Investigating the Perception of Feedback in Software Development Teams: An Initial Study

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Abstract. *The need for interaction between developers has increased over the decades, requiring efforts to promote effective communication. Feedback is an important tool that can be applied on different occasions, including informal conversations and planning meetings. However, an environment conducive to this practice is needed. We report a study on developers' perception regarding the feedback practice and how it is related to the developers' social identification with their teams. The results suggest that the perception of the feedback practice varies according to the occasion. We found evidence that feedback perception is correlated with participants' identification with their teams.*

Keywords. *Feedback; Social Identity; Software Development; Communication.*

1. Introduction

Software Engineering aims to establish sound and technical engineering principles to obtain reliable and efficient software systems. However, one may see that non-technical factors strongly influence the software development practice. Developers must develop soft skills, such as communication and continuously collaborate to perform software development tasks [Evaristo et al. 2004].

The need for interaction between software developers has increased considerably over the decades. However, there is still little knowledge about the impact of the participatory culture on software development [Storey et al. 2016]. Agile practices incorporated into the development process seek to bring a greater focus on individuals and their interactions than on processes and tools [Beck et al. 2001]. Such interactions require efforts from software professionals to promote effective communication towards reaching a participatory team culture [Jenkins et al. 2009]. Still, the exponential growth of remote work in recent years brings additional challenges for development teams, especially those related to interaction and communication [Neves de Souza et al. 2022].

Successful communication makes teamwork fluid, encouraging collaboration and building strong social ties [Morrison-Smith and Ruiz 2020]. The focus we give on feedback in this research refers to the practice of exchanging knowledge between individuals, which promotes stimulation and professional development under technical and behavioral aspects in the context of the group in which it is inserted [Siebra et al. 2019]. In this sense, [Kahmann and Mulder 2011] conceptualizes feedback as an essential communication tool, proposing a feedback culture model categorized into *organizational*, *task*, and *relationship* feedback. The feedback culture model predicts that the perceived quality of feedback can be measured through its frequency and relevance. Regarding the feedback culture in Software Engineering, [de Mello et al. 2014] identified that feedback incorporation is one of the characteristics of agility perceived as most relevant by software professionals.

In remote teams, feedback becomes even more critical due to factors such as physical and temporal distance and perception, which are based on timing and cognition, respectively. These factors are closely linked to social and interpersonal elements, including trust, motivation, and conflicts [Morrison-Smith and Ruiz 2020]. For example, teams that don't work in the same location and country tend to have less trust, which reduces the amount of feedback between their members. Several studies [Holmstrom et al. 2006, Kotlarsky and Oshri 2005, O'Leary and Mortensen 2010] suggest low trust resulting from distance affects workers' identification with a team. In addition to these factors, agile teams are also profoundly influenced by psychosocial factors because the dynamics of agile development require even greater communication and cooperation within the team and the organization [Gren et al. 2017].

In this way, we understand that the practice of feedback may be related to how much developers feel belonging to their teams, which is addressed by the Social Identity Theory (SI) from Social Psychology [Bäckevik et al. 2019]. This theory has only recently been explored in the Software Engineering field. They present a study on the effects that the SI of individuals can bring to the effectiveness of software development.

In this paper, we report our ongoing investigation on the perception of developers who work remotely regarding feedback practices and how these practices are related to developers' identification with their teams. In the first step of our investigation, reported in [de Souza et al. 2023], we conducted an opinion survey with 11 software developers working at different companies. Based on the study findings, we identified the need to investigate feedback in a particular case to understand the team's influence on the developers' perceptions in depth. Thus, in the second and new step of our investigation, we used the same survey instruments and data analysis procedures from the first study to investigate the feedback practice over a single team composed of 30 software developers, with the participation of 29 members. The results reveal a strong social identity of the developers to their team. Their identity is correlated with the perception of feedback practice, varying according to the occasion. Informal feedback is perceived as more frequent and relevant, highlighting the importance of informal communication in software development, even when formal feedback is promoted.

Besides this introduction, the paper is structured as follows: Section 2 addresses

the background and related works. Section 3 describes the first study design. Next, in Section 4, we report and discuss the first study results. Section 5 presents the second study, reporting and discussing its results. Finally, in Section 7, we provide the conclusion.

2. Background and Related Work

In this section, we introduce the main concepts employed to support our investigation: the theory of Social identity and feedback.

2.1. Social Identity

Social Identity describes how individuals relate to and reflect on the social groups they belong to [Abrams and Hogg 1990]. According to [Stets and Carter 2011], the core of identity is how one categorizes themselves in a specific role and how it is embodied. This includes meanings and expectations within that role, such as performance and behavior, and significantly impacts their self-esteem and self-concept. [Abrams and Hogg 1990] mention two fundamental aspects of self-concept: *Personal Identity* and *Social (Collective) Identity*.

Personal Identity pertains to an individual's specific attributes, such as skills, talents, and unique personal characteristics. It is how a person perceives themselves as an individual, emphasizing their distinct qualities, competencies, and intrinsic characteristics. On the other hand, Social Identity is a component of self-concept that arises from recognizing belonging to social groups. It entails an individual's perception of their association with specific social groups and the value and emotional significance linked to this connection. Social Identity is not confined to a single category; it can stem from various associations with groups based on race, gender, profession, and more. It is linked to how we view ourselves in relation to others and encompasses the categorization process [Abrams and Hogg 1990]. Cheek and Cutler (1985)[Cheek et al. 1985] introduced a third aspect of identity called Collective Identity. This aspect includes personal values, ideas, goals, and individual emotions that are shared collectively with other group members. On the other hand, for [Cheek et al. 1985], the concept of social identity refers to self-perception in relation to others (popularity, reputation).

Based on [Abrams and Hogg 1990] and [Cheek et al. 1985], [Luhtanen and Crocker 1992] developed a scale to assess social identity with four main dimensions: *group membership*, the *importance* of belonging to the group, *public collective self-esteem*, and *private collective self-esteem*. *Public collective self-esteem* pertains to how a group member perceives that individuals outside the group define their group. In contrast, *private collective self-esteem* concerns how a group member perceives that their group defines them.

2.2. Feedback

The term 'feedback' may be employed in Software Engineering for different purposes. For instance, the agile practice of feedback incorporation addresses customer feedback regarding product requirements [de Mello et al. 2014]. In this study, we mean by feedback *the practice of exchanging knowledge among individuals from the same social group*.

This practice promotes professional stimulation and development, encompassing technical and behavioral aspects within the group in which it takes place [Siebra et al. 2019].

Feedback has a fundamental role in organizational communication. The feedback practice creates a more fluid and autonomous work environment, establishing transparent relationships and strengthening trust among team members, reducing conflicts [Kahmann and Mulder 2011]. Besides, feedback boosts motivation, engagement, and individual development.

