meeting:

“We do try to come up with ways to improve some aspects of our process or whatever was bad, or we can’t decide or [for example] we do not know how to do a retro and assign someone to find out how; then try to revisit that.” P13 – Developer, Team Neptune

4.3 Reconstructing

The *Reconstructing* level of reflection occurs when a team constructs an agreement on a specific plan based on the team members’ perspectives. There were three out of the four teams (Jupiter, Saturn, Uranus) that seemed to engage in the reconstructing level as they performed further discussions and ended by generating action points.

Different Ideas and Perspectives. Different ideas and perspectives were collected and formulated in order to generate a plan or solution for the team. For example, the product manager for Team Saturn proposed a solution by asking a developer to finish their coding tasks, but from the developer’s perspective, it did not seem to be the best solution:

“Each one has their own point of view...to a single particular solution. Sometimes, say, if I’m a developer and I don’t think coding a particular piece of work in a certain way is a good practice, whereas product manager is saying, “No, but we have to release this as soon as possible,” ” P9 – Tester, Team Saturn and Jupiter

Although different perspectives often trigger a conflict, the conflict helps the teams to build an understanding about the best ways to improve for the next sprint. Different thoughts and perspectives would provide specific analysis from each team member, which would be useful to compile all the possibilities and extract the best solutions.

Generating a Plan. In reconstructing, teams generated plans agreed from their discussion in the retrospective meeting. Action points are an explicit outcome of the retrospective meeting. It is useful to remind all team members about what is the target for the next sprint, who is responsible for each action point, and what are the associated deadlines:

“So when they go up into their board and they are doing their sprint work, they can see, “Right, let’s not forget what came out of this retro” and it is getting ticked off.” P11- Scrum Master, Business Analyst and Product Owner, Team Uranus

Based on the observations, there was only one team, Team Jupiter that preserved concrete action points on their Scrum board (see Fig. 6). Teams Saturn and Uranus did not have action points but their Scrum Master made some notes during the meetings and shared the points that needed to be focused on at the end of retrospective meeting.

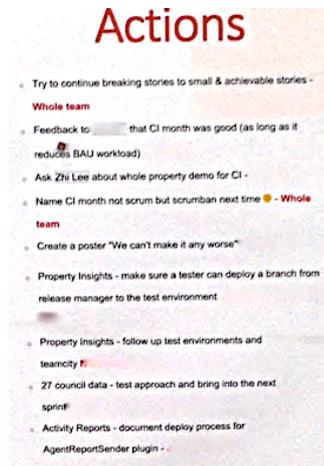


Fig. 6. Action Points generated by Team Jupiter posted on their Scrum Board (Photo taken during on-site observations)

5 Discussions

We now discuss the findings related to the levels of reflection achieved by the teams studied including presenting a reflection framework for agile retrospectives, implications for practice and limitations of the study.

5.1 Levels of Reflection

A key finding of our study was that not all teams were performing on every level of reflection. So while all teams performed retrospective meetings, not all achieved the higher levels of reflection, in particular *reconstructing*. Table 3 summarizes the levels of reflection achieved by each of the teams and the associated aspects or topics discussed in each level.

Three teams were found to be fully engaged in all levels of reflection and one of the teams, Team Neptune, performed partially on the first two levels and did not achieve the final level of reflection, i.e. *reconstructing*. Based on the observation of their retrospective meeting, they did not share their *feelings* explicitly and only focused on the *obstacles* related to changing of task priorities needing confirmation with the product manager. They did not discuss it further as once they agreed on that obstacle then the product manager directly proceeded to the Scrum Board, discussed the issue and wrapped up the meeting. They did not record any outcomes, such as a plan or action points, from the meeting. There was little evidence of evaluating previous actions, background reasons and the areas of improvement. Besides, the duration of the meeting was also short, around 15 minutes, and they reported performing retrospective meetings only when it was seen as necessary. Another interesting observation was that they had adapted the retrospective practice, which seemed too repetitive for them and people often seemed to have forgotten about what happened during the last two weeks' sprint. As result, they were used to placing all the individual reviews

written up on sticky notes in a “retro box” – a box especially allocated to collect individual reflection. If there were no sticky notes during a two weeks’ sprint, they would not perform a retrospective meeting.