[Kahmann and Mulder 2011] synthesize various approaches to feedback, including a theoretical approach focused on components: *source, message, and recipient*. The source determines who provides the feedback. The message specifies its content, and the recipient is the one who receives the feedback. Feedback sources comprise organizational and supervisory, relational, and task-related. The feedback message can be assessed through various means, including frequency and quality. Through these concepts, [Kahmann and Mulder 2011] propose a model of perceived feedback culture categorized according to the feedback sources and shaped by its message, as seen in Table 1.

Table 1. Feedback Classification [Kahmann and Mulder 2011]

Feedback from Tasks	Relationship Feedback	Organizational Feedback
Planning Meetings	Informal Conversations (Whatsapp and Telegram)	Formal Processes (Performance evaluation)
Daily Meetings		
Tasks Retrospective		

The feedback practice is essential for guiding and clarifying a team member's position within their team's procedures. It helps the team members understand their work's quality and how their task relates to others and the overall work. Consequently, team members tend to feel cared for, secure, and confident in cooperating with each other [Siebra et al. 2019].

2.3. Related Work

The social identity theory has been employed to understand intra and intergroup relations among various social groups from different fields, such as education and health. Hennessy et al. [Hennessy and West 1999] conducted an opinion survey on the social identity of healthcare professionals within a hospital community. The answers collected from the participants indicate that a strong identification with the workgroup is associated with high levels of in-group favoritism.

Jackson et al. [Jackson and Sherriff 2013] conducted a qualitative study based on the social identity theory to examine popularity and school intergroup relationships. The results of this study evidenced the influence of popularity on the dynamics of students' social relationships and identities. This demonstrates a significant connection with social identity, as popularity often affects students' self-perception about other groups and individuals in the school.

The aforementioned studies exemplify how the social identity theory has been employed to support research in different fields. Despite barely being explored in software engineering, we found initial works discussing the contributions of the theory to support the investigation of software engineering practice. Gren [Gren 2020] discuss the social nature of agile team practices, such as task planning, daily meetings, and tasks retrospective. The authors argue that the interactive nature of the agile practices performed by software development teams demands investigations supported by social theories, with height to the social identity theory. In this sense, Backevik et al. [Bäckevik et al. 2019] conducted an initial investigation on the potential effects of the developers' social identity on software development effectiveness. Through interviews with developers, the authors found that social identity influences developers' behavior, emphasizing the need for creating multifunctional and stable teams over time. From the perspective of applying the social identity theory, one may see that our research goes a step further than previous works by adapting a formal instrument designed to investigate social identity dimensions to support the analysis of the feedback practice in software development teams.

Feedback has long been recognized as a crucial element in software development teams, and several studies have shed light on its significance. [Murphy-Hill et al. 2019] investigated self-assessment and productivity factors among developers. The results suggest that non-technical factors like feedback, motivation, and mutual encouragement are beneficial for team performance. In a study by [Šteinberga and Šmite 2011], the authors found that the practice of feedback and face-to-face communication among agile development teams was found to enhance job satisfaction and code quality. When these practices are integrated into the development process, developers experience more positive emotions.

[Siebra et al. 2019] introduced a strategy for collaborative feedback based on engagement and team evolution results. Their studies demonstrated that this strategy assists team members in achieving standards related to their competence levels and actions driving their development.

The presented works underscore the importance of feedback and the potential benefits of social identity in the software development practice. However, these initial studies do not investigate the correlation between the developers' social identity and the feedback practice in their teams. They also do not explore the different occasions and circumstances in which feedback may occur in development teams, including the predominant remote work. Besides, we did not identify in the field the employment of consolidated instruments from Social Psychology to support the analysis of the developers' social identity. Thus, our research aims to fill these gaps by investigating how the developers' social identity can shape their feedback practice.

3. First Study Design

The main goal of our investigation is *to characterize how software developers perceive the feedback practice in their teams and how the developers' identification with their teams may influence this practice*. To achieve this goal, we first designed an opinion survey [Linåker et al. 2015] based on previous works on social identity

[Luhtanen and Crocker 1992] and feedback culture[Kahmann and Mulder 2011]. Considering the study goal, we intend to answer the following research questions (RQs):

- RQ1. *How do software professionals perceive the feedback practice in their teams?*
- RQ2. *What are the challenges for feedback practice software professionals perceive in their teams?*
- RQ3. *How is the identification of the software professionals with their teams?*

To answer RQ1, we sought to characterize the developers' perception of the frequency of the feedback provided and received and the relevance of the feedback received on different occasions. For RQ2, we asked developers to enumerate perceived challenges to provide and receive feedback within their teams. To answer RQ3, we adapted and extended the instrument proposed by [Luhtanen and Crocker 1992] to characterize the four dimensions of social identity in social groups. Besides, we analyze the correlation between the feedback practice and the identification of professionals with their teams.

3.1. Population and Sample

In the first study, we counted on the participation of eleven Brazilian software professionals recruited by convenience. We opted for convenience sampling once we aimed to recruit professionals working in different environments but with characteristics of interaction in common, including similar development processes, occasions for feedback in common, and remote work. For this purpose, we need to gather with representatives (non-participants) detailed information about the participants' working environments. In this sense, considering the particularities of remote work discussed in previous works [Neves de Souza et al. 2022], we sought to identify professionals from teams who were working exclusively in this format. The study had the participation of 11 professionals distributed among three teams, each team coming from a different organization. The individual characteristics of the participants were collected through the survey and presented in First Study Results. Next, we present the organizations and teams of the participants involved in the survey.

One of the organizations is an IT consultancy company with over 30 years in the market and composed of over 3,000 employees. This company conducts several distributed projects with teams across Brazil and the United States. The participants of this company work on developing software systems to support the management of IT services and projects from a company in the oil and gas distribution segment. Another organization operates in the insurance business, with teams that work on e-commerce systems projects. The third organization is a Brazilian public and internationally recognized century-old university. This university has a department with teams dedicated to developing and maintaining academic systems for internal and external use. The three organizations have defined software development processes and adopted agile practices to build new software systems. All the teams work remotely.

Through informal conversations conducted with the leader of each team, we identified the occasions for feedback foreseen in the development processes, as well as the

resources the teams employ for informal communication. We found that all teams involved in the study share the same set of feedback occasions for the three feedback types predicted in [Kahmann and Mulder 2011].

3.2. Questionnaire

The survey questionnaire (Table 2) resulted from adjustments and improvements in a previous version submitted to a pilot with two researchers. The study participants were individually recruited by email to answer the survey questionnaire, composed of three blocks. The first block addresses the participant's characterization, including information about his team. The second block comprises 16 questions to characterize the participant's identification with his current team. Among them, there are 12 closed questions adapted from [Luhtanen and Crocker 1992] to characterize four dimensions of social identification: belonging to the group, the importance of being in the group, public collective self-esteem, and private collective self-esteem. Responses to these questions are given through a seven-point Likert agreement scale (1 - strongly agree, 7 - strongly disagree). This block also has four open questions to contextualize the participant's identification with his team.

The third block of the survey questionnaire comprises five questions to characterize the perception of feedback in the participant's team. The three closed questions in this block aim to collect the participants' perceptions about the feedback provided/received in the different interaction occasions mapped in Population and Sample (Table 1). The answers to these questions follow a four-point Likert scale (1 - Very Low, 2 - Low, 3 - High, 4 - Very High). Table 2 presents the survey questions.

Table 2: Survey Questions

Question	Answer Type
Basic information	
Q1 - What is your gender?	Closed
Q2 - Is the company you work for public or private? How many people are there on your team?	Open
Q3 - What is your role within your software development team?	Closed
Q4 - Describe your attributions and some examples of tasks within your software development team.	Open
Q5 - How old are you?	
Q6 - What is your total career experience time?	
Identification with team	
Q7 - I understand that I am part of my software development team.	Likert
Q8 - I understand that I have much to offer to the software development team I belong to.	
Q9 - I am a cooperative player in my software development team.	

Question	Answer Type
Q10 - Describe your interaction on projects with your software development team.	Open
Q11 - I am pleased to be part of the software development team I belong to.	Likert
Q12 - I understand that my team does not collaborate enough for the project.	
Q13 - Could you cite examples of situations and/or reasons why you felt satisfaction or not for belonging to your software development team?	Open
Q14 - Overall, other teams consider my software development team good.	Likert
Q15 - On average, most people consider my team to be more effective than other project teams.	
Q16 - The other project teams respect my software development team.	
Q17 - Others notice the synergy between my team and the other teams on the project.	
Q18 - In general terms, how do you define the perception of outsiders concerning your software development team?	Open
Q19 - My software development team is an important reflection of who I am.	Likert
Q20 - My software development team is important to my perception of the kind of person I am.	
Q21 - Generally, being part of my software development team is an important part of my self-image.	
Q22 - Describe how you are influenced by your software development team.	Open
Feedback	
Q23 - How often do you give feedback to your software development team?	Likert
Q24 - How often do you receive feedback from your software development team?	
Q25 - Is the feedback received within your project team relevant?	
Q26 - Feedback is an important tool to encourage unity, interaction, and trust, in addition to promoting motivation among software project teams. However, remote teams can encounter several challenges, whether technical or social. Mention the difficulties in giving feedback within your software development team.	Open
Q27 - Mention the positives and negatives you notice when receiving feedback from your software project team colleagues.	

3.3. Data Analysis

The analysis of the survey responses includes (1) a comparative analysis of respondents' profiles; (2) an analysis of distributions on the perception of frequency and relevance when providing/receiving feedback; (3) the open coding of answers to open-ended questions about challenges to provide and receive feedback; (4) a comparative analysis of the four dimensions of social identity based on the distribution of frequencies and median; (5) a correlation analysis between providing and receiving feedback; (6) a correlation analysis between developers' perceptions of feedback and their identification with the team.

4. First Study Results

In this section, we present the results obtained by the application of the questionnaire. Participants' responses to each question are publicly available[1]. The answers to the characterization block confirm that all study participants have experience with software development. Most of them have a predominant technical profile (eight respondents, 72%), performing different activities in the software life cycle (Table 3). Two respondents indicated that they have experience in both development and management. A single participant highlighted his experience as a product owner. Regarding the time of experience with software development, the participants are between one and 28 years old, with a mean and median of 11 and six years, respectively. Thus, we can observe that the experience of the survey participants is heterogeneous in terms of time and played roles.

Table 3: Characterization of Participants

Id	Occupation	Experience (Years)	Main Activities
1	Mid-level Developer	6	Development and maintenance; performance monitoring; failure monitoring
2	Senior Developer	16	Technical decision-making; impediment removal; conducting alignment meetings.
3	Others	20	Full-stack developer; Management
4	Senior Developer	23	Development and Maintenance.
5	Analyst	28	Systems support; requirements gathering; support to the development team; tests; deployment; monitoring of indicators.
6	Mid-level Developer	4	Backend development; maintenance; operational support
7	Mid-level Developer	3	Development; systems support and maintenance

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[1]https://anonymous.4open.science/r/Feedback-in-Software-Teams-236D

Id	Occupation	Experience (Years)	Main Activities
8	Mid-level Developer	14	Development; failure correction; application interface design and implementation
9	Analyst	6	Application versioning control; systems support; database administration
10	Entry-level Developer	1	Development; UX; modeling; database encoding; maintenance of systems and applications; tests
11	Entry-level Developer	2	Development; systems support

4.1. Feedback Practice

Regarding the perception of providing feedback within the team (Figure 1), most participants pointed out a high frequency during delivery planning (DP). Perceived frequency is also higher in informal conversations (IC). When asked how often the participants receive feedback within their development team, we observed that the median tends to be high on all feedback occasions (Figure 2). Regarding receiving feedback, the medians of all feedback occasions pointed to a perception of low relevance, except for informal conversations (Figure 3).
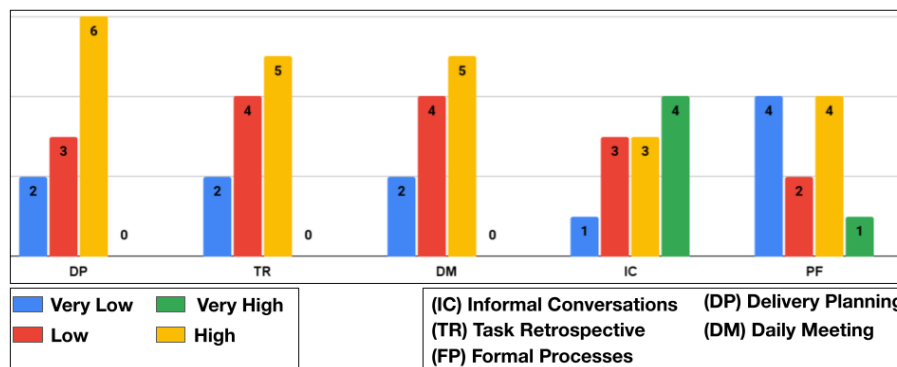

Figure 1. Perception of Provided Feedback Frequency.

Thus, in response to *RQ1*, we can highlight that developers tend to perceive they provide feedback with low frequency on different occasions, although they tend to perceive a high frequency of receiving feedback on the same ones. Exceptions include a perceived high frequency of both providing and receiving feedback in delivery planning (DP) and informal conversations (IC). Besides, we found that most participants perceive a high relevance of the feedback received only in informal conversations.