The case of Team Neptune is likely related to the fact that three out of six members of Team Neptune were new to agile projects. They had in effect introduced a new reflective practice, that of using a retro box, as a way to identify the need for conducting a standard retrospective. However, a lack of reaching the reconstruction level suggests that they were not able to generate a plan for improvement as several aspects of the retrospective meeting were missing.

Table 3. Levels of Reflection Achieved by the Teams
(J: Jupiter; S: Saturn; U: Uranus; N: Neptune)

Levels of Reflection	Aspects discussed in retrospective meeting	J	S	U	N
Reporting and responding	Obstacles	√	√	√	√
	Feelings	√	√	√	X
Relating and reasoning	Analyzing previous action points	√	√	√	√
	Identifying background reasons	√	√	√	√
	Areas of improvement	√	√	√	X
Reconstructing	Different ideas and perspectives	√	√	√	X
	Generating a plan	√	√	√	X

Our findings confirm that the levels of reflection are related and build on each other [14]. Furthermore, we show that the highest level of reflection, *reconstructing*, may not be reached at all or not reached effectively until the prior levels are accomplished effectively. Based on these findings, we present a reflection framework for agile retrospectives (Fig. 7) that combines the five steps of the standard agile retrospective – *set the stage, gather data, generate insight and decide what to do, close the retrospective* – and the levels of reflection – *reporting and responding, relating and reasoning, and reconstructing* [14] within those steps.

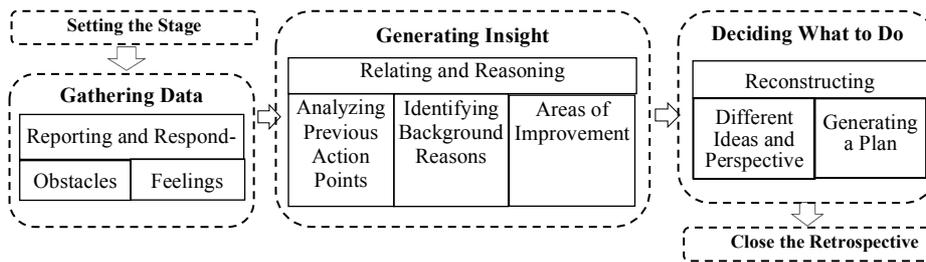


Fig. 7. Reflection in Agile Retrospective Meeting

Setting the stage involves welcoming and explaining the aim of the retrospective meeting. *Gathering data* step embodies the *reporting and responding* level of reflection as agile teams share their reviews (e.g. *obstacles and feelings*). Sharing and discussing obstacles and feelings in retrospective meetings was seen to correspond to

‘descriptive reflection’ [19] – a reflection which attempts to answer questions such as: *What is happening? What is this working, and for whom? For whom is it not working? How do I know? How am I feeling? What am I pleased and/or concerned about? What do I not understand?* The obstacles and feelings shared by all team members answer these questions. From the obstacles and feelings reported, the teams would be able to record and collect important points of the previous sprint. By having reviews (e.g. obstacles and feelings) of the previous sprint, team members can be prepared to deal with other similar experiences.

Generating insight step embodies the *relating and reasoning* level, where agile teams are involved in *analyzing previous action points* and the *background reasons* behind identified issues. Discussing these aspects was seen to be related to ‘descriptive reflection’, which attempts to answer questions: *does this relate to any of my stated goals and to what extent are they being met?*[19] and *why the issues happen in the previous sprint?* The answers to these questions support the reflection in the form of comparative analysis and looking back to the background issues, which help agile teams to *determine what areas needed to be focused on.*

In the *deciding what to do* step, agile teams move to deep analysis on ideas or perspective shared in order to *generate plans* or ways to improve for the next sprint. It can be seen that there is a transformation in the discussion from answering *what is happening?* in the previous sprint; to *what are the alternative views of what is happening?* and *what are the implications of the matter when viewed from these alternative perspectives?* [19]. These questions are answered when all team members provide their accounts about solutions of the obstacles or ways to improve, which are embodied in the *reconstructing* level. *Close the retrospective* step involves summarizing the outcomes of the retrospective meeting.