RQ2 addresses the challenges regarding feedback, which can help to understand the results obtained for RQ1. The challenges and negative points most frequently reported by the participants were: fear of having the feedback rejected (3), being fair with negative feedback (3), physical distance from colleagues (3), and unavailability of supporting tools
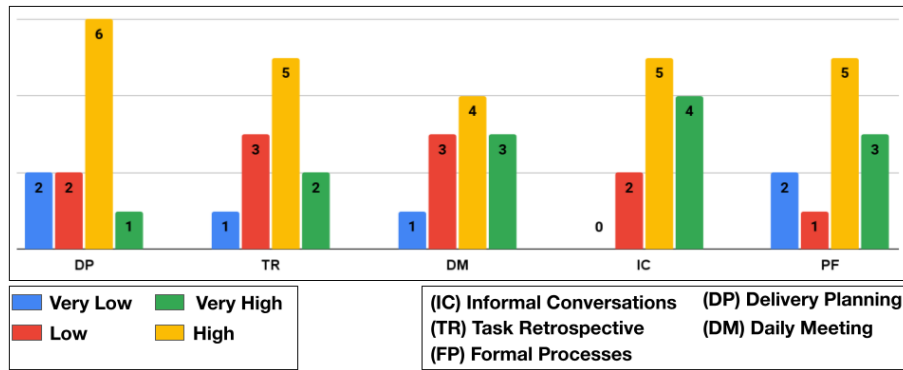
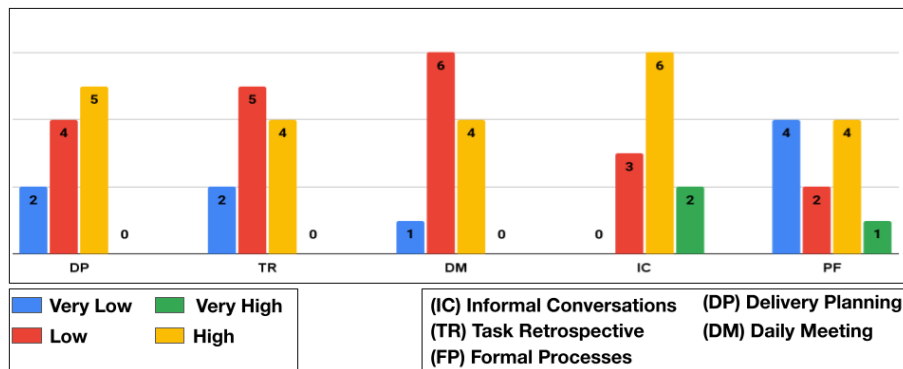**Figure 2. Perception of Received Feedback Frequency.**

Figure 3. Perception of Received Feedback Relevancy.

(2). For some participants, the fact that the recipient of the feedback does not consider its content generates a disincentive to provide it: "*Many people completely ignore the feedback, which discourages them from continuing to do this process*", "*...there is resistance to putting in practice*" (P3). The concern to be fair in negative feedback has to do with avoiding conflicts: "*Trying to understand the particularities of each one, as well as their difficulties*", and "*make it clear that it is nothing personal, that it's something for personal growth*" (P5).

Regarding the distance from colleagues, the context of remote work emerges as the main concern: "*...lack of interpersonal relationship*", "*...since there isn't so much contact, there may be insecurity in giving feedback*" (P8). This distance is also related to the lack of awareness about the right time to provide feedback: "*I'm afraid of interrupting an important activity during my day-to-day*" (P9). On the other hand, one of the participants reported realizing a greater need for feedback in the remote environment: "*In remote environments, I believe feedback has to be more frequent because there is no eye contact, immediate exchange of experiences, daily conversations.*" (P8).

The results suggest developers could provide feedback more frequently, but eventually feel inhibited from doing so due to the fear of the negative impact that their feedback may have on colleagues and the task potentialized by the remote work environment. Otherwise, the positive factors indicated by the participants about the feedback suggest that

everyone recognizes the benefits of receiving feedback, with emphasis on personal and professional development (7) "*Possibility of personal and professional growth*", "*...opportunity to score points that I can improve*" (P5) and the improvement of the work process (4) "*perception of opportunities for improvements in the work process*" (P3).

4.2. Social Identity

In the following subsections, we present the results of the identification of the survey participants by the four dimensions of social identity [Luhtanen and Crocker 1992].

4.2.1. Affiliation Value

The median of responses to the three questions related to estimating group affiliation (Q7, Q8, and Q9) indicated a trend of 1-total agreement. Most respondents perceive themselves to be participatory and useful in their teams. Regarding the interaction with their team, the participants highlighted that the team "*...communicates very well*" (P1) highlighting the awareness with mutual support "*We always try to support each other in order to achieve a goal that benefits the team as a whole*" (P4). Only one participant indicated little agreement in group affiliation "*...I receive a demand and I act on it*" (P6).

4.2.2. Private Collective Self Esteem

The medians of responses to Q11 and Q12 also indicated a trend of 1-total agreement, revealing that participants perceive solid collective self-esteem in their teams. This result was reflected in the developers' answers to the open question. Six participants demonstrated arguments that demonstrate this self-esteem in their teams. They highlighted positive emotions and behaviors, such as harmony, cooperation, partnership, commitment, and patience: "*...the team is very cooperative...*" (P1), "*...we have a good harmony and maturity...*" (P5), "*...I see patience and understanding...*" (P11).

4.2.3. Public Collective Self Esteem

Regarding how other teams perceive the participants' teams, questions 14, 15, 16, and 17 presented, respectively, the medians 2, 3, 2, and 2. These results suggest a lesser positive perception of this dimension among the participants than previous ones. From the open responses, we identified the pride of six participants about how their teams are positively perceived by colleagues from other teams: "*...technical reference...*" (P2), "*...(external) people are surprised on our ability to handle all demands with a relatively small team...*" and "*...in many moments we are praised...*" (P1). Three participants argued that the positive perception among teams is harmed by their different profiles and conflicts of interest during the projects' execution. However, only one participant indicated that his team has a negative external image.

4.2.4. Relevance

Regarding the perceived relevance of the participants' team to himself (Q19, Q20, Q21), the answers revealed medians 3, 2, and 2, respectively. The developers' answers to the open question indicate that the teams positively influence them in different aspects. Six participants argued that the team influences their behavior: "*...I am influenced to always improve my skills, not only technical but as a person...*" (P4), "*...when we feel respected, we also respect...*" (P11), "*...everything I know I owe to my team. I learned, I learn, and I will learn a lot from them.*" (P8). In addition, six participants revealed the teams' positive influence over their technical skills: "*...they inspire me to develop and code better*" (P7), "*...continuous improvement to live up to the team's qualification...*" (P9), "*...some people have knowledge and expertise in certain subjects ... I always listen very carefully to the statements of others...*" (P5). Two less experienced participants also highlighted that they are continuously learning with their respective teams: "*...as the least experienced member of the team, I'm very influenced on my way to work, always trying to absorb the best practices...*" (P1).

4.2.5. Summarization (RQ3)

Overall, the results indicate that, from different perspectives, the survey participants tend to feel identified with their corresponding teams. Considering the arguments presented, we can highlight that they tend to feel part of the teams in which they work and to be inspired by them both behaviorally and technically, perceiving their teams as cooperative and well-regarded by others.

4.3. Social Identity and Feedbacks

The application of the social identity theory in this study is grounded on our understanding that the developers' perceptions about the identification with their teams can influence their internal feedback practice. Despite we do not intend to score social identity in the teams investigated, we understand that the developers' perceptions about social identity dimensions may help to understand their feedback practice. More specifically, we identified particular items from the group self-esteem that may directly address the developers' perceptions about feedback practice. In this sense, we may highlight that the feeling of affiliation to the team may stimulate the feedback practice. Thus, we hypothesize that there is a direct correlation between the developer's affiliation and the frequency with which he provide feedback. In addition, we also understand that the developers' perception of the team's importance is related to the perception of the feedback received from the team members. Thus, we also hypothesize that *there is a direct correlation between the team's relevance to the developer and the perceived relevance of the received feedback.*

To test these hypotheses, we resorted to Spearman's nonparametric paired test to calculate the correlation coefficients between the distributions of feedback and the social identity dimensions. We performed 30 tests in total. In 15 tests, we evaluated the correlation between the items about affiliation (Q7, Q8, and Q9) and the perceived frequency of providing feedback on the five occasions evaluated (Q23). In 15 other tests, we eval-

uated the correlation between the responses to the items about relevance (Q19, Q20, and Q21) and the perceived relevance of the received feedback on the five occasions evaluated (Q25).

We found predominantly direct correlations[2] , ranging from weak to very strong correlations [Dancey and Reidy 2007]. However, we found statistical significance (p-value ¡ 0.05) only for four calculated correlations. The tests reveal strong/very strong correlations between the developer's sense of belonging with their team (Q7) and the frequency of providing feedback (Q23) during the planning of upcoming deliveries and in informal conversations (-0.6296, p-value = 0.03793 and -0.75416, p-value= 0.00733). That is, the more the developer feels part of the team, the more often he provides feedback on those occasions. The tests also reveal that there is a very strong correlation between the perception that the team is important to understand who the developer is (Q20) and the perceived relevance of the received feedback (Q25) during the planning of the next deliveries (-0.77166, p -value= 0.0054). A strong correlation was also identified between the perception that the team is an important part of the developer's self-image (Q21) and the perceived relevance of the received feedback (Q25) during informal conversations (-0.66186, p-value= 0.02653).

4.3.1. Discussion

The survey findings indicate that participants tend to feel part of their teams, which inspires them and influences their behavior. Furthermore, the opinions collected reveal a positive perception of the team's public and private collective self-esteem. However, participants raised concerns and challenges, mostly related to social factors to improve teamwork.

The study findings reveal that the feedback practice of developers is directly correlated with certain aspects of their social identity regarding their teams. This correlation may be stronger depending on the occasion in which the feedback occurs. Besides, the degree of correlation varies according to the feedback occasion. This behavior may be also related to the strength of the whole team's social identity. For instance, the team's social identity may reflect the trust between team members, affecting the extent to which feedback is perceived in different contexts [Holmstrom et al. 2006, Kotlarsky and Oshri 2005, O'Leary and Mortensen 2010]. Challenges in preserving trustworthiness in collaborations may affect how team members perceive and become engaged in the feedback process, especially in feedback occasions requiring higher interaction. However, once we employed a sample composed of developers from different teams, we could not observe the influence of the social identity of the whole team over the feedback practice.

It is important to note that informal feedback seems to be a frequent and reciprocal practice among developers, encouraged by the sense of belonging to the team and how

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[2]The interpretation of the negative correlation coefficients as direct correlations considers that distributions based on a descending Likert scale (social identity) are compared with an ascending Likert scale (feedback) as presented in the study design.

much the developer sees the team as part of his self-image. A similar trend was observed for planning the next deliveries, which can be partially explained by the fact that these retrospectives are planned to occur when the demand and pressure for immediate results may be lower than other ceremonies. On the other hand, a possible explanation for the lack of feedback practice on more technical and formal occasions lies in the concern of how this feedback would be absorbed, avoiding potential conflicts that may even affect the identification of developers with their respective teams.

Delivery planning was also identified as a prominent occasion for providing and receiving relevant feedback correlated to the developers' social identity. One possible reason for this finding is that delivery planning typically requires careful team thinking to schedule tasks and allocate resources, which can be facilitated by mutual trust and team identification. For this purpose, the team may act on planning how to overcome and mitigate concerns such as the quality and communication issues eventually raised in retrospective tasks. On the other hand, daily meetings are frequent but short-time occasions in which the team focuses on evaluating and reporting progress on technical tasks.

5. Second Study

The findings of the opinion survey pointed to the importance of investigating in more depth the relationship between social identity dimensions and feedback practice. Besides, the particular characteristics of each team may influence the results despite their similarities. In this sense, we identified the need to shift our investigation to investigate the case of a single software development team.

For the second suty, we picked up another team from the same IT department involved in the first study (see Section 3.1. We selected this team aiming to gain a deeper understanding of how the team composition, including characteristics, roles, and working arrangement influenced the results.

The team comprises 30 members who work on various projects and organize themselves into sub-teams for each project. Most (93.1%) team members work in a fully remote arrangement. The remaining members work in a hybrid format, but most time they work remotely. This reality encompasses newcomers and those with more time on the team. Due to the nature of the activities performed, which do not require in-person meetings of the entire group, many members barely have the opportunity to meet in person. However, the team has adapted to remote work, adjusting their routines and communication practices to fit this context.

The team adopts well-defined development processes and agile practices as the base for conducting its system projects. Through informal conversations with their leader, we identified the group's modes of operation, feedback occasions, and working context. The team uses the same set of feedback occasions as those mapped in the first study, besides the "sprint review." We incorporated this occasion into the feedback categorization outlined in the [Kahmann and Mulder 2011] model, classifying it as "task-related feedback" and included it in the questionnaire.

In addition to including "sprint review" as a feedback occasion, we modified the

initial questions to better understand the participants' profiles. In the first study, we differentiated between public and private companies because three distinct teams were involved. In the second, we focused on understanding the participants' profiles by investigating the remote work modalities within the team. We asked participants about the remote work modalities they adopt, including the alternatives: 100% *remote,* 100% *face-to-face work,* 50% *Hybrid (Equally face-to-face and Remote), Hybrid Mostly face-to-face, and Hybrid Mostly Remote*. Furthermore, we broadened the options for roles in the questionnaire to cover all team members' activities.