5.2 Implications for Practice

For the researchers in the area of reflective practice and agile teams, our findings present a new perspective for exploring reflective practice in agile teams. Using the framework presented in the previous section, researchers can study agile teams’ reflective practice in terms of levels of reflection both in retrospective meetings and other practices that involve reflection (e.g. daily standup, pair programming [8]). Future studies can explore new aspects or topics covered in each level and further explore how the levels build upon each other in different team contexts.

For agile practitioners, our findings show that not all agile teams reach all levels of reflection by simply performing retrospectives. By being aware of the different levels of reflection meant to be achieved in each retrospective step, teams can consciously strive to achieve the most out of their retrospective meetings. In particular, they can see that only *reporting and responding* and *relating and reasoning* levels are not enough rather *reconstructing* to generate action points and following up on those points in future meetings is critical to harnessing retrospective meetings to achieve continuous improvement. Thus, in order to maximize the benefits of their retrospective meetings, we recommend agile teams use our reflection framework (Fig. 7) to self-assess their level as a whole based on their personal understanding of their team context and track it in practice to achieve higher levels of reflection.

5.3 Limitations

A key limitation of this study lies in the fact that observations of a single retrospective meeting per team is not strong enough to establish and confirm a particular team's overall level of reflection. For example, it may be that in other retrospective meetings of Team Neptune reach higher levels of reflection. However, the findings were arrived at by combining the data from interviews as well as the observations, which provides multiple perspectives that support the findings. Another related limitation is that the findings are limited to the contexts studied in this research, which in turn are dictated by the availability of participants. Further studies can confirm, adapt, or extend our framework to include different team contexts and reflective practices.

6 Conclusions

Previous studies have focused on specifying the techniques of conducting a retrospective meeting, with little focus on how the reflection in the retrospective meeting actually occurs.

In response to the *RQ1: What aspects are focused on during the retrospective meeting?* There are seven important aspects discussed in the retrospective meetings: *obstacles, feelings, previous action points, background reasons, areas of improvement, different ideas and perspectives and generating a plan.*

In response to the *RQ 2: How does reflection occur in the retrospective meeting?* We found that the reflection that occurs in retrospective meetings can be classified into three levels of reflection [14], *reporting and responding, relating and reasoning, and reconstructing.* The topics or aspects of reflection discussed during retrospective meetings (e.g. obstacles, feelings etc.) were seen to be associated with these levels of reflection.

One of the key contributions of our work is to present a reflection framework for agile retrospective meetings that explains and embeds the three levels of reflection within the five steps of a standard agile retrospective meeting. Critically, we show that agile teams may not achieve all levels of reflection simply by performing retrospective meetings. As the levels of reflection build upon each other, teams need to effectively discuss their obstacles and feelings in the reporting and responding level, followed by discussing previous action points, background reasons, and areas of improvement in the relating and reasoning level and finally, sharing different ideas and perspectives and generating a plan or action points in the reconstructing level. Embedding these levels of reflection into the retrospective meeting will help agile teams achieve better focus and higher levels of reflection from performing retrospective meetings. Another implication is an increase in their awareness of the main aspects that need to be discussed in the retrospective meeting and how to formulate these aspects to generate a plan for improvement.

This study has limitations on the observations of a single retrospective meeting per team. It is recommended that future research need to perform further investigation (i.e. more than two observations) and provide more evidence (e.g. video or record the meeting discussions). In addition, the reflection framework is a starting point for further research to validate or extend our framework to include different team contexts and reflective practices.

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