Twenty-nine of the thirty developers comprising this team participated in the survey. We detail the characteristics of the participants in Section 5.1

5.1. Results

In this section, we present the results obtained with the study execution. Participants' responses to each question and the profile table are also publicly available [3]. The characterization data reveal that all 29 participants are involved in various stages of the software development lifecycle. Most participants (19 individuals) have a full-stack developer profile, performing multiple roles ranging from system analysis and development to software maintenance.

On the other hand, ten participants have a management profile, with responsibilities that include process analysis, requirements gathering, project management, and testing. One of the participants has a more technical profile, focusing on testing, optimization, environment monitoring, and providing user support. Regarding software development experience, participants ranged from seven months to 38 years, with a median of 12 years. Thus, we may argue that the survey sample is composed of a diverse group in experience level and roles. Out of the 29 participants, 27 work 100% remotely, while 2 follow a hybrid regime, with the majority of their time spent in remote work.

5.1.1. Feedback Practice

The perception of feedback provided within the software development team indicated a high frequency on most occasions, as shown in Figure 4. However, the median was low during the daily meeting (DM), suggesting that feedback provided on this occasion is less common than on others.

When we asked how often participants receive feedback within their team, we observed a positive trend, as shown in Figure 5. The median was high in most situations, indicating that participants reported receiving feedback frequently in various contexts. However, DM again stood out with a low median. Regarding the relevance of the received feedback, the medians for most occasions pointed to a perception of high relevance (Figure 6), except for Delivery Planning (DP) and Daily Meeting (DM), which indicated a "Very High" and "Low" tendency, respectively.

Thus, in response to RQ1, developers tend to perceive *that they provide and receive feedback in a balanced manner with high frequency on various occasions. Excep-*
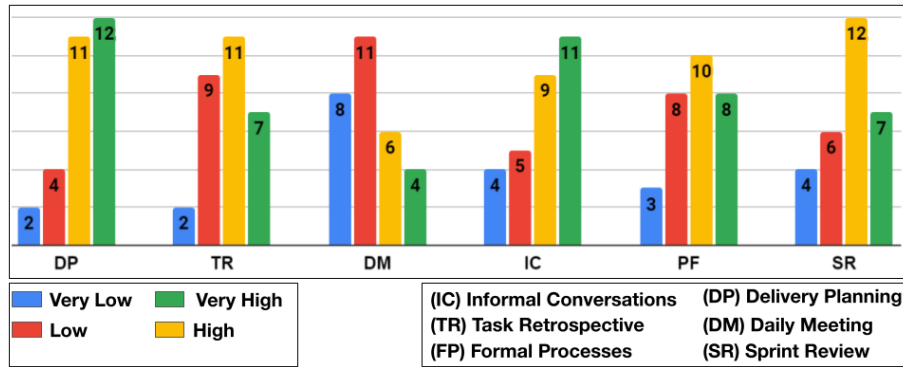
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[3]https://anonymous.4open.science/r/Feedback-in-Software-Teams-236D

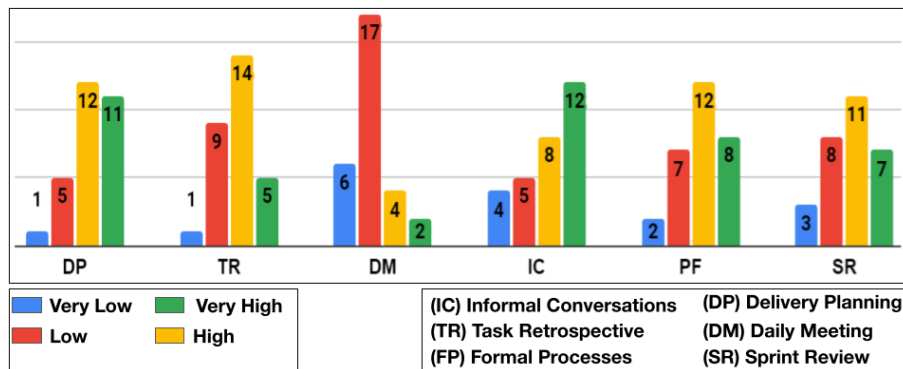**Figure 4. Step 2 - Perception of Provided Feedback Frequency**

Figure 5. Step 2 - Perception of Received Feedback Frequency

tions include a low perception of frequency in providing and receiving feedback during daily meetings. Besides, the perceived relevance of the feedback received during daily meetings tends to be low. On the other hand, most participants perceive the feedback received on other occasions is relevant.

The challenges of feedback practice reported by the participants (RQ2) help us understand the results obtained for RQ1. The challenges and negative points were diverse: communication/comprehension issues (8), lack of synchronous work (4), social issues (4), technology usage (3), and process-related difficulties (2). Few participants indicated no challenges, and only one stated not to provide feedback. Some participants reported misunderstanding or problems in expressing themselves: "*...occasional misunderstandings about what I am conveying to the team, but generally resolved quickly...*" (P2), "*...Understanding others and expressing feedback well is not always so simple...*" (P24).

Lack of synchronous work can lead to even more isolation: "*...work ends up being a bit more isolated, with each one having their own time...*" (P12), "*...sometimes getting the team together at the same time. So, it might happen that a team member is not present at the time of this feedback.*" (P4). The use of technology aims to compensate for the distance. Still, spontaneous communication is affected: "*If you are using a written communication tool, you need to find a good moment and choose your words carefully for the*
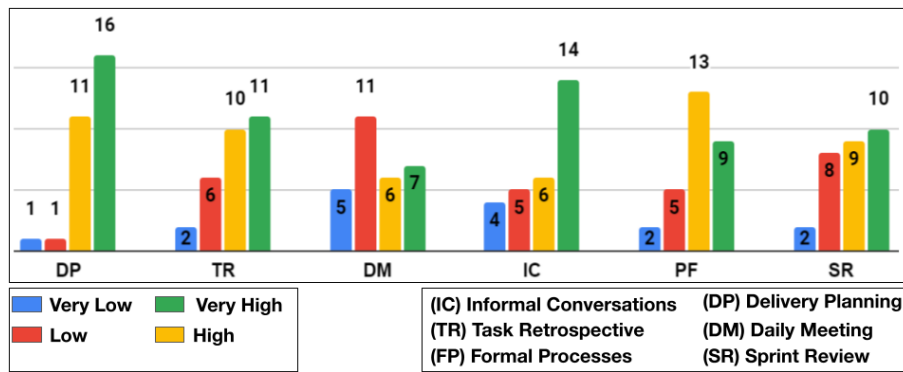
Figure 6. Step 2 - Perception of Received Feedback Relevancy

feedback to be well-received" (P6), "*Sometimes, giving feedback in a team chat and an important demand arises, causing the feedback to get lost*" (P20).

Similar to the first study results, concerns about the distance caused by remote work are also evident: "*I don't feel comfortable due to the lack of visual and social contact*" (P13). On the other hand, the need to find a formal moment to provide feedback emerged due to the lack of clarity about the appropriate timing: "*Finding a formal process to present feedback and organize information*" (P14).

The perception of high relevance in most feedback occasions found in the quantitative data is confirmed in the open-ended responses when asking about the positive and negative aspects of receiving feedback from team members. The positive factors indicated by the participants suggest that they all recognize the benefits of receiving feedback, with an emphasis on the possibility of professional improvement: "*We have the chance to reevaluate our work and improve it*" (P16), "*Possibility to positively influence and be influenced in both professional and personal aspects*" (P19), motivation: "*Feedback is a fundamental way to keep the team engaged*" (P11), "*Positive feedback is motivating for the whole team*" (P24), direct impacts on daily activities: "*...solutions found by one developer can end up benefiting others*" (P12), as well as the due recognition for the work done: "*They recognize your effort*" (P9).

Participants mentioned the possible reaction to the provided feedback as a negative aspect: "*Some have a hierarchy problem and end up lacking professional respect*" (P13), "*We need to be patient to listen to what the other person says*" (P15), lack of feedback: "*...when problems occur precisely due to the lack of feedback*" (P26), specific or poorly formulated feedback: "*...very vague or sometimes very raw...*", lack or alteration of processes: "*changes in business rules that contradict what was previously aligned by the team*" (P2), excessive feedback: "*... it's exhausting and unnecessary*" (P7).

Five participants understood that receiving feedback from colleagues at work has no negative consequences: "*I don't see any negatives because, for me, everything is a learning experience*" (P5). One participant preferred to refrain from expressing an opinion on this issue of the positives and negatives of receiving feedback from colleagues in a software project team.

5.1.2. Social Identity

The median of responses to the questions about the group affiliation (Q8, Q9, and Q10) indicates a trend of 1 - total agreement. This result demonstrates that most participants feel deeply connected and engaged in their respective teams, preserving a solid perception of affiliation with the group: *"We are a team, one person's problem is somewhat everyone's problem"* (P8) and *"Interaction with my team is great"* (P3).

The analysis of responses to questions Q12 and Q13 revealed positive medians (1 - total agreement) regarding private collective self-esteem. It is important to note that in question 13, formulated negatively, participants responded with the opposite value, indicating total agreement with private self-esteem. One of the main reasons we found for the developers' satisfaction with their team is the positive perception of the collaborative dynamics, *"The team is very united, and everyone is always willing to help"* (P17), the team productivity, *"An example of great satisfaction is when I can deliver a solution to an important project requirement"* (P11), and the perception of mutual respect, *"...respect for all team members is necessary. Currently, I find this respect, and that's why I am satisfied"* (P16).

Regarding the perception of external individuals about the development team, the results show a positive trend for questions 15, 16, 17, and 18, with medians of 1, 4, 1, and 3, suggesting a partially positive view of public self-esteem. The negative result for Q16 may be partially explained by the lack of interaction between subteams *"In general, the teams don't communicate with each other, and we don't know how the progress of the other projects is going and how the team is perceiving us"* (P7), potentialized by remote work: *"Due to the current work arrangement, I have few elements to assert this..."* (P6).

When asked about the importance of the team and its influence on them (Q20, Q21, Q22), the survey participants revealed a mostly positive perception, with medians of 2, 3, and 3, respectively. Open-ended responses indicate the team's influence on various aspects. Twenty participants mentioned how their teams inspire them to improve their skills, both technical and personal, emphasizing continuous learning provided by the team: *"...always willing to seek new solutions, as well as learning to use new technologies"* (P2), *"I am influenced by the enthusiasm, willingness, dedication, and cordiality. It brings me the feeling of giving back everything positive I receive with the skills I have"* (P8), *"due to the quality and diversity of professionals in the team, the level of discussion is high, which motivates me to research and learn more"* (P12). Five participants indicated the diverse experience and knowledge of their colleagues as an essential factor in motivating technical change: *"My development team has diverse knowledge, and although each one has a more evident skill, I am influenced to seek knowledge to always collaborate with the team constantly"* (P21), *"There is some influence in decisions through other members because they have known for years how the procedures at the university work"* (P20).

The survey results indicate that the survey participants tend to share a solid identification with the team (RQ3) despite their less positive perception of the public collective self-esteem. Most participants actually feel like team members and recognize the positive influence of this membership in their lives. The arguments given in the open questions

strengthen the positive perception of the team, suggesting the predominance of a healthy working environment in which the members continuously learn and share experiences despite environmental challenges, such as asynchronous remote work.

5.1.3. Social Identity and Feedback Practice

We tested two hypotheses: (1) there is a direct correlation between the developers' affiliation and the frequency with which they provide feedback; and (2) there is a direct correlation between the relevance of the team to the developer and the perceive relevance of the feedback received. We used the non-parametric Spearman's rank correlation test to calculate the correlations between the distributions of feedback and Social Identity. A total of 36 tests were conducted. In 18 tests, we evaluated the correlation between the responses to the affiliation items (Q8, Q9, and Q10) and the perceived frequency of providing feedback for each of the six occasions assessed (Q24). In the other 18 tests, we evaluated the correlation between the responses to the importance items (Q20, Q21, and Q22) and the perceived relevance of the received feedback for each of the six occasions assessed (Q25).

We found predominantly direct correlations between feedback and social identity[4], ranging from weak to moderate [Dancey and Reidy 2007] ones. From the 36 tests performed, we identified seven statistically significant correlations (p-value ¡ 0.05). We found weak to moderate correlations between the perception that the team is a significant reflection of who the developer is (Q20) and the perceived relevance of feedback during *planning meetings*, *tasks retrospective*, *daily meetings*, and *formal processes* (rs = -0.44645, p = 0.01519; rs = -0.39839, p = 0.03231; rs = -0.42536, p = 0.02143, and rs = -0.41375, p = 0.02567). In other words, the more the developer feels that the team reflects who they are, the more they perceive the feedback received during these occasions as relevant to them.

The tests also reveal moderate correlations between the understanding that the team is important for perceiving who the developer is (Q21) and the perceived relevance of received feedback (Q26) during *tasks retrospective* (rs = -0.42898, p = 0.02023). Weak and moderate correlations were found between the perception that the team is an important part of the developer's self-image (Q22) and the perceived relevance of received feedback (Q26) during *tasks retrospective* and *daily meetings* (rs= -0.5183, p= 0.00397 and rs= -0.37939, p= 0.04238).

5.1.4. Providing and Receiving Feedback

Considering that all the study participants are from a single team, we want to verify the balance between their perceptions about providing and receiving feedback on the different occasions investigated. A balanced perception would indicate cohesion in the group and

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[4]The interpretation of the negative correlation coefficients as direct correlations considers that distributions based on a descending Likert scale (social identity) are compared with an ascending Likert scale (feedback) as presented in the study design.

interpersonal communication, promoting team collaboration. We applied the Spearman rank correlation test over the distributions of responses to questions Q24 and Q25 for each feedback occasion. We found significantly direct correlations, ranging from strong to very strong ones (Dancey and Reidy, 2007). We identified strong correlations between giving and receiving feedback in Delivery Planning, Retrospective, Daily Planning, and Formal Processes (rs = 0.71344, p= 1E-05; rs= 0.71731, p= 1E-05; rs= 0.62628, p= 0.00028). For Informal Conversations and Sprint Review occasions, we found very strong correlations (rs= 0.92246, p= 0 and rs = 0.89809, p= 0).

The strong correlations we found in the feedback practice indicate that the team members feel free to provide feedback as they receive it. This behavior contributes to the team's self-esteem and the relevance of the team to its members. Besides, it evidences that the team investigated has a solid feedback culture.

5.1.5. Discussion

The results of the second study indicate that participants tend to feel part of their teams, which inspires them and influences how they behave. Furthermore, the opinions collected reveal a positive perception of the team's public and private collective self-esteem, although the intensity of public collective self-esteem was less expressive. It is important to highlight that, during the study period, the team faced several challenges related to political issues and a high demand for work, while at the same time dealing with limited human resources. These challenges, combined with the criticism received, may have influenced the team's public collective self-esteem.

The developers provide and receive feedback in a balanced way and with high frequency and relevance on several occasions, except for daily meetings. The balanced practice of feedback on multiple occasions, including formal ones, suggests a solid and healthy interaction within the team, which may be related to the strength of the team's identity and trust among its members. This conclusion corroborates previous studies (Holmström et al., 2006; Kotlarsky et al., 2005; O'Brien et al., 2010), which highlighted the influence of trust on the way feedback is perceived in different contexts, even on formal occasions. In the first study, we identified the need to investigate this relationship further, and the results of the second study indicate the importance of this aspect for understanding the dynamics of feedback practice in software development teams.

Although the team faces challenges related to the social aspects and physical distancing, the results suggest its maturity and integration as a group. The team demonstrated a balanced feedback practice on several occasions, suggesting an ability to overcome social and communication challenges, possibly reflecting the team cohesion.

The sample collected from the specific team allowed us to explore the complexity and diversity of feedback practices in a software development team with a solid social identity. The findings from both studies demonstrate several similarities between the social identification of the participants and the feedback practice. Both indicate that participants tend to feel part of their teams, which inspires and influences their behavior. Just like in the opinion survey, the feedback collected in the specific team also reveals a posi-

tive perception of the team's public and private collective self-esteem, although there are also complementary concerns and challenges to improve teamwork and the perception of external individuals about the teams.

Although we found strong correlations in the opinion survey for informal conversations and delivery planning, we found low to moderate correlations for all feedback occasions in the specific team, except for informal conversations. Despite these differences, the perception of the frequency and relevance of feedback in informal conversations is high in both samples. This finding highlights the fundamental role of informal communication in the software development process, even when formal feedback is institutionally promoted. The high perception of the frequency and relevance of feedback in informal conversations underscores the importance of these unstructured interactions within the team. Feedback provided casually during these conversations can be perceived as more genuine and valuable, contributing to a greater sense of belonging and connection among team members. It may be associated with the specific team's willingness to promote a culture of open and informal communication, reflecting its solid social identity and the sense of belonging among members.

Delivery planning once again proved to be a standout occasion for providing and receiving relevant feedback on tasks, being correlated with the social identity of the developers on the specific team. This correlation suggests that structured moments of review and planning are key opportunities to promote a culture of constructive and results-oriented feedback within the team. The active involvement of team members in planning and resource allocation can further strengthen the sense of belonging and engagement.

Although sprint reviews are occasions of short duration and frequent evaluations and progress reporting, we identified them as a conducive environment for giving and receiving feedback, indicating that feedback practices may vary. Exploring how these meetings are conducted and perceived by team members can provide valuable insights into the effectiveness of these practices in promoting a feedback culture.

In conclusion, the results indicate that even in development teams with solid social identity, feedback practices can vary considerably depending on the feedback occasion. Additionally, we understand that other sociotechnical factors than social identity and the occasions available may influence feedback practices, such as cultural aspects and the degree of synchronous work among team members. Thus, we intend to replicate this study with software teams in different sociotechnical contexts, such as other countries. We hope our ongoing research on feedback practices in remote teams can contribute to promoting an effective culture of collaboration in software development teams.

6. Conclusion

The investigation reported in this paper aims to characterize the developers' perceptions about the feedback practice in software development teams and how this practice is correlated with the teams' social identity. As far as we know, this is the first empirical study conducted in the field adapting formal instruments from the social identity theory for characterizing the social identity of development teams.

The first study involved the participation of developers from different organiza-

tions. It allowed us to identify initial trends related to a strong sense of team belonging and the influence of the team on the developer's behavior, particularly in terms of public and private collective self-esteem. It also brought to light concerns and challenges related to social factors that affect teamwork. Furthermore, the study revealed a strong positive correlation between the perception of feedback practices and aspects of the developers' social identity within their teams, depending on the occasion of the feedback, with emphasis on informal conversations and delivery planning.

We then evolved the protocol and conducted a second study with 29 developers from the same team. This approach provided a deeper understanding of the feedback and communication dynamics within a remote work environment, revealing that the team, despite facing significant challenges like high workloads and political tensions, maintained a balanced and frequent feedback practice. This practice, particularly during informal interactions, reflected a high level of team cohesion and trust, which helped the team overcome social and communication barriers. These findings indicate that the team's strong social identity played a critical role in promoting effective feedback practices, even in challenging circumstances.

Our investigation focuses on remote teams, which may limit the applicability of our findings to working environments in which dynamics are predominantly in-person. Although the study explored the challenges of remote work, the need for future research to investigate how these factors impact feedback practices in different work contexts is acknowledged.

The experience of this study indicates the importance of further investigations into the different occasions of feedback in software teams. The study results also exemplify the contributions of applying group-oriented social psychology theories, such as social identity and social representations, to investigate the software development practice.

We intend to not only replicate our survey in other teams with different settings but also to conduct observational studies to investigate in more depth the feedback dynamics. We expect that observing teams with different cultural backgrounds and levels of social identity will lead us to characterize the feedback dynamics on different occasions, especially in the less formal ones, such as informal conversations and technical meetings. Through this characterization, we expect to provide evidence-based guidelines to diagnose and improve the feedback practice in software development teams.

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